East coast otter trawl fishery regional risk assessments

Species of conservation concern data report

Supplementary material

Queensland Government

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The Department of Agriculture and Fisheries proudly acknowledges all First Nations peoples (Aboriginal peoples and Torres Strait Islanders) and the Traditional Owners and Custodians of the country on which we live and work. We acknowledge their continuing connection to land, waters and culture and commit to ongoing reconciliation. We pay our respect to their Elders past and present.

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Definitions and Abbreviations

BRD	–	Bycatch Reduction Device.
ECOTF	–	East Coast Otter Trawl Fishery.
EPBC Act	–	*Environment Protection and Biodiversity Conservation Act 1999.*
ERA	–	Ecological Risk Assessment.
IUCN Red List	–	Refers to the IUCN Red List extinction risk assessments. For the purpose of this ERA, both IUCN extinction risk classifications and conservation listings (e.g. under the EPBC Act *or Nature Conservation Act 1992*) were used and referenced as the 'conservation status' of a species.
LCA	–	Likelihood and Consequence Analysis.
SOCC	–	Species of Conservation Concern.
SOCI	–	Species of Conservation Interest. A historical term formally applied to no-take species that were subject to additional reporting requirements. This was primarily done through the Species of Conservation Interest (SOCI) logbook. The SOCI logbook was superseded in 2021 by the Threatened, Endangered and Protected Animals logbook.
TED	–	Turtle Excluder Device.
TEPA logbook	–	Threatened, Endangered, and Protected Animals logbook is used to monitor interactions with non-target species that are subject to mandatory reporting requirements. The TEPA logbook replaced the Conservation Interest (SOCI) logbook in 2021.

Overview

The intent of this Data Report is to support the East Coast Otter Trawl Fishery (ECOTF) Regional Risk Assessment Technical Report. The Technical Report provides a detailed account of the findings of five regional risk assessments undertaken for the ECOTF. The Data Report (this report) provides an overview of the key considerations and justifications behind the scoring decisions for each species across the five trawl management regions.

Background

Trawl operations on the Queensland east coast will interact with a wide range of species, including some that are the subject of more significant conservation concerns (referred to herein as Species of Conservation Concern or SOCC). In 2023 a whole-of-fishery (Level 2) Ecological Risk Assessment (ERA) was completed for 62 priority SOCC (Dedini *et al.*, 2023).

In 2024, the East Coast Otter Trawl Fishery (ECOTF) was subject to a secondary risk assessment. This assessment considered the same 62 SOCC, however, quantified risk within each of the five management regions. The intent of the assessment was to provide further insight into the extent of any inter-regional risk variability.

The scope of each regional assessment was determined through a review of each species distribution, interaction potential and prescribed fishing boundaries. This review produced an assessment list of 43 species for the Northern Trawl Region, 46 species for the Central Trawl Region, 46 species for the Southern Inshore Trawl Region, 49 species for the Southern Offshore Trawl Region and 30 species for the Moreton Bay Trawl Region. These species were then subjected to a Likelihood and Consequence Analysis (LCA) to determine an indicative (low, low-medium, medium or high) risk rating within each region.

The LCA is a qualitative assessment method, which is highly flexible and has fewer data requirements. One of the key benefits being that the LCA is able to consider more anecdotal evidence including information provided through targeted consultation. Other factors also considered as part of this review are outlined below.

Target Species

- Across the ECOTF, fishers will target a range of Tier 1 (target), Tier 2 (secondary) and Tier 3 (byproduct) species (Department of Agriculture and Fisheries, 2021e; d; c; b; a). While species classifications differ among regions, target and secondary species for the ECOTF predominantly include a range of prawns, scallops and bug species.

- A review of the species targeted by regional trawl operations provided insight into the habitat and depth ranges where operations are likely to occur. This, by extension, allowed for inferences to be made regarding the interaction potential of the assessed SOCC. To summarise, if the habitat and depth preferences of a SOCC overlaps with those of a targeted species, the interaction potential would be heightened.

- For example, the Northern Trawl Region will target tiger prawns (Tier 1 species; *Penaeus esculentus* and *P. semisulcatus*) and various secondary (Tier 2) and byproduct (Tier 3) species (e.g. endeavour prawns, *Metapenaeus endeavouri*; Moreton Bay bugs, *Thenus* spp. etc.). Adult

tiger prawns are associated with coastal areas in both fine mud and coarse sediments to depths of 200 m (Australian Fisheries Management Authority, 2023b). While adult endeavour prawns and Moreton Bay bugs (secondary species) exhibit a more limited bathymetric range (up to 60 m and 100 m respectively), they are found in similar environments and substrates (Australian Fisheries Management Authority, 2023b; a). Based on this information, it is expected that regional fishing activities will typically occur over soft substrates (e.g. sand, mud) to various depths (Australian Fisheries Management Authority, 2023b; a). As a result, it is reasonable to assume that vessels actively pursuing these species will have a higher probability of interacting with SOCC that also share these habitat and depth preferences.

Operational considerations

- It is a mandatory requirement that all vessels operating within the ECOTF are fitted with compliant Bycatch Reduction Devices (BRDs) and Turtle Excluder Devices (TEDs). The aim of these devices are to reduce negative encounters with non-target species. Regionally-approved BRDs permitted for use are outlined within the *Fisheries (Commercial Fisheries) Regulation 2019* (State of Queensland, 2019a).
- A fisher must record all interactions with species listed within the Threatened, Endangered and Protected Animals (TEPA) logbook. This logbook applies to various species including marine turtles, syngnathids, sea snakes and some elasmobranchs.
- When compared with historic levels, effort has declined through time within the ECOTF. It is acknowledged that for some species, effort reductions and the introduction of regional effort caps would assist in terms of minimising the interaction potential and the extent of any consequence. This factor, along with an understanding of the current fishing environment and effort trends was considered as part of the LCA.
- Ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program also provide some species refuge from regional trawl fishing activities (Great Barrier Reef Marine Park Authority, 2022a; b). Similarly, species will be afforded additional protection in state-managed marine parks (e.g. Moreton Bay Marine Park, Great Sandy Marine Park). These protections were taken into consideration as part of the LCA.

Data Report: Appendix A—Preliminary scoring and justifications of the Likelihood and Consequence Analysis for species assessed as part of the Northern Trawl Regional Risk Assessment

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
Marine turtles						
Loggerhead turtle	*Caretta caretta*		3	2	**Likelihood:** The likelihood assessment considered the distribution and habitat preferences of each species when reviewing their potential to interact with trawl operations in the Northern Trawl Region. These considerations included the location and prevalence of foraging, nesting and rookery sites along the Queensland east coast (Limpus, 2007a; b; 2008a; b; c; 2009). The likelihood assessment also considered the level of uncertainty surrounding the data on regional marine turtle interaction rates. For all species, excluding the leatherback turtle (*Dermochelys coriacea)*, a weight-of-evidence approach supported the assignment of a more conservative likelihood score. Across the complex, data deficiencies made it more difficult to differentiate between species and/or identify where there was a lower likelihood of the consequence coming to fruition within the current fishing environment. Accordingly, some of the species may have been assigned a more conservative or precautionary score for this aspect of the Likelihood and Consequence Analysis (LCA). *Dermochelys coriacea* displays an affinity for pelagic water environments and the species is less likely to interact with regional trawl operations (Department of the Environment, 2023c). While historic records show that *D. coriacea* has previously nested in central-southern Queensland, there has been a progressive decline in the breeding frequency of this species on the Queensland east coast (Limpus, 2009). For this species, a score of remote (1) was considered appropriate for this aspect of the LCA. Of the remaining species, the green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*) and flatback turtle (*Natator depressus*) have prominent nesting/breeding or	**Consequence**: The available evidence including third-party assessments did not support a deviation from the default consequence score of moderate (2) for these species (Subcommittee, 1996; Seminoff, 2004; Abreu-Grobois & Plotkin, 2008; Wallace *et al.*, 2013; Casale & Tucker, 2017; Department of the Environment, 2023f; a; b; c; d; e). A number of measures implemented across the East Coast Otter Trawl Fishery (ECOTF) reduce the impact of the fishery on this complex and, therefore, the consequence e.g. the use of a Turtle Excluder Device (TED), Bycatch Reduction Devices (BRDs) and an extensive system of spatial/temporal closures. Effort levels for the ECOTF have also declined through time and are now capped under the harvest strategies (Department of Agriculture and Fisheries, 2021a; e; c; d; b; 2023). In past Ecological Risk Assessments (ERAs), a decline in effort has been directly linked to a decline in risk levels (Pears *et al.*, 2012b; Jacobsen *et al.*, 2015). While difficult to quantify, effort has declined since these assessments and it is reasonable to assume that the consequences of trawl fishing have not increased in the proceeding years. These measures support the assignment of a consequence score at the lower end of the spectrum i.e. moderate (2) *versus* severe (3) or major (4). While TEDs will be effective at reducing the capture of marine turtles, data submitted through the Threatened, Endangered and Protected Animals (TEPA) logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution and may underestimate the total number of marine turtle interactions. The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region.
Green turtle	*Chelonia mydas*		3	2		
Leatherback turtle	*Dermochelys coriacea*		1	2		
Hawksbill turtle	*Eretmochelys imbricata*		3	2		
Olive ridley turtle	*Lepidochelys olivacea*		3	2		
Flatback turtle	*Natator depressus*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					foraging sites located in the Northern Trawl Region. While breeding sites for the olive ridley turtle (*Lepidochelys olivacea*) are all located in northern Australia, this species is commonly encountered in tropical waters. This increases the likelihood of the species interacting with regional trawl fishing activities (Limpus, 2007a; b; 2008b; c). The ongoing roll-out of the Data Validation Plan may provide further avenues to review and refine the likelihood scores for this region. Depending on the outputs of this program, the scope of the assessment could also be reviewed and refined (e.g.) removing *D. coriacea* from future assessments as a low-risk element.	However, cross-comparisons with data compiled from adjacent fisheries, namely the Northern Prawn Fishery (NPF), supports the hypothesis that the number of marine turtle interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining the consequence score more difficult. Taking a weight-of-evidence approach to the consequence assessment, a score of moderate (2) was considered appropriate for this region. This score takes into consideration risk mitigation measures, declining effort trends and current management limitations e.g. an inability to verify reported interaction / release fates and uncertainty surrounding the species that interact with trawl fishers in this region.
Syngnathids						
Tiger pipefish	*Filicampus tigris*		3	2	**Likelihood:** A review of species distributions and habitat preferences determined that the four listed species have a higher potential to interact with regional trawl fishing activities. Information on the habitat preferences of these four species is readily available and suggest they occupy a range of hard and soft substrates at varying depth levels. While they will be found in grounds accessed by trawl fishers, not all habitats will be conducive to trawl fishing. They will also be afforded a degree of protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). Distributional data was less reliable with information sources often having conflicting range information. This issue is complicated by the fact that the syngnathid taxonomic history is complex and somewhat fluid i.e. varying classifications and, at times, a lack of uniformity. This makes it more difficult to define/quantify regional distributions. These combined factors increased the level of uncertainty regarding the interaction potential of these species. As a result, a more conservative approach was adopted and a likelihood score of possible (3) was applied. It is acknowledged that these scores may be an overestimate for this region. With	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of moderate (2) (Pollom, 2016a; Pollom, 2017b; a). This score is considered appropriate given a) the inability to verify reported interaction and release fates and b) species extinction risk classifications. While BRDs may be effective at reducing the capture of some syngnathids, a high proportion will (likely) be captured within the codend of the trawl net. Of note, all interactions with non-retainable syngnathids are required to be reported within the TEPA logbook. However, data reported through these logbooks has poor resolution and provides limited insight into regional catch compositions. As there is currently no mechanism in place to validate TEPA logbook data, a score of moderate was considered reasonable. With an effective mechanism to verify interaction and release fates, these scores could be further refined.
Spiny seahorse	*Hippocampus spinosissimus*		3	2		
Great seahorse	*Hippocampus kelloggi*		3	2		
Bentstick pipefish	*Trachyrhamphus bicoarctatus*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					improved information on syngnathid bycatch compositions, these scores may be refined in future risk assessments.	
White's seahorse	*Hippocampus whitei*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Duncker's pipehorse	*Solegnathus dunckeri*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Pallid pipehorse	*Solegnathus hardwickii*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Pallid pipehorse (*Solegnathus hardwickii*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus hardwickii* occupies a range of habitats including those associated with sponges, gorgonians and possibly coral reef edges, typically at depths between 12 and 100 m (Pollom, 2017d). These habitat preferences will provide *S. hardwickii* with a degree of natural protection from trawl fishing activities. The species will also be provided (some) refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). These factors will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Solegnathus hardwickii* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of Queensland, 2019b). Based on a review of historic syngnathid catch, it is hypothesised that the interaction potential for this species will be higher in operations fishing further south. However, such inferences must be observed with caution as records of syngnathid harvest do not account for all interactions (e.g. discarded individuals). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With	**Consequence**: There was sufficient evidence to support a deviation from the default consequence score of moderate (2) to severe (3). This score is considered appropriate as this species will have similar vulnerabilities to the Duncker's pipehorse (*S. dunckeri* [assessed in the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions]). Key considerations given to this score include a) the ineffectiveness of TEDs/BRDs in terms of excluding this species from the net, b) a species extinction risk classification of Data Deficient (Pollom, 2017d) and c) the allowable retention of this species (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards). Based on these factors, a score of moderate was considered reasonable for this species. With an effective mechanism to verify interaction and release fates, this score could be further refined.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					improved information on syngnathid catch compositions, this score may be refined in future risk assessments.	
Straightstick pipefish	*Trachyrhamphus longirostris*		5	1	**Likelihood:** A review of distributions and habitat preferences indicate that the straightstick pipefish (*Trachyrhamphus longirostris*) and the ribboned pipefish (*Haliichthys taeniophorus*) may interact with trawl fishing activities occurring in this region. These species occupy both soft and hard substrates to varying depths (Austin, 2016; Lourie, 2016; Pollom, 2016b; Bray & Thompson, Undated). *Trachyrhamphus longirostris* inhabits environments with varying degrees of susceptibility to trawling activities. Individuals occurring in muddy and sandy substrates are more likely to interact with trawl operations, while those residing in seagrass or estuarine environments will be provided a higher degree of protection (Austin, 2016; Bray & Thompson, Undated). *Haliichthys taeniophorus* has an affinity for weedy habitats that border on open substrates (Lourie, 2016). While interactions with this species may still occur, individuals will likely find refuge in areas less conducive to trawl fishing (e.g. coral and rocky environments). *Haliichthys taeniophorus* also demonstrates a limited bathymetric range up to 20 m (Lourie, 2016), further reducing the probability of significant interactions. The available information suggests that trawl fishing activities will have a minimal impact on regional stocks or populations. habitat preferences of *T. longirostris* and *H. taeniophorus* will provide them with a degree of natural protection from trawl fishing activities. These species will also be provided (some) refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). Note–While *T. longirostris* distributions may vary among sources, range information provided within the IUCN Red List and the Species Profile and Threats Database was considered the most current for this species (Austin, 2016). As a result, this species was only progressed for assessment within the	**Consequence**: The available evidence did not support a deviation from the default consequence score of minor (1). This score was considered appropriate due to a) both species exhibiting an extinction risk classification of Least Concern (Austin, 2016; Pollom, 2016b) and b) risk ratings of low in the Level 2 ERA (Dedini *et al.*, 2023). While the extent of interactions with these two species remains uncertain, it is expected that fishing activities will have a very low to negligible impact on regional populations. This determination is based on the premise that *T. longirostris* and *H. taeniophorus* will be afforded some refuge across their ranges in environments that are less conducive to trawl fishing. In the case of *H. taeniophorus*, potential encounters will be restricted to the northernmost areas of this region where its distribution overlaps with a limited area of the Northern Trawl Region. For both species, the extent of any consequence will also be reduced through ancillary mechanisms e.g. the Great Barrier Reef Marine Park Representative Areas Program.
Ribboned pipefish	*Haliichthys taeniophorus*		5	1		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					Northern Trawl Region. If additional information becomes available, the inclusion of this species in other regional assessments may be revisited.	
Sea snakes						
Reef shallows sea snake	*Aipysurus duboisii*		2	2	**Likelihood**: The reef shallows sea snake (*Aipysurus duboisii)* will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus duboisii* is often associated with seagrass beds, corals (over sand) and reef-adjacent areas to a depth of 80 m (Courtney *et al.*, 2010; Lukoschek *et al.*, 2010). While the species has a broad bathymetric range, it will typically occur in shallow environments to depths of 50 m (Lukoschek *et al.*, 2010). The habitat preferences of this species coincide with areas utilised by regional operations. However, *A. duboisii* will find refuge in areas less conducive to trawl fishing (e.g. seagrass). Similarly, the species will be afforded protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Aipysurus duboisii* interactions are more likely to occur in the Central Trawl Region where reef-associated species (e.g. red spot king prawns) are actively targeted (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score could be refined in future risk assessments.	**Consequence**: A review of the available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Lukoschek *et al.*, 2010). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Lukoschek *et al.*, 2010) and mortality rate estimates (*n* = 465 interactions with 5 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as the most recent assessment suggests it has a decreasing population trend (Lukoschek *et al.*, 2010). *Aipysurus duboisii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
						comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Mosaic sea snake	*Aipysurus mosaicus*		2	2	**Likelihood**: The mosaic sea snake (*Aipysurus mosaicus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus mosaicus* is often associated with soft substrates (e.g. mud, estuaries etc.) to a depth of 50 m (Rasmussen *et al.*, 2021a). While some of these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Aipysurus mosaicus* interactions are more likely to occur in shallow-water operations outside of the ECOTF, namely the River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). Note–While limited, any interactions eventuating within the ECOTF are more likely to be attributed to regions targeting red spot king prawns and tiger/endeavour prawns.	**Consequence**: A review of available evidence supported increasing the consequence score from minor (1) to moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021a). This decision largely reflects the level of uncertainty surrounding regional sea snake catch compositions (see below). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), stable population trend (Rasmussen *et al.*, 2021a), and reasonable post-interaction survival rates (n = 95 interactions with 5.3 per cent mortality; Courtney *et al.*, 2010). *Aipysurus mosaicus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Based on this information it is expected that this species will be capable of withstanding trawl interactions to some degree. However, due to limited sample sizes within sea snake bycatch studies, a more precautionary score was adopted (Milton *et al.*, 2009; Courtney *et al.*, 2010). Given the available information, a

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
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						rating of moderate (2) was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Olive sea snake	*Aipysurus laevis*		2	2	**Likelihood**: The olive sea snake (*Aipysurus laevis*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus laevis* is often associated with soft and hard substrates (e.g. sand, coral reefs and inter-tidal areas) to depths between 10 and 40 m (Crowe-Riddell *et al.*, 2021). While some of these habitats overlap with trawl grounds, the species is more commonly associated with reefs (Udyawer *et al.*, 2014; Crowe-Riddell *et al.*, 2021). These preferences will limit the exposure of this species to trawl fishing activities. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Aipysurus laevis* interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score could be refined in future risk assessments.	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Crowe-Riddell *et al.*, 2021). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Crowe-Riddell *et al.*, 2021), and reasonable post-interaction survival rates (*n* = 515 interactions with 9.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Crowe-Riddell *et al.*, 2021). *Aipysurus laevis* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the

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		Northern	L	C	Likelihood	Consequence
						ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spine-bellied sea snake	*Hydrophis curtus*		4	2	**Likelihood**: The spine-bellied sea snake (*Hydrophis curtus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. curtus* is often associated with estuaries, continental shelves, reef-adjacent areas and soft substrate environments (e.g. seagrasses, sand, mud) to depths between 4 and 55 m (Rasmussen *et al.*, 2021b). The species though is known to have an affinity for seagrass meadows between 1–4 m deep (Udyawer *et al.*, 2016b). Some of the habitats utilised by this species coincide with areas fished by regional trawl operations. However, the species will find refuge in environments less conducive to trawling (e.g. seagrass), thus limiting overall regional interactions. Individuals will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). *Hydrophis curtus* interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). The score applied to the likelihood component may be an overestimate for this region. However, this species is known to have high interaction rates across the ECOTF (Courtney *et al.*, 2010), and a more precautionary approach was employed to	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Rasmussen *et al.*, 2021b), and reasonable post-interaction survival rates (*n* = 931 interactions with 5.8 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Rasmussen *et al.*, 2021b). *Hydrophis curtus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					account for the cumulative pressures on this species. This score could be further refined with additional information.	was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Elegant sea snake	*Hydrophis elegans*		3	2	**Likelihood**: The elegant sea snake (*Hydrophis elegans*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. elegans* is often associated with soft and hard substrates (e.g. sand, mud, coral reefs, seagrass, estuaries and rivers) to depths of 110 m (Milton, 2010a; Department of the Environment, 2024). This species is also known to have an affinity for seagrass meadows in depths less than three metres (Udyawer *et al.*, 2016b). Some of the habitats utilised by this species will coincide with areas fished by regional trawl operations. However, the species will find refuge in environments that are less conducive to trawling (e.g. seagrass), thus limiting overall regional interactions. Individuals will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). *Hydrophis elegans* interactions are more likely to occur in the Central Trawl Region. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010). Overall, the extent of regional-specific interactions with this species remains uncertain and as a result a precautionary score of possible (3) was applied. It is acknowledged that this score may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score may be further refined.	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Least Concern, stable population trend (Milton, 2010a), and moderate post-interaction survival rates (n = 347 interactions with 17 per cent mortality; Milton *et al.*, 2009; n = 186 interactions with 12.4 per cent mortality; Courtney *et al.*, 2010). Of notable importance, previous research has demonstrated a correlation between sea snake sizes and mortality (Courtney *et al.*, 2010). As a larger species attaining a length up to 260 cm (Department of the Environment, 2024), *H. elegans* may experience greater mortality rates. While potentially limited for larger individuals, *H. elegans* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
						fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spectacled sea snake	*Hydrophis kingii*		3	2	**Likelihood**: The spectacled sea snake (*Hydrophis kingii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. kingii* will inhabit a range of environments including soft substrates (e.g. sand, mud) and inter-reef areas to depths of 22 m (Milton *et al.*, 2010b). Given the overlap of suitable habitat and the targeted operational areas, *H. kingii* interactions are expected to occur in this region. This species though will be afforded protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, the Central Trawl Region is likely to experience marginally higher interaction rates for this species. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). Overall, the extent of regional-specific interactions with this species remains uncertain and as a result a precautionary score of possible (3) was applied. It is acknowledged that this score may be an overestimate and with improved information	**Consequence**: A review of available evidence did not support, a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Milton *et al.*, 2010b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton *et al.*, 2010b) and mortality rate estimates (n = 30 interactions with 26.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton *et al.*, 2010b). *Hydrophis kingii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					on sea snake bycatch compositions, this score could be refined in future risk assessments.	number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Turtle-headed sea snake	*Emydocephalus annulatus*		5	1	**Likelihood**: The turtle-headed sea snake (*Emydocephalus annulatus*) has a broad distribution along the east coast of Queensland (Lukoschek, 2010a; Udyawer *et al.*, 2020). Across its range, *E. annulatus* will inhabit sandy, rocky and coral reef environments to depths of 40 m (Lukoschek, 2010a). While some of these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be rare. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). The species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments as a low-risk element. Note–*Emydocephalus annulatus* was assigned a higher likelihood rating as the corresponding consequence score was very low. This species absence in a previous trawl bycatch study suggests it will experience refuge from operations and regional trawl fishing activities are unlikely to have a negative or long-term impact on populations.	**Consequence**: The available evidence supported a deviation from the default score of moderate (2) to minor (1) (Milton *et al.*, 2009; Courtney *et al.*, 2010). *Emydocephalus annulatus* was not encountered within a comprehensive study observing the presence of sea snake species in trawl bycatch (Courtney *et al.*, 2010). This suggests that trawl interactions in the ECOTF are rare. In the (unlikely) event of an interaction, *E. annulatus* will benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the weight accumulating within the codend of a net, thus minimising the risk of potential crushing if an encounter occurs (Milton *et al.*, 2009). *Emydocephalus annulatus* was included in the assessment due to sufficient uncertainty surrounding its distribution and interaction potential. The consequence score assigned to this species was considered reasonable due to the expected rarity of an encounter occurring in this region. With improved data on regional sea snake bycatch compositions, this species could potentially be removed from future assessments. For reference, *E. annulatus* has an extinction risk classification of Least Concern with a declining population trend (Lukoschek, 2010a).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
Olive-headed sea snake	*Hydrophis major*		2	2	**Likelihood**: The olive-headed sea snake (*Hydrophis major*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis major* is often associated with sandy and muddy environments in tidal creeks, offshore continental shelves or gulf areas to depths of 22 m (Guinea *et al.*, 2010). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, encounters are more likely to occur in the Central Trawl Region. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Guinea *et al.*, 2010) and moderate post-interaction survival rates (*n* = 163 interaction with 13 per cent mortality; Milton *et al.*, 2009; *n* = 55 interactions with 18.2 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Guinea *et al.*, 2010; Milton *et al.*, 2010b). *Hydrophis major* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
						ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Small-headed sea snake	*Hydrophis macdowelli*		2	2	**Likelihood**: The small-headed sea snake (*Hydrophis macdowelli*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis macdowelli* is often associated with sandy environments in estuary, nearshore or inter-reef areas to depths of 26 m (Milton *et al.*, 2010a). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this species could potentially be removed from future risk assessments involving this region.	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton *et al.*, 2010a) and mortality rates (*n* = 153 interactions with 33.3 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton *et al.*, 2010a). Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study only reported a three per cent mortality rate (Wassenberg *et al.*, 2001). While notably different, this distinction may be attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (*n* = 37). *Hydrophis macdowelli* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
						number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spotted sea snake	*Hydrophis ocellatus*		2	2	**Likelihood**: The spotted sea snake (*Hydrophis ocellatus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis ocellatus* is often associated with sandy inter-reefal environments to depths of 84 m (Milton, 2010b; Udyawer *et al.*, 2014). While these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton, 2010b) and comparatively lower survival rates (*n* = 94 interactions with 27.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton, 2010b). Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study reported a lower mortality rate of 18 per cent (Wassenberg *et al.*, 2001). While notably different, this distinction may be partially attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (*n* = 67). *Hydrophis ocellatus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
						While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Horned sea snake	*Hydrophis peronii*		2	2	**Likelihood**: The horned sea snake (*Hydrophis peronii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis peronii* is often associated with sandy, reef-adjacent environments to depths of 60 m (Lukoschek, 2010b). While these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (e.g. red spot king prawns) are actively targeted. This inference was	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Lukoschek, 2010b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), population trend (stable) (Lukoschek, 2010b) and moderate post-interaction survival rates (*n* = 271 interactions with 17.3 per cent mortality; Courtney *et al.*, 2010). *Hydrophis peronii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Beaked sea snake	*Hydrophis zweifeli*		2	2	**Likelihood**: The beaked sea snake (*Hydrophis zweifeli*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region (and otter trawl activities in general) may be uncommon. *Hydrophis zweifeli* is often associated with soft substrate environments (e.g. sand, mud) as well as estuaries and creeks in shallow waters (Great Barrier Reef Marine Park Authority, 2011). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment.	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Rasmussen, 2018). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Data Deficient, population trend (unknown) (Rasmussen, 2018) and high survival rates (n = 81 interactions with 1.2 per cent mortality; Courtney *et al.*, 2010). *Hydrophis zweifeli* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					When compared, encounters are more likely to occur in shallow-water operations outside of the ECOTF, namely the Black Tiger Prawn Broodstock Fishery and the River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments of this region as a low-risk element. Note–Information relating to this species habitat and depth preferences was based on an assessment of *Enhydrina schistosa* in the Great Barrier Reef (Great Barrier Reef Marine Park Authority, 2011). As a result of phylogenetic restructuring, *E. schistosa* has since been removed as a species occurring in Australian waters and replaced by *H. Zweifeli* (Ukuwela *et al.*, 2013; Udyawer *et al.*, 2016a).	(currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Stoke's sea snake	*Hydrophis stokesii*		1	2	**Likelihood**: The Stoke's sea snake (*Hydrophis stokesii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis stokesii* is associated with various substrates (e.g. reefs, mud, sand) and environments (e.g. harbours) to a maximum depth of 50 m (Sanders *et al.*, 2018). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment.	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), population trend (unknown) (Sanders *et al.*, 2018) and reasonable survival rates (n = 91 interactions with 10 per cent mortality; Milton *et al.*, 2009). Of interest, another study reported a higher mortality rate of 16.7 per cent (Courtney *et al.*, 2010). While notably different, this distinction may be partially attributed to the Courtney *et al.* (2010) study consisting of a smaller sample size (n = 30). *Hydrophis stokesii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					When compared, interactions are more likely to occur (though in low numbers) in the Central Trawl Region where reef-associated species (e.g. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments in this region as a low-risk element.	and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Northern Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Sharks						
Collared carpetshark	*Parascyllium collare*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Brownbanded bambooshark	*Chiloscyllium punctatum*		5	1	**Likelihood**: The brownbanded bambooshark (*Chiloscyllium punctatum*) was assigned a higher likelihood rating as the corresponding consequence score was very low. All the available evidence (including this species current extinction risk classification and fishery status) suggests that trawl fishing activities within this region will not have a negative or long-term impact on this species (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There is reasonable confidence that current fishing activities within the Northern Trawl Region will not have a significant	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Chiloscyllium punctatum* is a common benthic shark species and it is abundant within its preferred habitats (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There are few concerns surrounding the long-term sustainability of the species and it has been classified as Least Concern under the IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					impact on regional populations and/or contribute to a significant, negative consequence for this species.	indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023b). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The high productivity of *C. punctatum* contributed to these findings. Fishing activities within the current fishing environment are unlikely to result in a long-term, negative consequence for this species.
Colclough's shark	*Brachaelurus colcloughi*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Crested hornshark	*Heterodontus galeatus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Eastern angelshark	*Squatina albipunctata*		1	3	**Likelihood**: There is evidence that the eastern angelshark (*Squatina albipunctata*) will interact with east coast trawl operations and be caught as bycatch. Based on the available information, interactions with this species are more likely to occur in the Southern Offshore Trawl Region (Rigby *et al.*, 2016b; Campbell *et al.*, 2017). While the distribution of *S. albipunctata* overlaps with the Northern Trawl Region, the depth profile (35–415 m) of this species provides it with a high degree of natural protection. This inference is supported by the *Action Plan for Australian Sharks and Rays* which notes that *S. albipunctata* experiences lower fishing pressures in northeast Queensland (Kyne *et al.*, 2021). These findings supported the assignment of a lower likelihood score for this species in this region. With improved information on regional elasmobranch bycatch compositions, this species could potentially be removed from future assessments as a low-risk element.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given the current understanding of the *S. albipunctata* population trend (depleting; Kyne *et al.*, 2023f) and Australian extinction risk classification (Vulnerable; Kyne *et al.*, 2021). These factors make the species more vulnerable to trawl fishing activities and reduce its capacity to absorb regional fishing-related mortalities. The Northern Trawl Region represents the northern extent of the eastern angelshark range. This will have some bearing on how frequently this species interacts with regional trawl fishers and, by extension, their potential to contribute to an undesirable event. While noting these limitations, the status of the population on the Australian east coast places this species in a more precarious position and increases the probability that current fishing levels will have a negative impact on regional populations.
Eastern banded catshark	*Atelomycterus marnkalha*		2	2	**Likelihood**: The eastern banded catshark (*Atelomycterus marnkalha*) is an endemic benthic shark with limited data sets.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					The available evidence suggests that this species is more likely to interact with trawl operations in central and northern Queensland (Jacobsen & Bennett, 2007; Kyne *et al.*, 2023m). Interaction rates for this species though are expected to be low when compared to other benthic sharks and batoids (pers. comm. Ian Jacobsen). Habitat information is limited for this species, although specimens were primarily caught in sandy to coarse rubble substrates (Jacobsen & Bennett, 2007; Pitcher *et al.*, 2007). This suggests that some of the habitats preferred by this species are less conducive to trawl fishing activities. This species may also be afforded additional refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). A weight-of-evidence approach indicates that there is a lower likelihood of regional trawl fishing activities negatively impacting *A. marnkalha* populations. This inference though has yet to be fully tested and future assessments would benefit from additional information on regional elasmobranch bycatch compositions. Similarly, with improved information on regional shark bycatch compositions, *A. marnkalha* could potentially be removed from risk assessments involving this region.	The assigned score is considered appropriate given the current understanding of the *A. marnkalha* Australian extinction risk classification (Least Concern), population status (nothing to infer or suspect a population reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023m). While information levels for *A. marnkalha* are limited, a weight-of-evidence approach suggests that the consequences for this species are less severe. Accordingly, it was assigned a lower score for this aspect of the assessment. Future risk assessments would benefit from additional information on the elasmobranch catch compositions in this region. This information could be used to further refine the *A. marnkalha* risk profile and determine the need to undertake further assessment.
Zebra shark	*Stegostoma tigrinum*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the zebra shark (*Stegostoma tigrinum*). The species will derive considerable benefit from the use of a TED and be afforded refuge from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). While immature animals will still be caught as bycatch, the majority of sub-adult and adult specimens will likely escape through the TED opening (Brewer *et al.*, 2006; Campbell *et al.*, 2020). Applying a weight-of-evidence approach indicates that there is a lower likelihood of the consequence coming to fruition in the	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Stegostoma tigrinum* is a common shark with a wide northern and eastern Australian distribution. The productivity of this species is considered low for an oviparous (egg-laying) species. However, there is limited (current) concerns surrounding the conservation status or long-term sustainability of the species. *Stegostoma tigrinum* has an Australian extinction risk classification of Least Concern with nothing to infer or suspect a population decline across its known range (Kyne *et al.*, 2021). A corresponding status assessment also indicates that

