Seafood Risk Assessment

Commonwealth Trawl Sector

Prepared for the Fisheries Research and Development Corporation

Assessment Summary

Commonwealth Trawl Sector – Otter Trawl	Units of Assessment:	
	Product Names:	***Blue Grenadier, Blue-eye Trevalla, Orange Roughy, Pink Ling, Gemfish, Gould's Squid, Ocean Jacket***
	Species:	Blue Grenadier *Macruronus novaezelandiae* Blue-eye Trevalla *Hyperoglyphe antarctica* Orange Roughy *Hoplostethus atlanticus* Pink Ling *Genypterus blacodes* Gemfish *Rexea solandri* Gould's Squid *Nototodarus gouldii* Ocean Jacket *Nelusetta ayraud*
	Stocks:	Blue Grenadier – South eastern stock Blue-eye Trevalla – Eastern stock Orange Roughy – Cascade stock and Eastern Zone stock Pink Ling – Eastern stock and Western stock Gemfish – Eastern stock and Western stock Gould's Squid – South eastern Australia Ocean Jacket – CTS area
	Gear types:	Otter Trawl
	Year of Assessment:	2017

Fishery Overview

This summary has been adapted from Helidoniotis et al (2017a):

The Commonwealth Trawl Sector (CTS) of the Southern and Eastern Scalefish and Shark Fishery (SESSF) stretches from Sydney southwards around Tasmania to Cape Jervis in South Australia, where it abuts the Great Australian Bight Trawl Sector (GABTS; Figure 1). The CTS and Scalefish Hook Sector (SHS) are major domestic sources of fresh scalefish for the Sydney and Melbourne markets, and there is minimal international export from these fisheries.

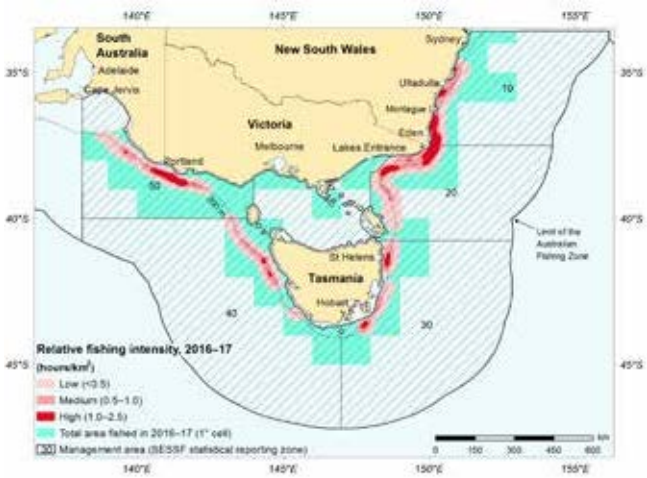
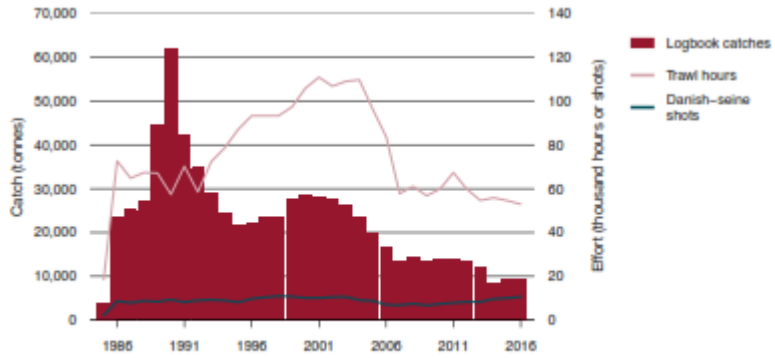


Figure 1: Relative fishing intensity in the CTS in the 2016-17 fishing season. (Source: Helidoniotis et al, 2017a).

The SESSF is a multisector, multigear and multispecies fishery, targeting a variety of fish and shark stocks using different gear types in different areas or depth ranges. Effort in the SESSF is distributed across all fishery areas, but since about 2005 has become increasingly concentrated on the shelf rather than in slope or deeper waters. The CTS predominantly uses otter trawl and Danish-seine methods. Pair trawling and midwater trawling methods are also permitted under the SESSF management plan.