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					Northern Trawl Region and/or within the current fishing environment.	it is being sustainably fished across its known range (Kyne *et al.*, 2023l). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The above considerations indicate that current fishing activities pose limited consequences for the long-term conservation status or sustainability of this species
Piked spurdog	*Squalus megalops*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Australian weasel shark	*Hemigaleus australiensis*		2	2	**Likelihood**: Bycatch surveys indicate that the Australian weasel shark (*Hemigaleus australiensis*) will interact with the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Campbell, 2022). However, there is limited information on the current rates of capture and/or its capacity to survive a trawl interaction. Expectations are that *H. australiensis* interactions will be less frequent, particularly when compared to other benthic shark and ray species. It is further hypothesised that trawl fishing activities within the Northern Trawl Region will not lead to a long-term, negative change to the conservation / fishery status of this species. This inference is supported by evidence obtained through third-party assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australiensis*. *Hemigaleus australiensis* is a small, wide-spread whaler species that is fairly common/abundant throughout its known distribution. Anecdotal evidence suggests the species is highly productive and fast growing (Ebert *et al.*, 2021; Kyne *et al.*, 2021). These factors increase the capacity of the species to absorb fishing mortalities and rebound after potential decline. As it is a smaller whaler species, *H. australiensis* will derive less benefit from the use of a TED i.e. both immature and mature sharks will be caught as bycatch. At present there is limited information on how successfully *H. australiensis* survives a trawl fishing event. While noting the above deficiencies, evidence indicates that key risks for this species are currently being managed. The species has an Australian extinction risk classification of Least Concern (Kyne *et al.*, 2021) with corresponding status assessments indicating that the species is being sustainably fished across its known distribution. Interactions with this species are also more likely in gillnet and line fisheries. These findings were accounted for in the consequence assessment.
Pale spotted catshark	*Asymbolus pallidus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
Grey spotted catshark	*Asymbolus analis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Orange spotted catshark	*Asymbolus rubiginosus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Batoids						
Australian butterfly ray	*Gymnura australis*		3	2	**Likelihood**: Operations within the Northern Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting this overlap, the Australian butterfly ray (*Gymnura australis*) is broadly distributed (Jacobsen & Bennett, 2009; Last *et al.*, 2016b) and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Within the Northern Trawl Region, the species may be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *G. australis* is frequently found in soft-bottom substrates that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). These preferences factored into the species receiving a higher likelihood score. Bycatch data for the ECOTF provides limited insight into *G. australis* interaction rates and landing/release fates (alive, dead or moribund). However, a weight-of-evidence approach suggests that it may be one of the more common elasmobranchs caught in prawn-trawl fisheries (Courtney *et al.*, 2007; Jacobsen, 2007; Pitcher *et al.*, 2007; Kyne, 2008). Catch data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score.	**Consequence**: The available evidence, including that contained in third-party assessments (Campbell *et al.,* 2017; Kyne *et al.,* 2021), supported a downgrading of the default consequence score from severe (3) to moderate (2). The reduced score better reflects what is known about the conservation / extinction risk status of this species (Least Concern), population trend (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023o). While noting these considerations, the use of a TED/BRD will be less effective for this species, with immature individuals and adults likely to be caught as trawl bycatch (Jacobsen, 2007). Once captured, *G. australis* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Campbell *et al.*, 2017). This, in part, is due to the species having a very flattened morphology and limited external protections e.g. hardened denticles or skin (pers. comm. I. Jacobsen). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species.	
Yellowback stingaree	*Urolophus sufflavus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Patchwork stingaree	*Urolophus flavomosaicus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sandyback stingaree	*Urolophus bucculentus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Kapala stingaree	*Urolophus kapalensis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Greenback stingaree	*Urolophus viridis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Common stingaree	*Trygonoptera testacea*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Australian whipray	*Himantura australis*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the Australian whipray (*Himantura australis*). Due to its depth profile (0–45 m), this species will only interact with operations targeting prawns in shallower waters (Last *et al.*, 2016b; Kyne *et al.*, 2023p). If and when this species is caught in the ECOTF, a high proportion of the sub-adults and adults will experience a contact without capture event. While difficult to quantify, contact without capture events are less likely to end in significant injuries or impede the long-term survivability of the animal. *Himantura australis* will also be afforded refuge from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in the	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australis*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern), (suspected) stable population trend (Kyne *et al.*, 2021) and sustainability status (Sustainable; Kyne *et al.*, 2023p). The maximum disc width of this species assists in terms of reducing the size of the potential consequence. *Himantura australis* reaches at least 183 cm disc width and the vast majority of sub-adult and adult specimens, if caught, will be excluded from the net via the TED. It is recognised that a score of moderate (2) may be an overestimate for this species. With additional information on

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					Northern Trawl Region and/or within the current fishing environment. With additional information on regional bycatch compositions, this species could potentially be removed from future ERAs involving this region.	regional elasmobranch catch rates, this score could be further refined.
Blackspotted whipray	*Maculabatis astra*		3	2	**Likelihood**: Trawl operators within the Northern Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Kyne, 2008; Pears *et al.*, 2012b). While noting this overlap, the blackspotted whipray (*Maculabatis astra*) is broadly distributed and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. astra* interaction rates and landing/release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. The species will be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *M. astra* are commonly found in habitats that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). Based on the available data, interactions with this species are more likely to occur in waters <75 m and in operations targeting tiger, endeavour and banana prawns (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. astra* and the brown whipray (*M. toshi*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	**Consequence**: The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Kyne *et al.*, 2021; Kyne *et al.*, 2023q). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023q). As a smaller batoid, *M. astra* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 92 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality rates are largely unknown for this species (Kyne *et al.*, 2023q). However, a composite study including both *M. astra* and *M. toshi* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. astra* as a standalone species. These factors limited refinements to the consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
Brown whipray	*Maculabatis toshi*		3	2	**Likelihood**: Trawl operators within the Northern Trawl Region fish in habitats preferred by the brown whipray (*Maculabatis toshi*) and there is evidence that it forms part of the elasmobranch trawl bycatch across its Queensland range (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). While acknowledging this overlap, notable portions of this species' range will experience light or negligible fishing (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into the *M. toshi* interaction rates and landing/release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. The species will be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *M. toshi* are commonly found in soft-bottom substrates that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). As with the blackspotted whipray (*M. astra*), *M. toshi* interactions are more likely to occur in waters <75 m and in operations targeting tiger, endeavour and banana prawns (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). With improved information on elasmobranch bycatch compositions, this score could potentially be refined in future risk assessments involving this region. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. toshi* and *M. astra*. Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	**Consequence**: The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trend (nothing to infer a reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023q). As a smaller batoid, *M. toshi* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 82 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality levels for this species are largely unknown (Kyne *et al.*, 2023q). However, a composite study including both *M. toshi* and *M. astra* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. toshi* as a standalone species. These factors limited refinements to the consequence score for this species.
Estuary stingray	*Hemitrygon fluviorum*		3	3	**Likelihood**: The depth profile (0–28 m) and distribution of the estuary stingray (*Hemitrygon fluviorum*) will overlap with the effort footprint of the Northern Trawl Region. Within this region, interactions are more likely to occur in trawl operations	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023w).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					targeting prawns in shallower water environments and in closer proximity to estuaries or mangrove lined stretches of coastline. *Hemitrygon fluviorum* will be exposed to lower levels of effort and experience fewer fishing pressures within this region, particularly at the northern extent of its range. The interaction potential for this species is also expected to be higher in trawl regions situated further south (e.g. Moreton Bay) and within the River and Inshore Beam Trawl Fishery. While noting the above, there is (currently) limited information on *H. fluviorum* interactions in the ECOTF. This absence of information extends to each region and makes it more difficult to quantify or assess the extent of the risk posed to this species (e.g. negligible, low, medium or high). For these reasons, the species was assigned a more precautionary likelihood score for the Northern Trawl Region. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. With improved information on regional elasmobranch catch compositions, this species could potentially be removed from future risk assessments involving this region.	The revised score better reflects what is known about this species Australian extinction risk classification (Vulnerable), population trends (suspected reduction of greater than 30 per cent) and protection status under the *Nature Conservation Act 1992* (Near Threatened; Queensland Government, 1992; Kyne *et al.*, 2021). It is recognised that the threats posed to the species are wider than commercial fishing with habitat degradation also identified as a key threat (Kyne *et al.*, 2021). Fishing mortalities though have the potential to compound historic range contractions and population declines. Some of the potential consequences being further range contractions, reduced genetic diversity and the fragmentation of regional populations. As this species prefers brackish waters and mangrove-fringed estuaries (Last *et al.*, 2016b; Kyne *et al.*, 2023w), a consequence score of severe may be an overestimate for this region. There is, however, limited information on elasmobranch catch compositions in the Northern Trawl Region. This makes it difficult to assess the extent and frequency (none, low, medium or high) of interactions with this species.
Coral sea maskray	*Neotrygon trigonoides*		3	2	**Likelihood**: The Coral Sea maskray (*Neotrygon trigonoides*) will interact with east coast trawl operations and be caught as bycatch in the Northern Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon trigonoides* is a common elasmobranch that is often associated with reefal and continental shelf environments to depths of 170 m (Kyne *et al.*, 2021). The species will be afforded a degree of natural protection from trawl fishing and it is also found in areas exposed to fewer fishing pressures (Kyne *et al.*, 2021). Similarly, a proportion of the population will be protected from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Zoning Plan. These factors reduce the likelihood of the consequence coming to fruition under the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. trigonoides* is a key component of the elasmobranch catch in the scallop fishery (Courtney *et*	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. trigonoides*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Sherman *et al.*, 2021), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023u). *Neotrygon trigonoides* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. trigonoides* are likely to have high levels of post-interaction mortality (Kyne *et al.*, 2023u). These factors limited

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					al., 2007). Studies also demonstrate this species will interact with the shallow-water eastern king prawn and tiger/endeavour prawn sectors (Courtney *et al.*, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. Capture rates are also expected to be higher for this species as TEDs are less effective in terms of excluding smaller rays from the catch. This inference is supported by results from bycatch composition studies which show *N. trigonoides* are caught with some frequency (*n* = 385; Campbell *et al.*, 2017). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments. Note–Catch data for this species was typically reported as *Dasyatis kuhlii* or *N. kuhlii* (Jacobsen, 2007; Kyne, 2008; Last *et al.*, 2016a; Last *et al.*, 2016b).	refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Speckled maskray	*Neotrygon picta*		3	2	**Likelihood**: The speckled maskray (*Neotrygon picta*) will interact with east coast trawl operations and be caught as bycatch in the Northern Trawl Region (Jacobsen, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon picta* is a common elasmobranch that is often associated with soft substrates and continental shelf environments to depths between 5–100 m (Kyne *et al.*, 2021; Bray, Undated). Some of these areas will coincide with regions actively fished by trawl operators. It will also be found in areas where fishing is either absent or limited (Kyne *et al.*, 2021). Similarly, *N. picta* will be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). These factors reduce the likelihood of the consequence coming to fruition in the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. picta* is a key component of the elasmobranch catch in the scallop sector (Kyne, 2008).	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. picta*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Pierce *et al.*, 2015), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023af). *Neotrygon picta* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. picta* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Kyne, 2008). These factors

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					Bycatch studies also suggest that the species will be caught in shallow-water operations targeting tiger and endeavour prawns (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. This uncertainty was taken into consideration as part of this assessment and contributed to *N. picta* receiving a marginally higher likelihood score. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Bottlenose wedgefish	*Rhynchobatus australiae*		3	2	**Likelihood**: The bottlenose wedgefish (*Rhynchobatus australiae*) will interact with east coast trawl operations and be caught as bycatch in the Northern Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Rhynchobatus australiae* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths of 60 m (Kyne, 2008; Kyne *et al.*, 2021). While studies are limited, the available data indicates that *R. australiae* will be caught as bycatch in the scallop, tiger and endeavour prawn sectors (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). Historic bycatch records for *R. australiae* were reported in a complex which included the eyebrow wedgefish (*R. palpebratus*) or under the synonym *R. djiddensis*. This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. australiae*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species Australian extinction risk classification (Near Threatened; Kyne *et al.*, 2021), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023r). As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. australiae* from the catch (Campbell *et al.*, 2020). The size of *R. australiae* may also assist in terms of it surviving a trawl interaction (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). This inference though requires further testing and cannot be confirmed without additional information on *R. australiae* interaction rates and release fates.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					on bycatch compositions, this score may be refined in future assessments.	
Eyebrow wedgefish	*Rhynchobatus palpebratus*		3	2	**Likelihood**: The eyebrow wedgefish (*Rhynchobatus palpebratus*) will interact with east coast trawl operations and be caught as bycatch in the Northern Trawl Region (Kyne, 2008; Pears *et al.*, 2012b). *Rhynchobatus palpebratus* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths between 5–60 m (Kyne, 2008; Kyne *et al.*, 2021). While studies are limited, the available data indicates that *R. palpebratus* will be caught as bycatch in the scallop, tiger and endeavour prawn sectors (Kyne, 2008; Pears *et al.*, 2012b). Historic bycatch records for *R. palpebratus* were reported in a complex which included the bottlenose wedgefish (*R. australiae*) or under the synonym *R. djiddensis*. This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. palpebratus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Near Threatened; Kyne & Rigby, 2019), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023x). As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. palpebratus* (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The size of *R. palpebratus* may also assist in terms of it surviving a trawl interaction (Kyne, 2008). This inference though requires further testing and cannot be confirmed without additional information on *R. palpebratus* interaction rates and release fates.
Eastern shovelnose ray	*Aptychotrema rostrata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Giant guitarfish	*Glaucostegus typus*		2	2	**Likelihood**: The giant guitarfish (*Glaucostegus typus*) has been recorded as bycatch in the ECOTF and the species will (likely) interact with regional trawl operations (Pears *et al.*, 2012b; Campbell *et al.*, 2017). *Glaucostegus typus* inhabits a range of demersal environments including intertidal and offshore areas to depths of 100 m (Kyne *et al.*, 2021; Kyne *et al.*, 2023y). While these habitat preferences overlap with the ECOTF, areas of its distribution will have limited exposure to fishing activities (Kyne	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *G. typus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of its Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021). Within Australia, *G. typus* has a (suspected) stable population (Kyne *et al.*, 2021) and it has been assessed as sustainably fished across its known distribution (Kyne *et al.*, 2023y).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					et al., 2021). Juveniles also display an affinity for intertidal areas (Kyne *et al.*, 2021) which may assist in terms of reducing their exposure to trawl fishing during these early life stages. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in this region and/or within the current fishing environment. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	Results from previous risk assessments also supported the assignment of a consequence score at the lower end of the spectrum (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *G. typus* is a large batoid, it will derive considerable benefit from the use of a TED (Brewer *et al.*, 2004; Brewer *et al.*, 2006). While immature rays may still be caught, most sub-adult and adult specimens will be excluded from the net via the TED. Data on *G. typus* post-interaction mortality rates are limited and the outputs vary between assessments. One report with a relatively small sample size (*n* = 10) recorded a 100 per cent mortality rate (Campbell *et al.*, 2017). In contrast, data provided through the Fishery Observer Program demonstrated more moderate survival levels (19 out of 28 individuals released alive; Pears *et al.*, 2012b). These differing results combined with an absence of information on regional catch rates introduced an element of uncertainty into this assessment. This uncertainty supported the retention of a moderate (2) rating *versus* a downgraded score of minor (1).
Sydney skate	*Dentiraja australis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Endeavour skate	*Dentiraja endeavouri*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Argus skate	*Dentiraja polyommata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Narrow sawfish	*Anoxypristis cuspidata*		3	3	**Likelihood**: The depth profile (0–128 m) and distribution of the narrow sawfish (*Anoxypristis cuspidata*) overlaps with the effort footprint of the Northern Trawl Region. Data compiled through the TEPA logbooks indicates that this species will interact with regional trawl operations. These interactions are more likely to occur in shallow water environments (<40 m) and in operations targeting tiger and endeavour prawns. However, the extent of these interactions have yet to be fully quantified or validated. Similarly, it is unclear how much protection this species is afforded through	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3). The revised score better reflects what is known about this species population trend (suspected reduction >30 per cent) and extinction risk classification (Vulnerable; Kyne *et al.*, 2021). It also aligns more closely with stock status assessments which classified the *A. cuspidata* population as Depleting (Kyne *et al.*, 2023ac) and broader concerns surrounding the long-term sustainability of the species e.g. is

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This species is expected to interact more frequently with trawl operators fishing in northern Australia. Evidently, *A. cuspidata* is one of the more common elasmobranch bycatch species caught in the NPF (Stobutzki *et al.*, 2002; Brewer *et al.*, 2004; Brewer *et al.*, 2006; Campbell *et al.*, 2020). While noting the above, there is (currently) limited information on *A. cuspidata* interactions in the ECOTF. This absence of information extends to all ECOTF regions and makes it more difficult to quantify or assess the extent of the risk posed by this fishery (e.g. negligible, low, medium or high). For these reasons, the species was assigned a more precautionary likelihood score for the Northern Trawl Region. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. With improved information on elasmobranch bycatch compositions, this score could be refined in future risk assessments.	considered Critically Endangered on a global scale (Haque *et al.*, 2023). Other considerations that contributed to this decision included a) the importance of the region as one of the few remaining sawfish strongholds (Department of the Environment, 2015; Kyne *et al.*, 2021), b) the potential for this species to incur *in-situ* or post-interaction mortalities and c) the increased risk of injury due to entanglements (due to their large rostrums). Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (moderate, 2). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing activities to contribute to an unintended consequence e.g. continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that *A. cuspidata* be listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – bringing it into line with other sawfish species (Kyne *et al.*, 2021).
Green sawfish	*Pristis zijsron*		3	4	**Likelihood**: The green sawfish (*Pristis zijsron*) has experienced considerable range contractions and population declines on the Queensland east coast. These contractions have led to the hypothesis that the species is now regionally extirpated in waters south of the Whitsundays (Peverell, 2005; Department of the Environment, 2019; Kyne *et al.*, 2023z). This, by default, leaves areas covered by the Northern Trawl Region as one of the few remaining strongholds for this species on the Queensland east coast. Within the ECOTF, green sawfish interactions are more likely to occur within the Northern and Central regions. These interactions have the potential to exacerbate historic (negative) population trends and increases the likelihood of the	**Consequence**: The available evidence, including that contained in third-party assessments supported increasing the default consequence score from severe (3) to major (4). The revised score better reflects what is known about the *P. zijsron* population trends (suspected reduction >80 per cent) and extinction risk classification (Critically Endangered; Kyne *et al.*, 2021). Other considerations that contributed to this decision included a) the importance of this region as one of the few remaining green sawfish strongholds on the Queensland east coast (Department of the Environment, 2015; Kyne *et al.*, 2021), b) the potential for this species to incur *in-situ* or post-interaction mortalities and c) the increased risk of injury due to entanglements (due to their large rostrums).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Northern	L	C	Likelihood	Consequence
					consequence coming to fruition within the current fishing environment. Given the extent of the declines, this could theoretically occur at low rates of fishing mortality. Sawfish data for the ECOTF has poor species resolution and potentially underestimates the total number of fishing mortalities. In reality, it is difficult to ascertain how frequently this species interacts with the ECOTF and/or determine the likelihood of the fishery impacting regional populations. This uncertainty required the adoption of a more precautionary assessment approach and the assignment of a higher score for this component of the assessment. It is recognised that the likelihood or potential for *P. zijsron* interactions to occur in this region have declined through time. For example, effort levels across the ECOTF have reduced over time and remain well below historic averages. While not universal, declining effort will frequently result in lower levels of bycatch and, for some species, a reduced interaction potential. While noting these declines, the risk or likelihood of *P. zijsron* experiencing a significant consequence remains high. This is due to the fact that the species has experienced significant range contractions / population declines. These declines mean that that even small levels of fishing mortality could contribute to an undesirable consequence. Given this potential, it was determined that *P. zijsron* required a higher likelihood score for this region. The continued roll-out of the Data Validation Plan provides an ideal opportunity to improve our understanding of sawfish interactions in the Northern Trawl Region. With additional information, the regional risk profile for this species could be further refined and improved.	Any interaction with this species will be with a population that has experienced some decline and/or may be with a remnant population. The potential consequences for this species are significant and could include exacerbating historic range contractions, a reduction in genetic diversity and the further fragmentation of a remnant population/s. These (potential) impacts warranted the assignment of a major (4) consequence score. Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (severe, 3). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing activities to contribute to an unintended consequence e.g. continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that the EPBC listing for *P. zijsron* be increased from Vulnerable to Critically Endangered (Kyne *et al.*, 2021). If this recommendation were adopted, it would see *P. zijsron* listed in the same category as the speartooth shark (*Glyphis glyphis*) and above a number of the marine turtle species.

Data Report: Appendix B—Preliminary scoring and justifications of the Likelihood and Consequence Analysis for species assessed as part of the Central Trawl Regional Risk Assessment

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Marine turtles						
Loggerhead turtle	*Caretta caretta*		3	2	**Likelihood:** The likelihood assessment considered the distribution and habitat preferences of each species when reviewing their potential to interact with trawl operations in the Central Trawl Region. These considerations included the location and prevalence of foraging, nesting and rookery sites along the Queensland east coast (Limpus, 2007a; b; 2008a; b; c; 2009). The likelihood assessment also considered the level of uncertainty surrounding the data on regional marine turtle interaction rates. For all species, excluding the leatherback turtle (*Dermochelys coriacea*), a weight-of-evidence approach supported the assignment of a more conservative likelihood score. Across the complex, data deficiencies made it more difficult to differentiate between species and/or identify where there was a lower likelihood of the consequence coming to fruition within the current fishing environment. Accordingly, some of the species may have been assigned a more conservative or precautionary score for this aspect of the Likelihood and Consequence Analysis (LCA). *Dermochelys coriacea* displays an affinity for pelagic water environments and the species is less likely to interact with regional trawl operations (Department of the Environment, 2023c). While historic records show that *D. coriacea* has previously nested in central-southern Queensland, there has been a progressive decline in the breeding frequency of this species on the Queensland east coast (Limpus, 2009). For this species, a score of remote (1) was considered appropriate for this aspect of the LCA. Of the remaining species, the green turtle (*Chelonia mydas*) and flatback turtle (*Natator depressus*) have prominent nesting/breeding or foraging sites located in the Central Trawl Region (Limpus, 2007b; 2008b). These behaviours increase	**Consequence**: The available evidence including third-party assessments did not support a deviation from the default consequence score of moderate (2) for these species (Subcommittee, 1996; Seminoff, 2004; Abreu-Grobois & Plotkin, 2008; Wallace *et al.*, 2013; Casale & Tucker, 2017; Department of the Environment, 2023f; a; b; c; d; e). A number of measures implemented across the East Coast Otter Trawl Fishery (ECOTF) reduce the impact of the fishery on this complex and, therefore, the consequence e.g. the use of a Turtle Excluder Device (TED), Bycatch Reduction Devices (BRDs) and an extensive system of spatial/temporal closures. Effort levels for the ECOTF have also declined through time and are now capped under the harvest strategies (Department of Agriculture and Fisheries, 2021a; e; c; d; b; 2023). In past Ecological Risk Assessments (ERAs), a decline in effort has been directly linked to a decline in risk levels (Pears *et al.*, 2012b; Jacobsen *et al.*, 2015). While difficult to quantify, effort has declined since these assessments and it is reasonable to assume that the consequences of trawl fishing have not increased in the proceeding years. These measures support the assignment of a consequence score at the lower end of the spectrum i.e. moderate (2) *versus* severe (3) or major (4). While TEDs will be effective at reducing the capture of marine turtles, data submitted through the Threatened, Endangered and Protected Animals (TEPA) logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution and may underestimate the total number of marine turtle interactions. The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent
Green turtle	*Chelonia mydas*		3	2		
Leatherback turtle	*Dermochelys coriacea*		1	2		
Hawksbill turtle	*Eretmochelys imbricata*		3	2		
Olive ridley turtle	*Lepidochelys olivacea*		3	2		
Flatback turtle	*Natator depressus*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					the likelihood of a *C. mydas* or *N. depressus* interacting with regional trawl operations. While not universal, key nesting and rookery sites for the hawksbill (*Eretmochelys imbricata*) and loggerhead turtle (*Caretta caretta*) are located further north and south respectively. However, both are migratory species and may be encountered with more frequency in this region (Limpus, 2007a; 2008a). While breeding sites for the olive ridley turtle (*Lepidochelys olivacea*) are all located in northern Australia, this species is more commonly encountered in tropical waters. This increases the likelihood that this species will interact with regional trawl fishing activities (Limpus, 2007a; b; 2008b; c). Interactions with this species are arguably more likely in the Northern Trawl Region. With that said, *L. olivacea* is considered one of the five 'year round' resident turtle species in Moreton Bay, south-east Queensland (Department of Environment Science and Innovation, 2021). The ongoing roll-out of the Data Validation Plan may provide further avenues to review and refine the likelihood scores for this region. Depending on the outputs of this program, the scope of the assessment could also be reviewed and refined e.g. removing *D. coriacea* from future assessments as a low-risk element.	fisheries, namely the Northern Prawn Fishery (NPF), supports the hypothesis that the number of marine turtle interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining the consequence score more difficult. Taking a weight-of-evidence approach to the consequence assessment, a score of moderate (2) was considered appropriate for this region. This score takes into consideration risk mitigation measures, declining effort trends and management limitations e.g. an inability to verify reported interaction / release fates and uncertainty surrounding the species that interact with trawl fishers in this region.
Syngnathids						
Tiger pipefish	*Filicampus tigris*		3	2	**Likelihood:** A review of species distributions and habitat preferences determined that the four listed species have a higher potential to interact with regional trawl fishing activities. Information on the habitat preferences of these four species is readily available and suggest that most occupy a range of both hard and soft substrates to varying depths. While they will be found in grounds accessed by trawl fishers, not all habitats will be conducive to trawl fishing. They will also be afforded a degree of protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of moderate (2) (Pollom, 2016a; Pollom, 2017b; a). This score is considered appropriate given a) the inability to verify reported interaction and release fates and b) species extinction risk classifications. While BRDs may be effective at reducing the capture of some syngnathids, a high proportion will (likely) be captured within the codend of a trawl net. Of note, all interactions with non-retainable syngnathids are required to be reported within the TEPA logbook. However,
Spiny seahorse	*Hippocampus spinosissimus*		3	2		
Great seahorse	*Hippocampus kelloggi*		3	2		
Bentstick pipefish	*Trachyrhamphus bicoarctatus*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Distributional data was less reliable with information sources often having conflicting range information. This issue is complicated by the fact that the syngnathid taxonomic history is complex and somewhat fluid i.e. varying classifications and, at times, a lack of uniformity. This makes it more difficult to define/quantify regional distributions. These combined factors increased the level of uncertainty regarding the interaction potential between these species and trawling apparatus. As a result, a more conservative approach was adopted and a likelihood score of possible (3) was applied. It is acknowledged that these scores may be an overestimate for this region. With improved information on syngnathid bycatch compositions, these scores may be refined in future risk assessments.	data reported through these logbooks has poor resolution and provides limited insight into regional catch compositions. As there is currently no mechanism in place to validate TEPA logbook data, a score of moderate was considered reasonable. With an effective mechanism to verify interaction and release fates, these scores could be further refined.
White's seahorse	*Hippocampus whitei*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Duncker's pipehorse	*Solegnathus dunckeri*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Pallid pipehorse	*Solegnathus hardwickii*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Pallid pipehorse (*Solegnathus hardwickii*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus hardwickii* occupies a range of habitats including those associated with sponges, gorgonians and possibly coral reef edges, typically at depths between 12 and 100 m (Pollom, 2017d). These habitat preferences will provide *S. hardwickii* with a degree of natural protection from trawl fishing activities. It will also be provided (some) refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). These factors will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Solegnathus hardwickii* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of	**Consequence**: There was sufficient evidence to support a deviation from the default consequence score of moderate (2) to severe (3). This score was considered appropriate as this species will have similar vulnerabilities to the Duncker's pipehorse (*S. dunckeri* [assessed in the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions]). Key considerations given to this score included a) the ineffectiveness of TEDs/BRDs in terms of excluding this species from the net, b) a species extinction risk classification of Data Deficient (Pollom, 2017d) and c) the allowable retention of this species (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Queensland, 2019b). Based on a review of historic syngnathid catch it is hypothesised that the interaction potential for this species will be higher in operations fishing further south. However, such inferences must be observed with caution as records of syngnathid harvest do not account for all interactions (e.g. discarded individuals). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	Based on these factors, a score of moderate was considered reasonable for this species. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Straightstick pipefish	*Trachyrhamphus longirostris*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Ribboned pipefish	*Haliichthys taeniophorus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sea snakes						
Reef shallows sea snake	*Aipysurus duboisii*		4	2	**Likelihood**: The reef shallows sea snake (*Aipysurus duboisii)* has a distribution which extends along the entire east coast of Queensland (Lukoschek *et al.*, 2010; Udyawer *et al.*, 2020). Across its range, *A. duboisii* will inhabit seagrass beds, corals (over sand) and reef-adjacent areas to a depth of 80 m (Courtney *et al.*, 2010; Lukoschek *et al.*, 2010). While the species has a broad bathymetric range, it will typically occur in shallow environments to a depth of 50 m (Lukoschek *et al.*, 2010). Habitat and depth range preferences of *A. duboisii* increase its interaction potential in the Central Trawl Region. This inference is supported by results from a bycatch study which demonstrated that this species exhibited the second highest number of interactions within the red spot king prawn sector (*n* = 432; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Lukoschek *et al.*, 2010). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Lukoschek *et al.*, 2010) and mortality rate estimates (*n* = 465 interactions with 5 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as the most recent assessment suggests it has a decreasing population trend (Lukoschek *et al.*, 2010). *Aipysurus duboisii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					score assigned to the likelihood component (Udyawer *et al.*, 2020). Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Mosaic sea snake	*Aipysurus mosaicus*		2	2	**Likelihood**: The mosaic sea snake (*Aipysurus mosaicus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus mosaicus* is often associated with soft substrates (e.g. mud, estuaries etc.) to a depth of 50 m (Rasmussen *et al.*, 2021a). While some of these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Aipysurus mosaicus* interactions are more likely to occur in shallow-water operations outside of the ECOTF, namely the River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions	**Consequence**: A review of available evidence supported increasing the consequence score of minor (1) to moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021a). This decision largely reflects the level of uncertainty surrounding regional sea snake catch compositions (see below). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), stable population trend (Rasmussen *et al.*, 2021a), and reasonable post-interaction survival rates (n = 95 interactions with 5.3 per cent mortality; Courtney *et al.*, 2010). *Aipysurus mosaicus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score may be refined in future risk assessments. Note–While limited, any interactions eventuating within the ECOTF are more likely to be attributed to regions targeting red spot king prawns and tiger/endeavour prawns.	(currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Based on this information it is expected that this species will be capable of withstanding trawl interactions to some degree. However, due to limited sample sizes within sea snake bycatch studies, a more precautionary score was adopted (Milton *et al.*, 2009; Courtney *et al.*, 2010). Given the available information, a rating of moderate (2) was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Olive sea snake	*Aipysurus laevis*		4	2	**Likelihood**: The olive sea snake (*Aipysurus laevis*) has a broad distribution extending along the east coast of Queensland (Udyawer *et al.*, 2020; Crowe-Riddell *et al.*, 2021). Across its range, *A. laevis* will inhabit a range of environments including soft and hard substrates (e.g. sand, coral reefs and inter-tidal areas) to depths between 10 and 40 m (Crowe-Riddell *et al.*, 2021). Of these habitats, this species is more commonly associated with reefs (Udyawer *et al.*, 2014; Crowe-Riddell *et al.*, 2021). Habitat and depth range preferences for *A. laevis* increase its interaction potential in the Central Trawl Region. This inference is supported by results from a bycatch study which demonstrated that this species exhibited the highest number of interactions within the red spot king prawn sector (*n* = 478;	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Crowe-Riddell *et al.*, 2021). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Crowe-Riddell *et al.*, 2021), and reasonable post-interaction survival rates (*n* = 515 interactions with 9.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Crowe-Riddell *et al.*, 2021). *Aipysurus laevis* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spine-bellied sea snake	*Hydrophis curtus*		4	2	**Likelihood**: Evidence suggests that the spine-bellied sea snake (*Hydrophis curtus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. curtus* is often associated with estuaries, continental shelves, reef-adjacent areas and soft substrate environments (e.g. seagrasses, sand, mud) to depths between 4 and 55 m (Rasmussen *et al.*, 2021b), though has displayed an affinity for seagrass meadows between 1–4 m deep (Udyawer *et al.*, 2016b). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries, 2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of (Least Concern; Rasmussen *et al.*, 2021b), and reasonable post-interaction survival rates (n = 931 interactions with 5.8 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Rasmussen *et al.*, 2021b). *Hydrophis curtus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Habitat and depth range preferences for *H. curtus* increase its interaction potential in the Central Trawl Region. This inference is supported by results from a bycatch study which demonstrated that this species exhibited the third highest number of interactions within the red spot king prawn sector (*n* = 324; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Elegant sea snake	*Hydrophis elegans*		4	2	**Likelihood**: Evidence suggests that the elegant sea snake (*Hydrophis elegans*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. elegans* is often associated with soft and hard substrates (e.g. sand, mud, coral reefs, seagrass, estuaries and rivers) to depths of 110 m (Milton, 2010a; Department of the Environment, 2024). Moreover, this species has displayed an affinity for seagrass meadows in depths less than three metres (Udyawer *et al.*, 2016b). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries, 2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Least Concern, stable population trend (Milton, 2010a), and moderate post-interaction survival rates (*n* = 347 interactions with 17 per cent mortality; Milton *et al.*, 2009; n = 186 interactions with 12.4 per cent mortality; Courtney *et al.*, 2010). Of notable importance, previous research has demonstrated a correlation between sea snake sizes and mortality (Courtney *et al.*, 2010). As a larger species attaining a length up to 260 cm (Department of the Environment, 2024), *H. elegans* may experience greater mortality rates.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Habitat and depth range preferences for *H. elegans* increase its interaction potential in the Central Trawl Region. This inference is supported by results from a bycatch study which demonstrated that this species interacts with vessels operating in the red spot king prawn sector (*n* = 71; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	While potentially limited for larger individuals, *H. elegans* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spectacled sea snake	*Hydrophis kingii*		3	2	**Likelihood**: Evidence suggests that the spectacled sea snake (*Hydrophis kingii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. kingii* will inhabit a range of environments including soft substrates (e.g. sand, mud) and inter-reef areas to depths of 22 m (Milton *et al.*, 2010b). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries,	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Milton *et al.*, 2010b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton *et al.*, 2010b) and mortality rate estimates (*n* = 30 interactions with 26.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton *et al.*, 2010b)

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023). The overlap between suitable *H. kingii* habitat and fished areas increase the probability of an interaction occurring in this region. With that said, encounters are expected to remain relatively low when compared to other assessed species. This inference is supported by results from a bycatch study which demonstrated limited interactions between *H. kingii* and vessels operating in the red spot king prawn sector (*n* = 27; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). The available evidence supported the assignment of a marginally lower likelihood score for this species. While interactions within this region may be higher compared to the Northern Trawl Region, the difference is minute and is not expected to substantially impact the overall score. With additional information, this component may be further refined. Note–This species will be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment.	*Hydrophis kingii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Turtle-headed sea snake	*Emydocephalus annulatus*		5	1	**Likelihood**: The turtle-headed sea snake (*Emydocephalus annulatus*) has a broad distribution along the east coast of Queensland (Lukoschek, 2010a; Udyawer *et al.*, 2020). Across its range, *E. annulatus* will inhabit sandy, rocky and coral reef environments to depths of 40 m (Lukoschek, 2010a). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be rare. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). The species will also be provided	**Consequence**: The available evidence supported a deviation from the default score of moderate (2) to minor (1) (Milton *et al.*, 2009; Courtney *et al.*, 2010). *Emydocephalus annulatus* was not encountered within a comprehensive study observing the presence of sea snake species in trawl bycatch (Courtney *et al.*, 2010). This suggests that trawl interactions in the ECOTF are rare. In the (unlikely) event of an interaction, *E. annulatus* will benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					(some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments in this region as a low-risk element. Note–*Emydocephalus annulatus* was assigned a higher likelihood rating as the corresponding consequence score was very low. This species absence in a previous trawl bycatch study suggests it will experience refuge from operations and regional trawl fishing activities are unlikely to have a negative or long-term impact on populations.	weight accumulating within the codend of a net, thus minimising the risk of potential crushing if an encounter occurs (Milton *et al.*, 2009). *Emydocephalus annulatus* is unlikely to interact with trawling apparatus, though was included in the assessment due to sufficient uncertainty surrounding its distribution and interaction potential. The consequence score assigned to this species was considered reasonable due to the expected rarity of an encounter in this region. With improved data on regional sea snake bycatch compositions, this species could potentially be removed from future assessments. For reference, *E. annulatus* has an extinction risk classification of Least Concern with a declining population trend (Lukoschek, 2010a).
Olive-headed sea snake	*Hydrophis major*		3	2	**Likelihood:** The olive-headed sea snake (*Hydrophis major*) has a distribution extending along the Queensland east coast (Guinea *et al.*, 2010; Udyawer *et al.*, 2020). Across its range, *H. major* will typically inhabit sandy and muddy environments in tidal creeks, offshore continental shelves or gulf areas to depths of 22.2 m (Guinea *et al.*, 2010). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries, 2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023). The overlap between suitable *H. major* habitat and the fished area increase the probability of an interaction occurring in this region. With that said, encounters are expected to remain relatively low when compared to other assessed species. This inference is supported by results from a bycatch study which demonstrated limited interactions between this species and vessels operating in the red spot king prawn sector (n = 27; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Guinea *et al.*, 2010) and moderate post-interaction survival rates (n = 163 interaction with 13 per cent mortality; Milton *et al.*, 2009; n = 55 interactions with 18.2 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Guinea *et al.*, 2010; Milton *et al.*, 2010b). *Hydrophis major* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Based on the reviewed information, this score was considered to be reasonable. While encounters may be marginally higher within this region, interaction rates are expected to be higher for other species. With additional information, this component may be further refined. Note–This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment.	species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Small-headed sea snake	*Hydrophis macdowelli*		4	2	**Likelihood**: The small-headed sea snake (*Hydrophis macdowelli*) has a distribution extending along the Queensland east coast (Milton *et al.*, 2010a; Udyawer *et al.*, 2020). Across its range, *H. macdowelli* will inhabit sandy environments in estuary, nearshore or inter-reef areas to depths of 26 m (Milton *et al.*, 2010a). In comparison, regional trawl operations will fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries, 2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023). The overlap between suitable *H. macdowelli* habitat and the fished area increase the probability of an interaction occurring in this region. This inference is supported by results from a bycatch study which demonstrated that this species interacts with vessels operating in the red spot king prawn sector (*n* = 148; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton *et al.*, 2010a) and mortality rates (*n* = 153 interactions with 33.3 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton *et al.*, 2010a). Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study only reported a three per cent mortality rate (Wassenberg *et al.*, 2001). While notably different, this distinction may be attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (*n* = 37).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	*Hydrophis macdowelli* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spotted sea snake	*Hydrophis ocellatus*		4	2	**Likelihood:** The spotted sea snake (*Hydrophis ocellatus*) has a distribution extending along the Queensland east coast (Milton, 2010b; Udyawer *et al.*, 2020). Across its range, *H. ocellatus* will inhabit sandy inter-reefal environments to depths of 84.6 m (Milton, 2010b; Udyawer *et al.*, 2014). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries,	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton, 2010b) and comparatively lower survival rates (*n* = 94 interactions with 27.7 per cent mortality; Courtney *et al.*, 2010). A lower

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023). The overlap between suitable *H. ocellatus* habitat and the fished area increase the probability of an interaction occurring in this region. This inference is supported by results from a bycatch study which demonstrated that this species interacts with vessels operating in the red spot king prawn sector (*n* = 77; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	consequence score was not considered for this species as population trends are currently unknown (Milton, 2010b). Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study reported a lower mortality rate of 18 per cent (Wassenberg *et al.*, 2001). While notably different, this distinction may be partially attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (*n* = 67). *Hydrophis ocellatus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Horned sea snake	*Hydrophis peronii*		4	2	**Likelihood:** Evidence suggests that the horned sea snake (*Hydrophis peronii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. peronii* will inhabit sandy, reef-adjacent environments to depths of 60 m (Lukoschek, 2010b). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries, 2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023). The overlap between suitable *H. peronii* habitat and the fished area increase the probability of an interaction occurring in this region. This inference is supported by results from a bycatch study which demonstrated that this species interacts with vessels operating in the red spot king prawn sector (*n* = 262; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). Note–While encounters with this species are expected, it may experience (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Lukoschek, 2010b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), population trend (stable) (Lukoschek, 2010b) and moderate post-interaction survival rates (*n* = 271 interactions with 17.3 per cent mortality; Courtney *et al.*, 2010). *Hydrophis peronii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Beaked sea snake	*Hydrophis zweifeli*		2	2	**Likelihood**: Evidence suggests that the beaked sea snake (*Hydrophis zweifeli*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region (and otter trawl activities in general) may be uncommon. *Hydrophis zweifeli* is often associated with soft substrate environments (e.g. sand, mud) as well as estuaries and creeks in shallow waters (Great Barrier Reef Marine Park Authority, 2011). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, encounters are more likely to occur in shallow-water operations outside of the ECOTF, namely the Black Tiger Prawn Broodstock Fishery and the River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments of this region as a low-risk element. Note–Information relating to this species habitat and depth preferences was based on an assessment of *Enhydrina schistosa* in the Great Barrier Reef (Great Barrier Reef Marine Park Authority, 2011). As a result of phylogenetic restructuring, *E. schistosa* has since been removed as a species occurring in	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Rasmussen, 2018). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Data Deficient, population trend (unknown) (Rasmussen, 2018) and high survival rates (n = 81 interactions with 1.2 per cent mortality; Courtney *et al.*, 2010). *Hydrophis zweifeli* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution data submitted through the TEPA logbook cannot (currently) be validated (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					Australian waters and replaced by *H. Zweifeli* (Ukuwela *et al.*, 2013; Udyawer *et al.*, 2016a).	
Stoke's sea snake	*Hydrophis stokesii*		3	2	**Likelihood**: The Stoke's sea snake (*Hydrophis stokesii*) has a distribution extending along the Queensland east coast (Sanders *et al.*, 2018; Udyawer *et al.*, 2020). Across its range, *H. stokesii* will inhabit various substrates (e.g. reefs, mud, sand) and environments (e.g. harbours) to a maximum depth of 50 m (Sanders *et al.*, 2018). In comparison, regional trawl operations will typically fish over soft substrates (e.g. sand, mud) and reef-adjacent environments to various depths; depending on the species being targeted (Department of Agriculture and Fisheries, 2021a; Australian Fisheries Management Authority, 2023b; a; Fox *et al.*, 2023). Despite the depth range and habitat preferences of *H. stokesii* coinciding with a portion of this region's effort footprint, interactions are expected to be more limited. Where interactions do occur within the Central Trawl Region, they may be restricted to shallow-water areas within this species depth range.[1] This inference is supported by results from a bycatch study which demonstrated that this species will have limited interactions with operations in the red spot king prawn sector (*n* = 22; Courtney *et al.*, 2010). Information obtained through documented occurrence records was also utilised to inform the score assigned to the likelihood component (Udyawer *et al.*, 2020). While interaction rates for *H. stokesii* may be marginally higher within this region, the overall number of interactions will likely remain low. This inference though could not be confirmed due to an absence of information on regional sea snake bycatch compositions. As the extent of regionally specific interactions remains uncertain for this species a precautionary score of possible (3)	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), population trend (unknown) (Sanders *et al.*, 2018) and reasonable survival rates (*n* = 91 interactions with 10 per cent mortality; Milton *et al.*, 2009). Of interest, another study reported a higher mortality rate of 16.7 per cent (Courtney *et al.*, 2010). While notably different, this distinction may be partially attributed to the Courtney *et al.* (2010) study consisting of a smaller sample size (*n* = 30). *Hydrophis stokesii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Central Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score

[1] A study in the Gulf of Carpentaria determined that the interaction potential with this species will vary with depth, and interactions in northern latitudes are more commonly associated with shallow-water environments (Wassenberg *et al.*, 1994). Conversely, interactions in southern latitudes are more likely to occur in deeper water.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					was applied. With additional information, this component may be further refined. Note–This species will also be provided (some) protection from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment.	was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Sharks						
Collared carpetshark	*Parascyllium collare*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Brownbanded bambooshark	*Chiloscyllium punctatum*		5	1	**Likelihood**: The brownbanded bambooshark (*Chiloscyllium punctatum*) was assigned a higher likelihood rating as the corresponding consequence score was very low. All the available evidence suggests that trawl fishing activities within this region will not have a negative or long-term impact on this species. This included information obtained through third-party assessments regarding the species current extinction risk classification and fishery status (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There is reasonable confidence that current fishing activities within the Central Trawl Region will not have a significant impact on regional populations and/or contribute to a significant, negative consequence for this species.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Chiloscyllium punctatum* is a common benthic shark species and it is abundant within its preferred habitats (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There are few concerns surrounding the long-term sustainability of the species and it has been classified as Least Concern under the Australian IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023b). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The high productivity of *C. punctatum* contributed to these findings. Fishing activities within the current fishing environment are unlikely to result in a long-term, negative consequence for this species.
Colclough's shark	*Brachaelurus colcloughi*		3	3	**Likelihood**: Information on the Colclough's shark (*Brachaelurus colcloughi*) is limited and further research is required on the distribution of this species on the Queensland east coast.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score (Kyne *et al.*, 2021; Kyne *et al.*, 2023c). The consequence assessment for *B. colcloughi* had to consider a high number of uncertainties. These uncertainties

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					The majority of information on *B. colcloughi* comes from less than 80 individuals; most of which were caught in the waters encompassed within the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions. However, a number of *B. colcloughi* specimens have also been caught in close proximity to the Central Trawl Region boundary (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c). If it does occur in this region, it is more likely to be encountered by operations fishing the southernmost extent of the Central Trawl Region (Department of Agriculture and Fisheries, 2021a). Depth ranges, habitat preferences, nocturnal behaviours and refuge/availability (e.g. marine park zones) will assist in terms of reducing the interaction/encounterability potential for this species. It is also recognised that trawl effort (across the fishery) has declined and remains below historic averages. While not universal, declining effort levels can translate to lower levels of bycatch and, for some species, a reduced interaction potential. This inference though requires testing and additional information on elasmobranch bycatch compositions in the Central Trawl Region. While noting the above, there remains a high level of uncertainty surrounding a) the population structure of *B. colcloughi*, b) the productivity/abundance of this species and c) interaction rates within this region of the ECOTF. This uncertainty has been reflected in the likelihood score assigned to this species. It is recognised that the likelihood score assigned to this species may be an overestimate for this region. The severity of any potential impact (negligible, low, medium or high) though, remains unknown and requires further investigations. Until then, the decision was made to take a more precautionary assessment approach. The outputs of the Data Validation Plan may assist in terms of refining the *B. colcloughi* risk assessment through time (Department of Agriculture and Fisheries, 2018).	relate to the distribution of this species on the Queensland east coast, its potential to interact with the ECOTF and the capacity of the animal to survive a trawl interaction. Individuals caught in the sweep of the net will derive less benefits from using a TED and BRD as it only attains a maximum total length of 75 cm (Kyne *et al.*, 2021). This means that both immature and mature animals will be caught as bycatch in this fishery. The consequence score for this species is considered appropriate given the level of uncertainty and the outputs of third-party assessments (Kyne *et al.*, 2021) that determined the species: - Is endemic with a restricted geographical range. - Occurs at naturally low abundances with an inferred population decline (<10,000 mature individuals; an inferred continuing decline). - Has an elevated (deteriorating) extinction risk classification (Vulnerable). When these factors are considered, it is expected that this species has a higher vulnerability and/or lower resilience to rebound from fishing-related mortalities. It also suggests that there is an increased potential for trawl fishing activities to negatively impact regional populations and/or its extinction risk classification. It is recognised that the score assigned to this component of the assessment may overestimate the consequence for this species. In this instance though, the limited levels of information and the species' naturally low abundance warranted the adoption of a more precautionary approach. With improved information on regional elasmobranch bycatch compositions, the consequence score could be refined and (potentially) reduced.
Crested hornshark	*Heterodontus galeatus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Eastern angelshark	*Squatina albipunctata*		2	3	**Likelihood**: There is evidence that the eastern angelshark (*Squatina albipunctata*) will interact with east coast trawl operations and be caught as bycatch. Based on the available information, interactions with this species are more likely to occur in the Southern Offshore Trawl Region (Rigby *et al.*, 2016b; Campbell *et al.*, 2017). While the distribution of *S. albipunctata* overlaps with the Central Trawl Region, the majority of effort/fishing occurs at the lower bounds of this species depth profile (35–415 m). To this extent, the eastern angelshark will be afforded a degree of natural protection from trawl fishing activities. This inference is supported by the *Action Plan for Australian Sharks and Rays* which notes that the eastern angelshark experiences lower fishing pressures in northeast Queensland (Kyne *et al.*, 2021). The above findings supported the assignment of a lower likelihood score for this species in this region. With improved information on regional elasmobranch bycatch compositions, this species could potentially be removed from future assessments as a low-risk element.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given the current understanding of the *S. albipunctata* population trend (depleting; Kyne *et al.*, 2023f) and extinction risk classification (Vulnerable; Kyne *et al.*, 2021). These factors make the species more vulnerable to trawl fishing activities and reduce its capacity to absorb regional fishing-related mortalities. The Central Trawl Region represents the northern extent of the eastern angelshark range. This will have some bearing on how frequently this species interacts with regional trawl fishers and, by extension, their potential to contribute to an undesirable event. While noting these limitations, the status of the population on the Australian east coast places this species in a more precarious position and increases the probability that current fishing levels will have a negative impact on regional populations.
Eastern banded catshark	*Atelomycterus marnkalha*		2	2	**Likelihood**: The eastern banded catshark (*Atelomycterus marnkalha*) is an endemic benthic shark with limited data sets. The available evidence suggests that this species is more likely to interact with trawl operations in central and northern Queensland (Jacobsen & Bennett, 2007; Kyne *et al.*, 2023m). Interaction rates for this species though are expected to be low when compared to other benthic batoids and rays (pers. comm. Ian Jacobsen). Habitat information is limited for this species, although specimens were primarily caught in sandy to coarse rubble substrates (Jacobsen & Bennett, 2007; Pitcher *et al.*, 2007). This suggests that some of the habitats preferred by this species are less conducive to trawl fishing activities. The species may also be afforded additional refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b).	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. The assigned score is considered appropriate given the current understanding of the *A. marnkalha* Australian extinction risk classification (Least Concern), population status (nothing to infer or suspect a population reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023m). While information levels for *A. marnkalha* are limited, a weight-of-evidence approach suggests that the consequences for this species are less severe. Accordingly, it was assigned a lower score for this aspect of the assessment. Future risk assessments though would benefit from additional information on the elasmobranch catch compositions in this region. This information could be used to further refine the *A.*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					A weight-of-evidence approach indicates that there is a lower likelihood of regional trawl fishing activities negatively impacting *A. marnkalha* populations. This inference though has yet to be fully tested and future assessments would benefit from additional information on regional elasmobranch bycatch compositions. Similarly, with improved information on regional shark bycatch compositions, *A. marnkalha* could potentially be removed from risk assessments involving this region.	*marnkalha* risk profile and determine the need to undertake further assessment.
Zebra shark	*Stegostoma tigrinum*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the zebra shark (*Stegostoma tigrinum*). The species will derive considerable benefit from the use of a TED and be afforded refuge from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). While immature animals will still be caught as bycatch, the majority of sub-adult and adult specimens will likely escape through the TED opening (Brewer *et al.*, 2006; Campbell *et al.*, 2020). Applying a weight-of-evidence approach indicates that there is a lower likelihood of the consequence coming to fruition in the Central Trawl Region and/or within the current fishing environment.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Stegostoma tigrinum* is a common shark with a wide northern and eastern Australian distribution. The productivity of this species is considered low for an oviparous (egg-laying) species. However, there is limited (current) concerns surrounding the conservation status or long-term sustainability of the species. *Stegostoma tigrinum* has an extinction risk classification of Least Concern with nothing to infer or suspect a population decline across its known range (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023l). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The above considerations indicate that current fishing activities pose limited consequences for the long-term conservation status or sustainability of this species
Piked spurdog	*Squalus megalops*		3	2	**Likelihood**: There is evidence that the piked spurdog (*Squalus megalops*) will be caught as bycatch in the ECOTF (Rigby *et al.*, 2016b). *Squalus megalops* is a common endemic shark species that is often associated with deeper water environments. The depth profile of this species (0–732 m) extends well beyond the operational constraints of regional trawl fishers. These habitat	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given what is known about the *S. megalops* population trend (increasing; Rigby & Kyne, 2020), Australian extinction risk classification (Least

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					preferences will provide the species with considerable protection from trawl fishing activities within the Central Trawl Region (Department of Agriculture and Fisheries, 2021a). It also reduces the likelihood of the consequence coming to fruition in the current fishing environment. Across the ECOTF, there is limited information on the composition and structure of the elasmobranch bycatch. While not universal, information levels for deepwater species are often less developed when compared to inshore species (pers. comm. I. Jacobsen). These factors increase the level of uncertainty and support the adoption of a more precautionary risk assessment approach. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With improved information on regional elasmobranch catch compositions, this species could potentially be removed from future risk assessments involving this region.	Concern; Kyne *et al.*, 2021) and fisheries status assessment (Sustainable; Kyne *et al.*, 2023j). During deliberations, some consideration was given to reducing the consequence score for this species in this region. It was ultimately determined that any score reduction would require additional information on *S. megalops* interaction rates and confirmation that it had a low interaction potential in this region. For reference, *S. megalops* has been included in two previous ERAs examining longer-term trawl risks. This assessment indicated that *S. megalops* was at higher risk from trawl fishing activities (Campbell *et al.*, 2017; Dedini *et al.*, 2023). The results of these assessments factored into the decision to assign this species a consequence score of moderate (2).
Australian weasel shark	*Hemigaleus australiensis*		2	2	**Likelihood**: Bycatch surveys indicate that the Australian weasel shark (*Hemigaleus australiensis*) will be caught as bycatch in the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Campbell, 2022). However, there is limited information on the current rates of capture and/or its capacity to survive a trawl interaction. Expectations are that *H. australiensis* interactions will be less frequent, particularly when compared to other benthic shark and ray species. It is further hypothesised that trawl fishing activities within the Central Trawl Region will not lead to a long-term, negative change to the conservation / fishery status of this species. This inference is supported by evidence obtained through third-party assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australiensis*. *Hemigaleus australiensis* is a small, wide-spread whaler species that is fairly common/abundant throughout its known distribution. Anecdotal evidence suggests the species is highly productive and fast growing (Ebert *et al.*, 2021; Kyne *et al.*, 2021). These factors increase the capacity of the species to absorb fishing mortalities and rebound after a potential decline. As a smaller species, *H. australiensis* will derive less benefit from the use of a TED i.e. both immature and mature sharks will be caught as bycatch. At present there is limited information on how successfully *H. australiensis* is able to survive a trawl fishing event. While noting the above deficiencies, evidence indicates that key risks for this species are currently being managed. The species has an Australian extinction risk classification of Least Concern (Kyne *et al.*, 2021) with corresponding status assessments indicating that the species is being sustainably fished across its known distribution. Interactions with this

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
						species are also more likely in gillnet and line fisheries. These findings were accounted for in the consequence assessment.
Pale spotted catshark	*Asymbolus pallidus*		2	2	**Likelihood**: The pale spotted catshark (*Asymbolus pallidus*) is one of three morphologically similar, deepwater shark species that interact with the ECOTF. The *A. pallidus* distribution overlaps with the eastern section of the Central Trawl Region and they may be encountered by operators fishing in deeper water environments. There are notable gaps in the level of information on deepwater shark interaction rates and release fates. However, anecdotal evidence suggests that this species exhibits higher rates of on-deck mortalities (Kyne *et al.*, 2021). Catch-rate uncertainty and increased mortality potential was taken into consideration as part of the likelihood component. Of notable importance, the depth profile of *A. pallidus* (225–440 m) provides this species with a high degree of natural protection. This profile suggests that a very small portion of the *A. pallidus* range will be exposed to trawl fishing activities within the Central Trawl Region. This factor was given considerable weighting in the likelihood assessment and contributed to the species being assigned a rare (2) score. Based on the available data (Courtney *et al.*, 2007; Kyne, 2008; Rigby *et al.*, 2016b; Campbell, 2022), interactions are more likely to occur in the Southern Offshore Trawl Region where operators target eastern king prawns (*M. plebejus*) in deeper water environments. With additional information on regional catch compositions, this species could (potentially) be removed from future risk assessments involving this region.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. pallidus*. *Asymbolus pallidus* is a small, endemic shark species with a restricted geographical range. The distribution and depth profile of this species reduced the interaction potential and, by default, the extent of the potential consequence. As it is a smaller species, TEDs will be less effective in terms of excluding it from the catch. Anecdotal evidence suggests that, when caught, the species experiences high levels of on-deck mortalities (Kyne *et al.*, 2021). While noting the above limitations, the available evidence suggests that fishing-related risks are being managed within the current fishing environment. The species has an Australian extinction risk classification of Least Concern, a (suspected) stable population trend and a sustainable fishing status (Kyne *et al.*, 2021; Kyne *et al.*, 2023i). These factors supported the assignment of a consequence score at the lower end of the spectrum.
Grey spotted catshark	*Asymbolus analis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Orange spotted catshark	*Asymbolus rubiginosus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Batoids						

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Australian butterfly ray	*Gymnura australis*		3	2	**Likelihood**: Operations within the Central Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting this overlap, the Australian butterfly ray (*Gymnura australis*) is broadly distributed (Jacobsen & Bennett, 2009; Last *et al.*, 2016b) and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Within the Central Trawl Region, the species may be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *G. australis* is frequently found in soft-bottom substrates that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). These preferences factored into the species receiving a higher likelihood score. Bycatch data for the ECOTF provides limited insight into *G. australis* interaction rates and release fates (alive, dead or moribund). However, a weight-of-evidence approach suggests that it may be one of the more common elasmobranchs caught in prawn-trawl fisheries (Courtney *et al.*, 2007; Jacobsen, 2007; Pitcher *et al.*, 2007; Kyne, 2008). Catch data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition within the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species.	**Consequence**: The available evidence, including that contained in third-party assessments (Campbell *et al.,* 2017; Kyne *et al.,* 2021), supported a downgrading of the default consequence score from severe (3) to moderate (2). The reduced score better reflects what is known about the conservation / extinction risk status of this species (Least Concern), population trend (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023o). While noting these considerations, the use of a TED/BRD will be less effective for this species, with immature individuals and adults likely to be caught as trawl bycatch (Jacobsen, 2007). Once captured, *G. australis* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Campbell *et al.*, 2017). This, in part, is due to the species having a very flattened morphology and limited external protections e.g. hardened denticles or skin (pers. comm. I. Jacobsen). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Yellowback stingaree	*Urolophus sufflavus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Patchwork stingaree	*Urolophus flavomosaicus*		3	2	**Likelihood**: Regional operations will fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Pears *et al.*, 2012b; Campbell *et al.*, 2017). While noting this overlap, the bathymetric range of the patchwork stingaree (*Urolophus flavomosaicus*) extends beyond trawled areas (60–320 m) and a notable portion of its range will experience limited fishing effort (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *U. flavomosaicus* interaction rates and release fates (alive, dead or moribund). Based on the available data, interactions are more likely to occur in deeper water environments (Kyne *et al.*, 2023ad) and in the Southern Offshore Trawl Region. This inference was supported by a broader review of elasmobranch bycatch within the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition within the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. To refine this score, further information is required on the elasmobranch bycatch composition within this region. Note–One study observing trawl bycatch within the eastern king prawn sector inferred that *U. flavomosaicus* may not occur on the east coast, and such records would be more appropriately listed as conspecific with the sandyback stingaree (*U. bucculentus*) (Rigby *et al.*, 2016b). This factor adds to the challenges of determining this species interaction potential in the ECOTF. Similarly, anecdotal evidence suggests smaller rays may exhibit higher interaction rates with this fishery. The accuracy of this assessment cannot be determined at this point in time.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *U. flavomosaicus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne *et al.*, 2019a), population trend (suspected to be stable; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ad). As a smaller batoid, *U. flavomosaicus* will derive fewer benefits from the use of a TED/BRD, with immature and adult individuals likely to be caught as trawl bycatch. Once captured, *U. flavomosaicus* are expected to have high levels of post-interaction mortality and may abort pups during an encounter (Kyne *et al.*, 2021; Kyne *et al.*, 2023ad). These factors limited refinements to the consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Sandyback stingaree	*Urolophus bucculentus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Kapala stingaree	*Urolophus kapalensis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Greenback stingaree	*Urolophus viridis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Common stingaree	*Trygonoptera testacea*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Australian whipray	*Himantura australis*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the Australian whipray (*Himantura australis*). Due to its depth profile (0–45 m), this species will only interact with operations targeting prawns in shallower waters (Last *et al.*, 2016b; Kyne *et al.*, 2023p). If and when this species is caught in the ECOTF, a high proportion of the sub-adults and adults will experience a contact without capture event. While difficult to quantify, contact without capture events are less likely to end in significant injuries or impede the long-term survivability of the animal. *Himantura australis* will also be afforded refuge from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in the Central Trawl Region and/or within the current fishing environment. With additional information on bycatch compositions, this species could potentially be removed from future ERAs involving this region.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australis*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern), (suspected) stable population trend (Kyne *et al.*, 2021) and sustainability status (Sustainable; Kyne *et al.*, 2023p). The maximum disc width of this species assists in terms of reducing the size of the potential consequence. *Himantura australis* reaches at least 183 cm disc width and the vast majority of sub-adult and adult specimens, if caught, will be excluded from the net via the TED. It is recognised that a score of moderate (2) may be an overestimate for this species. With additional information on regional elasmobranch catch rates, this score could be further refined.
Blackspotted whipray	*Maculabatis astra*		3	2	**Likelihood**: Trawl operations within the Central Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Kyne, 2008; Pears *et al.*, 2012b). While noting this overlap, the blackspotted whipray (*Maculabatis astra*) is broadly distributed	**Consequence**: The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Kyne *et al.*, 2021; Kyne *et al.*, 2023q).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. astra* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. The species will be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *M. astra* are commonly found in habitats that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). Based on the available data, interactions with this species are more likely to occur in waters <75 m and in operations targeting tiger, endeavour and banana prawns (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. astra* and the brown whipray (*M. toshi*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023q). As a smaller batoid, *M. astra* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 92 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality rates are largely unknown for this species (Kyne *et al.*, 2023q). However, a composite study including both *M. astra* and *M. toshi* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. astra* as a standalone species. These factors limited refinements to the consequence score for this species.
Brown whipray	*Maculabatis toshi*		3	2	**Likelihood**: Trawl operations within the Central Trawl Region fish in habitats preferred by the brown whipray (*Maculabatis toshi*) and there is evidence that it forms part of the elasmobranch trawl bycatch across its Queensland range (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). While acknowledging this overlap, notable portions of this species' range will experience light or negligible fishing (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into the *M. toshi* interaction rates and landing/release fates (alive, dead or	**Consequence:** The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trend (nothing to infer a reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023s).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. The species will be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *M. toshi* are commonly found in soft-bottom substrates that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). As with the blackspotted whipray (*M. astra*), *M. toshi* interactions are more likely to occur in waters <75 m and in operations targeting tiger, endeavour and banana prawns (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). With improved information on elasmobranch bycatch compositions, this score could potentially be refined in future risk assessments involving this region. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. toshi* and *M. astra*. Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	As a smaller batoid, *M. toshi* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 82 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality levels for this species are largely unknown (Kyne *et al.*, 2023q). However, a composite study including both *M. toshi* and *M. astra* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. toshi* as a standalone species. These factors limited refinements to the consequence score for this species
Estuary stingray	*Hemitrygon fluviorum*		3	3	**Likelihood**: The depth profile (0–28 m) and distribution of the estuary stingray (*Hemitrygon fluviorum*) will overlap with the effort footprint of the Central Trawl Region. To this extent, the species may interact with trawl operations within this region. Interactions with this species are more likely to occur in trawl operations targeting prawns in shallower environments and/or in closer proximity to estuaries or mangrove lined stretches of coastline. At a regional level, the likelihood of trawl fishing activities contributing to a negative consequence are expected to be higher in regions located further south (e.g. Moreton Bay) and within the River and Inshore Beam Trawl Fishery. While noting the above, there is (currently) limited information on *H. fluviorum* interactions in the ECOTF. This absence of information extends to each region and makes it more difficult to quantify or assess the extent of the risk posed to this species (e.g. negligible, low, medium or high). For these	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023w). The revised score better reflects what is known about this species Australian extinction risk classification (Vulnerable), population trends (suspected reduction of greater than 30 per cent) and protection status under the *Nature Conservation Act 1992* (Near Threatened; Queensland Government, 1992; Kyne *et al.*, 2021). It is recognised that the threats posed to the species are wider than commercial fishing with habitat degradation also identified as a key threat (Kyne *et al.*, 2021). Fishing mortalities though have the potential to compound historic range contractions and population declines. Some of the potential consequences

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					reasons, the species was assigned a more precautionary likelihood score for the Central Trawl Region. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. With improved information on regional elasmobranch catch compositions, this species could potentially be removed from future risk assessments involving this region.	being further range contractions, reduced genetic diversity and the fragmentation of regional populations. As this species prefers brackish waters and mangrove-fringed estuaries (Last *et al.*, 2016b; Kyne *et al.*, 2023w), a consequence score of severe may be an overestimate for this region. There is, however, limited information on elasmobranch catch compositions in the Central Trawl Region. This makes it difficult to assess the extent and frequency (none, low, medium or high) of interactions with this species.
Coral sea maskray	*Neotrygon trigonoides*		3	2	**Likelihood** The Coral Sea maskray (*Neotrygon trigonoides*) will interact with east coast trawl operations and be caught as bycatch in the Central Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon trigonoides* is a common elasmobranch that is often associated with reefal and continental shelf environments to depths of 170 m (Kyne *et al.*, 2021). The species will be afforded a degree of natural protection from trawl fishing and it is also found in areas exposed to fewer fishing pressures (Kyne *et al.*, 2021). Similarly, a proportion of the population will be protected from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Zoning Plan. These factors reduce the likelihood of the consequence coming to fruition under the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. trigonoides* is a key component of the elasmobranch catch in the scallop fishery (Courtney *et al.*, 2007). Studies also demonstrate this species will interact with the shallow-water eastern king prawn and tiger/endeavour prawn sectors (Courtney *et al.*, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. Capture rates are also expected to be higher for this species as TEDs are less effective in terms of excluding smaller rays from the catch. This inference is supported by results from bycatch composition studies which show *N. trigonoides* are caught with some frequency (*n* = 385; Campbell *et al.*, 2017).	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. trigonoides*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Sherman *et al.*, 2021), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023u). *Neotrygon trigonoides* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. trigonoides* are likely to have high levels of post-interaction mortality (Kyne *et al.*, 2023u). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments. Note–Catch data for this species was typically reported as *Dasyatis kuhlii* or *N. kuhlii* (Jacobsen, 2007; Kyne, 2008; Last *et al.*, 2016a; Last *et al.*, 2016b).	
Speckled maskray	*Neotrygon picta*		3	2	**Likelihood**: The speckled maskray (*Neotrygon picta*) will interact with east coast trawl operations and be caught as bycatch in the Central Trawl Region (Jacobsen, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon picta* is a common elasmobranch that is often associated with soft substrates and continental shelf environments to depths between 5–100 m (Kyne *et al.*, 2021; Bray, Undated). Some of these areas will coincide with regions actively fished by trawl operators. It will also be found in areas where fishing is either absent or limited (Kyne *et al.*, 2021). Similarly, *N. picta* will be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). These factors reduce the likelihood of the consequence coming to fruition in the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. picta* is a key component of the elasmobranch catch in the scallop sector (Kyne, 2008). Bycatch studies also suggest that the species will be caught in shallow-water operations targeting tiger and endeavour prawns (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. This uncertainty was taken into consideration as part of this assessment and contributed to *N. picta* receiving a marginally higher likelihood score. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. picta*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Pierce *et al.*, 2015), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023af). *Neotrygon picta* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. picta* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Kyne, 2008). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					assigned to this species could potentially be refined in future assessments.	
Bottlenose wedgefish	*Rhynchobatus australiae*		3	2	**Likelihood**: The bottlenose wedgefish (*Rhynchobatus australiae*) will interact with east coast trawl operations and be caught as bycatch in the Central Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Rhynchobatus australiae* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths of 60 m (Kyne, 2008; Kyne *et al.*, 2021). While studies are limited, the available data indicates that *R. australiae* will be caught as bycatch in the scallop, tiger and endeavour prawn sectors (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). Historic bycatch records for *R. australiae* were reported in a complex which included the eyebrow wedgefish (*R. palpebratus*) or under the synonym *R. djiddensis*. This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. australiae*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species Australian extinction risk classification (Near Threatened; Kyne *et al.*, 2021), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023r). As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. australiae* from the catch (Campbell *et al.*, 2020). The size of *R. australiae* may also assist in terms of it surviving a trawl interaction (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). This inference though requires further testing and cannot be confirmed without additional information on *R. australiae* interaction rates and release fates.
Eyebrow wedgefish	*Rhynchobatus palpebratus*		3	2	**Likelihood**: The eyebrow wedgefish (*Rhynchobatus palpebratus*) will interact with east coast trawl operations and be caught as bycatch in the Central Trawl Region (Kyne, 2008; Pears *et al.*, 2012b). *Rhynchobatus palpebratus* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths between 5–60 m (Kyne, 2008; Kyne *et al.*, 2021). While studies are limited, the available data indicates that *R. palpebratus* will be caught as	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. palpebratus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Near Threatened; Kyne & Rigby, 2019), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023x).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					bycatch in the scallop, tiger and endeavour prawn sectors (Kyne, 2008; Pears *et al.*, 2012b). Historic bycatch records for *R. palpebratus* were reported in a complex which included the bottlenose wedgefish (*R. australiae*) or under the synonym *R. djiddensis*. This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. palpebratus* (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The size of *R. palpebratus* may also assist in terms of it surviving a trawl interaction (Kyne, 2008). This inference though requires further testing and cannot be confirmed without additional information on *R. palpebratus* interaction rates and release fates.
Eastern shovelnose ray	*Aptychotrema rostrata*		3	2	**Likelihood**: Regional operations fish in habitats preferred by the eastern shovelnose ray (*Aptychotrema rostrata*) and there is evidence that it forms part of the elasmobranch trawl bycatch along the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Bycatch data is available for this species and provides some insight into *A. rostrata* interaction rates and release fates (alive, dead or moribund). One study demonstrated that *A. rostrata* dominated the elasmobranch catch in both the scallop and shallow water eastern king prawn sectors (Courtney *et al.*, 2007). Similar results were observed in another bycatch study focused on areas south of the Great Barrier Reef Marine Park. In this instance, *A. rostrata* was the most commonly encountered species across the entire assessment (n = 3,933; Campbell *et al.*, 2017). *Aptychotrema rostrata* will be a common component of the elasmobranch catch in this region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). While interactions are expected to be higher in more southern regions, this species will be encountered across the entire ECOTF. For these reasons, a likelihood score of possible (3) was considered reasonable.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. rostrata*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne & Stevens, 2015), population trend (nothing to infer or suspect a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ah). While noting these considerations, evidence suggests that a) *A. rostrata* will derive less benefit from the use of a TED and b) remains abundant within trawl bycatch (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). The use of BRD designs like the Fisheye though, may assist in terms of excluding this species from the trawl catch (Courtney *et al.*, 2007). Further, anecdotal evidence suggests that *A. rostrata* have reasonably good post-interaction survival rates (Kyne, 2008; Campbell *et al.*, 2017; Kyne *et al.*, 2021). These factors contributed to the species receiving a consequence score at the lower end of the spectrum.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	
Giant guitarfish	*Glaucostegus typus*		2	2	**Likelihood**: The giant guitarfish (*Glaucostegus typus*) has been recorded as bycatch in the ECOTF and the species will (likely) interact with regional trawl operations (Pears *et al.*, 2012b; Campbell *et al.*, 2017). *Glaucostegus typus* inhabits a range of demersal environments including intertidal and offshore areas to depths of 100 m (Kyne *et al.*, 2021; Kyne *et al.*, 2023y). While these habitat preferences overlap with the ECOTF, areas of its distribution will have limited exposure to fishing activities (Kyne *et al.*, 2021). Juveniles also display an affinity for intertidal areas (Kyne *et al.*, 2021) which may assist in terms of reducing their exposure to trawl fishing during these early life stages. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in this region and/or within the current fishing environment. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *G. typus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of its Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021). Within Australia, *G. typus* has a (suspected) stable population (Kyne *et al.*, 2021) and it has been assessed as sustainably fished across its known distribution (Kyne *et al.*, 2023y). Results from previous risk assessments also supported the assignment of a consequence score at the lower end of the spectrum (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *G. typus* is a large batoid, it will derive considerable benefit from the use of a TED (Brewer *et al.*, 2004; Brewer *et al.*, 2006). While immature rays may still be caught, most sub-adult and adult specimens will be excluded from the net via the TED. Data on *G. typus* post-interaction mortality rates are limited and the outputs vary between assessments. One report with a relatively small sample size (n = 10) recorded a 100 per cent mortality rate (Campbell *et al.*, 2017). In contrast, data provided through the Fishery Observer Program demonstrated more moderate survival levels (19 out of 28 individuals released alive; Pears *et al.*, 2012b). These differing results combined with an absence of information on regional catch rates introduced an element of uncertainty into this assessment. This uncertainty supported the retention of a moderate (2) rating *versus* a downgraded score of minor (1).
Sydney skate	*Dentiraja australis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Endeavour skate	*Dentiraja endeavouri*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
Argus skate	*Dentiraja polyommata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Narrow sawfish	*Anoxypristis cuspidata*		2	3	**Likelihood**: The depth profile (0–128 m) and distribution of the narrow sawfish (*Anoxypristis cuspidata*) overlaps with the effort footprint of the Central Trawl Region. Data compiled through the TEPA logbooks indicates that this species will interact with regional trawl operations. These interactions are more likely to occur in shallow water environments (<40 m). However, the extent of these interactions have yet to be fully quantified or validated. Similarly, it is unclear how much protection this species is afforded through ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). This species is expected to interact more frequently with trawl operators fishing in northern Australia. Evidently, *A. cuspidata* is one of the more common elasmobranch bycatch species caught in the NPF (Stobutzki *et al.*, 2002; Brewer *et al.*, 2004; Brewer *et al.*, 2006; Campbell *et al.*, 2020). While noting the above, there is (currently) limited information on *A. cuspidata* interactions in the ECOTF. This absence of information extends to all ECOTF regions and makes it more difficult to quantify or assess the extent of the risk posed by this fishery (e.g. negligible, low, medium or high). For these reasons, the species was assigned a more precautionary likelihood score for the Central Trawl Region. Based on this information, a likelihood score of rare (2) was considered to be appropriate for this region. With improved information on elasmobranch bycatch compositions, this score could be refined in future risk assessments. Note–While *A. cuspidata* distributions may vary among sources, range information provided within the *Action Plan for Australian Sharks and Rays* was considered the most current for this species (Kyne *et al.*, 2021). As a result, this species was only progressed for assessment within the Northern and Central Trawl Regions. If additional information becomes	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3). The revised score better reflects what is known about this species population trend (suspected reduction >30 per cent) and extinction risk classification (Vulnerable; Kyne *et al.*, 2021). It also aligns more closely with stock status assessments which classified the *A. cuspidata* population as Depleting (Kyne *et al.*, 2023ac) and broader concerns surrounding the long-term sustainability of the species e.g. is considered Critically Endangered on a global scale (Haque *et al.*, 2023). Other considerations that contributed to this decision included a) the importance of the region as one of the few remaining sawfish strongholds (Department of the Environment, 2015; Kyne *et al.*, 2021), b) the potential for this species to incur *in-situ* or post-interaction mortalities and c) the increased risk of injury due to entanglements (due to their large rostrums). Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (moderate, 2). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing activities to contribute to an unintended consequence e.g. continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that *A. cuspidata* be listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – bringing it into line with other sawfish species (Kyne *et al.*, 2021).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					available, the inclusion of this species in other regional assessments may be revisited.	
Green sawfish	*Pristis zijsron*		3	4	**Likelihood**: The green sawfish (*Pristis zijsron*) has experienced considerable range contractions and population declines on the Queensland east coast. These contractions have led to the hypothesis that the species is now regionally extirpated in waters south of the Whitsundays (Peverell, 2005; Department of the Environment, 2019; Kyne *et al.*, 2023z). This, by default, leaves areas covered by the northern Queensland as one of the few remaining strongholds for this species on the Queensland east coast. Within the ECOTF, green sawfish interactions are more likely to occur within the Northern and Central regions. These interactions have the potential to exacerbate historic (negative) population trends and increases the likelihood of the consequence coming to fruition within the current fishing environment. Given the extent of the declines, this could theoretically occur at low rates of fishing mortality. Historic population declines and range contractions make green sawfish interactions less likely in the Central Trawl Region. With that said, any green sawfish interaction in this region would most likely be with a remnant population. This increases the likelihood of the consequence coming to fruition within the current fishing environment. Given the extent of the population declines, this could theoretically occur at low rates of fishing mortality. These concerns were considered sufficient to assign this species with a higher likelihood score. Sawfish data for the ECOTF has poor species resolution and potentially underestimates the total number of fishing mortalities. In reality, it is difficult to ascertain how frequently this species interacts with the ECOTF and/or determine the likelihood of the fishery impacting regional populations. This uncertainty required the adoption of a more precautionary assessment approach and the assignment of a higher score for this component of the assessment. It is recognised that the likelihood or potential for *P. zijsron* interactions to occur in this region have declined through time.	**Consequence**: The available evidence, including that contained in third-party assessments supported increasing the default consequence score from severe (3) to major (4). The revised score better reflects what is known about the *P. zijsron* population trends (suspected reduction >80 per cent) and extinction risk classification (Critically Endangered; Kyne *et al.*, 2021). Other considerations that contributed to this decision included a) the importance of this region as one of the few remaining green sawfish strongholds on the Queensland east coast (Department of the Environment, 2015; Kyne *et al.*, 2021), b) the potential for this species to incur *in-situ* or post-interaction mortalities and c) the increased risk of injury due to entanglements (due to their large rostrums). Any interaction with this species will be with a population that has experienced some decline and/or may be with a remnant population. The potential consequences for this species are significant and could include exacerbating historic range contractions, a reduction in genetic diversity and the further fragmentation of a remnant population/s. These (potential) impacts warranted the assignment of a major (4) consequence score. Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (severe, 3). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing activities to contribute to an unintended consequence e.g. continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that the EPBC listing for *P. zijsron* be increased from Vulnerable to Critically Endangered (Kyne *et al.*, 2021). If this recommendation were adopted, it would see *P. zijsron*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Central	L	C	Likelihood	Consequence
					For example, effort levels across the ECOTF have reduced over time and remain well below historic averages. While not universal, declining effort will frequently result in lower levels of bycatch and, for some species, a reduced interaction potential. While noting these declines, the risk or likelihood of *P. zijsron* experiencing a significant consequence remains high. This is due to the fact that the species has experienced significant range contractions / population declines. These declines mean that that even small levels of fishing mortality could contribute to an undesirable consequence. Given this potential, it was determined that *P. zijsron* required a higher likelihood score for this region. The continued roll-out of the Data Validation Plan provides an ideal opportunity to improve our understanding of sawfish interactions in the Central Trawl Region. With additional information, the regional risk profile for this species could be further refined and improved.	listed in the same category as the speartooth shark (*Glyphis glyphis*) and above a number of the marine turtle species.