In 2016–17, trawlers reported 52,215 hours of fishing effort, representing a decrease from the 54,078 hours in 2015–16 (Figure 2). The number of active trawlers decreased slightly from 37 vessels in 2015–16 to 34 vessels in 2016–17. The total landings of all species in the CTS in 2016-17 was 8,691t, down slightly from the 9,025t taken in 2015–16. Flathead, Blue Grenadier, Pink Ling, eastern school whiting and Orange Roughy (eastern zone) accounted for approximately 77 per cent of the catch.



Source: Australian Fisheries Management Authority

Figure 2: Total catch and fishing effort in the CTS, 1985 to 2016. (Source: Helidoniotis et al, 2017a).

Ten Units of Assessment (UoAs) are assessed in this report - one for each separate stock assessed in combination with the gear type (otter trawl) and the management system (Australian Commonwealth) (Table 1).

Table 1: Unit of Assessment summary.

Unit of Assessment	Stock	Gear type	Management system
UoA1	Blue Grenadier	Otter Trawl	Australian Commonwealth
UoA2	Blue-eye Trevalla	Otter Trawl	Australian Commonwealth
UoA3	Orange Roughy – Cascade	Otter Trawl	Australian Commonwealth
UoA4	Orange Roughy – Eastern	Otter Trawl	Australian Commonwealth
UoA5	Pink Ling – Eastern	Otter Trawl	Australian Commonwealth
UoA6	Pink Ling – Western	Otter Trawl	Australian Commonwealth
UoA7	Gemfish – Eastern	Otter Trawl	Australian Commonwealth
UoA8	Gemfish – Western	Otter Trawl	Australian Commonwealth
UoA9	Gould's Squid	Otter Trawl	Australian Commonwealth
UoA10	Ocean Jacket	Otter Trawl	Australian Commonwealth

For this assessment, target species have been selected by FRDC to allow for risk assessments using this framework to be tested. Additional target species may be added in future assessments.

Scoring

Performance Indicator	Blue Grenadier	Blue-Eye Trevalla	Orange Roughy - Cascade	Orange Roughy - Eastern	Pink Ling - Eastern	Pink Ling - Western	Gemfish - Eastern	Gemfish - Western	Gould's Squid	Ocean Jacket
COMPONENT 1										
1A: Stock Status	LOW	MEDIUM	LOW	MEDIUM	MEDIUM	LOW	HIGH	MEDIUM	LOW	MEDIUM
1B: Harvest Strategy	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	MEDIUM	LOW	MEDIUM
1C: Information and Assessment	LOW	LOW	LOW	LOW	LOW	LOW	MEDIUM	MEDIUM	LOW	MEDIUM
OVERALL	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	MEDIUM	LOW	MEDIUM
COMPONENT 2										
2A: Non-target Species	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
2B: ETP Species	PHR	PHR	MEDIUM	MEDIUM	PHR	MEDIUM	MEDIUM	MEDIUM	PHR	PHR
2C: Habitats	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
2D: Ecosystems	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
OVERALL	MEDIUM	MEDIUM	LOW	LOW	MEDIUM	LOW	LOW	LOW	MEDIUM	MEDIUM
COMPONENT 3										
3A: Governance and Policy	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
3B: Fishery-spec. Man. System	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
OVERALL	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW

Summary of main issues

- Most of the main stocks are estimated to be above the point of recruitment impairment (PRI), except for Eastern Gemfish. The stock is managed according to a formal rebuilding strategy which aims to recover the stock to the limit reference point by 2027, however there is limited evidence of rebuilding at this stage.
- The fishery appears relatively well-placed against most of the Component 2 performance indicators, although there is limited evidence of recovery for some 'conservation dependent' species (e.g. Eastern Gemfish, Blue Warehou).
- The fishery is well-positioned against P3 performance indicators.