Data Report: Appendix C—Preliminary scoring and justifications of the Likelihood and Consequence Analysis for species assessed as part of the Southern Inshore Trawl Regional Risk Assessment

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Marine turtles						
Loggerhead turtle	*Caretta caretta*		3	2	**Likelihood:** The likelihood assessment considered the distribution and habitat preferences of each species when reviewing their potential to interact with trawl operations in the Southern Inshore Trawl Region. These considerations included the location and prevalence of foraging, nesting and rookery sites along the Queensland east coast (Limpus, 2007a; b; 2008a; b; c; 2009). The likelihood assessment also considered the level of uncertainty surrounding the data on regional marine turtle interaction rates. For all species, excluding the leatherback turtle (*Dermochelys coriacea*) and the olive ridley turtle (*Lepidochelys olivacea*), a weight-of-evidence approach supported the assignment of a more conservative likelihood score. Across the complex, data deficiencies made it more difficult to differentiate between the remaining species and/or identify where there was a lower likelihood of the consequence coming to fruition within the current fishing environment. Accordingly, some of the species may have been assigned a more conservative or precautionary score for this aspect of the Likelihood and Consequence Analysis (LCA). *Dermochelys coriacea* displays an affinity for pelagic water environments and the species is less likely to interact with regional trawl operations (Department of the Environment, 2023c). While historic records show that *D. coriacea* has previously nested in central-southern Queensland, there has been a progressive decline in the breeding frequency of this species on the Queensland east coast (Limpus, 2009). For this species, a score of remote (1) was considered appropriate for this aspect of the LCA. *Lepidochelys olivacea* is more commonly encountered in tropical waters and interactions with this species will be less	**Consequence**: The available evidence including third-party assessments did not support a deviation from the default consequence score of moderate (2) for these species (Subcommittee, 1996; Seminoff, 2004; Abreu-Grobois & Plotkin, 2008; Wallace *et al.*, 2013; Casale & Tucker, 2017; Department of the Environment, 2023f; a; b; c; d; e). A number of measures implemented across the East Coast Otter Trawl Fishery (ECOTF) reduce the impact of the fishery on this complex and, therefore, the consequence e.g. the use of a Turtle Excluder Device (TED), Bycatch Reduction Devices (BRDs) and an extensive system of spatial/temporal closures. Effort levels for the ECOTF have also declined through time and are now capped under the harvest strategies (Department of Agriculture and Fisheries, 2021a; e; c; d; b; 2023). In past Ecological Risk Assessments (ERAs), a decline in effort has been directly linked to a decline in risk levels (Pears *et al.*, 2012b; Jacobsen *et al.*, 2015). While difficult to quantify, effort has declined since these assessments and it is reasonable to assume that the consequences of trawl fishing have not increased in the proceeding years. These measures support the assignment of a consequence score at the lower end of the spectrum i.e. moderate (2) *versus* severe (3) or major (4). While TEDs will be effective at reducing the capture of marine turtles, data submitted through the Threatened, Endangered and Protected Animals (TEPA) logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution and may underestimate the total number of marine turtle interactions. The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl
Green turtle	*Chelonia mydas*		3	2		
Leatherback turtle	*Dermochelys coriacea*		1	2		
Hawksbill turtle	*Eretmochelys imbricata*		3	2		
Olive ridley turtle	*Lepidochelys olivacea*		2	2		
Flatback turtle	*Natator depressus*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					frequent in southern Queensland (Department of the Environment, 2023e). The species is more likely to be encountered by fishers in the Northern Trawl Region and (potentially) the Central Trawl Region. While some consideration was given to removing *L. olivacea* from the Southern Inshore Trawl Region LCA, the species still has a broad range and it is considered a resident in Moreton Bay, south-east Queensland (Department of Environment Science and Innovation, 2021). Given these considerations, a reduced score of rare (2) was considered reasonable for this region. Of the remaining species, the green (*Chelonia mydas*), flatback (*Natator depressus*) and loggerhead turtles (*Caretta caretta*) have nesting/breeding and foraging sites within or in close proximity to the Southern Inshore Trawl Region (Limpus, 2007b; 2008a; b). These factors increase the likelihood of an interaction occurring within this region. Key nesting and rookery sites for the hawksbill turtle (*Eretmochelys imbricata*) are located further north (Limpus, 2007a; 2008c). However, *E. imbricata* is a highly migratory species and interactions with this species could occur throughout the five management regions. The ongoing roll-out of the Data Validation Plan may provide further avenues to review and refine the likelihood scores for this region. Depending on the outputs of this program, the scope of the assessment could also be reviewed and refined (e.g.) removing *D. coriacea* and *L. olivacea* from future assessments as a low-risk element.	Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the Northern Prawn Fishery (NPF), supports the hypothesis that the number of marine turtle interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining the consequence score more difficult. Taking a weight-of-evidence approach to the consequence assessment, a score of moderate (2) was considered appropriate for this region. This score takes into consideration risk mitigation measures, declining effort trends and management limitations e.g. an inability to verify reported interaction / release fates and uncertainty surrounding the species that interact with trawl fishers in this region.
Syngnathids						
Tiger pipefish	*Filicampus tigris*		3	2	**Likelihood:** A review of species distributions and habitat preferences determined that these five species have a higher potential to interact with regional trawl fishing activities. Information on the habitat preferences of these five species is readily available and suggest that most occupy a range of both hard and soft substrates to varying depths. While they will be	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of moderate (2) (Pollom, 2016a; Pollom, 2017b; a). This score is considered appropriate given a) the inability to verify reported interaction and release fates and b) species
Spiny seahorse	*Hippocampus spinosissimus*		3	2		
Great seahorse	*Hippocampus kelloggi*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Bentstick pipefish	*Trachyrhamphus bicoarctatus*		3	2	found in grounds accessed by trawl fishers, not all habitats will be conducive to trawl fishing. They will also be afforded a degree of protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). Distributional data was less reliable with information sources often having conflicting range information. This issue is complicated by the fact that the syngnathid taxonomic history is complex and somewhat fluid i.e. varying classifications and, at times, a lack of uniformity. This makes it more difficult to define/quantify regional distributions. These combined factors increased the level of uncertainty regarding the interaction potential between these species and trawling apparatus. As a result, a more conservative approach was adopted and a likelihood score of possible (3) was applied. It is acknowledged that these scores may be an overestimate for this region. With improved information on syngnathid bycatch compositions, these scores may be refined in future risk assessments.	extinction risk classifications. While BRDs may be effective at reducing the capture of some syngnathids, a high proportion will (likely) be captured within the codend of a trawl net. Of note, all interactions with non-retainable syngnathids are required to be reported within the TEPA logbook. However, data reported through these logbooks has poor resolution and provides limited insight into regional catch compositions. As there is currently no mechanism in place to validate TEPA logbook data, a score of moderate was considered reasonable. With an effective mechanism to verify interaction and release fates, these scores could be further refined. Note–Considerations were given to increase the consequence score for the White's seahorse (*Hippocampus whitei*) based on an extinction risk classification of Endangered (Harasti, 2017). However, a review of its preferred habitats and depths indicated that this species prefers three-dimensional structures (e.g. artificial anthropogenic structures, coral reef, macroalgal etc.) to depths of 12 m (Harasti, 2017). Hard substrates are less conducive to trawling and these factors significantly reduce the ability for fishing activities to impact populations. As a result, maintaining a consequence score of moderate (2) was considered appropriate for this species.
White's seahorse	*Hippocampus whitei*		3	2		
Duncker's pipehorse	*Solegnathus dunckeri*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Duncker's pipehorse (*Solegnathus dunckeri*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus dunckeri* occupies various habitats ranging from soft substrates that are more conducive to trawl fishing through to environments dominated by hard structures like sandstone, gravel, gorgonians and sponges (Pollom, 2017c). These habitat preferences will provide *S. dunckeri* with a degree of natural protection from trawl fishing activities. It will also be provided (some) refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). These factors will assist in terms of reducing the likelihood of the	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of severe (3). This score is considered appropriate based on a) the ineffectiveness of TEDs/BRDs in terms of excluding this species from the net, b) an extinction risk classification of Data Deficient (Pollom, 2017c) and c) the allowable retention of this species (trip limit = 50 combined individuals) (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					consequence coming to fruition within the current fishing environment. *Solegnathus dunckeri* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of Queensland, 2019b). Based on a review of historic syngnathid catch it is hypothesised that the interaction potential for this species will be higher in operations fishing further south. However, such inferences must be observed with caution as records of syngnathid harvest do not account for all interactions (e.g. discarded individuals). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	Based on these factors, the assigned score was considered to be reasonable. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Pallid pipehorse	*Solegnathus hardwickii*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Pallid pipehorse (*Solegnathus hardwickii*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus hardwickii* occupies a range of habitats including those associated with sponges, gorgonians and possibly coral reef edges, typically at depths between 12 and 100 m (Pollom, 2017d). These habitat preferences will provide *S. hardwickii* with a degree of natural protection from trawl fishing activities. The species will also be provided (some) refuge from trawl fishing activities through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). These factors will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Solegnathus hardwickii* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of	**Consequence**: There was sufficient evidence to support a deviation from the default consequence score of moderate (2) to severe (3). This score was considered appropriate as this species will have similar vulnerabilities to the Duncker's pipehorse (*S. dunckeri* [assessed in the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions]). Key considerations given to this score included a) the ineffectiveness of TEDs/BRDs in terms of excluding this species from the net, b) a species extinction risk classification of Data Deficient (Pollom, 2017d) and c) the allowable retention of this species (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					Queensland, 2019b). Based on a review of historic syngnathid catch it can be inferred that interactions may be more frequent within this region. However, such inferences must be observed with caution, as records of syngnathid harvest combines both permitted pipefish species into a single reporting field and does not account for discards. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	Based on these factors, the assigned score was considered to be reasonable. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Straightstick pipefish	*Trachyrhamphus longirostris*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Ribboned pipefish	*Haliichthys taeniophorus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sea snakes						
Reef shallows sea snake	*Aipysurus duboisii*		3	2	**Likelihood**: Evidence suggests that the reef shallows sea snake (*Aipysurus duboisii)* will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). *Aipysurus duboisii* is often associated with seagrass beds, corals (over sand) and reef-adjacent areas to a depth of 80 m (Courtney *et al.*, 2010; Lukoschek *et al.*, 2010). While the species has a broad bathymetric range, it will typically occur in shallow environments to depths of 50 m (Lukoschek *et al.*, 2010). The habitat preferences of *A. duboisii* coincide with areas utilised by regional trawl operations. However *A. duboisii* will find refuge in areas less conducive to trawling (e.g. seagrass). Similarly, the species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Lukoschek *et al.*, 2010). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Lukoschek *et al.*, 2010) and mortality rate estimates (*n* = 465 interactions with 5 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as the most recent assessment suggests it has a decreasing population trend (Lukoschek *et al.*, 2010). *Aipysurus duboisii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Aipysurus duboisii* interactions are more likely to occur in the Central Trawl Region where reef-associated species (e.g. red spot king prawns) are actively targeted (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). Overall, the extent of regional-specific interactions with this species remains uncertain and as a result a precautionary score of possible (3) was applied. It is acknowledged that this score may be an overestimate and with improved information on sea snake bycatch compositions, this score may be refined in future risk assessments involving the Southern Inshore Trawl Region.	the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Mosaic sea snake	*Aipysurus mosaicus*		2	2	**Likelihood**: The mosaic sea snake (*Aipysurus mosaicus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus mosaicus* is often associated with soft substrates (e.g. mud, estuaries etc.) to a depth of 50 m (Rasmussen *et al.*, 2021a). While some of these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Aipysurus mosaicus* interactions are more likely to occur in shallow-water operations outside of the ECOTF, namely the	**Consequence**: A review of available evidence supported increasing the consequence score from minor (1) to moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021a). This decision largely reflects the level of uncertainty surrounding regional sea snake catch compositions (see below). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), stable population trend (Rasmussen *et al.*, 2021a), and reasonable post-interaction survival rates (n = 95 interactions with 5.3 per cent mortality; Courtney *et al.*, 2010). *Aipysurus mosaicus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). While limited, any interactions eventuating within the ECOTF are more likely to be attributed to regions targeting red spot king prawns and tiger/endeavour prawns. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score may be refined in future risk assessments. Note–Saucer scallop is currently prohibited for retention in this region. If other retainable species absorb this latent effort, causing a shift to regional operations, this score may need further review.	the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Based on this information it is expected that this species will be capable of withstanding trawl interactions to some degree. However, due to limited sample sizes within sea snake bycatch studies, a more precautionary score was adopted (Milton *et al.*, 2009; Courtney *et al.*, 2010). Given the available information, a rating of moderate (2) was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Olive sea snake	*Aipysurus laevis*		3	2	**Likelihood**: The olive sea snake (*Aipysurus laevis*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus laevis* is often associated with soft and hard substrates (e.g. sand, coral reefs and inter-tidal areas) to depths between 10 and 40 m (Crowe-Riddell *et al.*, 2021). While some of these habitats overlap with trawl grounds, the species is more commonly associated with reefs (Udyawer *et*	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Crowe-Riddell *et al.*, 2021). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Crowe-Riddell *et al.*, 2021), and reasonable post-interaction survival rates (n = 515 interactions with 9.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					al., 2014; Crowe-Riddell *et al.*, 2021). These preferences will limit the exposure of this species to trawl fishing activities. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, *A. laevis* is likely to experience significantly higher interaction rates within the Central Trawl Region where red spot king prawns are actively targeted. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). Overall, the extent of regional-specific interactions with this species remains uncertain and as a result a precautionary score of possible (3) was applied. It is acknowledged that this score may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score may be refined in future risk assessments.	population trends are currently unknown (Crowe-Riddell *et al.*, 2021). *Aipysurus laevis* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spine-bellied sea snake	*Hydrophis curtus*		4	2	**Likelihood**: Evidence suggests that the spine-bellied sea snake (*Hydrophis curtus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. curtus* is often associated with estuaries, continental shelves, reef-adjacent areas and soft substrate environments (e.g. seagrasses, sand, mud) to depths between 4 and 55 m (Rasmussen *et al.*, 2021b). The species though is known to have an affinity for seagrass meadows between 1–4 m deep (Udyawer *et al.*, 2016b).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Rasmussen *et al.*, 2021b), and reasonable post-interaction survival rates (n = 931 interactions with 5.8 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					Some habitats utilised by this species coincide with operational areas within this region. However, the species will find refuge in environments that are less conducive to trawling (e.g. seagrass), thus limiting overall regional interactions. Individuals will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). *Hydrophis curtus* interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). The score applied to the likelihood component may be an overestimate for this region. However, this species is known to have high interaction rates across the ECOTF (Courtney *et al.*, 2010), and a more precautionary approach was employed to account for the cumulative pressures on this species. This score may be further refined with additional information.	population trends are currently unknown (Rasmussen *et al.*, 2021b). *Hydrophis curtus* will derive benefit from bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Elegant sea snake	*Hydrophis elegans*		3	2	**Likelihood**: Evidence suggests that the elegant sea snake (*Hydrophis elegans*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. elegans* is often associated with soft and hard substrates (e.g. sand, mud, coral reefs, seagrass, estuaries and rivers) to depths of 110 m (Milton, 2010a; Department of the Environment, 2024). This species is also	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Least Concern, stable population trend (Milton, 2010a), and moderate post-interaction survival rates (*n* = 347 interactions with 17 per cent mortality; Milton *et al.*, 2009; *n* =

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					known to have an affinity for seagrass meadows in depths less than three metres (Udyawer *et al.*, 2016b). Some of the habitats utilised by this species will coincide with areas fished by regional trawl operations. However, the species will find refuge in environments that are less conducive to trawling (e.g. seagrass), thus limiting overall regional interactions. Individuals will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). When compared, *H. elegans* interactions are more likely to occur in the Central Trawl Region. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010). Overall, the extent of regional-specific interactions with this species remains uncertain and as a result a precautionary score of possible (3) was applied. It is acknowledged that this score may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score may be further refined.	186 interactions with 12.4 per cent mortality; Courtney *et al.*, 2010). Of notable importance, previous research has demonstrated a correlation between sea snake sizes and mortality (Courtney *et al.*, 2010). As a larger species attaining a length up to 260 cm (Department of the Environment, 2024), *H. elegans* may experience greater mortality rates. While potentially limited for larger individuals, *H. elegans* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spectacled sea snake	*Hydrophis kingii*		2	2	**Likelihood**: The spectacled sea snake (*Hydrophis kingii*) will interact with trawling operations on the Queensland east coast	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Milton *et al.*, 2010b).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					(Courtney *et al.*, 2010), though encounters with this region may be less common. Across its range, *H. kingii* will inhabit a range of environments including soft substrates (e.g. sand, mud) and inter-reef areas to depths of 22 m (Milton *et al.*, 2010b). Given the overlap of suitable habitat and the targeted operational areas, *H. kingii* interactions may occur in this region – albeit limited. This species though will be will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions with this species are more likely within the Central Trawl Region where reef-associated species (red spot king prawns) are targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this species could potentially be removed from future risk assessments involving this region.	The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton *et al.*, 2010b) and mortality rate estimates (*n* = 30 interactions with 26.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton *et al.*, 2010b). *Hydrophis kingii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Turtle-headed sea snake	*Emydocephalus annulatus*		5	1	**Likelihood**: The turtle-headed sea snake (*Emydocephalus annulatus*) has a broad distribution along the east coast of Queensland (Lukoschek, 2010a; Udyawer *et al.*, 2020). Across	**Consequence**: The available evidence supported a deviation from the default score of moderate (2) to minor (1) (Milton *et al.*, 2009; Courtney *et al.*, 2010).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					its range, *E. annulatus* will inhabit sandy, rocky and coral reef environments to depths of 40 m (Lukoschek, 2010a). While some of these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be rare. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). The species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments in this region as a low-risk element. Note–*Emydocephalus annulatus* was assigned a higher likelihood rating as the corresponding consequence score was very low. This species absence in a previous trawl bycatch study suggests it will experience refuge from operations and regional trawl fishing activities are unlikely to have a negative or long-term impact on populations.	*Emydocephalus annulatus* was not encountered within a comprehensive study observing the presence of sea snake species in trawl bycatch (Courtney *et al.*, 2010). This suggests that trawl interactions in the ECOTF are rare. In the (unlikely) event of an interaction, *E. annulatus* will benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the weight accumulating within the codend of a net, thus minimising the risk of potential crushing if an encounter occurs (Milton *et al.*, 2009). *Emydocephalus annulatus* is unlikely to interact with trawling apparatus, though was included in the assessment due to sufficient uncertainty surrounding its distribution and interaction potential. The consequence score assigned to this species was considered reasonable due to the expected rarity of an encounter occurring in this region. With improved data on regional sea snake bycatch compositions, this species could potentially be removed from future assessments. For reference, *E. annulatus* has an extinction risk classification of Least Concern with a declining population trend (Lukoschek, 2010a).
Olive-headed sea snake	*Hydrophis major*		2	2	**Likelihood**: The olive-headed sea snake (*Hydrophis major*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis major* is often associated with sandy and muddy environments in tidal creeks, offshore continental shelves or gulf areas to depths of 22 m (Guinea *et al.*, 2010). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Guinea *et al.*, 2010) and moderate post-interaction survival rates (*n* = 163 interaction with 13 per cent mortality; Milton *et al.*, 2009; *n* = 55 interactions with 18.2 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Guinea *et al.*, 2010; Milton *et al.*, 2010b). *Hydrophis major* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, encounters are more likely to occur in the Central Trawl Region, though will remain low in contrast to other assessed species. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Small-headed sea snake	*Hydrophis macdowelli*		2	2	**Likelihood** The small-headed sea snake (*Hydrophis macdowelli*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis macdowelli* is often associated with sandy environments in estuary, nearshore or inter-reef areas to depths of 26 m (Milton *et al.*, 2010a). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be limited. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton *et al.*, 2010a) and mortality rates (*n* = 153 interactions with 33.3 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton *et al.*, 2010a).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this species could potentially be removed from future risk assessments involving this region.	Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study only reported a three per cent mortality rate (Wassenberg *et al.*, 2001). While notably different, this distinction may be attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (n = 37). While potentially limited for this species, *Hydrophis macdowelli* will derive (some)benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Spotted sea snake	*Hydrophis ocellatus*		2	2	**Likelihood**: The spotted sea snake (*Hydrophis ocellatus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis ocellatus* is often associated with sandy inter-reefal environments to depths of 84 m (Milton, 2010b; Udyawer *et al.*, 2014). While these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton, 2010b) and comparatively lower survival rates (*n* = 94 interactions with 27.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton, 2010b). Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study reported a lower mortality rate of 18 per cent (Wassenberg *et al.*, 2001). While notably different, this distinction may be partially attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (*n* = 67). *Hydrophis ocellatus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
						reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Horned sea snake	*Hydrophis peronii*		2	2	**Likelihood**: The horned sea snake (*Hydrophis peronii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis peronii* is often associated with sandy, reef-adjacent environments to depths of 60 m (Lukoschek, 2010b). While these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (e.g. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Lukoschek, 2010b). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), population trend (stable) (Lukoschek, 2010b) and moderate post-interaction survival rates (*n* = 271 interactions with 17.3 per cent mortality; Courtney *et al.*, 2010). *Hydrophis peronii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
						reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Beaked sea snake	*Hydrophis zweifeli*		1	2	**Likelihood**: The beaked sea snake (*Hydrophis zweifeli*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region (and otter trawl activities in general) may be uncommon. *Hydrophis zweifeli* is often associated with soft substrate environments (e.g. sand, mud) as well as estuaries and creeks in shallow waters (Great Barrier Reef Marine Park Authority, 2011). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, encounters are more likely to occur in shallow-water operations outside of the ECOTF, namely the Black Tiger Prawn Broodstock Fishery and the River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of remote (1) may be an overestimate for this region. With improved information on	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Rasmussen, 2018). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Data Deficient, population trend (unknown) (Rasmussen, 2018) and high survival rates (n = 81 interactions with 1.2 per cent mortality; Courtney *et al.*, 2010). *Hydrophis zweifeli* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result,

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					regional sea snake bycatch compositions, this species could potentially be removed from future assessments of this region as a low-risk element. Note–Information relating to this species habitat and depth preferences was based on an assessment of *Enhydrina schistosa* in the Great Barrier Reef (Great Barrier Reef Marine Park Authority, 2011). As a result of phylogenetic restructuring, *E. schistosa* has since been removed as a species occurring in Australian waters and replaced by *H. Zweifeli* (Ukuwela *et al.*, 2013; Udyawer *et al.*, 2016a).	this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Stoke's sea snake	*Hydrophis stokesii*		1	2	**Likelihood**: The Stoke's sea snake (*Hydrophis stokesii*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis stokesii* is associated with various substrates (e.g. reefs, mud, sand) and environments (e.g. harbours) to a maximum depth of 50 m (Sanders *et al.*, 2018). While some of these habitat preferences coincide with areas utilised by regional trawl operations, interactions are expected to be somewhat limited. This species will also be provided (some) protection from trawl fishing activities through marine national parks (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. When compared, interactions are more likely to occur (though in low numbers) in the Central Trawl Region where reef-associated species (e.g. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). With improved information on regional sea snake bycatch compositions, this species could potentially be removed from future assessments in this region as a low-risk element.	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), population trend (unknown) (Sanders *et al.*, 2018) and reasonable survival rates (n = 91 interactions with 10 per cent mortality; Milton *et al.*, 2009). Of interest, another study reported a higher mortality rate of 16.7 per cent (Courtney *et al.*, 2010). While notably different, this distinction may be partially attributed to the Courtney *et al.* (2010) study consisting of a smaller sample size (n = 30). *Hydrophis stokesii* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Inshore Trawl

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
						Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Sharks						
Collared carpetshark	*Parascyllium collare*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Brownbanded bambooshark	*Chiloscyllium punctatum*		5	1	**Likelihood**: The brownbanded bambooshark (*Chiloscyllium punctatum*) was assigned a higher likelihood rating as the corresponding consequence score was very low. All the available evidence suggests that trawl fishing activities within this region will not have a negative or long-term impact on this species. This included information obtained through third-party assessments regarding the species current extinction risk classification and fishery status (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There is reasonable confidence that current fishing activities within the Southern Inshore Trawl Region will not have a significant impact on regional populations and/or contribute to a significant, negative consequence for this species.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Chiloscyllium punctatum* is a common benthic shark species and it is abundant within its preferred habitats (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There are few concerns surrounding the long-term sustainability of the species and it has been classified as Least Concern under the IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023b). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The high productivity of *C. punctatum* contributed to these findings. Fishing activities within the current fishing environment are unlikely to result in a long-term, negative consequence for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Colclough's shark	*Brachaelurus colcloughi*		4	3	**Likelihood**: Information on the Colclough's shark (*Brachaelurus colcloughi*) is limited and further research is required on the distribution of this species on the Queensland east coast. However, bycatch surveys suggest that *B. colcloughi* may occur within waters of the Southern Inshore Trawl Region (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c). The majority of information on *B. colcloughi* comes from less than 80 individuals; most of which were caught in the waters encompassed within the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c). Datasets for *B. colcloughi* are limited and it is difficult to ascertain how frequently this species might interact with trawl operations in the Southern Inshore Trawl Region. This species though is endemic, has a highly limited range and is expected to occur at a low natural abundance (Kyne *et al.*, 2011; Kyne *et al.*, 2015; Kyne *et al.*, 2023c). These factors increase the potential or likelihood of trawl fishing activities contributing to a negative event across its known range/distribution. Depth ranges, habitat preferences, nocturnal behaviours and refuge/availability (e.g. marine park zones) will assist in terms of reducing the interaction/encounterability potential for this species. It is also recognised that trawl effort (across the fishery) has declined through time and remains below historic averages. While not universal, declining effort levels can translate to lower levels of bycatch and, for some species, a reduced interaction potential. This inference though requires testing and additional information on elasmobranch bycatch compositions in the Southern Inshore Trawl Region. While noting the above, there remains a high level of uncertainty surrounding a) the population structure of *B. colcloughi*, b) the productivity/abundance of this species and c) interaction rates within this region of the ECOTF. This uncertainty has been reflected in the likelihood score assigned to this species.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score (Kyne *et al.*, 2021; Kyne *et al.*, 2023c). The consequence assessment for *B. colcloughi* had to consider a high number of uncertainties. These uncertainties relate to the distribution of this species on the Queensland east coast, its potential to interact with the ECOTF and the capacity of the animal to survive a trawl interaction. Individuals caught in the sweep of the net will derive less benefits from using a TED and BRD as it only attains a maximum total length of 75 cm (Kyne *et al.*, 2021). This means that both immature and mature animals will be caught as bycatch in this fishery. The consequence score for this species is considered appropriate given the level of uncertainty and the outputs of third-party assessments (Kyne *et al.*, 2021) that determined the species: - Is endemic with a restricted geographical range. - Occurs at naturally low abundances with an inferred population decline (<10,000 mature individuals; an inferred continuing decline). - Has an elevated (deteriorating) extinction risk classification (Vulnerable). When these factors are considered, it is expected that this species has a higher vulnerability and/or lower resilience to rebound from fishing-related mortalities. It also suggests that there is an increased potential for trawl fishing activities to negatively impact regional populations and the extinction risk classification. It is recognised that the score assigned to this component of the assessment may overestimate the consequence for this species. In this instance though, the limited levels of information and the species' naturally low abundance warranted the adoption of a more precautionary approach. With improved information on regional elasmobranch bycatch

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					It is recognised that the likelihood score assigned to this species may be an overestimate for this region. Though the severity of any potential impact (negligible, low, medium or high) remains unknown and requires further investigations. Until then, the decision was made to take a more precautionary assessment approach. The outputs of the Data Validation Plan may assist in terms of refining the *B. colcloughi* risk assessment through time (Department of Agriculture and Fisheries, 2018).	compositions, the consequence score could be refined and (potentially) reduced.
Crested hornshark	*Heterodontus galeatus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Eastern angelshark	*Squatina albipunctata*		1	3	**Likelihood**: There is evidence that the eastern angelshark (*Squatina albipunctata*) will be caught as bycatch in the ECOTF. Based on the available information, interactions with this species are more likely to occur in the Southern Offshore Trawl Region (Rigby *et al.*, 2016b; Campbell *et al.*, 2017). While the distribution of *S. albipunctata* overlaps with the Southern Inshore Trawl Region, the majority of effort/fishing occurs at the lower bounds of this species depth profile (35–415 m). To this extent, the eastern angelshark will be afforded a degree of natural protection from trawl fishing activities. This inference is supported by the *Action Plan for Australian Sharks and Rays* which notes that the eastern angelshark experiences lower fishing pressures in northeast Queensland (Kyne *et al.*, 2021). The above findings supported the assignment of a lower likelihood score for this species in this region. Given the low interaction potential for this species in the Southern Inshore Trawl Region, it is unlikely that the consequence will come to fruition within the current fishing environment. With improved information on regional elasmobranch bycatch compositions, this species could potentially be removed from future assessments as a low-risk element.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given the current understanding of the *S. albipunctata* population trend (depleting; Kyne *et al.*, 2023f) and extinction risk classification (Vulnerable; Kyne *et al.*, 2021). These factors make the species more vulnerable to trawl fishing activities and reduce its capacity to absorb regional fishing-related mortalities. The Southern Inshore Trawl Region represents the northern extent of the eastern angelshark range. This will have some bearing on how frequently this species interacts with regional trawl fishers and, by extension, their potential to contribute to an undesirable event. While noting these limitations, the status of the population on the Australian east coast places this species in a more precarious position and increases the probability that current fishing levels will have a negative impact on regional populations.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Eastern banded catshark	*Atelomycterus marnkalha*		2	2	**Likelihood**: The eastern banded catshark (*Atelomycterus marnkalha*) is an endemic benthic shark species with limited data sets. The available evidence suggests that this species is more likely to interact with trawl operations in central and northern Queensland (Jacobsen & Bennett, 2007; Kyne *et al.*, 2023m). Interaction rates for this species though are expected to be low when compared to other benthic sharks and batoids (pers. comm. Ian Jacobsen). Habitat information is limited for this species, although specimens were primarily caught in sandy to coarse rubble substrates (Jacobsen & Bennett, 2007). This suggests that some of the habitats preferred by this species are less conducive to trawl fishing activities. *Atelomycterus marnkalha* may also be afforded additional protections from trawling in sections of the Great Barrier Reef Marine Park (GBRMP) which overlap with the Southern Inshore Trawl Region (Great Barrier Reef Marine Park Authority, 2022a; b). A weight-of-evidence approach indicates that there is a lower likelihood of regional trawl fishing activities negatively impacting *A. marnkalha* populations. This inference though has yet to be fully tested and future assessments would benefit from additional information on regional elasmobranch bycatch compositions. Similarly, with improved information on regional shark bycatch compositions, *A. marnkalha* could potentially be removed from risk assessments involving this region.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. The assigned score is considered appropriate given the current understanding of the *A. marnkalha* Australian extinction risk classification (Least Concern), population status (nothing to infer or suspect a population reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023m). While information levels for *A. marnkalha* are limited, a weight-of-evidence approach suggests that the consequences for this species are less severe. Accordingly, it was assigned a lower score for this aspect of the assessment. Future risk assessments though would benefit from additional information on the elasmobranch catch compositions in this region. This information could be used to further refine the *A. marnkalha* risk profile and determine the need to undertake further assessment.
Zebra shark	*Stegostoma tigrinum*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the zebra shark (*Stegostoma tigrinum*). The species will derive considerable benefit from the use of a TED and be afforded refuge from trawl fishing activities through ancillary programs like the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). While immature animals will still be caught as bycatch, the majority of sub-adult and adult	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Stegostoma tigrinum* is a common shark with a wide northern and eastern Australian distribution. The productivity of this species is considered low for an oviparous (egg-laying) species. However, there is limited (current) concerns surrounding the conservation status or long-term sustainability of the species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					specimens will likely escape through the TED opening (Brewer *et al.*, 2006; Campbell *et al.*, 2020). Applying a weight-of-evidence approach indicates that there is a lower likelihood of the consequence coming to fruition in the Southern Inshore Trawl Region and/or within the current fishing environment.	*Stegostoma tigrinum* has an extinction risk classification of Least Concern with nothing to infer or suspect a population decline across its known range (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known distribution (Kyne *et al.*, 2023l). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The above considerations indicate that current fishing activities pose limited consequences for the long-term conservation status or sustainability of this species
Piked spurdog	*Squalus megalops*		1	2	**Likelihood**: There is evidence that the piked spurdog (*Squalus megalops*) will be caught as bycatch in the ECOTF (Rigby *et al.*, 2016b). *Squalus megalops* is a common endemic shark species that is often associated with deeper water environments. The depth profile of this species (0–732 m) extends well beyond the operational constraints of regional trawl fishers. These habitat preferences will provide the species with considerable protection from trawl fishing activities within the Southern Inshore Trawl Region. It also reduces the likelihood of the consequence coming to fruition within the current fishing environment.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given what is known about the *S. megalops* population trend (increasing; Rigby & Kyne, 2020), Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021) and fisheries status assessment (Sustainable; Kyne *et al.*, 2023j). During deliberations, some consideration was given to reducing the consequence score for this species in this region. It was determined that any score reduction would require additional information on *S. megalops* interaction rates and confirmation that it had a low interaction potential in this region. For reference, *S. megalops* has been included in two previous ERAs examining longer-term trawl risks. This assessment indicated that *S. megalops* was at higher risk from trawl fishing activities (Campbell *et al.*, 2017; Dedini *et al.*, 2023). The results of these assessments factored into the decision to assign this species a consequence score of moderate (2).
Australian weasel shark	*Hemigaleus australiensis*		2	2	**Likelihood**: Bycatch surveys indicate that the Australian weasel shark (*Hemigaleus australiensis*) will be caught as bycatch in the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007;	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australiensis*.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					Campbell, 2022). However, there is limited information on current capture rates and/or its ability to survive a trawl interaction. Expectations are that *H. australiensis* interactions will be less frequent, particularly when compared to other benthic shark and ray species. It is further hypothesised that trawl fishing activities within the Southern Inshore Trawl Region will not lead to a long-term, negative change to the conservation / fishery status of this species. This inference is supported by evidence obtained through third-party assessments.	*Hemigaleus australiensis* is a small, wide-spread whaler species that is fairly common/abundant throughout its known distribution. Anecdotal evidence suggests the species is highly productive and fast growing (Ebert *et al.*, 2021; Kyne *et al.*, 2021). These factors increase the capacity of the species to absorb fishing mortalities and rebound after a potential decline. As a smaller species, *H. australiensis* will derive less benefit from the use of a TED i.e. both immature and mature sharks will be caught as bycatch. At present there is limited information on how successfully *H. australiensis* survives a trawl fishing event. While noting the above deficiencies, evidence suggests that key risks for this species are currently being managed. The species has an Australian extinction risk classification of Least Concern (Kyne *et al.*, 2021) with corresponding status assessments indicating that the species is being sustainably fished across its known distribution. These findings were accounted for in the consequence assessment.
Pale spotted catshark	*Asymbolus pallidus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Grey spotted catshark	*Asymbolus analis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Orange spotted catshark	*Asymbolus rubiginosus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Batoids						
Australian butterfly ray	*Gymnura australis*		3	2	**Likelihood**: Operations within the Southern Inshore Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting this overlap, the Australian butterfly ray (*Gymnura australis*) is broadly distributed (Jacobsen & Bennett, 2009; Last *et al.*, 2016b) and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the	**Consequence**: The available evidence, including that contained in third-party assessments (Campbell *et al.,* 2017; Kyne *et al.,* 2021), supported a downgrading of the default consequence score from severe (3) to moderate (2). The reduced score better reflects what is known about the conservation / extinction risk status of this species (Least Concern), population trends (suspected to be stable) and

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					likelihood of the consequence coming to fruition in the short-to-medium term. Within the Southern Inshore Trawl Region, the species may be afforded additional protection through the Great Barrier Reef Marine Park Representative Areas Program (Great Barrier Reef Marine Park Authority, 2022a; b). However, *G. australis* is frequently found in soft-bottom substrates that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). These preferences factored into the species receiving a higher likelihood score. Bycatch data for the ECOTF provides limited insight into *G. australis* interaction rates and release fates (alive, dead or moribund). However, a weight-of-evidence approach suggests that it may be one of the more common elasmobranchs caught in prawn-trawl fisheries (Courtney *et al.*, 2007; Jacobsen, 2007; Pitcher *et al.*, 2007; Kyne, 2008). Catch data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species.	fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023o). While noting these considerations, the use of a TED/BRD will be less effective for this species, with immature individuals and adults likely to be caught as trawl bycatch (Jacobsen, 2007). Once captured, *G. australis* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Campbell *et al.*, 2017). This, in part, is due to the species having a very flattened morphology and limited external protections e.g. hardened denticles or skin (pers. comm. I. Jacobsen). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Yellowback stingaree	*Urolophus sufflavus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Patchwork stingaree	*Urolophus flavomosaicus*		3	2	**Likelihood**: Regional operations will fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Pears *et al.*, 2012b; Campbell *et al.*, 2017). While noting this overlap, the bathymetric range of the patchwork stingaree (*Urolophus flavomosaicus*) extends beyond trawled areas (60–320 m) and a notable portion of its range will experience	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *U. flavomosaicus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne *et al.*,

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					limited fishing effort (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *U. flavomosaicus* interaction rates and release fates (alive, dead or moribund). Based on the available data, interactions are more likely to occur in deeper water environments (Kyne *et al.*, 2023ad) and in the Southern Offshore Trawl Region. This inference was supported by a broader review of elasmobranch bycatch within the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. To refine this score, further information is required on the composition of this portion of the catch. Note–One study observing trawl bycatch within the eastern king prawn sector inferred that *U. flavomosaicus* may not occur on the east coast, and such records would be more appropriately listed as conspecific with the sandyback stingaree (*U. bucculentus*) (Rigby *et al.*, 2016b). This factor adds to the challenges of determining this species interaction potential in the ECOTF. Similarly, anecdotal evidence suggests smaller rays may exhibit higher interaction rates with this fishery. The accuracy of this assessment cannot be determined at this point in time.	2019a), population trend (suspected to be stable; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ad). While noting these considerations, as a smaller batoid, *U. flavomosaicus* will derive fewer benefits from the use of a TED/BRD, with immature and adult individuals likely to be caught as trawl bycatch. Once captured, *U. flavomosaicus* are expected to have high levels of post-interaction mortality and may abort pups during an encounter (Kyne *et al.*, 2021; Kyne *et al.*, 2023ad). These factors limited refinements to the consequence score for this species.
Sandyback stingaree	*Urolophus bucculentus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Kapala stingaree	*Urolophus kapalensis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Greenback stingaree	*Urolophus viridis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Common stingaree	*Trygonoptera testacea*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Australian whipray	*Himantura australis*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the Australian whipray (*Himantura australis*). Due to its depth profile (0–45 m), this species will only interact with operations targeting prawns in shallower waters (Last *et al.*, 2016b; Kyne *et al.*, 2023p). If and when this species is caught in the ECOTF, a high proportion of the sub-adults and adults will experience a contact without capture event. While difficult to quantify, contact without capture events are less likely to end in significant injuries or impede the long-term survivability of the animal. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in the Southern Inshore Trawl Region and/or within the current fishing environment. With additional information on bycatch compositions, this species could potentially be removed from future ERAs involving this region.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australis*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern), (suspected) stable population trend (Kyne *et al.*, 2021) and sustainability status (Sustainable; Kyne *et al.*, 2023p). The maximum disc width of this species assists in terms of reducing the size of the potential consequence. *Himantura australis* reaches at least 183 cm disc width and the vast majority of sub-adult and adult specimens, if caught, will be excluded from the net via the TED. It is recognised that a score of moderate (2) may be an overestimate for this species. With additional information on regional elasmobranch catch rates, this score could be further refined.
Blackspotted whipray	*Maculabatis astra*		3	2	**Likelihood**: Trawl operations within the Southern Inshore Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Kyne, 2008; Pears *et al.*, 2012b). While noting this overlap, the blackspotted whipray (*Maculabatis astra*) is broadly distributed and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. astra* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as	**Consequence**: The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Kyne *et al.*, 2021; Kyne *et al.*, 2023q). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023q). As a smaller batoid, *M. astra* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 92 cm (Kyne *et al.*, 2021) and some adults will be

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Within the Southern Inshore Trawl Region, the species will be afforded additional protection through the marine national parks program (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). However, *M. astra* are commonly found in habitats that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). Based on the available data, interactions with this species are more likely to occur in waters <75 m (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. astra* and the brown whipray (*M. toshi*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality rates are largely unknown for this species (Kyne *et al.*, 2023q). However, a composite study including both *M. astra* and *M. toshi* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. astra* as a standalone species. These factors limited refinements to the consequence score for this species.
Brown whipray	*Maculabatis toshi*		3	2	**Likelihood**: Trawl operations within the Southern Inshore Trawl Region fish in habitats preferred by the brown whipray (*Maculabatis toshi*) and there is evidence that it forms part of the elasmobranch trawl bycatch across its Queensland range (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). While acknowledging this overlap, notable portions of this species' range will experience light or negligible fishing (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. toshi* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Within the Southern Inshore Trawl Region, the species will be afforded additional protection through the marine national	**Consequence:** The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trend (nothing to infer a reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). As a smaller batoid, *M. toshi* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 82 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					parks program (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). However, *M. toshi* are commonly found in habitats that are more conducive to trawl fishing activities (pers. comm. I. Jacobsen). Based on the available data, interactions with this species are more likely to occur in waters <75 m and in operations targeting tiger, endeavour and banana prawns (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. toshi* and the blackspotted whipray (*M. astra*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality levels for this species are largely unknown (Kyne *et al.*, 2023q). However, a composite study including both *M. toshi* and *M. astra* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. toshi* as a standalone species. These factors limited refinements to the consequence score for this species.
Estuary stingray	*Hemitrygon fluviorum*		2	3	**Likelihood**: The depth profile (0–28 m) and distribution of the estuary stingray (*Hemitrygon fluviorum*) will overlap with the effort footprint of the Southern Inshore Trawl Region. However, a notable portion of trawl operators in this region will fish in areas where *H. fluviorum* are less likely to be encountered, namely targeting saucer scallops (*Y. balloti*) and Moreton Bay Bugs (*Thenus* spp.) (Department of Agriculture and Fisheries, 2021d). These fishing patterns reduce the likelihood of an estuary stingray interaction occurring in this region. When compared, interactions with this species are more likely to occur in trawl operations targeting prawns in shallower water environments and/or in closer proximity to estuaries or mangrove lined stretches of coastline. At a regional level, the likelihood of trawl fishing activities contributing to a negative consequence are expected to be higher in regions located further south (e.g. Moreton Bay) and within the River and Inshore Beam Trawl Fishery.	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023w). The revised score better reflects what is known about this species Australian extinction risk classification (Vulnerable), population trends (suspected reduction of greater than 30 per cent) and protection status under the *Nature Conservation Act 1992* (Near Threatened; Queensland Government, 1992; Kyne *et al.*, 2021). It is recognised that the threats posed to the species are wider than commercial fishing with habitat degradation also identified as a key threat (Kyne *et al.*, 2021). Fishing mortalities though have the potential to compound historic range contractions and population declines. Some of the potential consequences being further range contractions, reduced genetic diversity and the fragmentation of regional populations.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					With improved information on regional elasmobranch catch compositions, this species could potentially be removed from future risk assessments involving this region.	As this species prefers brackish waters and mangrove-fringed estuaries (Last *et al.*, 2016b; Kyne *et al.*, 2023w), a consequence score of severe may be an overestimate for this region. There is, however, limited information on elasmobranch catch compositions in the Southern Inshore Trawl Region. This makes it difficult to assess the extent and frequency (none, low, medium or high) of interactions with this species.
Coral sea maskray	*Neotrygon trigonoides*		3	2	**Likelihood**: The Coral Sea maskray (*Neotrygon trigonoides*) will interact with east coast trawl operations and be caught as bycatch in the Southern Inshore Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon trigonoides* is a common elasmobranch that is often associated with reefal and continental shelf environments to depths of 170 m (Kyne *et al.*, 2021). The species will be afforded a degree of natural protection from trawl fishing and it is also found in areas exposed to fewer fishing pressures (Kyne *et al.*, 2021). Similarly, a proportion of the population will be protected from trawl fishing activities through the marine national parks program (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). These factors reduce the likelihood of the consequence coming to fruition under the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. trigonoides* is a key component of the elasmobranch catch in the scallop fishery (Courtney *et al.*, 2007). Studies also demonstrate this species will interact with the shallow-water eastern king prawn and tiger/endeavour prawn sectors (Courtney *et al.*, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. Capture rates are also expected to be higher for this species as TEDs are less effective in terms of excluding smaller rays from the catch. This inference is supported by results from bycatch composition studies which	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. trigonoides*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Sherman *et al.*, 2021), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023u). *Neotrygon trigonoides* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. trigonoides* are likely to have high levels of post-interaction mortality (Kyne *et al.*, 2023u). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					show *N. trigonoides* are caught with some frequency (*n* = 385; Campbell *et al.*, 2017). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments. Note–Catch data for this species was typically reported as *Dasyatis kuhlii* or *N. kuhlii* (Jacobsen, 2007; Kyne, 2008; Last *et al.*, 2016a; Last *et al.*, 2016b).	
Speckled maskray	*Neotrygon picta*		3	2	**Likelihood**: The speckled maskray (*Neotrygon picta*) will interact with east coast trawl operations and be caught as bycatch in the Southern Inshore Trawl Region (Jacobsen, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon picta* is a common elasmobranch that is often associated with soft substrates and continental shelf environments to depths between 5–100 m (Kyne *et al.*, 2021; Bray, Undated). The species will be afforded a degree of natural protection from trawl fishing and it is also found in areas exposed to fewer fishing pressures (Kyne *et al.*, 2021). Similarly, a proportion of the population will be protected from trawl fishing activities through the marine national parks program (Department of Environment and Science, 2020a; Great Barrier Reef Marine Park Authority, 2022a; b). These factors reduce the likelihood of the consequence coming to fruition under the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. picta* is a key component of the elasmobranch catch in the scallop sector (Kyne, 2008). Bycatch studies also suggest that the species will be caught in shallow-water operations targeting tiger and endeavour prawns (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. This uncertainty was taken into	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. picta*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Pierce *et al.*, 2015), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023af). *Neotrygon picta* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. picta* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Kyne, 2008). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					consideration as part of this assessment and contributed to *N. picta* receiving a marginally higher likelihood score. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	
Bottlenose wedgefish	*Rhynchobatus australiae*		3	2	**Likelihood**: The bottlenose wedgefish (*Rhynchobatus australiae*) will interact with east coast trawl operations and be caught as bycatch in the Southern Inshore Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Rhynchobatus australiae* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths of 60 m (Kyne, 2008; Kyne *et al.*, 2021). While studies are limited, the available data indicates that *R. australiae* will be caught as bycatch in the scallop, tiger and endeavour prawn sectors (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). Historic bycatch records for *R. australiae* were reported in a complex which included the eyebrow wedgefish (*R. palpebratus*) or under the synonym *R. djiddensis*. This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. australiae*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species Australian extinction risk classification (Near Threatened; Kyne *et al.*, 2021), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023r). As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. australiae* from the catch (Campbell *et al.*, 2020). The size of *R. australiae* may also assist in terms of it surviving a trawl interaction (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). This inference though requires further testing and cannot be confirmed without additional information on *R. australiae* interaction rates and release fates.
Eyebrow wedgefish	*Rhynchobatus palpebratus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
Eastern shovelnose ray	*Aptychotrema rostrata*		3	2	**Likelihood**: Regional operations will fish in habitats preferred by the eastern shovelnose ray (*Aptychotrema rostrata*) and there is evidence that it forms part of the elasmobranch trawl bycatch along the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Bycatch data is available for this species and provides some insight into *A. rostrata* interaction rates and release fates (alive, dead or moribund). One study demonstrated that *A. rostrata* dominated the elasmobranch catch in both the scallop and shallow water eastern king prawn sectors (Courtney *et al.*, 2007). Similar results were observed in another bycatch study focused on areas south of the GBRMP. In this instance, *A. rostrata* was the most commonly encountered species across the entire assessment (*n* = 3,933; Campbell *et al.*, 2017). Interactions with other sectors targeting deepwater eastern king prawns and tiger/endeavour prawns were less frequent (Courtney *et al.*, 2007; Pears *et al.*, 2012b; Rigby *et al.*, 2016b). *Aptychotrema rostrata* will be a common component of the elasmobranch catch in this region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). For these reasons, a likelihood score of possible (3) was considered reasonable. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. rostrata*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne & Stevens, 2015), population trends (nothing to infer or suspect a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ah). While noting these considerations, evidence suggests that a) *A. rostrata* will derive less benefit from the use of a TED and b) remains abundant within trawl bycatch (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). The use of BRD designs like the Fisheye though, may assist in terms of excluding this species from the trawl catch (Courtney *et al.*, 2007). Further, anecdotal evidence suggests that *A. rostrata* have reasonably good post-interaction survival rates (Kyne, 2008; Campbell *et al.*, 2017; Kyne *et al.*, 2021). These factors contributed to the species receiving a consequence score at the lower end of the spectrum.
Giant guitarfish	*Glaucostegus typus*		2	2	**Likelihood**: The giant guitarfish (*Glaucostegus typus*) has been recorded as bycatch in the ECOTF and the species will (likely) interact with regional trawl operations (Pears *et al.*, 2012b; Campbell *et al.*, 2017). *Glaucostegus typus* inhabits a range of demersal environments including intertidal and offshore areas to depths of 100 m (Kyne *et al.*, 2021; Kyne *et al.*, 2023y). While these habitat preferences overlap with the ECOTF, areas of its distribution will have limited exposure to fishing activities (Kyne	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *G. typus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of its Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021). Within Australia, *G. typus* has a (suspected) stable population (Kyne *et al.*, 2021) and it has been assessed as sustainably fished across its known distribution (Kyne *et al.*, 2023y).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					et al., 2021). Juveniles also display an affinity for intertidal areas (Kyne *et al.*, 2021) which may assist in terms of reducing their exposure to trawl fishing during these early life stages. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in this region and/or within the current fishing environment. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	Results from previous risk assessments also supported the assignment of a consequence score at the lower end of the spectrum (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *G. typus* is a large batoid, it will derive considerable benefit from the use of a TED (Brewer *et al.*, 2004; Brewer *et al.*, 2006). While immature rays may still be caught, most sub-adult and adult specimens will be excluded from the net via the TED. Data on *G. typus* post-interaction mortality rates are limited and the outputs vary between assessments. One report with a relatively small sample size (*n* = 10) recorded a 100 per cent mortality rate (Campbell *et al*., 2017). In contrast, data provided through the Fishery Observer Program demonstrated more moderate survival levels (19 out of 28 individuals released alive; Pears *et al.*, 2012b). These differing results combined with an absence of information on regional catch rates introduced an element of uncertainty into this assessment. This uncertainty supported the retention of a moderate (2) rating *versus* a downgraded score of minor (1).
Sydney skate	*Dentiraja australis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Endeavour skate	*Dentiraja endeavouri*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Argus skate	*Dentiraja polyommata*		2	2	**Likelihood**: Regional operations will fish in habitats preferred by the argus skate (*Dentiraja polyommata*) and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b). *Dentiraja polyommata* has a broad depth range (135–400 m) and it is more commonly found in demersal environments on the continental slope and shelf (Kyne *et al.*, 2021; Kyne *et al.*, 2023n). This depth profile limits the probability of *D. polyommata* having significant interactions with fishing operations in the Southern Inshore Trawl Region. When compared, *D. polyommata* interactions are more likely to occur	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *D. polyommata*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne & Rigby, 2015), population trends (suspected to be stable; Kyne *et al.*, 2021) and fisheries status (Sustainable; Kyne *et al.*, 2023n). As a smaller batoid, *D. polyommata* will derive fewer benefits from the use of a TED/BRD (Kyne *et al.*, 2023n). Captured, *D. polyommata* are expected to have higher rates of post-

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					in the Southern Offshore Trawl Region where deep-water environments are more actively fished (Department of Agriculture and Fisheries, 2021e). A weight-of-evidence approach indicates that there is a lower likelihood of the consequence coming to fruition in this region and/or within the current fishing environment. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	interaction mortalities (Kyne *et al.*, 2021). This inference is supported by data collected through a previous Fishery Observer Program which showed that 100 per cent of individuals were discarded in a dead or moribund state (*n* = 102; Pears *et al.*, 2012b).
Narrow sawfish	*Anoxypristis cuspidata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Green sawfish	*Pristis zijsron*		3	4	**Likelihood**: The green sawfish (*Pristis zijsron*) has experienced considerable range contractions and population declines on the Queensland east coast. These contractions have led to the hypothesis that the species is now regionally extirpated in waters south of the Whitsundays (Peverell, 2005; Department of the Environment, 2019; Kyne *et al.*, 2023z). Historic population declines and range contractions make green sawfish interactions less likely in the Southern Inshore Trawl Region. With that said, any green sawfish interaction in this region would most likely be with a remnant population. This increases the likelihood of the consequence coming to fruition within the current fishing environment. Given the extent of the population declines, this could theoretically occur at low rates of fishing mortality. These concerns were considered sufficient to assign this species with a higher likelihood score. Sawfish data for the ECOTF has poor species resolution and potentially underestimates the total number of fishing mortalities. In reality, it is difficult to ascertain how frequently this species interacts with the ECOTF and/or determine the likelihood of the fishery impacting regional populations. This uncertainty required the adoption of a more precautionary assessment approach and the assignment of a higher score for this component of the assessment. It is recognised that the likelihood or potential for *P. zijsron* interactions to occur in this region have declined through time.	**Consequence**: The available evidence, including that contained in third-party assessments, supported a deviation from the default score of severe (3) to major (4). The revised score better reflects what is known about green sawfish population trends (suspected reduction >80 per cent) and extinction risk classification (Critically Endangered; Kyne *et al.*, 2021). Other considerations that contributed to this decision included a) the potential for this species to incur *in-situ* or post-interaction mortalities and b) the increased risk of injury due to entanglements (due to their large rostrums). Any interaction with this species will be with a population that has experienced some decline and/or may be with a remnant population. The potential consequences for this species are significant and could include exacerbating historic range contractions, a reduction in genetic diversity and the further fragmentation of a remnant population/s. These (potential) impacts warranted the assignment of a major (4) consequence score. Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (severe, 3). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Inshore	L	C	Likelihood	Consequence
					For example, effort levels across the ECOTF have reduced over time and remain well below historic averages. While not universal, declining effort will frequently result in lower levels of bycatch and, for some species, a reduced interaction potential. While noting these declines, the risk or likelihood of *P. zijsron* experiencing a significant consequence remains high. This is due to the fact that the species has experienced significant range contractions / population declines. These declines mean that that even small levels of fishing mortality could contribute to an undesirable consequence. Given this potential, it was determined that *P. zijsron* required a higher likelihood score for this region. The continued roll-out of the Data Validation Plan provides an ideal opportunity to improve our understanding of sawfish compositions in the Southern Inshore Trawl Region. With additional information, the regional risk profile for this species could be further refined and improved.	activities to contribute to an unintended consequence e.g. continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing for *P. zijsron* be increased from Vulnerable to Critically Endangered (Kyne *et al.*, 2021). If this recommendation were adopted, it would see *P. zijsron* listed in the same category as the speartooth shark (*Glyphis glyphis*) and above a number of the marine turtle species.

Data Report: Appendix D—Preliminary scoring and justifications of the Likelihood and Consequence Analysis for species assessed as part of the Southern Offshore Trawl Regional Risk Assessment

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
Marine turtles						
Loggerhead turtle	*Caretta caretta*		3	2	**Likelihood:** The likelihood assessment considered the distribution and habitat preferences of each species when reviewing their potential to interact with trawl operations in the Southern Offshore Trawl Region. These considerations included the location and prevalence of foraging, nesting and rookery sites along the Queensland east coast (Limpus, 2007a; b; 2008a; b; c; 2009). The likelihood assessment also considered the level of uncertainty surrounding the data on regional marine turtle interaction rates. A weight-of-evidence approach supported the assignment of likelihood scores of rare (2) or possible (3) for all six species. Across the complex, data deficiencies made it more difficult to differentiate between the species and/or identify where there was a lower likelihood of the consequence coming to fruition within the current fishing environment. Accordingly, some of the species may have been assigned a more conservative or precautionary score for this aspect of the Likelihood and Consequence Analysis (LCA). While historic records show that the leatherback turtle (*Dermochelys coriacea*) has previously nested in central-southern Queensland, there has been a progressive decline in the breeding frequency of this species on the Queensland east coast (Limpus, 2009). However, the life-history of *D. coriacea* displays an affinity for pelagic water environments (Department of the Environment, 2023c) and may be encountered with more frequence in this region (when compared to other regions). With that said, the depth profile of this species (depth range 0–1300 m; Wallace *et al.*, 2013) provides it with considerable refuge beyond the operational limits of the ECOTF. Accordingly the species was assigned a likelihood score of rare (2).	**Consequence**: The available evidence including third-party assessments did not support a deviation from the default consequence score of moderate (2) for these species (Subcommittee, 1996; Seminoff, 2004; Abreu-Grobois & Plotkin, 2008; Wallace *et al.*, 2013; Casale & Tucker, 2017; Department of the Environment, 2023f; a; b; c; d; e). A number of measures implemented across the East Coast Otter Trawl Fishery (ECOTF) reduce the impact of the fishery on this complex and, therefore, the consequence e.g. the use of a Turtle Excluder Device (TED), Bycatch Reduction Devices (BRDs) and an extensive system of spatial/temporal closures. Effort levels for the ECOTF have also declined through time and are now capped under the harvest strategies (Department of Agriculture and Fisheries, 2021a; e; c; d; b; 2023). In past Ecological Risk Assessments (ERAs), a decline in effort has been directly linked to a decline in risk levels (Pears *et al.*, 2012b; Jacobsen *et al.*, 2015). While difficult to quantify, effort has declined since these assessments and it is reasonable to assume that the consequences of trawl fishing have not increased in the proceeding years. These measures support the assignment of a consequence score at the lower end of the spectrum i.e. moderate (2) *versus* severe (3) or major (4). While TEDs will be effective at reducing the capture of marine turtles, data submitted through the Threatened, Endangered and Protected Animals (TEPA) logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution and may underestimate the total number of marine turtle interactions. The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Offshore
Green turtle	*Chelonia mydas*		3	2		
Leatherback turtle	*Dermochelys coriacea*		2	2		
Hawksbill turtle	*Eretmochelys imbricata*		3	2		
Olive ridley turtle	*Lepidochelys olivacea*		2	2		
Flatback turtle	*Natator depressus*		1	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					The flatback turtle (*Natator depressus*) will likely have more restricted interactions with this region of the ECOTF due to it having a restricted bathymetric range (10–40 m; Subcommittee, 1996). This species will likely be more prevalent within inshore environments and be encountered with more regularity in tropical waters of the Great Barrier Reef Marine Park (GBRMP) (Department of the Environment, 2023f). The olive ridley turtle (*Lepidochelys olivacea*) is more commonly encountered in tropical waters and interactions with this species will be less frequent in southern Queensland (Department of the Environment, 2023e). The species is more likely to be encountered by fishers in the Northern Trawl Region and (potentially) the Central Trawl Region. While some consideration was given to removing *L. olivacea* from the Southern Offshore Trawl Region LCA, the species still has a broad range and it is considered a resident in Moreton Bay, south-east Queensland (Department of Environment Science and Innovation, 2021). Given these considerations, a reduced score of rare (2) was considered reasonable for this region. Of the remaining species, the green (*Chelonia mydas*) and loggerhead turtle (*Caretta caretta*) have nesting/breeding and foraging sites within or in close proximity to the Southern Offshore Trawl Region (Limpus, 2007b; 2008a; b). These factors increase the likelihood of an interaction occurring within this region. Key nesting and rookery sites for the hawksbill turtle (*Eretmochelys imbricata*) are located further north (Limpus, 2007a; 2008c). However, *E. imbricata* is a highly migratory species and interactions with this species could occur throughout the five management regions. Of these three, it is hypothesised that *C. mydas* will interact more frequently with regional trawl operations. This inference is based on the fact that *C. mydas* has larger populations and are found in higher abundances across key sections of central and southern Queensland. The ongoing roll-out of the Data Validation Plan may provide further avenues to review and refine the likelihood scores for	Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the Northern Prawn Fishery (NPF), supports the hypothesis that the number of marine turtle interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining the consequence score more difficult. Taking a weight-of-evidence approach to the consequence assessment, a score of moderate (2) was considered appropriate for this region. This score takes into consideration risk mitigation measures, declining effort trends and management limitations e.g. an inability to verify reported interaction / release fates and uncertainty surrounding the species that interact with trawl fishers in this region.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					this region. Depending on the outputs of this program, the scope of the assessment could also be reviewed and refined (e.g.) removing *L. olivacea* and, potentially, *N. depressus* and *D. coriacea* from future assessments.	
Syngnathids						
Tiger pipefish	*Filicampus tigris*		3	2	**Likelihood:** A review of species distributions and habitat preferences determined that these five species have a higher potential to interact with regional trawl fishing activities. Information on species habitat preferences is readily available and most will occupy a range of both hard and soft substrates to varying depths. While they will be found in grounds accessed by trawl fishers, not all habitats will be conducive to trawl fishing. To this extent, the listed species will be afforded a degree of natural protection from trawl fishing activities. Distributional data was less reliable with information sources often having conflicting range information. This issue is complicated by the fact that the syngnathid taxonomic history is complex and somewhat fluid i.e. varying classifications and, at times, a lack of uniformity. This makes it more difficult to define/quantify regional distributions. These combined factors increased the level of uncertainty regarding the interaction potential between these species and trawling apparatus. As a result, a more conservative approach was adopted and a likelihood score of possible (3) was applied. It is acknowledged that these scores may be an overestimate for this region. With improved information on syngnathid bycatch compositions, these scores may be refined in future risk assessments.	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of moderate (2) (Pollom, 2016a; Pollom, 2017b; a). This score is considered appropriate given a) the inability to verify reported interaction and release fates and b) extinction risk classifications. While BRDs may be effective at reducing the capture of some syngnathids, a high proportion will (likely) be captured within the codend of the net. Of note, all interactions with non-retainable syngnathids are required to be reported within the TEPA logbook. However, data reported through these logbooks has poor resolution and provides limited insight into regional catch compositions. As there is currently no mechanism in place to validate TEPA logbook data, a score of moderate was considered reasonable. With an effective mechanism to verify interaction and release fates, these scores could be further refined. Note–Considerations were given to increase the consequence score for the White's seahorse (*Hippocampus whitei*) based on an extinction risk classification of Endangered and decreasing population trend (Harasti, 2017). However, a review of its preferred habitats and depths indicated that this species prefers three-dimensional structures (e.g. artificial anthropogenic structures, coral reef, macroalgal etc.) to depths of 12 m (Harasti, 2017). Hard substrates are less conducive to trawling and while regional operations will occur in shallow water, a significant amount of effort in the Southern Offshore Trawl Region will be in deeper waters (attributed to Fisheries Management). These factors significantly reduce the ability for fishing activities to impact populations and maintaining a
Spiny seahorse	*Hippocampus spinosissimus*		3	2		
Great seahorse	*Hippocampus kelloggi*		3	2		
Bentstick pipefish	*Trachyrhamphus bicoarctatus*		3	2		
White's seahorse	*Hippocampus whitei*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						consequence score of moderate (2) was considered appropriate for this species.
Duncker's pipehorse	*Solegnathus dunckeri*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Duncker's pipehorse (*Solegnathus dunckeri*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus dunckeri* occupies a range of habitats ranging from soft substrates that are more conducive to trawl fishing through to environments dominated by hard structures like sandstone, gravel, gorgonians and sponges (Pollom, 2017c). These habitat preferences will provide *S. dunckeri* with a degree of natural protection from trawl fishing activities. These factors will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Solegnathus dunckeri* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of Queensland, 2019b). Based on a review of historic syngnathid catch it is hypothesised that the interaction potential for this species will be higher in central and southern Queensland. However, such inferences must be observed with caution as records of syngnathid harvest do not account for all interactions (e.g. discarded individuals). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of severe (3). This score is considered appropriate based on a) the ineffectiveness of TEDs/BRDs in terms of excluding this species from the net, b) an extinction risk classification of Data Deficient (Pollom, 2017c) and c) the allowable retention of this species (trip limit = 50 combined individuals) (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards). Based on these factors, the assigned score was considered to be reasonable. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Pallid pipehorse	*Solegnathus hardwickii*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Pallid pipehorse (*Solegnathus hardwickii*) has an increased potential to interact with regional trawl fishing activities.	**Consequence**: There was sufficient evidence to support a deviation from the default consequence score of moderate (2) to severe (3). This score was considered appropriate as this species will have similar vulnerabilities to the Duncker's pipehorse (*S. dunckeri* [assessed in the Southern Inshore,