Outlook

Blue Grenadier

Component	Outlook	Comments
Target species	Stable	The most recent stock assessment (2013) predicted spawning biomass to remain well above the target reference point.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Blue-eye Trevalla

Component	Outlook	Comments
Target species	Stable	The 2017 stock assessment estimated the stock to be between the limit and target reference points. Although catch rate has declined over the past two years, catches have been below Recommended Biological Catch (RBC) which should lead to stock growth towards the target reference point.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Orange Roughy – Cascade stock

Component	Outlook	Comments
Target species	Stable	Spawning biomass estimates prior to 2009 were well above target levels and catches have been well below the RBC in all but one year (2009) since then.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Orange Roughy – Eastern stock

Component	Outlook	Comments
Target species	Improving	The most recent assessments suggest the stock trajectory is increasing, with the stock now above the limit reference point after a long period of being classified as overfished. Recovery should continue under conservative catch limits.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Pink Ling – Eastern stock

Component	Outlook	Comments
Target species	Improving	The Pink Ling eastern stock is projected to recover to B_{MSY} or above within two mean generation times under the current Commonwealth harvest strategy. The NSW Government is currently implementing a Commercial Fisheries Business Adjustment Program which aims to reduce excess harvesting capacity and link shares to either catch or fishing effort. A catch quota is expected to commence for Pink Ling in the OTLF from December 2018.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Pink Ling – Western stock

Component	Outlook	Comments
Target species	Stable	Stock assessments show the western Pink Ling stock is above the target, with catches well below western RBC levels.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Gemfish - Eastern

Component	Outlook	Comments
Target species	Uncertain	Stock projections suggest the stock should rebuild to the limit reference point by 2027, although recruitment levels have been below average in recent years and there is limited evidence of recovery to date.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Gemfish - Western

Component	Outlook	Comments
Target species	Uncertain	There are uncertainties around the Tier 1 and Tier 4 assessments for this stock, although catches have been stable in recent years and are low as a proportion of the RBC and below the Great Australian Bight catch trigger. Alternative assessment approaches are currently being explored.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Gould's Squid

Component	Outlook	Comments
Target species	Stable	Fishing effort is currently low in the context of historical effort levels, influenced by economic conditions.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

Ocean Jacket

Component	Outlook	Comments
Target species	Stable	Ocean Jacket is a bycatch species in the CTS, and has been subject to large fluctuations in abundance elsewhere. Catch rates increased between 2003 and 2007 and have remained at relatively high levels since. ShelfRAG noted that ERAs for the SESSF have rated Ocean Jackets relatively low risk, and stable/rising CPUE provide little incentive for inclusion in the quota system.
Environmental impact of fishing	Stable	Lower risk scores may be achieved with additional evidence that measures in place to ensure the CTS does not hinder recovery of ETP species are being implemented successfully.
Management system	Stable	No major changes are expected to Component 3 PIs

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Disclaimer

This assessment has been undertaken in a limited timeframe based on publicly available information. Although all reasonable efforts have been made to ensure the quality of the report, neither this company nor the assessment' s authors warrant that the information contained in this assessment is free from errors or omissions. To the maximum extent permitted by law, equity or statute, neither this company nor the authors accept any form of liability, be it contractual, tortious or otherwise, for the contents of this report or for any consequences arising from misuse or any reliance placed on it.

Background

This report sets out the results of an assessment against a seafood risk assessment procedure, originally developed for Coles Supermarkets Australia by MRAG Asia Pacific. FRDC is grateful for Coles' permission to use its Responsibly Sourced Seafood Framework. The aim of the procedure was to allow for the rapid screening of uncertified source fisheries to identify major sustainability problems, and to assist seafood buyers in procuring seafood from fisheries that are relatively well-managed and have lower relative risk to the aquatic environment. It uses elements from the GSSI benchmarked MSC Fishery Standard version 2.0, but is neither a duplicate of it nor a substitute for it. The methodology used to apply the framework differs substantially from an MSC Certification. Consequently, any claim about the rating of the fishery based on this assessment should not make any reference to the MSC.

This report is a "live" document that will be reviewed and updated on an annual basis.

Methods

Risk Assessment

Detailed methodology for the risk assessment procedure is found in MRAG AP (2015). The following provides a brief summary of the method as it relates to the information provided in this report.

Assessments are undertaken according to a 'unit of assessment' (UoA). The UoA is a combination of three main components: (i) the target species and stock; (ii) the gear type used by the fishery; and (iii) the management system under which the UoA operates.