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					Solegnathus hardwickii occupies a range of habitats including those associated with sponges, gorgonians and possibly coral reef edges, typically at depths between 12 and 100 m (Pollom, 2017d). These habitat preferences will provide *S. hardwickii* with a degree of natural protection from trawl fishing activities. This will assist in terms of reducing the likelihood of the consequence coming to fruition within the current fishing environment. *Solegnathus hardwickii* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of Queensland, 2019b). Based on a review of historic syngnathid catch it is hypothesised that the interaction potential for this species will be higher in central and southern Queensland. However, such inferences must be observed with caution as records of syngnathid harvest do not account for all interactions (e.g. discarded individuals). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	Southern Offshore and Moreton Bay Trawl Regions]). Key considerations given to this score included a) an ineffectiveness of TEDs/BRDs to exclude this species from capture, b) a species extinction risk classification of Data Deficient (Pollom, 2017d) and c) the allowable retention of this species (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards). Based on these factors, the assigned score was considered to be reasonable. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Straightstick pipefish	*Trachyrhamphus longirostris*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Ribboned pipefish	*Haliichthys taeniophorus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sea snakes						
Reef shallows sea snake	*Aipysurus duboisii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Mosaic sea snake	*Aipysurus mosaicus*		1	2	**Likelihood**: Evidence suggests that the mosaic sea snake (*Aipysurus mosaicus*) will interact with trawling operations on	**Consequence**: A review of the available evidence supported increasing the consequence score from minor (1) to moderate (2) (Courtney *et al.*, 2010; Rasmussen *et al.*, 2021a). This

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus mosaicus* is often associated with soft substrates (e.g. mud, estuaries etc.) to a depth of 50 m (Rasmussen *et al.*, 2021a). While some of these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be limited. When compared, encounters are more likely to occur in shallow-water operations outside of the ECOTF, namely the River and Inshore Beam Trawl Fishery (formerly referred to as the Inshore Beam Trawl Fishery) (Courtney *et al.*, 2010). This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of remote (1) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this species could potentially be removed from future risk assessments involving this region. Note–While limited, any interactions eventuating within the ECOTF are more likely to be attributed to regions targeting red spot king prawns and tiger/endeavour prawns.	decision largely reflects the level of uncertainty surrounding regional sea snake catch compositions (see below). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern), stable population trend (Rasmussen *et al.*, 2021a), and reasonable post-interaction survival rates (*n* = 95 interactions with 5.3 per cent mortality; Courtney *et al.*, 2010). *Aipysurus mosaicus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Offshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Based on this information it is expected that this species will be capable of withstanding trawl interactions to some degree. However, due to limited sample sizes within sea snake bycatch studies, a more precautionary score was adopted (Milton *et al.*, 2009; Courtney *et al.*, 2010). Given the available information, a rating of moderate (2) was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						(2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Olive sea snake	*Aipysurus laevis*		2	2	**Likelihood**: The olive sea snake (*Aipysurus laevis*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Aipysurus laevis* is often associated with soft and hard substrates (e.g. sand, coral reefs and inter-tidal areas) to depths between 10 and 40 m (Crowe-Riddell *et al.*, 2021). While some of these habitats overlap with trawl grounds, the species is more commonly associated with reefs (Udyawer *et al.*, 2014; Crowe-Riddell *et al.*, 2021). These preferences will limit the exposure of this species to trawl fishing activities within this region. *Aipysurus laevis* interactions are more likely to occur in shallow-water operations where reef-associated species (i.e. red spot king prawns in the Central Trawl Region. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score could be refined in future risk assessments.	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Courtney *et al.*, 2010; Crowe-Riddell *et al.*, 2021). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Crowe-Riddell *et al.*, 2021), and reasonable post-interaction survival rates (*n* = 515 interactions with 9.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Crowe-Riddell *et al.*, 2021). *Aipysurus laevis* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Offshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						(2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spine-bellied sea snake	*Hydrophis curtus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Elegant sea snake	*Hydrophis elegans*		3	2	**Likelihood**: The elegant sea snake (*Hydrophis elegans*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. elegans* is often associated with soft and hard substrates (e.g. sand, mud, coral reefs, seagrass, estuaries and rivers) to depths of 110 m (Milton, 2010a; Department of the Environment, 2024). This species is also known to have an affinity for seagrass meadows in depths less than three metres (Udyawer *et al.*, 2016b). Some of these habitats utilised by this species will coincide with areas utilised by regional trawl operations. However, the species will find considerable refuge in environments that are less conducive to trawling (e.g. seagrass) and/or not fished in this region. The extent of any encounters occurring within the Southern Offshore Trawl Region may be further reduced as fishing activities will occur across a broad depth range. Given these considerations, while expected, encounters are likely to be restricted to shallow-water operational areas within this species depth range. *Hydrophis elegans* interactions are more likely to occur in the Central Trawl Region. This inference is supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010). Overall, the extent of regional-specific interactions with this species remains uncertain and as a result a precautionary score of possible (3) was applied. It is acknowledged that this score may be an overestimate for this region. With improved information on sea snake bycatch compositions, this score may be further refined.	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Least Concern, stable population trend (Milton, 2010a), and moderate post-interaction survival rates (*n* = 347 interactions with 17 per cent mortality; Milton *et al.*, 2009; *n* = 186 interactions with 12.4 per cent mortality; Courtney *et al.*, 2010). Of notable importance, previous research has demonstrated a correlation between sea snake sizes and mortality (Courtney *et al.*, 2010). As a larger species attaining a length up to 260 cm (Department of the Environment, 2024), *H. elegans* may experience greater mortality rates. While potentially limited for larger individuals, *H. elegans* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Offshore Trawl Region. However, cross-comparisons with data compiled

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spectacled sea snake	*Hydrophis kingii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Turtle-headed sea snake	*Emydocephalus annulatus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Olive-headed sea snake	*Hydrophis major*		2	2	**Likelihood**: The olive-headed sea snake (*Hydrophis major*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis major* is often associated with sandy and muddy environments in tidal creeks, offshore continental shelves or gulf areas to depths of 22 m (Guinea *et al.*, 2010). In the unlikely event *H. major* were to interact with this sector of the ECOTF, these encounters would likely be confined to Offshore Trawl Region B. When compared, encounters are more likely to occur in the Central Trawl Region, though will remain low in contrast to other assessed species. Where interactions with the Southern Offshore Trawl Region do occur, they are likely to be restricted to shallow-water areas within this species depth range. This inference was supported by a review of sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Guinea *et al.*, 2010) and moderate post-interaction survival rates (*n* = 163 interaction with 13 per cent mortality; Milton *et al.*, 2009; *n* = 55 interactions with 18.2 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Guinea *et al.*, 2010; Milton *et al.*, 2010b). *Hydrophis major* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Offshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Small-headed sea snake	*Hydrophis macdowelli*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Spotted sea snake	*Hydrophis ocellatus*		2	2	**Likelihood**: The spotted sea snake (*Hydrophis ocellatus*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010), though encounters with this region may be less common. *Hydrophis ocellatus* is often associated with sandy inter-reefal environments to depths of 84 m (Milton, 2010b; Udyawer *et al.*, 2014). While these habitat preferences coincide with areas utilised by regional operations, interactions are expected to be somewhat limited. When compared, interactions are more likely to occur in the Central Trawl Region where reef-associated species (i.e. red spot king prawns) are actively targeted. This inference was supported by a review of sea snake interactions in the trawl	**Consequence**: Evidence through third-party assessments did not support a deviation from the default score of moderate (2) (Wassenberg *et al.*, 2001; Courtney *et al.*, 2010; Milton *et al.*, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification (Least Concern; Milton, 2010b) and comparatively lower survival rates (*n* = 94 interactions with 27.7 per cent mortality; Courtney *et al.*, 2010). A lower consequence score was not considered for this species as population trends are currently unknown (Milton, 2010b). Based on the outputs of a study by Courtney *et al.* (2010), this species is likely capable of withstanding a portion of trawl-

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					fishery (Courtney *et al.*, 2010) and documented occurrence records for the Queensland east coast (Udyawer *et al.*, 2020).	related mortalities, though it may be prone to higher mortalities than other assessed sea snakes. Of interest, another study reported a lower mortality rate of 18 per cent (Wassenberg *et al.*, 2001). While notably different, this distinction may be partially attributed to the Wassenberg *et al.* (2001) study consisting of a smaller sample size (*n* = 67). *Hydrophis ocellatus* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Southern Offshore Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Horned sea snake	*Hydrophis peronii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
Beaked sea snake	*Hydrophis zweifeli*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Stoke's sea snake	*Hydrophis stokesii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sharks						
Collared carpetshark	*Parascyllium collare*		3	2	**Likelihood**: Anecdotal evidence suggests that operators fishing within the Southern Offshore Trawl Region will interact with the collared carpetshark (*Parascyllium collare*). The species has a depth profile that overlaps with the regional effort footprint (20–175 m) and a distribution that increases its exposure to trawl fishing activities in Offshore Trawl Region B (Department of Agriculture and Fisheries, 2021e). While difficult to quantify, regional trawl fishers are expected to have (comparatively) low interactions with *P. collare*. It is further anticipated that this species will not experience a significant or long-term negative consequence within the current fishing environment (Kyne *et al.*, 2021). The strength of these inferences though have yet to be fully tested and requires further exploration. Given the level of uncertainty surrounding regional catch rates, the LCA applied a precautionary approach to the *P. collare* likelihood assessment. With improved information, it is conceivable that this score could be refined and reduced. Noting that the rating for this species is still situated at the lower end of the risk spectrum.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Parascyllium collare* is a relatively common but poorly known benthic shark species. It has a restricted range on the Australian east coast and interactions will be confined to the Southern Offshore and Moreton Bay Trawl Regions. This species is thought to be relatively productive and it has been classified as Least Concern under the Australian IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also indicates that this species is being sustainably fished across its known range (Kyne *et al.*, 2023d). However, data deficiencies make it more difficult to assess the (potential) impact of regional trawl fishing on species populations. Of note, *P. collare* has been included in two previous ERAs involving the ECOTF. These assessments included waters now encompassed within the Southern Offshore Trawl Region and assigned the species a low-medium (Jacobsen *et al.*, 2015) and medium (Campbell *et al.*, 2017) risk rating. Overall, it is unlikely that current fishing activities within the Southern Offshore Trawl Region will lead to this species experiencing a significant, long-term consequence. The key caveats being a) interactions with this species have yet to be fully quantified, b) there remains a degree of uncertainty surrounding the capture of this species in this region, and c) the species has registered marginally higher risk ratings in previous ERAs. All of these factors contributed to the collared

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						carpetshark being assigned a more precautionary consequence score. The conservation and fishing status were key considerations within this assessment in terms of the consequence score assigned to this species. If one or both assessments were to be downgraded then this risk assessment would need to be reviewed. Similarly, with improved information on elasmobranch bycatch compositions, this score could be refined and potentially reduced.
Brownbanded bambooshark	*Chiloscyllium punctatum*		5	1	**Likelihood**: The brownbanded bambooshark (*Chiloscyllium punctatum*) was assigned a higher likelihood rating as the corresponding consequence score was very low. All the available evidence suggests that trawl fishing activities within this region will not have a negative or long-term impact on this species. This includes information obtained from third-party assessments regarding the species current extinction risk classification and fishery status (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There is reasonable confidence that current fishing activities within the Southern Offshore Trawl Region will not have a significant impact on regional populations.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Chiloscyllium punctatum* is a common benthic shark species and it is abundant within its preferred habitats (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There are few concerns surrounding the long-term sustainability of the species and it has been classified as Least Concern under the Australian IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023b). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The high productivity of *C. punctatum* contributed to these findings. Fishing activities within the current fishing environment are unlikely to result in a long-term, negative consequence for this species.
Colclough's shark	*Brachaelurus colcloughi*		4	3	**Likelihood**: Information on the Colclough's shark (*Brachaelurus colcloughi*) is limited and further research is required on the distribution of this species on the Queensland east coast. However, bycatch surveys indicate that *B. colcloughi* occurs within waters of the Southern Offshore Trawl Region (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c).	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score (Kyne *et al.*, 2021; Kyne *et al.*, 2023c). The consequence assessment for *B. colcloughi* had to consider a high number of uncertainties. These uncertainties relate to the distribution of this species on the Queensland east

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					The majority of information on *B. colcloughi* comes from less than 80 individuals; most of which were caught in the waters encompassed within the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c). Of which, anecdotal evidence suggests that the species is more likely to be encountered in offshore trawl operations. Datasets for *B. colcloughi* are limited and it is difficult to ascertain how frequently this species might interact with trawl operations in the Southern Offshore Trawl Region. This species though is endemic, has a highly limited range and is expected to occur at a low natural abundance (Kyne *et al.*, 2011; Kyne *et al.*, 2015; Kyne *et al.*, 2023c). These factors increase the potential or likelihood of trawl fishing activities contributing to a negative event across its known range/distribution. Depth ranges, habitat preferences, nocturnal behaviours and refuge/availability (e.g. marine park zones) will assist in terms of reducing the interaction/encounterability potential for this species. It is also recognised that trawl effort (across the fishery) has declined through time and remains below historic averages. While not universal, declining effort levels can translate to lower levels of bycatch and, for some species, a reduced interaction potential. This inference though requires testing and additional information on elasmobranch bycatch compositions in the Southern Offshore Trawl Region. While noting the above, there remains a high level of uncertainty surrounding a) the population structure of *B. colcloughi*, b) the productivity/abundance of this species and c) interaction rates within this region of the ECOTF. This uncertainty has been reflected in the likelihood score assigned to this species. It is recognised that the likelihood score assigned to this species may be an overestimate for this region. The severity of any potential impact (negligible, low, medium or high) though, remains unknown and requires further investigations. Until	coast, its potential to interact with the ECOTF and the capacity of the animal to survive a trawl interaction. Individuals caught in the sweep of the net will derive less benefits from using a TED and BRD as it only attains a maximum total length of 75 cm (Kyne *et al.*, 2021). This means that both immature and mature animals will be caught as bycatch in this fishery. The consequence score for this species is considered appropriate given the level of uncertainty and the outputs of third-party assessments (Kyne *et al.*, 2021) that determined the species: - Is endemic with a restricted geographical range. - Occurs at naturally low abundances with an inferred population decline (<10,000 mature individuals; an inferred continuing decline). - Has an elevated (deteriorating) extinction risk classification (Vulnerable). When these factors are considered, it is expected that this species has a higher vulnerability and/or lower resilience to rebound from fishing-related mortalities. It also suggests that there is an increased potential for trawl fishing activities to negatively impact regional populations and the extinction risk classification. It is recognised that the score assigned to this component of the assessment may overestimate the consequence for this species. In this instance though, the limited levels of information and the species' naturally low abundance warranted the adoption of a more precautionary approach. With improved information on regional elasmobranch bycatch compositions, the consequence score could be refined and (potentially) reduced.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					then, the decision was made to take a more precautionary assessment approach. The outputs of the Data Validation Plan may assist in terms of refining the *B. colcloughi* risk assessment through time (Department of Agriculture and Fisheries, 2018).	
Crested hornshark	*Heterodontus galeatus*		3	2	**Likelihood**: The distribution of the crested hornshark (*Heterodontus galeatus*) increases the likelihood of the species interacting with operations in the Southern Offshore Trawl Region. While difficult to quantify, regional trawl fishers are expected to have (comparatively) low interactions with this species. It is further anticipated that this species will not experience a significant or long-term negative consequence within the current fishing environment. The strength of these inferences though have yet to be fully tested and requires further exploration. Given this, the LCA applied a precautionary approach to the *H. galeatus* assessment. With improved information, it is conceivable that this score could be refined and reduced. Noting that the likelihood rating for this species is still situated at the lower end of the risk spectrum.	**Consequence**: *Heterodontus galeatus* was assessed as Least Concern under the Australian IUCN Red List criteria, with its fishing status defined as sustainable (Kyne *et al.*, 2021; Kyne *et al.*, 2023e). These outputs suggest that fishing activities within the Southern Offshore Trawl Region, at present, will not lead to a significant or long-term consequence for this species. While noting these results, regional risk assessments involving the ECOTF have produced varying results. The species was assessed as a medium risk under the base-case scenario applied by Campbell *et al.* (2017) but registered a rating of precautionary high under a more conservative assessment scenario. The species was also included in two larger-scale assessments where it registered ratings of low and low-intermediate (Jacobsen *et al.*, 2015; Dedini *et al.*, 2023). Given these varying results and uncertainty surrounding regional interaction rates, the consequence score for *H. galeatus* was increased from the default (minor, 1) to moderate (2). This decision was precautionary and marginally increased the risk rating for this species in the Southern Offshore Trawl Region. While the consequence score assigned to this species was increased, it is still situated at the lower end of the risk spectrum. With improved information on regional elasmobranch bycatch compositions, this score could potentially be refined and reduced.
Eastern angelshark	*Squatina albipunctata*		3	3	**Likelihood**: There is evidence that the eastern angelshark (*Squatina albipunctata*) will interact with east coast trawl operations and be caught as bycatch. *Squatina albipunctata* interactions are most likely to occur in the Southern Offshore Trawl Region (Rigby *et al.*, 2016b;	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given the current understanding of the *S. albipunctata* population trend (depleting; Kyne *et al.*, 2023f) and Australian extinction risk

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					Campbell *et al.*, 2017). Trawl operations in this region actively fish across a broader cross-section of the *S. albipunctata* depth profile (35–415 m). This contributed to the region receiving a marginally higher score for the likelihood component of the LCA. *Squatina albipunctata* interactions will be confined to operations targeting deepwater eastern king prawns (*M. plebejus*). However, The depth profile of this species will afford it a degree of natural protection from trawl fishing activities. This inference is supported by third-party assessments which demonstrate that this species is exposed to fewer fishing pressures across the northern extent of its range (Kyne *et al.*, 2021). These factors were taken into consideration when assigning the eastern angelshark a likelihood score of possible (3) *versus* a higher option. It is recognised that the likelihood score assigned to this species may represent an overestimate for this region. The severity of any potential impact (negligible, low, medium or high) though, remains unknown and requires further investigations. Until then, the decision was made to take a more precautionary assessment approach. The outputs of the Data Validation Plan may assist in terms of refining the risk profile of this species (Department of Agriculture and Fisheries, 2018).	classification (Vulnerable; Kyne *et al.*, 2021). These factors make the species more vulnerable to trawl fishing activities and reduce its capacity to absorb regional fishing-related mortalities. Within the ECOTF, *S. albipunctata* is more likely to be caught in the Southern Offshore Trawl Region. However, there is limited information on elasmobranch interaction rates in this region and it is difficult to quantify the extent of any (potential) impacts. These deficiencies combined with the *S. albipunctata* conservation status increases the probability that regional trawl fishing activities will, or have the potential to, contribute to a broader undesirable event. Some of the potential consequences include a continued reduction in the Australian east coast population and a southerly contraction of the *S. albipunctata* distribution.
Eastern banded catshark	*Atelomycterus marnkalha*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Zebra shark	*Stegostoma tigrinum*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the zebra shark (*Stegostoma tigrinum*). The *S. tigrinum* depth profile (0–62 m) suggests that it will have limited interactions with a key component of this region, the deepwater eastern king prawn (*M. plebejus*) sector. This means that interactions with species will be largely confined to	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Stegostoma tigrinum* is a common shark with a wide northern and eastern Australian distribution. The productivity of this species is considered low for an oviparous (egg-laying) species. However, there is limited (current) concerns surrounding the conservation status or long-term sustainability of the species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					Offshore Region B (Department of Agriculture and Fisheries, 2021e). *Stegostoma tigrinum* will derive considerable benefit from the use of a TED. TEDs have proven to be highly effective at excluding larger sharks from the trawl catch including *S. tigrinum* (Brewer *et al.*, 2006; Campbell *et al.*, 2020). While immature animals may still be caught as bycatch, the majority of sub-adult and adult specimens will likely escape through the TED opening. Applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in the Southern Offshore Trawl Region and/or within the current fishing environment.	*Stegostoma tigrinum* has an Australian extinction risk classification of Least Concern with nothing to infer or suspect a population decline across its known range (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known distribution (Kyne *et al.*, 2023l). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The above considerations indicate that current fishing activities pose limited consequences for the long-term conservation status or sustainability of this species.
Piked spurdog	*Squalus megalops*		4	2	**Likelihood**: There is evidence that the piked spurdog (*Squalus megalops*) will interact with east coast trawl operations and be caught as bycatch (Rigby *et al.*, 2016b). *Squalus megalops* is a common endemic shark species that is often associated with deeper water environments. The depth profile of this species (0–732 m) extends well beyond the operational constraints of regional trawl fishers. These habitat preferences provide the species with considerable protection from trawl fishing activities within the Southern Offshore Trawl Region. It also reduces the likelihood of the consequence coming to fruition in the current fishing environment. While noting the above, operators in the Southern Offshore Trawl Region fish across a broader cross-section of the *S. megalops* depth profile. Interactions with this species are also more likely to occur in the deepwater eastern king prawn (*M. plebejus*) sector. These factors, combined with uncertainty surrounding *S. megalops* interaction rates and release fates, supported the adoption of a more precautionary risk assessment approach. It is acknowledged that a likelihood score of occasional (4) may be an overestimate for this species in this region. With improved information on regional elasmobranch catch	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. This score is considered appropriate given what is known about the *S. megalops* population trend (increasing; Rigby & Kyne, 2020), Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021) and fisheries status assessment (Sustainable; Kyne *et al.*, 2023j). While noting the above, there is limited information on interaction rates in this region and/or survival rates for trawl-caught *S. megalops*. However, anecdotal evidence suggests that deepwater elasmobranch species tend to have poor post-interaction survival rates (Kyne *et al.*, 2021). During deliberations, some consideration was given to reducing the consequence score for this species in this region. It was determined that any score reduction would require additional information on *S. megalops* interaction rates and confirmation that it had a low interaction potential in this region. This decision also considered the outputs of two previous risk assessments which indicated *S. megalops* was at higher risk from trawl fishing activities (Campbell *et al.*, 2017; Dedini *et al.*, 2023). The results of these assessments factored into the

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					compositions, this species could potentially be removed from future risk assessments involving this region.	decision to assign this species a consequence score of moderate (2).
Australian weasel shark	*Hemigaleus australiensis*		2	2	**Likelihood**: Bycatch surveys indicate that the Australian weasel shark (*Hemigaleus australiensis*) will interact with the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Campbell, 2022). However, there is limited information on its current capture rates and/or its ability to survive a trawl interaction. Expectations are that *H. australiensis* interactions will be less frequent, particularly when compared to other benthic shark and ray species. It is further hypothesised that trawl fishing activities within the Southern Offshore Trawl Region will not lead to a long-term, negative change to the conservation / fishery status of this species. This inference is supported by evidence obtained through third-party assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australiensis*. *Hemigaleus australiensis* is a small, wide-spread whaler species that is fairly common/abundant throughout its known distribution. Evidence suggests that the species is highly productive and fast growing (Ebert *et al.*, 2021; Kyne *et al.*, 2021). These factors increase the capacity of the species to absorb fishing mortalities and rebound after a potential decline. As a smaller species, *H. australiensis* will derive less benefit from the use of a TED i.e. both immature and mature sharks will be caught as bycatch. At present there is limited information on how successfully *H. australiensis* survives a trawl fishing event. While noting the above deficiencies, evidence suggests that key risks for this species are currently being managed. The species has an Australian extinction risk classification of Least Concern (Kyne *et al.*, 2021) with corresponding status assessments indicating that the species is being sustainably fished across its known distribution (Kyne *et al.*, 2023a). Applying a weight-of-evidence approach indicates that regional trawl fishing activities will not pose a risk to the long-term sustainability of this species on the Queensland east coast.
Pale spotted catshark	*Asymbolus pallidus*		3	2	**Likelihood**: The pale spotted catshark (*Asymbolus pallidus*) is one of three morphologically similar, deepwater shark species that interact with trawl operations in the Southern Offshore Trawl Region. While the *A. pallidus* distribution overlaps with the north-eastern section of the Southern Offshore Trawl Region, its depth profile (225–440 m) provides the species with a high degree of natural protection (Ebert *et al.*, 2021; Kyne *et al.*, 2021). Within this area, *A. pallidus* interactions are more likely to occur in operations targeting deepwater eastern king prawns	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. pallidus*. *Asymbolus pallidus* is a small, endemic shark species with a restricted geographical range. The distribution and depth profile of this species reduced the interaction potential and, by default, the extent of the potential consequence. As it is a smaller species, TEDs will be less effective in terms of excluding it from the catch. Anecdotal evidence suggests that, when caught, the species experiences high levels of on-deck mortalities (Kyne *et al.*, 2021).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					(*M. plebejus*) across Offshore Region A (Courtney *et al.*, 2007; Kyne, 2008; Rigby *et al.*, 2016b; Department of Agriculture and Fisheries, 2021e; Campbell, 2022). There are notable gaps in the level of information on deepwater shark interaction rates and release fates. However, anecdotal evidence suggests that this species exhibits higher rates of on-deck mortalities (Kyne *et al.*, 2021). Catch-rate uncertainty and increased mortality potential was taken into consideration as part of the likelihood component. Improving the level of information on regional shark catch compositions may facilitate further refinements of this score and a potential reduction in the overall rating.	While noting the above, the available evidence suggests that fishing-related risks are being managed within the current fishing environment. The species currently has an Australian extinction risk classification of Least Concern, a (suspected) stable population trend and a fishing status of sustainable (Kyne *et al.*, 2021; Kyne *et al.*, 2023i). These factors supported the assignment of a consequence score at the lower end of the spectrum.
Grey spotted catshark	*Asymbolus analis*		3	2	**Likelihood**: The grey spotted catshark (*Asymbolus analis*) is one of three morphologically similar, deepwater shark species that interact with trawl operations in the Southern Offshore Trawl Region. The northern extent of the *A. analis* distribution sits well below the pale spotted catshark (*Asymbolus pallidus*) and the species has a broader depth profile (25–200 m). While its depth profile (potentially) exposes *A. analis* to a larger cross-section of fishing activities, most interactions are expected to occur in the deepwater eastern king prawns (*M. plebejus*) sector (Kyne, 2008; Rigby *et al.*, 2016b). Information on trawl bycatch in deepwater fisheries remains limited and there are notable gaps in the level of information on deepwater shark interaction rates and release fates. However, anecdotal evidence suggests that this species exhibits higher rates of on-deck mortalities (Kyne *et al.*, 2021). Higher rates of mortality increase the likelihood of the consequence coming to fruition within the current fishing environment.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. analis*. *Asymbolus analis* is a small, endemic shark species with a restricted geographical range. The northern limit of its range does not exceed K'gari (formerly Fraser Island) which limits its interaction potential and the extent of the consequence. As it is a smaller species, TEDs will be less effective in terms of excluding *A. analis* from the catch. Anecdotal evidence suggests that, when caught, the species experiences high levels of on-deck mortalities (Kyne *et al.*, 2021). While noting the above, the available evidence suggests that fishing-related risk are being managed within the current fishing environment. The species currently has an Australian extinction risk classification of Least Concern (Kyne *et al.*, 2021), a stable population trend (Kyne & Bennett, 2015) and a fishing status of sustainable (Kyne *et al.*, 2023g). In addition, *A. analis* was included in a quantitative ERA examining trawl-related risks in southern Queensland. The species registered a low-risk rating under the base-case scenario and a more conservative scenario that accounted for reference point variability (Campbell *et al.*, 2017). Given the above, some consideration was given to assigning *A. analis* a lower consequence score. This could not be

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
						supported given the level of uncertainty surrounding regional interaction rates. With improved data, there may be further avenues to review and refine this score. With that said, the species was assigned a consequence score at the lower end of the spectrum.
Orange spotted catshark	*Asymbolus rubiginosus*		3	2	**Likelihood**: The orange spotted catshark (*Asymbolus rubiginosus*) is one of three morphologically similar, deepwater shark species that interact with trawl operations in the Southern Offshore Trawl Region. The *A. rubiginosus* distribution is similar to the grey spotted catshark (*A. analis*). However, the depth profile of this species is broader (25–540 m), affording it a higher degree of natural protection. Within the Southern Offshore Trawl Region, *A. rubiginosus* interactions will be largely confined to operations targeting eastern king prawns (*M. plebejus*) in deeper water environments (Kyne, 2008; Rigby *et al.*, 2016b). Expectations are that the majority of deepwater catsharks caught in this region of the ECOTF will include this species or *A. analis*. Information on trawl bycatch in deepwater fisheries remains limited, albeit improving. There are notable gaps in the level of information on deepwater shark interaction rates and release fates. However, anecdotal evidence suggests that this species exhibits higher rates of on-deck mortalities (Kyne *et al.*, 2021). Higher rates of mortality increase the likelihood of the consequence coming to fruition within the current fishing environment. As part of the assessment process, some consideration was given to reducing the likelihood score for this species. The premise being that a larger proportion of the population would (theoretically) be protected from trawl fishing activities. Current data sets though could not support this change, with the assessment adopting a more precautionary approach.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. rubiginosus*. *Asymbolus rubiginosus* is a small, endemic shark species with a restricted geographical range. The northern limit of its range does not exceed K'gari (formerly Fraser Island) which limits its interaction potential and the extent of the consequence. As it is a smaller species, TEDs will be less effective in terms of excluding *A. rubiginosus* from the catch. Anecdotal evidence suggests that, when caught, the species experiences high levels of on-deck mortalities (Kyne *et al.*, 2021). While noting the above, the available evidence suggests that fishing-related risks are being managed within the current fishing environment. The species currently has an Australian extinction risk classification of Least Concern, a (suspected) stable population trend and a fishing status of sustainable (Kyne *et al.*, 2021; Kyne *et al.*, 2023h). In addition, *A. rubiginosus* was included in a quantitative ERA examining trawl-related risks in southern Queensland. The species registered a low-risk rating under the base-case scenario and a more conservative scenario that accounted for reference point variability (Campbell *et al.*, 2017). Given the above, some consideration was given to assigning *A. rubiginosus* a lower consequence score. This could not be supported given the level of uncertainty surrounding regional interaction rates. With improved data, there may be further avenues to review and refine this score. With that said, the species was assigned a consequence score at the lower end of the spectrum.
Batoids						

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
Australian butterfly ray	*Gymnura australis*		2	2	**Likelihood**: Operations within the Southern Offshore Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting this overlap, the Australian butterfly ray (*Gymnura australis*) is broadly distributed (Jacobsen & Bennett, 2009; Last *et al.*, 2016b) and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *G. australis* interaction rates and release fates (alive, dead or moribund). However, a weight-of-evidence approach suggests that it may be one of the more common elasmobranchs caught in prawn-trawl fisheries (Courtney *et al.*, 2007; Jacobsen, 2007; Pitcher *et al.*, 2007; Kyne, 2008). Catch data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a marginally higher score. Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species.	**Consequence**: The available evidence, including that contained in third-party assessments (Campbell *et al.,* 2017; Kyne *et al.,* 2021), supported a downgrading of the default consequence score from severe (3) to moderate (2). The reduced score better reflects what is known about the conservation / extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023o). While noting these considerations, the use of a TED/BRD will be less effective for this species, with immature individuals and adults likely to be caught as trawl bycatch (Jacobsen, 2007). Once captured, *G. australis* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Campbell *et al.*, 2017). This, in part, is due to the species having a very flattened morphology and limited external protections e.g. hardened denticles or skin (pers. comm. I. Jacobsen). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Yellowback stingaree	*Urolophus sufflavus*		2	3	**Likelihood**: Regional operations will fish in habitats preferred by the yellowback stingaree (*Urolophus sufflavus*) and there is evidence that it forms part of the elasmobranch trawl bycatch (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Urolophus sufflavus* has a restricted distribution on the Australian east coast and Queensland interactions will be confined to Offshore Trawl Region B. The species has a depth profile that extends from 45–320 m and interactions are more likely to occur within the deepwater eastern king prawn sector. This inference was supported by a broader review of	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *U. sufflavus*. A score of severe (3) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Vulnerable), Australian population trend (inferred reduction of greater than 30 per cent) and fisheries status under the *Shark and Ray Report Card*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					elasmobranch bycatch within the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). This information also suggests that *U. sufflavus* interactions will be less frequent when compared to other stingarees (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). These factors, combined with a somewhat restricted distribution (when compared to the Kapala stingaree, *U. kapalensis* and common stingaree, *Trygonoptera Testacea*), were considered reasonable grounds to assign *U. sufflavus* with a likelihood score of rare (2).	(Depleting; Kyne *et al.*, 2019b; Kyne *et al.*, 2021; Kyne *et al.*, 2023ag). In addition to these considerations, *U. sufflavus* is a smaller batoid and will derive few benefits from the use of a TED/BRD. Captured *U. sufflavus* are likely to have higher post-interaction mortality rates and may abort pups during an encounter (Kyne *et al.*, 2021; Kyne *et al.*, 2023ag). These factors limited refinements to the consequence score for this species. It is recognised that the consequence score assigned to this species may represent an overestimate for this region. However, the available data did not support a downgrading of this score. With additional information on regional elasmobranch catch rates, this score could be further refined.
Patchwork stingaree	*Urolophus flavomosaicus*		3	2	**Likelihood**: Regional operations will fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Pears *et al.*, 2012b; Campbell *et al.*, 2017). While noting this overlap, the bathymetric range of the patchwork stingaree (*Urolophus flavomosaicus*) extends beyond trawled areas (60–320 m) and a notable portion of its range will experience limited fishing effort (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *U. flavomosaicus* interaction rates and release fates (alive, dead or moribund). Based on the available data, interactions are more likely to occur in deeper water environments (Kyne *et al.*, 2023ad). This includes waters actively fished in the Southern Offshore Trawl Region. This inference was supported by a broader review of elasmobranch bycatch within the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *U. flavomosaicus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne *et al.*, 2019a), population trend (suspected to be stable; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ad). While noting these considerations, as a smaller batoid, *U. flavomosaicus* will derive fewer benefits from the use of a TED/BRD, with immature and adult individuals likely to be caught as trawl bycatch. Once captured, *U. flavomosaicus* are expected to have higher post-interaction mortality rates and may abort pups during an encounter (Kyne *et al.*, 2021; Kyne *et al.*, 2023ad). These factors limited refinements to the consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					likelihood assessment and resulted in the assignment of a more precautionary risk score. To refine this score, further information is required on the composition of this portion of the catch. Note–One study observing trawl bycatch within the eastern king prawn sector inferred that *U. flavomosaicus* may not occur on the east coast, and such records would be more appropriately listed as conspecific with the sandyback stingaree (*U. bucculentus*) (Rigby *et al.*, 2016b). This factor adds to the challenges of determining this species interaction potential in the ECOTF. Similarly, anecdotal evidence suggests smaller rays may exhibit higher interaction rates with this fishery. The accuracy of this assessment cannot be determined at this point in time.	
Sandyback stingaree	*Urolophus bucculentus*		2	3	**Likelihood**: Regional operations will fish in habitats preferred by the sandyback stingaree (*Urolophus bucculentus*) and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Rigby *et al.*, 2016b; Campbell *et al.*, 2017). *Urolophus bucculentus* has a restricted distribution on the Australian east coast and Queensland interactions will be confined to the Offshore Trawl Region B. The species has a depth profile that extend from 65–274 m and interactions are more likely to occur within the deepwater eastern king prawn sector. This inference was supported by a broader review of elasmobranch bycatch within the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). These factors, combined with a somewhat restricted distribution (when compared to the Kapala stingaree, *U. kapalensis* and the common stingaree, *Trygonoptera Testacea*) were considered to be reasonable grounds to justify a likelihood score of rare (2). Note–This species may experience more interactions when compared with the morphologically similar species, the	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *U. bucculentus*. A score of severe (3) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Vulnerable), population trend (inferred reduction of greater than 30 per cent) and fisheries status under the *Shark and Ray Report Card* (Depleting; Kyne *et al.*, 2019c; Kyne *et al.*, 2021; Kyne *et al.*, 2023ae). Results from previous risk assessments also supported the assignment of a more moderate consequence score (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *U. bucculentus* is a smaller batoid, it will derive fewer benefits from the use of a TED/BRD. Captured *U. bucculentus* are expected to have higher post-interaction mortality rates and may abort pups during an encounter (Kyne *et al.*, 2021; Kyne *et al.*, 2023ae). These factors limited refinements to the consequence score for this species. It is recognised that the consequence score assigned to this species may represent an overestimate for this region. However, the available data did not support a downgrading of

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					yellowback stingaree (*U. sufflavus)* (Rigby *et al.*, 2016b; Campbell *et al.*, 2017).	this score. With additional information on regional elasmobranch catch rates, this score could be further refined.
Kapala stingaree	*Urolophus kapalensis*		3	3	**Likelihood**: Regional operations will fish in habitats preferred by the Kapala stingaree (*Urolophus kapalensis*) and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). Bycatch data is available for this species and provides some insight into *U. kapalensis* interaction rates, although release fate (alive, dead or moribund) information is more limited. *Urolophus kapalensis* has been identified as a key contributor to the elasmobranch bycatch in the shallow water eastern king prawn sector (Courtney *et al.*, 2007; Kyne, 2008). The species also featured in a bycatch study examining trawl fishing activities south of the GBRMP. In this assessment, *U. kapalensis* recorded the sixth highest number of reports within the elasmobranch complex (*n* = 121; Campbell *et al.*, 2017). A weight-of-evidence approach suggests that *U. kapalensis* is one of the more frequently encountered stingarees in the ECOTF (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). Based on its distribution on the Australian east coast, all of the Queensland trawl interactions will occur in the Southern Offshore Trawl Region (Kyne *et al.*, 2021). When compared to similar species such as the greenback stingaree (*U. viridis*) or the sandyback stingaree (*U. bucculentus*), the probability of interacting with *U. kapalensis* will be higher. This elevated the likelihood of the consequence occurring under the current fishing environment. For these reasons, and those outlined in the corresponding consequence section, a likelihood score of possible (3) was considered reasonable.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *U. kapalensis*. A score of severe (3) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Near Threatened), population trends (suspected reduction approaching 30 per cent) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne & Bennett, 2019; Kyne *et al.*, 2021; Kyne *et al.*, 2023ab). Results from previous risk assessments also supported the assignment of a more moderate consequence score (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *U. kapalensis* is a smaller batoid, it will derive fewer benefits from the use of a TED/BRD. Captured *U. kapalensis* are expected to have higher post-interaction mortality rates and may abort pups during an encounter (Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023ab). These factors limited refinements to the consequence score for this species. Some of the potential consequences for this species include the potential to contribute to further declines in regional populations and a contraction of the northern range limit.
Greenback stingaree	*Urolophus viridis*		3	2	**Likelihood:** The greenback stingaree (*Urolophus viridis*) has not been recorded as bycatch in the ECOTF. However, the distribution and depth profile of this species is similar to the Kapala stingaree (*U. kapalensis*) and the sandyback stingaree (*U. bucculentus*; Last *et al.*, 2016b; Kyne *et al.*, 2021). Both *U.*	**Consequence**: A review of the available data (and interaction potential) supported a downgrading of the default consequence score from severe (3) to moderate (2). The ability to reduce this score further was limed by data

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					kapalensis and *U. bucculentus* have been reported from the ECOTF and these species make up a notable portion of the stingaree bycatch. Given the prevalence of *U. kapalensis* and *U. bucculentus* in the elasmobranch trawl bycatch, it is conceivable that *U. viridis* also interacts with southern Queensland trawl operations. Accordingly, this species was included in the Southern Offshore Trawl Region LCA as a precautionary measure. *Urolophus viridis* is an endemic species with a restricted range on the Australian east coast. There are some concerns surrounding the status of this species and the impact of commercial fishing across its known range. Evidence suggests that *U. viridis* interacts more frequently with fisheries situated further south. Trawl operations in the Southern Offshore Trawl Region though have the potential to contribute to these broader risks/impacts. These potential risks include contributing to a contraction of the northern range limit. These factors, when combined with uncertainty surrounding stingaree catch compositions in the Southern Offshore Trawl Region, supported the assignment of a more precautionary likelihood score. To refine this score, further information is required on the composition of this portion of the catch.	deficiencies and uncertainty surrounding regional elasmobranch bycatch compositions. The available evidence identified some notable concerns surrounding the conservation status and sustainability of this species. These concerns were the catalyst behind the original decision to include this species in the Southern Offshore Trawl Region LCA. *Urolophus viridis* has been assessed as Vulnerable under the IUCN Red List criteria with a complementary analysis classifying the fishing status as depleted (Kyne *et al.*, 2021; Kyne *et al.*, 2023aa). Within these assessments, commercial fishing (specifically trawl fishing) was identified as a high-threat element. Overall, a consequence score of moderate (2) was considered appropriate for this species. This rating is marginally lower than *U. kapalensis* which has documented interactions with this fishery. It is recognised that a score of moderate (2) may overestimate the consequence for this species within this region. A reduction in this score though would require further information on regional bycatch compositions.
Common stingaree	*Trygonoptera testacea*		4	2	**Likelihood**: Regional operations will fish in habitats preferred by the common stingaree (*Trygonoptera testacea*) and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). Bycatch data is available for this species and provides some insight into *T. testacea* interaction rates, although release fate (alive, dead or moribund) information is more limited. *Trygonoptera testacea* has been identified as a key contributor to the elasmobranch bycatch in the shallow water eastern king prawn sector (Courtney *et al.*, 2007; Kyne, 2008). The species also featured in a bycatch study examining trawl fishing activities south of the GBRMP. In this study, *T. testacea* had	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *T. testacea*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Near Threatened), population trend (suspected reduction approaching 30 per cent) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne & Last, 2019; Kyne *et al.*, 2021; Kyne *et al.*, 2023t). Results from previous risk assessments also supported the assignment of a more moderate consequence score (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					the second highest number of interactions for an elasmobranch species (*n* = 1,270; Campbell *et al.*, 2017). A weight-of-evidence approach suggests that *T. testacea* is likely to be one of the more frequently encountered stingarees in the ECOTF (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). When factors such as high interaction rates, suspected high post-interaction mortality, stress-induced parturition of pups, population trends and this species risk extinction status are taken into account, the probability of the consequence eventuating under the current fishing environment is considered to be elevated. For these reasons, a likelihood score of occasional (4) was considered reasonable.	As a smaller batoid, *T. testacea* will likely derive limited benefits from the use of a TED/BRD (Campbell *et al.*, 2017). Captured *T. testacea* are expected to have higher post-interaction mortality rates and females may abort pups during an encounter (Kyne, 2008; Campbell *et al.*, 2017; Kyne *et al.*, 2021). These factors limited refinements to the consequence score for this species.
Australian whipray	*Himantura australis*		1	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the Australian whipray (*Himantura australis*). Due to its depth profile (0–45 m), this species will only interact with operations targeting prawns in shallower waters (Last *et al.*, 2016b; Kyne *et al.*, 2023p). In this region, these interactions will most likely be confined to Offshore Region B (Department of Agriculture and Fisheries, 2021e). If and when this species is caught in the Southern Offshore Trawl Region, a high proportion of the sub-adults and adults will experience a contact without capture event. While difficult to quantify, contact without capture events are less likely to end in significant injuries or impede the long-term survivability of the animal. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in the Southern Offshore Trawl Region and/or within the current fishing environment. With additional information on bycatch compositions, this species could potentially be removed from future ERAs involving this region.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australis*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern), (suspected) stable population trend (Kyne *et al.*, 2021) and sustainability status (Sustainable; Kyne *et al.*, 2023p). The maximum disc width of this species assists in terms of reducing the size of the potential consequence. *Himantura australis* reaches at least 183 cm disc width and the vast majority of sub-adult and adult specimens, if caught, will be excluded from the net via the TED. It is recognised that a score of moderate (2) may be an overestimate for this species. With additional information on regional elasmobranch catch rates, this score could be further refined.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
Blackspotted whipray	*Maculabatis astra*		3	2	**Likelihood**: Trawl operations within the Southern Offshore Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Kyne, 2008; Pears *et al.*, 2012b). While noting this overlap, the blackspotted whipray (*Maculabatis astra*) is broadly distributed and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. astra* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Based on the available data, interactions may be more frequent within shallow-water operations (Jacobsen *et al.*, 2015). While difficult to quantify, this species may also be encountered with more frequency in Offshore Trawl Region B. Data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. astra* and the brown whipray (*M. toshi*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	**Consequence**: The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Kyne *et al.*, 2021; Kyne *et al.*, 2023q). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023q). As a smaller batoid, *M. astra* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 92 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality rates are largely unknown for this species (Kyne *et al.*, 2023q). However, a composite study including both *M. astra* and *M. toshi* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. astra* as a standalone species. These factors limited refinements to the consequence score for this species.
Brown whipray	*Maculabatis toshi*		3	2	**Likelihood**: Trawl operations within the Southern Offshore Trawl Region fish in habitats preferred by the brown whipray (*Maculabatis toshi*) and there is evidence that it forms part of the elasmobranch trawl bycatch across its Queensland range	**Consequence:** The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3)

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					(Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). While acknowledging this overlap, notable portions of this species' range will experience light or negligible fishing (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. toshi* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Based on the available data, interactions may be more frequent within shallow-water operations (Jacobsen *et al.*, 2015). While difficult to quantify, this species may also be encountered with more frequency in Offshore Trawl Region B. Data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. toshi* and the blackspotted whipray (*M. astra*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	to moderate (2) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trend (nothing to infer a reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). As a smaller batoid, *M. toshi* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 82 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality levels for this species are largely unknown (Kyne *et al.*, 2023q). However, a composite study including both *M. toshi* and *M. astra* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. toshi* as a standalone species. These factors limited refinements to the consequence score for this species.
Estuary stingray	*Hemitrygon fluviorum*		1	3	**Likelihood**: The depth profile (0–28 m) and distribution of the estuary stingray (*Hemitrygon fluviorum*) will overlap with the effort footprint of the Southern Offshore Trawl Region. However, a notable portion of trawl operators in this region will fish in areas where *H. fluviorum* are less likely to be found or encountered e.g. targeting deepwater eastern king prawns (*M.*	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023w). The revised score better reflects what is known about this species Australian extinction risk classification (Vulnerable),

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					plebejus). These fishing patterns reduce the likelihood of an estuary stingray interaction occurring in this region. When compared, interactions with this species are more likely to occur in trawl operations targeting prawns in shallower water environments and/or in closer proximity to estuaries or mangrove lined stretches of coastline. At a regional level, there is a higher probability of trawl operations interacting with this species in Offshore Region B. With improved information on regional elasmobranch catch compositions, this species could potentially be removed from future risk assessments involving this region.	population trends (suspected reduction of greater than 30 per cent) and protection status under the *Nature Conservation Act 1992* (Near Threatened; Queensland Government, 1992; Kyne *et al.*, 2021). It is recognised that the threats posed to the species are wider than commercial fishing with habitat degradation also identified as a key threat (Kyne *et al.*, 2021). Fishing mortalities though have the potential to compound historic range contractions and population declines. Some of the potential consequences being further range contractions, reduced genetic diversity and the fragmentation of regional populations. As this species prefers brackish waters and mangrove-fringed estuaries (Last *et al.*, 2016b; Kyne *et al.*, 2023w), a consequence score of severe may be an overestimate for this region. There is, however, limited information on elasmobranch catch compositions in the Southern Offshore Trawl Region. This makes it difficult to assess the extent and frequency (none, low, medium or high) of interactions with this species
Coral sea maskray	*Neotrygon trigonoides*		3	2	**Likelihood**: The Coral Sea maskray (*Neotrygon trigonoides*) will interact with east coast trawl operations and be caught as bycatch in the Southern Offshore Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon trigonoides* is a common elasmobranch that is often associated with reefal and continental shelf environments to depths of 170 m (Kyne *et al.*, 2021). While this bathymetric range coincides with the depths utilised by regional operations, this species will experience areas of refuge in habitats less conducive to trawling (e.g. coral reefs). Moreover, *N. trigonoides* will be afforded protection through marine reserves and portions of its distribution where fishing is limited (Kyne *et al.*, 2021). These factors reduce the likelihood of the consequence coming to fruition in the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. trigonoides* is a key component of the elasmobranch catch in the scallop fishery (Courtney *et*	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. trigonoides*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Sherman *et al.*, 2021), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023u). *Neotrygon trigonoides* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. trigonoides* are likely to have high levels of post-interaction mortality (Kyne *et al.*, 2023u). These factors limited

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					al., 2007). Studies also demonstrate this species will interact with the eastern king prawn and tiger/endeavour prawn sectors (Courtney *et al.*, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. Capture rates are also expected to be higher for this species as TEDs are less effective in terms of excluding smaller rays from the catch. This inference is supported by results from bycatch composition studies which show *N. trigonoides* are caught with some frequency (*n* = 385; Campbell *et al.*, 2017). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments. Note–Catch data for this species was typically reported as *Dasyatis kuhlii* or *N. kuhlii* (Jacobsen, 2007; Kyne, 2008; Last *et al.*, 2016a; Last *et al.*, 2016b).	refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Speckled maskray	*Neotrygon picta*		1	2	**Likelihood**: The speckled maskray (*Neotrygon picta*) will interact with east coast trawl operations and be caught as bycatch in the Southern Offshore Trawl Region (Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon picta* is a common elasmobranch that is often associated with soft substrates and continental shelf environments to depths between 5–100 m (Kyne *et al.*, 2021; Bray, Undated). While these habitat preferences coincide with areas utilised by regional operations, *N. picta* will be afforded some protection across its distribution where fishing is either absent or limited (Kyne *et al.*, 2021). These factors reduce the likelihood of the consequence coming to fruition within the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. picta* is a key component of the elasmobranch catch in the scallop sector (Kyne, 2008). Bycatch studies also suggest that the species will be caught in	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. picta*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Pierce *et al.*, 2015), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023af). *Neotrygon picta* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. picta* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Kyne, 2008). These factors

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					trawl operations targeting tiger and endeavour prawns (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). While noting these studies, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. This uncertainty was taken into consideration when assigning this likelihood score. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Bottlenose wedgefish	*Rhynchobatus australiae*		2	2	**Likelihood**: The bottlenose wedgefish (*Rhynchobatus australiae*) will interact with east coast trawl operations and be caught as bycatch in the Southern Offshore Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Rhynchobatus australiae* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths of 60 m (Kyne, 2008; Kyne *et al.*, 2021). Based on known information about trawling activities, these habitat preferences will only coincide with a limited portion of this region (e.g. shallow-water, inshore environments). These habitats are more likely to be fished in Offshore Region B. While studies are limited, the available data indicates that *R. australiae* will be caught as bycatch in the scallop, tiger and endeavour prawn sectors (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). Historic bycatch records for *R. australiae* were reported in a complex which included the eyebrow wedgefish (*R. palpebratus*) or under the synonym *R. djiddensis*. This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of rare (2) may be an overestimate for this species. With additional information on	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. australiae*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species Australian extinction risk classification (Near Threatened; Kyne *et al.*, 2021), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023r). As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. australiae* from the catch (Campbell *et al.*, 2020). The size of *R. australiae* may also assist in terms of it surviving a trawl interaction (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). This inference though requires further testing and cannot be confirmed without additional information on *R. australiae* interaction rates and release fates.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					bycatch compositions, this score may be refined in future assessments.	
Eyebrow wedgefish	*Rhynchobatus palpebratus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Eastern shovelnose ray	*Aptychotrema rostrata*		3	2	**Likelihood**: Regional operations will fish in habitats preferred by the eastern shovelnose ray (*Aptychotrema rostrata*) and there is evidence that it forms part of the elasmobranch trawl bycatch along the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Bycatch data is available for this species and provides some insight into *A. rostrata* interaction rates and release fates (alive, dead or moribund). One study demonstrated that *A. rostrata* dominated the elasmobranch catch in both the scallop and shallow water eastern king prawn sectors (Courtney *et al.*, 2007). Similar results were observed in another bycatch study focused on areas south of the GBRMP. In this instance, *A. rostrata* was the most commonly encountered species across the entire assessment (*n* = 3,933; Campbell *et al.*, 2017). Interactions with other sectors targeting deepwater eastern king prawns and tiger/endeavour prawns were less frequent (Courtney *et al.*, 2007; Pears *et al.*, 2012b; Rigby *et al.*, 2016b). *Aptychotrema rostrata* will be a likely contributor to the elasmobranch bycatch in this region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). For these reasons, a likelihood score of possible (3) was considered reasonable. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. rostrata*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne & Stevens, 2015), population trends (nothing to infer or suspect a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ah). While noting these considerations, evidence suggests that a) *A. rostrata* will derive less benefit from the use of a TED and b) remains abundant within trawl bycatch (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). The use of BRD designs like the Fisheye though, may assist in terms of excluding this species from the trawl catch (Courtney *et al.*, 2007). Further, anecdotal evidence suggests that *A. rostrata* have reasonably good post-interaction survival rates (Kyne, 2008; Campbell *et al.*, 2017; Kyne *et al.*, 2021). These factors contributed to the species receiving a consequence score at the lower end of the spectrum.
Giant guitarfish	*Glaucostegus typus*		2	2	**Likelihood**: The giant guitarfish (*Glaucostegus typus*) has been recorded as bycatch in the ECOTF and the species will (likely) interact with regional trawl operations (Pears *et al.*, 2012b; Campbell *et al.*, 2017).	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *G. typus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					Glaucostegus typus inhabits a range of demersal environments including intertidal and offshore areas to depths of 100 m (Kyne *et al.*, 2021; Kyne *et al.*, 2023y). While these habitat preferences overlap with the ECOTF, areas of its distribution will have limited exposure to fishing activities (Kyne *et al.*, 2021). Juveniles also display an affinity for intertidal areas (Kyne *et al.*, 2021) which may assist in terms of reducing their exposure to trawl fishing during these early life stages. Within this region, *G. typus* interactions are more likely to occur in Offshore Trawl Region B. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in this region and/or within the current fishing environment. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	*al.*, 2023) and our current understanding of its Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021). Within Australia, *G. typus* has a (suspected) stable population (Kyne *et al.*, 2021) and it has been assessed as sustainably fished across its known distribution (Kyne *et al.*, 2023y). Results from previous risk assessments also supported the assignment of a consequence score at the lower end of the spectrum (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *G. typus* is a large batoid, it will derive considerable benefit from the use of a TED (Brewer *et al.*, 2004; Brewer *et al.*, 2006). While immature rays may still be caught, most sub-adult and adult specimens will be excluded from the net via the TED. Data on *G. typus* post-interaction mortality rates are limited and the outputs vary between assessments. One report with a relatively small sample size (n = 10) recorded a 100 per cent mortality rate (Campbell *et al.*, 2017). In contrast, data provided through the Fishery Observer Program demonstrated more moderate survival levels (19 out of 28 individuals released alive; Pears *et al.*, 2012b). These differing results combined with an absence of information on regional catch rates introduced an element of uncertainty into this assessment. This uncertainty supported the retention of a moderate (2) rating *versus* a downgraded score of minor (1).
Sydney skate	*Dentiraja australis*		3	2	**Likelihood**: The Sydney skate (*Dentiraja australis*) will interact with east coast trawl operations and be caught as bycatch in the Southern Offshore Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). The *D. australis* depth profile (20–325 m) indicates that this species can and will interact with operations in Offshore Trawl Region A and B. However, information on regional interaction rates and release fates remains limited. Data deficiencies create a level of assessment uncertainty and supported the adoption of a more precautionary approach. This is reflected in the likelihood score assigned to this species.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *D. australis*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species Australian extinction risk classification (Vulnerable; Kyne *et al.*, 2021), population trends (inferred reduction of greater than 30 per cent; Kyne *et al.*, 2021; decreasing; Rigby *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Recovering; Kyne *et al.*, 2023k).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could be refined in future assessments.	Of note, a more recent global extinction risk classification classified *D. australis* as Near Threatened (Rigby *et al.*, 2021). Further, regional populations for this species are now expected to be in recovery (Kyne *et al.*, 2023k). These factors contributed to *D. australis* receiving a marginally lower consequence score. Results from previous risk assessments also supported the assignment of a lower consequence score (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). While noting these considerations, *D. australis* is a smaller batoid and it will derive fewer benefits from the use of a TED/BRD. Once captured, *D. australis* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Kyne, 2008). The combination of these factors supported the retention of a more moderate consequence score for this species.
Endeavour skate	*Dentiraja endeavouri*		3	3	**Likelihood**: Regional operations will fish in habitats preferred by the endeavour skate (*Dentiraja endeavouri*) and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Campbell *et al.*, 2017). Bycatch data for the ECOTF provides limited insight into *D. endeavouri* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Historic bycatch records for *D. endeavouri* were reported in a complex that included the argus skate (*D. polyommata*; Courtney *et al.*, 2007; Kyne, 2008). These species have since been separated and the distribution of *D. polyommata* extends further north (Rigby *et al.*, 2016a). This taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. However, evidence suggests that *D. endeavouri* are likely to be encountered within the deepwater eastern king prawn sector (Kyne *et al.*, 2021). This inference is supported by results from a trawl bycatch study in	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *D. endeavouri*. A score of severe (3) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Near Threatened), population trend (suspected reduction approaching 30 per cent) and fisheries status under the *Shark and Ray Report Card* (Depleting; Kyne *et al.*, 2021; Rigby & Derrick, 2021; Kyne *et al.*, 2023v). Results from previous risk assessments also supported the assignment of a more moderate consequence score (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). In addition, *D. endeavouri* is a smaller batoid and will likely derive fewer benefits from the use of a TED/BRD (Kyne *et al.*, 2023v). Captured *D. endeavouri* are expected to have higher rates of post-interaction mortality (Kyne *et al.*, 2021). The combination of these factors supported the retention of a more moderate consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					southern Queensland where *D. endeavouri* recorded the fifth highest number of reports within the elasmobranch complex (*n* = 128; Campbell *et al.*, 2017). Based on this species elevated potential to interact with the fishery, and the added element of uncertainty surrounding historical records, a likelihood score of possible (3) was considered reasonable.	
Argus skate	*Dentiraja polyommata*		4	2	**Likelihood**: Regional operations will fish in habitats preferred by the argus skate (*Dentiraja polyommata*) and there is evidence that it forms part of the elasmobranch trawl bycatch on the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b). Studies have shown that *D. polyommata* is one of the more abundant skate species caught as bycatch in the ECOTF (Courtney *et al.*, 2007; Kyne, 2008). For example, one study reported that *D. polyommata* comprised 50.1% of the total elasmobranch catch within the deepwater eastern king prawn sector (*n* = 768; Rigby *et al.*, 2016b). Within the ECOTF, the majority of the *D. polyommata* interactions will occur in the Southern Offshore Trawl Region. Of notable importance, historical catch records for *D. polyommata* were reported in a complex that included the endeavour skate (*D. endeavouri*). These species have since been separated and the distribution of *D. polyommata* extends further north (Rigby *et al.*, 2016a). This taxonomic variability makes it more difficult to interpret historical catch data for this species (and *D. endeavouri*). When factors such as high interaction rates and post-interaction mortality rates are considered, the probability of the consequence eventuating under the current fishing environment is considered to be elevated. For these reasons, a likelihood score of occasional (4) was considered reasonable. It is acknowledged that a likelihood score of occasional (4) may be an overestimate for this species. The ability to refine this score though was restricted by an absence	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *D. polyommata*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne & Rigby, 2015), population trends (suspected to be stable; Kyne *et al.*, 2021) and fisheries status (Sustainable; Kyne *et al.*, 2023n). As a smaller batoid, *D. polyommata* will derive fewer benefits from the use of a TED/BRD (Kyne *et al.*, 2023n). Captured, *D. polyommata* are expected to have higher rates of post-interaction mortalities (Kyne *et al.*, 2021). This inference is supported by data collected through a previous Fishery Observer Program which showed that 100 per cent of individuals were discarded in a dead or moribund state (*n* = 102; Pears *et al.*, 2012b).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					of information on elasmobranch interaction rates across and within the Southern Offshore Trawl Region.	
Narrow sawfish	*Anoxypristis cuspidata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Green sawfish	*Pristis zijsron*		2	4	**Likelihood**: The green sawfish (*Pristis zijsron*) has experienced considerable range contractions and population declines on the Queensland east coast. These contractions have led to the hypothesis that the species is now regionally extirpated in waters south of the Whitsundays (Peverell, 2005; Department of the Environment, 2019; Kyne *et al.*, 2023z). Within the ECOTF, *P. zijsron* interactions are more likely to occur within the Northern and Central Trawl Regions. Conversely, historic population declines and range contractions make *P. zijsron* interactions less likely in the Southern Offshore Trawl Region. It is important to note though that any sawfish interaction in this region would involve a remnant population. These interactions (if applicable) have the potential to exacerbate historic (negative) population trends and increases the likelihood of the consequence coming to fruition within the current fishing environment. Given the extent of the declines, this could theoretically occur at low rates of fishing mortality. These concerns were considered sufficient to assign this species with a higher likelihood score. At present, it is difficult to ascertain how frequently this species interacts with fishers operating in the Southern Offshore Trawl Region and/or determine the likelihood of the fishery impacting regional populations. This uncertainty required the adoption of a more precautionary assessment approach and the assignment of a higher score for this component of the assessment. It is recognised that the score assigned to this component of the LCA may be an overestimate. This inference though can only be tested with additional information on elasmobranch bycatch compositions within this region. The continued roll-out of the Data Validation Plan will assist in this process and improve our understanding of sawfish compositions in the	**Consequence**: The available evidence, including that contained in third-party assessments, supported a deviation from the default score of severe (3) to major (4). The revised score better reflects what is known about green sawfish population trends (suspected reduction >80 per cent) and extinction risk classification (Critically Endangered; Kyne *et al.*, 2021). Other considerations that contributed to this decision included a) the potential for this species to incur *in-situ* or post-interaction mortalities and b) the increased risk of injury due to entanglements (due to their large rostrums). Any interaction with this species will be with a population that has experienced some decline and/or may be with a remnant population. The potential consequences for this species are significant and could include exacerbating historic range contractions, a reduction in genetic diversity and the further fragmentation of a remnant population/s. These (potential) impacts warranted the assignment of a major (4) consequence score. Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (severe, 3). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing activities to contribute to an unintended consequence e.g. continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing for *P. zijsron* be

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Southern Offshore	L	C	Likelihood	Consequence
					Southern Offshore Trawl Region. With additional information, the regional risk profile for this species could be further refined and improved.	increased from Vulnerable to Critically Endangered (Kyne *et al.*, 2021). If this recommendation were adopted, it would see *P. zijsron* listed in the same category as the speartooth shark (*Glyphis glyphis*) and above a number of the marine turtle species.

Data Report: Appendix E—Preliminary scoring and justifications of the Likelihood and Consequence Analysis for species assessed as part of the Moreton Bay Trawl Regional Risk Assessment

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
Marine turtles						
Loggerhead turtle	*Caretta caretta*		3	2	**Likelihood:** The likelihood assessment considered the distribution and habitat preferences of each species when reviewing their potential to interact with trawl operations in the Moreton Bay Trawl Region. These considerations included the location and prevalence of foraging, nesting and rookery sites along the Queensland east coast (Limpus, 2007a; b; 2008a; b; c; 2009). The likelihood assessment also considered the level of uncertainty surrounding the data on regional marine turtle interaction rates. A weight-of-evidence approach supported the assignment of likelihood scores of remote (1) or possible (3) for all six species. Across the complex, data deficiencies made it more difficult to differentiate between the species and/or identify where there was a lower likelihood of the consequence coming to fruition within the current fishing environment. Accordingly, some of the species may have been assigned a more conservative or precautionary score for this aspect of the Likelihood and Consequence Analysis (LCA). The likelihood assessment determined that regional trawl fishers were less likely to interact with the leatherback turtle (*Dermochelys coriacea*), olive ridley turtle (*Lepidochelys olivacea*) and flatback turtle (*Natator depressus*). This is despite *N. depressus* and *L. olivacea* being considered 'resident' species in Moreton Bay (Department of Environment Science and Innovation, 2021). While fishers may still interact with these three species, the likelihood of the consequence coming to fruition within the current fishing environment was considered low. This decision was based on a number of key considerations including: - Data suggesting that the interaction potential for the *D. coriacea* is lower due to a) it having a close affinity with	**Consequence**: The available evidence including third-party assessments did not support a deviation from the default consequence score of moderate (2) for these species (Subcommittee, 1996; Seminoff, 2004; Abreu-Grobois & Plotkin, 2008; Wallace *et al.*, 2013; Casale & Tucker, 2017; Department of the Environment, 2023f; a; b; c; d; e). A number of measures implemented across the East Coast Otter Trawl Fishery (ECOTF) reduce the impact of the fishery on this complex and, therefore, the consequence e.g. the use of a Turtle Excluder Device (TED), Bycatch Reduction Devices (BRDs) and an extensive system of spatial/temporal closures. Effort levels for the ECOTF have also declined through time and are now capped under the harvest strategies (Department of Agriculture and Fisheries, 2021a; e; c; d; b; 2023). In past Ecological Risk Assessments (ERAs), a decline in effort has been directly linked to a decline in risk levels (Pears *et al.*, 2012b; Jacobsen *et al.*, 2015). While difficult to quantify, effort has declined since these assessments and it is reasonable to assume that the consequences of trawl fishing have not increased in the proceeding years. These measures support the assignment of a consequence score at the lower end of the spectrum i.e. moderate (2) *versus* severe (3) or major (4). While TEDs will be effective at reducing the capture of marine turtles, data submitted through the Threatened, Endangered and Protected Animals (TEPA) logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution and may underestimate the total number of marine turtle interactions. The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Moreton Bay Trawl
Green turtle	*Chelonia mydas*		3	2		
Leatherback turtle	*Dermochelys coriacea*		1	2		
Hawksbill turtle	*Eretmochelys imbricata*		3	2		
Olive ridley turtle	*Lepidochelys olivacea*		1	2		
Flatback turtle	*Natator depressus*		1	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					pelagic environments and b) evidence that breeding frequency for this species is in decline on the Queensland east coast (Limpus, 2009; Department of the Environment, 2023c). - Distributional data showing that *L. olivacea* is more commonly encountered in tropical waters and interactions with this species will be less frequent in southern Queensland. - Evidence that a) foraging range for the east Australian *N. depressus* stock lies almost totally within the Great Barrier Reef Marine Park (GBRMP) and b) rookeries/nesting sites for this species are situated well north of Moreton Bay (Limpus, 2008c). Of the remaining species, Moreton Bay is considered an important foraging site for the green turtle (*Chelonia mydas*) and loggerhead turtle (*Caretta caretta*). These two species may interact with Moreton Bay trawl fishers with more frequency; particularly the green turtle which can be found in higher numbers in south-east Queensland. Key nesting and rookery sites for the hawksbill turtle (*Eretmochelys imbricata*) are located further north (Limpus, 2007a; 2008c). However, *E. imbricata* is a highly migratory species and interactions with this species could occur throughout the five management regions.	Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the Northern Prawn Fishery (NPF), supports the hypothesis that the number of marine turtle interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining the consequence score more difficult. Taking a weight-of-evidence approach to the consequence assessment, a score of moderate (2) was considered appropriate for this region. This score takes into consideration risk mitigation measures, declining effort trends and management limitations e.g. an inability to verify reported interaction / release fates and uncertainty surrounding the species that interact with trawl fishers in this region.
Syngnathids						
Tiger pipefish	*Filicampus tigris*		3	2	**Likelihood:** Considerations given to the likelihood component included a review of species distributions and habitat preferences in relation to regional operational areas. It was determined that these five species will occupy a range of environments, some of which may increase their susceptibility to trawling interactions. For example, soft substrates including mud and sand will be more conducive to encounters with operations, while seagrass and hard substrates (e.g. corals) will provide these species with a degree of natural protection.	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of moderate (2) (Pollom, 2016a; Pollom, 2017b; a). This score is considered appropriate based on a) the inability to verify reported interaction and release fates and b) species extinction risk classifications. While BRDs may be effective at
Spiny seahorse	*Hippocampus spinosissimus*		3	2		
Great seahorse	*Hippocampus kelloggi*		3	2		
Bentstick pipefish	*Trachyrhamphus bicoarctatus*		3	2		

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
White's seahorse	*Hippocampus whitei*		3	2	They will also be afforded protection through the Moreton Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). Information on species habitat preferences is readily available and most will occupy a range of both hard and soft substrates to varying depths. However, distributional data is less reliable and information sources often had conflicting range information. In addition, significant taxonomic changes within the Syngnathidae family make it difficult to discern current distributions. These combined factors increased the level of uncertainty regarding the interaction potential between these species and trawling apparatus. As a result, a more conservative approach was adopted and a likelihood score of possible (3) was applied. It is acknowledged that these scores may be an overestimate for this region. With improved information on syngnathid bycatch compositions, these scores may be refined in future risk assessments.	reducing the capture of these species, some will likely be captured within the codend. Of note, all interactions with non-retainable syngnathids are required to be reported within the TEPA logbook. However, data reported through these logbooks has poor resolution and provides limited insight into regional catch compositions. As there is currently no mechanism in place to validate TEPA logbook data, a score of moderate was considered reasonable. With an effective mechanism to verify interaction and release fates, these scores may be refined. Note–Considerations were given to increase the consequence score for the White's seahorse (*Hippocampus whitei*) based on an extinction risk classification of Endangered and decreasing population trend (Harasti, 2017). However, a review of its preferred habitats and depths indicated that this species prefers three-dimensional structures (e.g. artificial anthropogenic structures, coral reef, macroalgal etc.) to depths of 12 m (Harasti, 2017). Hard substrates are less conducive to trawling and these factors significantly reduce the ability for fishing activities to impact populations. These factors significantly reduce the ability for fishing activities to impact populations and maintaining a consequence score of moderate (2) was considered appropriate for this species.
Duncker's pipehorse	*Solegnathus dunckeri*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Duncker's pipehorse (*Solegnathus dunckeri*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus dunckeri* occupies a range of habitats ranging from soft substrates that are more conducive to trawl fishing through to environments dominated by hard structures like sandstone, gravel, gorgonians and sponges (Pollom, 2017c). These habitat preferences will provide *S. dunckeri* with a degree of natural protection from trawl fishing activities. *Solegnathus dunckeri* will also be afforded additional protections through the Moreton Bay Marine Park Zoning Plan	**Consequence**: The available evidence, including through third-party assessments, did not support a deviation from the default consequence score of severe (3). This score is considered appropriate based on a) the ineffectiveness of TEDs/BRDs in terms of excluding this species from the net, b) an extinction risk classification of Data Deficient (Pollom, 2017c) and c) the allowable retention of this species (trip limit = 50 combined individuals) (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					(Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). *Solegnathus dunckeri* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of Queensland, 2019b). Based on a review of historic syngnathid catch it is hypothesised that the interaction potential for this species will be higher in operations fishing in central and southern Queensland. However, such inferences must be observed with caution as records of syngnathid harvest do not account for all interactions (e.g. discarded individuals). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards). Based on these factors, the assigned score was considered to be reasonable. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Pallid pipehorse	*Solegnathus hardwickii*		3	3	**Likelihood:** A review of this species distribution and habitat preferences determined that the Pallid pipehorse (*Solegnathus hardwickii*) has an increased potential to interact with regional trawl fishing activities. *Solegnathus hardwickii* occupies a range of habitats including those associated with sponges, gorgonians and possibly coral reef edges, typically at depths between 12 and 100 m (Pollom, 2017d). These habitat preferences will provide *S. hardwickii* with a degree of natural protection from trawl fishing activities. *Solegnathus hardwickii* will also be afforded additional protections through the Moreton Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). *Solegnathus hardwickii* is known to interact with the ECOTF and it can be retained for sale in this fishery (i.e. as part of a combined trip limit of 50 permitted pipefish) (State of Queensland, 2019b). Based on a review of historic syngnathid catch it can be inferred that interactions may be frequent within	**Consequence**: There was sufficient evidence to support a deviation from the default consequence score of moderate (2) to severe (3). This score was considered appropriate as this species will have similar vulnerabilities to the Duncker's pipehorse (*S. dunckeri* [assessed in the Southern Inshore, Southern Offshore and Moreton Bay Trawl Regions]). Key considerations given to this score included a) an ineffectiveness of TEDs/BRDs to exclude this species from capture, b) a species extinction risk classification of Data Deficient (Pollom, 2017d) and c) the allowable retention of this species (State of Queensland, 2019b). Of importance, reporting requirements for retainable syngnathid species are limited to the collection of data through catch logbooks. Operators are not currently required to report *S. dunckeri* or *S. hardwickii* discards or release fates. This increases the level of uncertainty surrounding total interaction rates and regional mortality rates (i.e. retained plus discards).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					this region. However, such inferences must be observed with caution, as records of syngnathid harvest combines both permitted pipefish species into a single reporting field and does not account for discards. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. However, there remains a high level of uncertainty surrounding regional catch and interaction rates (retained plus discards). This uncertainty warranted the adoption of a more precautionary score. With improved information on syngnathid bycatch compositions, this score may be refined in future risk assessments.	Based on these factors, the assigned score was considered to be reasonable. With an effective mechanism to verify interaction and release fates, this score could be further refined.
Straightstick pipefish	*Trachyrhamphus longirostris*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Ribboned pipefish	*Haliichthys taeniophorus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sea snakes						
Reef shallows sea snake	*Aipysurus duboisii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Mosaic sea snake	*Aipysurus mosaicus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Olive sea snake	*Aipysurus laevis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Spine-bellied sea snake	*Hydrophis curtus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Elegant sea snake	*Hydrophis elegans*		2	2	**Likelihood**: The elegant sea snake (*Hydrophis elegans*) will interact with trawling operations on the Queensland east coast (Courtney *et al.*, 2010). Across its range, *H. elegans* is often associated with soft and hard substrates (e.g. sand, mud, coral reefs, seagrass, estuaries and rivers) to depths of 110 m (Milton, 2010a; Department of the Environment, 2024). This species is also known to have an affinity for seagrass meadows in depths less than three metres (Udyawer *et al.*, 2016b).	**Consequence**: A review of available evidence did not support a deviation from the default score of moderate (2) (Milton *et al.*, 2009; Courtney *et al.*, 2010; Milton, 2010a). The assigned score is considered appropriate based on the known information regarding this species extinction risk classification of Least Concern, stable population trend (Milton, 2010a), and moderate post-interaction survival rates (*n* = 347 interactions with 17 per cent mortality; Milton *et al.*, 2009; *n* = 186 interactions with 12.4 per cent mortality; Courtney *et al.*,