Each UoA is assessed against three components:

1. Target fish stocks;
2. Environmental impact of fishing; and
3. Management system.

Each component has a number of performance indicators (PIs). In turn, each PI has associated criteria, scoring issues (SIs) and scoring guideposts (SGs). For each UoA, each PI is assigned one of the following scores, according to how well the fishery performs against the SGs:

- Low risk;
- Medium risk;
- Precautionary high risk; or
- High risk

Scores at the PI level are determined by the aggregate of the SI scores. For example, if there are five SIs in a PI and three of them are scored low risk with two medium risk, the overall PI score is low risk. If three are medium risk and two are low risk, the overall PI score is medium risk. If there are an equal number of low risk and medium risk SI scores, the PI is scored medium risk. If any SI scores precautionary high risk, the PI scores precautionary high risk. If any SI scores high risk, the PI scores high risk.

For this assessment, each component has also been given an overall risk score based on the scores of the PIs. Overall risk scores are either low, medium or high. The overall component risk score is low where the majority of PI risk scores are low. The overall risk score is high where any one PI is scored high risk, or two or more PIs score precautionary high risk. The overall risk score is medium for all other combinations (e.g. equal number of medium/low risk PI scores; majority medium PI scores; one PHR score, others low/medium).

Outlook

For each UoA, an assessment of the future 'outlook' is provided against each component. Assessments are essentially a qualitative judgement of the assessor based on the likely future performance of the fishery against the relevant risk assessment criteria over the short to medium term (0-3 years). Assessments are based on the available information for the UoA and take into account any known management changes. Outlook scores are provided for information only and do not influence current or future risk scoring.

Table 2: Outlook scoring categories.

Outlook score	Guidance
Improving	The performance of the UoA is expected to improve against the relevant risk assessment criteria.
Stable	The performance of the UoA is expected to remain generally stable against the relevant risk assessment criteria.
Uncertain	The likely performance of the UoA against the relevant risk assessment criteria is uncertain.
Declining	The performance of the UoA is expected to decline against the relevant risk assessment criteria.

Information sources

Information to support scoring is obtained from publicly available sources, unless otherwise specified. Scores are assigned on the basis of the objective evidence available to the assessor. A brief justification is provided to accompany the score for each PI. Information sources may include information gathered from the internet, fishery management agencies, scientific organisations or other sources.

Assessment Results

COMPONENT 1: Target fish stocks

1A: Stock Status

CRITERIA: (i)The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing.

(a) Stock Status

Blue Grenadier **LOW RISK**

Comparative analysis of otolith chemistry and shape indicates two separate biological stocks of Blue Grenadier: one in the region of the Great Australian Bight Trawl Sector (Commonwealth) and the other in the region of the Commonwealth Trawl Sector (Helidoniotis et al, 2017a). This assessment focuses on the stock in the CTS. The Blue Grenadier fishery can be divided into two sub-fisheries ('spawning' and 'non-spawning'). The 'spawning' sub-fishery is based in winter off western Tasmania and is only fished between June and September each year, while the 'non-spawning' sub-fishery operates all year and targets immature fish throughout the fishery range.

Helidoniotis et al (2017a) reported that "*the tier 1 integrated stock assessment was updated in 2013 (Tuck 2013), incorporating data to the end of 2012, as well as estimates of spawning biomass from industry-based acoustic surveys (2003 to 2010) and egg survey estimates of female spawning biomass (1994 to 1995). Results for the base-case model concluded that the spawning biomass in 2012 was around 77 per cent of the unexploited spawning stock biomass (SB_0) and in 2014 was forecast to be approximately 94 per cent of SB_0 (Tuck 2013).*"

On this basis, the stock is highly likely to be above the PRI and fishing mortality is at a level consistent with MSY.

Blue-eye Trevalla **MEDIUM RISK**

A single biological stock of Blue-eye Trevalla is assumed for Australian waters, separate from the New Zealand stock(s).

Blue-eye Trevalla is assessed as a tier 4 stock under the SESSF HSF. The most recent assessment of the stock was undertaken in 2017 (Haddon, 2017; in SERAG, 2017) using data including total catches, total discards and standardised catch-per-unit-effort (CPUE). The CPUE time series was a combination of catch-per-hook from dropline data (1997 to 2006) and auto-longline data (2002 to 2016). The CPUE timeseries is assessed against a target reference level assumed to be a proxy for spawning biomass of 48 per cent of unfished levels and a limit reference level that acts as a proxy for 20 per cent of unfished levels.

Standardised CPUE has decreased over the last two years from above the target reference point in 2014 to a point between the limit and the target reference point in 2016 (Figure 3). Tier 4 assessments do not assess the probability of being below the reference point. However, the RAG considers the current assessment to be conservative (SERAG, 2017).