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					Considering the habitat and depth preferences of regional-specific target/secondary species, interactions with *H. elegans* are expected to be limited. Moreover, this species will likely experience areas of refuge within its range that is less conducive to trawling (e.g. seagrass beds protected under the Moreton Bay Marine Park Zoning Plan). When compared, interactions with this species are more likely to occur within the Central Trawl Region. This inference is supported by results from a bycatch study on sea snake interactions in the trawl fishery (Courtney *et al.*, 2010) and documented occurrence records (Udyawer *et al.*, 2020). It is acknowledged that a likelihood score of rare (2) may be an overestimate for this region. With improved information, this species could potentially be removed from future risk assessments involving this region.	2010). Of notable importance, previous research has demonstrated a correlation between sea snake sizes and mortality (Courtney *et al.*, 2010). As a larger species attaining a length up to 260 cm (Department of the Environment, 2024), *H. elegans* may experience greater mortality rates. While potentially limited for larger individuals, *H. elegans* will derive benefit from mandatory bycatch mitigation strategies already enforced within the fishery (e.g. BRDs). In addition to increasing sea snake escapement, BRDs and TEDs will also reduce the total weight accumulating within the codend of a net, thus minimising the risk of sustaining *in-situ* injuries (via crushing) (Milton *et al.*, 2009). While BRDs will be effective at reducing the capture of sea snakes, data submitted through the TEPA logbook cannot (currently) be validated. The TEPA logbook data also has poor species resolution with this component of the catch frequently reported by generic identifiers (i.e. sea snakes). The extent of any under-reporting is difficult to quantify across the ECOTF and/or its relevance to the Moreton Bay Trawl Region. However, cross-comparisons with data compiled from adjacent fisheries, namely the NPF, supports the hypothesis that the number of sea snake interactions are under-reported in the ECOTF. In the LCA, this uncertainty made refining or reducing the consequence scores more difficult. As a result, this score was considered reasonable, though may be further refined with additional data. Note–It is acknowledged that taxonomic changes have occurred for some species since the study by Courtney *et al.* (2010) was completed. While this remains one of the more comprehensive sea snake bycatch assessments involving the ECOTF, further research on updated interaction and survival rates in the fishery may assist with further score refinements.
Spectacled sea snake	*Hydrophis kingii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
Turtle-headed sea snake	*Emydocephalus annulatus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Olive-headed sea snake	*Hydrophis major*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Small-headed sea snake	*Hydrophis macdowelli*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Spotted sea snake	*Hydrophis ocellatus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Horned sea snake	*Hydrophis peronii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Beaked sea snake	*Hydrophis zweifeli*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Stoke's sea snake	*Hydrophis stokesii*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sharks						
Collared carpetshark	*Parascyllium collare*		2	2	**Likelihood**: Operators in the Moreton Bay Trawl Region may interact with the collared carpet shark (*Parascyllium collare*). However, the depth profile (20–175 m) and distribution of this species suggests interactions are more likely in Southern Offshore Trawl Region B (Department of Agriculture and Fisheries, 2021e). Its occurrence on hard bottom substrates (amongst a variety of other habitats) will provide this species with a degree of protection from regional trawl fishing activities (Kyne *et al.*, 2021). It will also derive benefit from provisions governing the use of resources within Moreton Bay Marine Park (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). Moreton Bay trawl fishers are expected to have (comparatively) low interactions with *P. collare*. It is further anticipated that this species will not experience a significant or	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Parascyllium collare* is a relatively common but poorly known benthic shark species. It has a restricted range on the Australian east coast and interactions will be confined to the Southern Offshore and Moreton Bay Trawl Regions. This species is thought to be relatively productive and it has been classified as Least Concern under the Australian IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also indicates that this species it is being sustainably fished across its known range (Kyne *et al.*, 2023d). However, data deficiencies make it more difficult to assess the (potential) impact of regional trawl fishing on species populations. Overall, it is unlikely that current fishing activities within the Moreton Bay Trawl Region will lead to this species

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					long-term negative consequence within the current fishing environment (Kyne *et al.*, 2021). With improved information on regional elasmobranch bycatch compositions, this species could (potentially) be removed from the analysis as a low-risk element.	experiencing a significant, long-term consequence. The key caveats being a) interactions with this species have yet to be fully quantified, b) there remains a degree of uncertainty surrounding the capture of this species in this region, and c) the species has registered marginally higher risk ratings in previous ERAs (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). All of these factors contributed to the collared carpetshark being assigned a more precautionary consequence score. Within this assessment the conservation and fishing status were key considerations in terms of the consequence score assigned to this species. If one or both assessments were to be downgraded then this risk assessment would need to be reviewed. Similarly, with improved information on elasmobranch bycatch compositions, this score could be refined and potentially reduced.
Brownbanded bambooshark	*Chiloscyllium punctatum*		5	1	**Likelihood**: The brownbanded bambooshark (*Chiloscyllium punctatum*) was assigned a higher likelihood rating as the corresponding consequence score was very low. All the available evidence suggests that trawl fishing activities within this region will not have a negative or long-term impact on this species. This included information obtained through third-party assessments regarding the species current extinction risk classification and fishery status (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There is reasonable confidence that fishing activities within the Moreton Bay Trawl Region will not have a significant impact on regional populations.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species. *Chiloscyllium punctatum* is a common benthic shark species and it is abundant within its preferred habitats (Kyne *et al.*, 2021; Kyne *et al.*, 2023b). There are few concerns surrounding the long-term sustainability of the species and it has been classified as Least Concern under the Australian IUCN Red List criteria (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023b). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). Fishing activities within the current fishing environment are unlikely to result in a long-term, negative consequence for this species. The high productivity of *C. punctatum* contributed to these findings.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
Colclough's shark	*Brachaelurus colcloughi*		3	3	**Likelihood**: Information on the Colclough's shark (*Brachaelurus colcloughi*) is limited and further research is required on the distribution of this species on the Queensland east coast. However, bycatch surveys indicate that *B. colcloughi* occurs within Moreton Bay (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c). Datasets for *B. colcloughi* are limited and it is difficult to ascertain how frequently this species interacts with trawl operations in Moreton Bay. For example, all of the available information for this species is based on less than 100 individuals (Kyne *et al.*, 2023c). A number of these specimens have been collected from Moreton Bay. The best available evidence indicates that *B. colcloughi* is endemic, has a highly limited range and occurs at a naturally low abundance (Kyne *et al.*, 2011; Kyne *et al.*, 2015; Kyne *et al.*, 2023c). The depth profile (4–217 m) and specimen collection locations also suggest that there is a higher probability of the species being caught by trawl fishers in this region (Jacobsen, 2007; Kyne *et al.*, 2011; Kyne *et al.*, 2023c). The assigned score reflects the likelihood or probability of the species experiencing a negative, long-term consequence within the current fishing environment. The severity of this potential impact (negligible, low, medium or high) remains unknown and requires further investigation. Until then, the decision was made to take a more precautionary assessment approach. It is recognised that this score may be an overestimate for this region. Refinements to this score though will require further information on regional elasmobranch bycatch compositions.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score (Kyne *et al.*, 2021; Kyne *et al.*, 2023c). The consequence assessment for *B. colcloughi* had to consider a high number of uncertainties. These uncertainties relate to the distribution of this species on the Queensland east coast, its potential to interact with the ECOTF and the capacity of the animal to survive a trawl interaction. Individuals caught in the sweep of the net will derive less benefits from using a TED and BRD as it only attains a maximum total length of 75 cm (Kyne *et al.*, 2021). This means that both immature and mature animals will be caught as bycatch in this fishery. The consequence score for this species is considered appropriate given the level of uncertainty and the outputs of third-party assessments (Kyne *et al.*, 2021) that determined the species: - Is endemic with a restricted geographical range. - Occurs at naturally low abundances with an inferred population decline (<10,000 mature individuals; an inferred continuing decline). - Has an elevated (deteriorating) extinction risk classification (Vulnerable). When these factors are considered, it is expected that this species has a higher vulnerability and/or lower resilience to rebound from fishing-related mortalities. It also suggests that there is an increased potential for trawl fishing activities to negatively impact regional populations and the extinction risk classification. It is recognised that the score assigned to this component of the assessment may overestimate the consequence for this species. In this instance though, the limited levels of information and the species' naturally low abundance warranted the adoption of a more precautionary approach. With improved information on regional elasmobranch bycatch

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
						compositions, the consequence score could be refined and (potentially) reduced.
Crested hornshark	*Heterodontus galeatus*		2	2	**Likelihood**: The distribution of the crested hornshark (*Heterodontus galeatus*) increases the likelihood of the species interacting with operations in the Moreton Bay Trawl Region. Anecdotal evidence suggests that Moreton Bay trawl operations will interact with this species. The extent of these interactions though will be mitigated through provisions governing the use of resources within the marine park (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). The species preference for rocky-reef habitats would also assist in terms of minimising the number of interactions that occur in this region (Last & Stevens, 2009; Ebert *et al.*, 2021; Kyne *et al.*, 2021). Overall, there is a lower likelihood of regional trawl fishing activities contributing to a negative, long-term consequence for this species. While the nocturnal nature of this species may see it move into trawled areas (e.g. to feed), these interactions are expected to be comparatively low.	**Consequence**: *Heterodontus galeatus* was assessed as Least Concern under the Australian IUCN Red List criteria with its fishing status defined as sustainable (Kyne *et al.*, 2021; Kyne *et al.*, 2023e). These outputs suggest that fishing activities within Moreton Bay, at present, will not lead to a significant or long-term consequence for this species. While noting these results, regional risk assessments involving the ECOTF have produced varying results. The species was assessed as a medium risk under the base-case scenario applied by Campbell *et al.* (2017) but registered a rating of precautionary high under a more conservative assessment scenario. The species was also included in two larger-scale assessments where it registered ratings of low and low-intermediate (Jacobsen *et al.*, 2015; Dedini *et al.*, 2023). Given these varying results and uncertainty surrounding regional interaction rates, the consequence score for *H. galeatus* was increased from the default minor (1) to moderate (2). This decision was precautionary and did not increase the overall risk rating for the *H. galeatus* within the Moreton Bay Trawl Region. While the consequence score assigned to this species was increased, it is still situated at the lower end of the risk spectrum. With improved information on regional elasmobranch bycatch compositions, this score could potentially be refined and reduced.
Eastern angelshark	*Squatina albipunctata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Eastern banded catshark	*Atelomycterus marnkalha*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Zebra shark	*Stegostoma tigrinum*		2	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					long-term consequence for the zebra shark (*Stegostoma tigrinum*). *Stegostoma tigrinum* will derive considerable benefit from the use of a TED and be afforded refuge from trawl fishing activities through the Moreton Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). While immature animals may still be caught as bycatch, the majority of sub-adult and adult specimens will escape through the TED opening (Brewer *et al.*, 2006; Campbell *et al.*, 2020). When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in the Moreton Bay Trawl Region and/or within the current fishing environment.	*Stegostoma tigrinum* is a common shark with a wide northern and eastern Australian distribution. The productivity of this species is considered low for an oviparous (egg-laying) species. However, there is limited (current) concerns surrounding the conservation status or long-term sustainability of the species. *Stegostoma tigrinum* has an Australian extinction risk classification of Least Concern with nothing to infer or suspect a population decline across its known range (Kyne *et al.*, 2021). A corresponding status assessment also indicates that it is being sustainably fished across its known range (Kyne *et al.*, 2023l). The species has been included in a number of ERAs involving the ECOTF and typically registers ratings at the lower end of the risk spectrum (Pears *et al.*, 2012a; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Dedini *et al.*, 2023). The above considerations indicate that current fishing activities pose limited consequences for the long-term conservation status or sustainability of this species.
Piked spurdog	*Squalus megalops*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Australian weasel shark	*Hemigaleus australiensis*		2	2	**Likelihood**: Bycatch surveys indicate that the Australian weasel shark (*Hemigaleus australiensis*) will interact with the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Campbell, 2022). However, there is limited information on its current rates of capture and/or its ability to survive a trawl interaction. Expectations are that *H. australiensis* interactions will be less frequent in this region, particularly when compared to other benthic shark and ray species. It is further hypothesised that trawl fishing activities within the Moreton Bay Trawl Region will not lead to a long-term, negative change to the conservation / fishery status of this species. This inference is supported by evidence obtained through third-party assessments.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australiensis*. *Hemigaleus australiensis* is a small, wide-spread whaler species that is fairly common/abundant throughout its known distribution. Evidence suggests that the species is highly productive and fast growing (Ebert *et al.*, 2021; Kyne *et al.*, 2021). These factors increase the capacity of the species to absorb fishing mortalities and rebound after a potential decline. As a smaller species, *H. australiensis* will derive less benefit from the use of a TED i.e. both immature and mature sharks will be caught as bycatch. At present there is limited information on how successfully *H. australiensis* can survive a trawl fishing event.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
						While noting the above deficiencies, evidence suggests that key risks for this species are currently being managed. The species has an Australian extinction risk classification of Least Concern (Kyne *et al.*, 2021) with corresponding status assessments indicating that the species is being sustainably fished across its known distribution. These findings were accounted for in the consequence assessment.
Pale spotted catshark	*Asymbolus pallidus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Grey spotted catshark	*Asymbolus analis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Orange spotted catshark	*Asymbolus rubiginosus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Batoids						
Australian butterfly ray	*Gymnura australis*		3	2	**Likelihood**: Operations within the Moreton Bay Trawl Region fish in habitats preferred by the Australian butterfly ray (*Gymnura australis*). There is also evidence that it forms part of the elasmobranch trawl bycatch across a wide area of the ECOTF (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). The Australian butterfly ray (*Gymnura australis*) is broadly distributed (Jacobsen & Bennett, 2009; Last *et al.*, 2016b) and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This species will also be afforded additional protections through the Moreton Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). These factors reduce the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *G. australis* interaction rates and release fates (alive, dead or moribund). However, a weight-of-evidence approach suggests that it may be one of the more common elasmobranchs caught in prawn-trawl fisheries (Courtney *et al.*, 2007; Jacobsen, 2007; Pitcher *et al.*, 2007; Kyne, 2008).	**Consequence**: The available evidence, including that contained in third-party assessments (Campbell *et al.,* 2017; Kyne *et al.,* 2021), supported a downgrading of the default consequence score from severe (3) to moderate (2). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023o). While noting these considerations, the use of a TED/BRD will be less effective for this species, with immature individuals and adults likely to be caught as trawl bycatch (Jacobsen, 2007). Once captured, *G. australis* are likely to have moderate levels of post-interaction mortality (Stobutzki *et al.*, 2002; Campbell *et al.*, 2017). This, in part, is due to the species having a very flattened morphology and limited external protections e.g. hardened denticles or skin (pers. comm. I. Jacobsen).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					Catch data deficiencies introduce a degree of uncertainty surrounding the potential or likelihood of the consequence coming to fruition in the current fishing environment. This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species.	These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Yellowback stingaree	*Urolophus sufflavus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Patchwork stingaree	*Urolophus flavomosaicus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Sandyback stingaree	*Urolophus bucculentus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Kapala stingaree	*Urolophus kapalensis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Greenback stingaree	*Urolophus viridis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Common stingaree	*Trygonoptera testacea*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Australian whipray	*Himantura australis*		3	2	**Likelihood**: The available evidence suggests that regional trawl fishing activities are unlikely to result in a significant or long-term consequence for the Australian whipray (*Himantura australis*). Due to its depth profile (0–45 m), this species will only interact with operations targeting prawns in shallower waters (Last *et al.*, 2016b; Kyne *et al.*, 2023p). If and when this species is caught in the ECOTF, a high proportion of the sub-adults and adults will experience a contact without capture event. While difficult to quantify, contact without capture events are less likely to end in significant injuries or impede the long-term	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *H. australis*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern), (suspected) stable population trend (Kyne *et al.*, 2021) and sustainability status (Sustainable; Kyne *et al.*, 2023p).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					survivability of the animal. *Himantura australis* will also yield benefits from provisions governing the use of marine resources in the Moreton Bay Marine Park (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). Given the area of operation, the Moreton Bay Trawl Region was assigned a marginally higher likelihood score. It is recognised that this score may be an overestimate for this species in this region. With additional information on bycatch compositions, this species could potentially be removed from future ERAs involving this region.	The maximum disc width of this species assists in terms of reducing the size of the potential consequence. *Himantura australis* reaches at least 183 cm disc width and the vast majority of sub-adult and adult specimens, if caught, will be excluded from the net via the TED. It is recognised that a score of moderate (2) may be an overestimate for this species. With additional information on regional elasmobranch catch rates, this score could be further refined.
Blackspotted whipray	*Maculabatis astra*		3	2	**Likelihood**: Trawl operations within the Moreton Bay Trawl Region fish in habitats preferred by this species and there is evidence that it forms part of the elasmobranch trawl bycatch (Kyne, 2008; Pears *et al.*, 2012b). While noting this overlap, the blackspotted whipray (*Maculabatis astra*) is broadly distributed and notable portions of its range are lightly fished or unfished (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into *M. astra* interaction rates and release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. The species will be afforded additional protections through the Moreton Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). However, *M. astra* are commonly found in habitats that are more conducive to trawl fishing activities (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). Going forward, the provision of additional data on regional elasmobranch catch compositions / release fates may facilitate further refinement of the likelihood score assigned to this species.	**Consequence**: The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Kyne *et al.*, 2021; Kyne *et al.*, 2023q). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trends (suspected to be stable) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023q). As a smaller batoid, *M. astra* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 92 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality rates are largely unknown for this species (Kyne *et al.*, 2023q). However, a composite study including both *M. astra* and *M. toshi* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. astra* as a standalone species. These factors limited refinements to the consequence score for this species.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. astra* and the brown whipray (*M. toshi*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	
Brown whipray	*Maculabatis toshi*		3	2	**Likelihood**: Trawl operations within the Moreton Bay Trawl Region fish in habitats preferred by the brown whipray (*Maculabatis toshi*) and there is evidence that it forms part of the elasmobranch trawl bycatch across its Queensland range (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). While acknowledging this overlap, notable portions of this species' range will experience light or negligible fishing (Kyne *et al.*, 2021). This reduces the likelihood of the consequence coming to fruition in the short-to-medium term. Bycatch data for the ECOTF provides limited insight into the *M. toshi* interaction rates and landing/release fates (alive, dead or moribund). This uncertainty was taken into consideration as part of the likelihood assessment and resulted in the assignment of a more precautionary risk score. The species will be afforded additional protections through the Moreton Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). However, *M. toshi* are commonly found in habitats that are more conducive to trawl fishing activities (Kyne, 2008; Pears *et al.*, 2012b; Jacobsen *et al.*, 2015; Campbell *et al.*, 2017; Kyne *et al.*, 2021). With improved information on elasmobranch bycatch compositions, this score could potentially be refined in future risk assessments involving this region. Note–Catch data for this species was typically reported as *Himantura toshi* which included both *M. toshi* and the blackspotted whipray (*M. astra*). Taxonomic work has since split these two species and reclassified their genus (Last *et al.*, 2016b).	**Consequence:** The available evidence, including that contained in third-party assessments, supported a downgrading of the default consequence score from severe (3) to moderate (2) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). The reduced score better reflects what is known about the conservation/extinction risk status of this species (Least Concern), population trend (nothing to infer a reduction) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2021; Kyne *et al.*, 2023s). As a smaller batoid, *M. toshi* will derive fewer benefits from the use of a TED/BRD. However, the species has a maximum disc width of 82 cm (Kyne *et al.*, 2021) and some adults will be excluded from the net via the TED. The escapement potential for this species will be less for immature rays and smaller individuals which are more likely to pass through the TED bar spacings (Jacobsen & Bennett, 2011; Kyne *et al.*, 2021). Post-interaction mortality levels for this species are largely unknown (Kyne *et al.*, 2023q). However, a composite study including both *M. toshi* and *M. astra* suggests that the species has a reasonable post-interaction survival rate (Kyne, 2008). Due to a small sample size (n = 23) and an absence of species-specific mortality rates, it is difficult to ascertain how applicable this indication of mortality is to *M. toshi* as a standalone species. These factors limited refinements to the consequence score for this species

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
Estuary stingray	*Hemitrygon fluviorum*		3	3	**Likelihood**: The depth profile (0–28 m) and distribution of the estuary stingray (*Hemitrygon fluviorum*) will overlap with the effort footprint of the Moreton Bay Trawl Region. Interactions with this species are more likely to occur in trawl operations targeting prawns in shallower water environments and/or in closer proximity to estuaries or mangrove lined stretches of coastline. At a regional level, the likelihood of trawl fishing activities contributing to a negative consequence may be higher in the Moreton Bay Trawl Region. One of the inherent challenges of assessing the likelihood component for this species is that there is (currently) limited information on *H. fluviorum* interactions in the ECOTF. This absence of information extends to each region and makes it more difficult to quantify or assess the extent of the risk posed to this species (e.g. negligible, low, medium or high). For these reasons, the species was assigned a more precautionary likelihood score for the Moreton Bay Trawl Region. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this region. It is further recognised that the species is more likely to be caught in the River and Inshore Beam Trawl Fishery. Any refinements to this score though will require additional information on regional elasmobranch bycatch compositions.	**Consequence**: The available evidence, including that contained in third-party assessments, supported increasing the default consequence score from moderate (2) to severe (3) (Pears *et al.*, 2012b; Campbell *et al.*, 2017; Kyne *et al.*, 2021; Kyne *et al.*, 2023w). The revised score better reflects what is known about this species Australian extinction risk classification (Vulnerable), population trends (suspected reduction of greater than 30 per cent) and protection status under the *Nature Conservation Act 1992* (Near Threatened; Queensland Government, 1992; Kyne *et al.*, 2021). It is recognised that the threats posed to the species are wider than commercial fishing with habitat degradation also identified as a key threat (Kyne *et al.*, 2021). Fishing mortalities though have the potential to compound historic range contractions and population declines. Some of the potential consequences being further range contractions, reduced genetic diversity and the fragmentation of regional populations. As this species prefers brackish waters and mangrove-fringed estuaries (Last *et al.*, 2016b; Kyne *et al.*, 2023w), a consequence score of severe may be an overestimate for this region. There is, however, limited information on elasmobranch catch compositions in the Moreton Bay Trawl Region. This makes it difficult to assess the extent and frequency (none, low, medium or high) of interactions with this species.
Coral sea maskray	*Neotrygon trigonoides*		3	2	**Likelihood**: The Coral Sea maskray (*Neotrygon trigonoides*) will interact with east coast trawl operations and be caught as bycatch in the Moreton Bay Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Neotrygon trigonoides* is a common elasmobranch that is often associated with reefal and continental shelf environments to depths of 170 m (Kyne *et al.*, 2021). The species will be afforded a degree of natural protection from trawl fishing and it is also found in areas exposed to fewer fishing pressures (Kyne *et al.*, 2021). Similarly, a proportion of the population will be protected from trawl fishing activities through the Moreton	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *N. trigonoides*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Sherman *et al.*, 2021), population trend (nothing to infer a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023u).

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					Bay Marine Park Zoning Plan (Department of National Parks Sport and Racing, 2015; Department of Environment and Science, 2020b). These factors reduce the likelihood of the consequence coming to fruition in the current fishing environment. While studies are limited, information on ECOTF bycatch compositions indicate that *N. trigonoides* will interact with regional trawl fishers (Courtney *et al.*, 2007; Kyne, 2008). However, there remains a level of uncertainty surrounding interaction rates for this species at a whole-of-fishery and regional level. Capture rates for this species are also expected to be higher due to the ineffective nature of the TED for smaller rays. This inference is supported by results from a bycatch composition study which included a notable portion of *N. trigonoides* (*n* = 385; Campbell *et al.*, 2017). It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species in this region. With additional information on bycatch compositions, the score assigned to this species could potentially be refined in future assessments.	*Neotrygon trigonoides* is a smaller batoid and it will derive few benefits from the use of a TED/BRD (Brewer *et al.*, 2006; Campbell *et al.*, 2020). The species will continue to be caught as bycatch within the ECOTF with this component of the catch including both mature and immature rays. Once captured, *N. trigonoides* are likely to have high levels of post-interaction mortality (Kyne *et al.*, 2023u). These factors limited refinements to the consequence score for this species and contributed to it receiving a marginally higher rating.
Speckled maskray	*Neotrygon picta*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Bottlenose wedgefish	*Rhynchobatus australiae*		3	2	**Likelihood**: The bottlenose wedgefish (*Rhynchobatus australiae*) will interact with east coast trawl operations and be caught as bycatch in the Moreton Bay Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). *Rhynchobatus australiae* is a relatively common elasmobranch that is often associated with soft substrates and continental shelf environments to depths of 60 m (Kyne, 2008; Kyne *et al.*, 2021). While studies are limited, the available data indicates that *R. australiae* will be caught as bycatch in the scallop, tiger and endeavour prawn sectors (Courtney *et al.*, 2007; Jacobsen, 2007; Kyne, 2008). Historic bycatch records for *R. australiae* were reported in a complex which included the eyebrow wedgefish (*R. palpebratus*) or under the synonym *R. djiddensis*. This	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *R. australiae*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species Australian extinction risk classification (Near Threatened; Kyne *et al.*, 2021), population trend (suspected reduction approaching 30 per cent; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023r). As it is a larger batoid, the use of a TED will be more effective at reducing the capture of sexually mature *R. australiae* from the catch (Campbell *et al.*, 2020). The size of *R. australiae*

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					taxonomic variability makes it difficult to quantify interaction rates for individual species. It also introduces a degree of uncertainty into the regional risk assessments. These issues are further compounded by a general absence of information on regional elasmobranch bycatch compositions for the ECOTF. It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	may also assist in terms of it surviving a trawl interaction (Stobutzki *et al.*, 2002; Kyne, 2008; Campbell *et al.*, 2017). This inference though requires further testing and cannot be confirmed without additional information on *R. australiae* interaction rates and release fates.
Eyebrow wedgefish	*Rhynchobatus palpebratus*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Eastern shovelnose ray	*Aptychotrema rostrata*		3	2	**Likelihood**: Regional operations fish in habitats preferred by the eastern shovelnose ray (*Aptychotrema rostrata*) and there is evidence that it forms part of the elasmobranch trawl bycatch along the Queensland east coast (Courtney *et al.*, 2007; Kyne, 2008; Pears *et al.*, 2012b; Rigby *et al.*, 2016b; Campbell *et al.*, 2017). Bycatch data is available for this species and provides some insight into *A. rostrata* interaction rates and release fates (alive, dead or moribund). One study demonstrated that *A. rostrata* dominated the elasmobranch catch in both the scallop and shallow water eastern king prawn sectors (Courtney *et al.*, 2007). Similar results were observed in another bycatch study focused on areas south of the GBRMP. In this instance, *A. rostrata* was the most commonly encountered species across the entire assessment (*n* = 3,933; Campbell *et al.*, 2017). *Aptychotrema rostrata* will be caught as bycatch within the Moreton Bay Trawl Region (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). However, data deficiencies make it difficult to determine the extent of these interactions and/or the potential for regional trawl activities to impact regional populations. Given this, a more precautionary approach was applied with *A. rostrata* being assigned a likelihood score of possible (3).	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *A. rostrata*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of the species extinction risk classification (Least Concern; Kyne & Stevens, 2015), population trend (nothing to infer or suspect a reduction; Kyne *et al.*, 2021) and fisheries status under the *Shark and Ray Report Card* (Sustainable; Kyne *et al.*, 2023ah). While noting these considerations, evidence suggests that a) *A. rostrata* will derive less benefit from the use of a TED and b) remains abundant within trawl bycatch (Courtney *et al.*, 2007; Kyne, 2008; Campbell *et al.*, 2017). The use of BRD designs like the Fisheye though, may assist in terms of excluding this species from the trawl catch (Courtney *et al.*, 2007). Further, anecdotal evidence suggests that *A. rostrata* have reasonably good post-interaction survival rates (Kyne, 2008; Campbell *et al.*, 2017; Kyne *et al.*, 2021). These factors contributed to the species receiving a consequence score at the lower end of the spectrum.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					It is acknowledged that a likelihood score of possible (3) may be an overestimate for this species. With additional information on bycatch compositions, this score may be refined in future assessments.	
Giant guitarfish	*Glaucostegus typus*		2	2	**Likelihood**: The giant guitarfish (*Glaucostegus typus*) has been recorded as bycatch in the ECOTF and the species will (likely) interact with regional trawl operations (Pears *et al.*, 2012b; Campbell *et al.*, 2017). Despite this, regional trawl fishing activities are unlikely to contribute to a significant or long-term consequence for this species. *Glaucostegus typus* inhabits a range of demersal environments including intertidal and offshore areas to depths of 100 m (Kyne *et al.*, 2021; Kyne *et al.*, 2023y). While these habitat preferences overlap with the ECOTF, areas of its distribution will have limited exposure to fishing activities (Kyne *et al.*, 2021). Juveniles also display an affinity for intertidal areas (Kyne *et al.*, 2021) which may assist in terms of reducing their exposure to trawl fishing during these early life stages. When applying a weight-of-evidence approach, there is a lower likelihood of the consequence coming to fruition in this region and/or within the current fishing environment.	**Consequence**: The available evidence was not considered sufficient to alter the default consequence score for *G. typus*. A score of moderate (2) was considered appropriate given the rating assigned to this species in the Level 2 ERA (Dedini *et al.*, 2023) and our current understanding of its Australian extinction risk classification (Least Concern; Kyne *et al.*, 2021). Within Australia, *G. typus* has a (suspected) stable population (Kyne *et al.*, 2021) and it has been assessed as sustainably fished across its known distribution (Kyne *et al.*, 2023y). Results from previous risk assessments also supported the assignment of a consequence score at the lower end of the spectrum (Jacobsen *et al.*, 2015; Campbell *et al.*, 2017). As *G. typus* is a large batoid, it will derive considerable benefit from the use of a TED (Brewer *et al.*, 2004; Brewer *et al.*, 2006). While immature rays may still be caught, most sub-adult and adult specimens will be excluded from the net via the TED. Data on *G. typus* post-interaction mortality rates are limited and the outputs vary between assessments. One report with a relatively small sample size (n = 10) recorded a 100 per cent mortality rate (Campbell *et al.*, 2017). In contrast, data provided through the Fishery Observer Program demonstrated more moderate survival levels (19 out of 28 individuals released alive; Pears *et al.*, 2012b). These differing results combined with an absence of information on regional catch rates introduced an element of uncertainty into this assessment. This uncertainty supported the retention of a moderate (2) rating *versus* a downgraded score of minor (1).
Sydney skate	*Dentiraja australis*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
Endeavour skate	*Dentiraja endeavouri*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Argus skate	*Dentiraja polyommata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Narrow sawfish	*Anoxypristis cuspidata*		-	-	This species was not assessed due to either low/negligible interactions and/or is not expected to occur within this region.	
Green sawfish	*Pristis zijsron*		3	4	**Likelihood**: The green sawfish (*Pristis zijsron*) has experienced considerable range contractions and population declines on the Queensland east coast. These contractions have led to the hypothesis that the species is now regionally extirpated in waters south of the Whitsundays (Peverell, 2005; Department of the Environment, 2019; Kyne *et al.*, 2023z). Within the ECOTF, green sawfish interactions are more likely to occur within the Northern and Central regions. Conversely, historic population declines / range contractions make green sawfish interactions less likely in the Moreton Bay Trawl Region. For example, the last reported record of a green sawfish being caught in Moreton Bay was back in the 1960s (Johnson, 1999; Simpfendorfer, 2013; Kyne *et al.*, 2021). While noting the above, any interaction with a green sawfish in this region will involve a remnant population. These interactions (if applicable) have the potential to exacerbate historic (negative) population trends and increases the likelihood of the consequence coming to fruition within the current fishing environment. Given the extent of the declines, this could theoretically occur at low rates of fishing mortality. These concerns were considered sufficient to assign this species with a higher likelihood score. While unlikely, it is still difficult to ascertain if green sawfish are a) still present in Moreton Bay, b) caught by regional fishers and c) if they (if applicable) are being correctly identified. This uncertainty required the adoption of a more precautionary assessment approach and the assignment of a higher score for this component of the assessment.	**Consequence**: The available evidence, including that contained in third-party assessments supported increasing the default consequence score from severe (3) to major (4). The revised score better reflects what is known about the *P. zijsron* population trends (suspected reduction >80 per cent) and extinction risk classification (Critically Endangered; Kyne *et al.*, 2021). Other considerations that contributed to this decision included a) the importance of this region as one of the few remaining green sawfish strongholds on the Queensland east coast (Department of the Environment, 2015; Kyne *et al.*, 2021), b) the potential for this species to incur *in-situ* or post-interaction mortalities and c) the increased risk of injury due to entanglements (due to their large rostrums). Any interaction with this species will be with a population that has experienced some decline and/or may be with a remnant population. The potential consequences for this species are significant and could include exacerbating historic range contractions, a reduction in genetic diversity and the further fragmentation of a remnant population/s. These (potential) impacts warranted the assignment of a major (4) consequence score. Given historic reductions in trawl effort on the Queensland east coast, some consideration was given to maintaining the default score (severe, 3). It was determined that a more precautionary approach was required for this species. This decision recognises historic range contractions, population declines and ongoing concerns surrounding the conservation status of this species. This rating also reflects the potential for trawl fishing activities to contribute to an unintended consequence e.g.

Common name	Species name	Regional risk	LCA score		Influencing factors / justifications	
		Moreton Bay	L	C	Likelihood	Consequence
					It is recognised that the score assigned to this component of the LCA may be an overestimate. This inference though can only be tested with additional information on elasmobranch bycatch compositions within this region. The continued roll-out of the Data Validation Plan will assist in this process and improve our understanding of sawfish compositions in the Moreton Bay Trawl Region. With additional information, the regional risk profile for this species could be further refined and improved.	continued range contractions, reduced genetic diversity and the reduced (potential) viability of regional populations. For context, the *Action Plan for Australian Sharks and Rays* recommends that the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listing for *P. zijsron* be increased from Vulnerable to Critically Endangered (Kyne *et al.*, 2021). If this recommendation were adopted, it would see *P. zijsron* listed in the same category as the speartooth shark (*Glyphis glyphis*) and above a number of the marine turtle species.

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