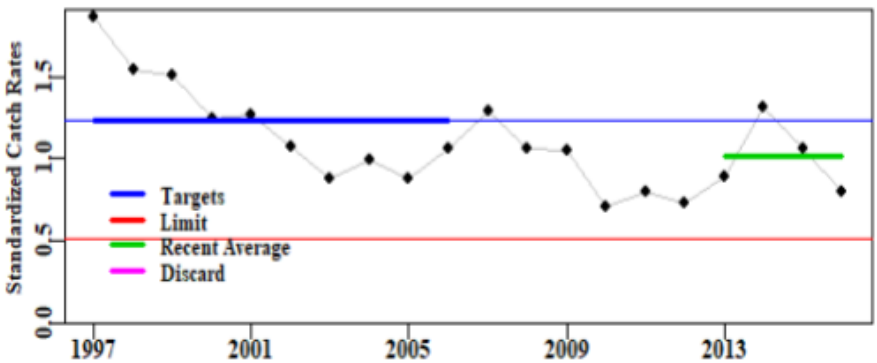

Figure 3: Standardised Blue eye Trevalla catch rates (Haddon 2017; in SERAG, 2017) combined dropline and longline catch-per-hook. The upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened line (Blue line) represents the reference period for catches and catch rates; the green line is the recent average catch rate.

Accordingly, there is evidence to indicate it is likely the stock is above the point of recruitment impairment (PRI), however there is less evidence that the stock is fluctuating at or around MSY. Accordingly, the stock scores medium risk.

Orange Roughy – Cascade Plateau **LOW RISK**

A genetic study by Gonçalves da Silva et al. (2012; in Helidoniotis et al, 2017a) concluded that Orange Roughy within the Australian Fishing Zone form a single genetic stock, but identified some differentiation between Albany/Esperance, Hamburger Hill (in the Great Australian Bight) and south-eastern Australia. However, as residency or slow migration may result in separate demographic units despite genetic similarity (Morison et al., 2013), the Australian orange rough fishery is managed and assessed as a number of discrete regional management units.

The Cascade Plateau shows a different catch history to all other Orange Roughy fisheries, and is considered the only fishery not to have been depleted (Helidoniotis et al, 2017a).

Helidoniotis et al (2017a) report that spawning aggregations of Cascade Plateau Orange Roughy were assessed using acoustic survey abundance indices between 2003 and 2009. These assessments rely on the single largest acoustic estimate of biomass each year because spawning aggregations on the Cascade Plateau are highly variable and have shown no discernible trends in volume or estimated biomass over time (Morison et al. 2013). No formal stock assessment has been undertaken since 2009 due to a lack of effort and thus new data for the fishery. The projections from the 2009 model predicted that, if the 315 t long-term RBC was fully caught by 2011, the spawning biomass of the stock would be at $0.64SB_0$ in 2011 (Morison et al., 2012). Catches since 2007 have been low and it is considered that environmental factors limit the formation of spawning aggregations. Given that spawning biomass estimates prior to 2009 were well above target levels and catches have been well below the RBC in all but one year (2009), there is evidence that the Cascade Plateau stock is highly likely to be above PRI and above levels consistent with MSY.

Orange Roughy – Eastern zone — MEDIUM RISK

Helidoniotis et al (2017a) report that the eastern zone was declared overfished in 2006, with spawning stock biomass declining to 10 per cent of unfished levels ($0.1SB_0$) following the large catches taken in the late 1980s and early 1990s. Catches were subsequently limited to incidental catch allowances only, with most of the historical fishing grounds for Orange Roughy deeper than 700 m closed to trawling in January 2007 (AFMA, 2006).

The stock was most recently assessed in 2017, using catch, acoustic and age-composition data (SERAG, 2017). The assessment (2017) indicated that the stock was above the limit reference point, and was estimated to be at 33% of unfished biomass for the beginning of 2018.

Acoustic survey results undertaken in 1999, 2006, 2010, 2012, 2013 and 2016 at St. Helen's Hill and St. Patrick's Head indicate an increasing population (SERAG, 2017).

Given the estimate of biomass is above the limit reference point but below the default B_{MSY} reference point in the HSF of B_{40}, we have scored this SI medium risk.

Pink Ling – Eastern stock — MEDIUM RISK

Although genetic variation between eastern and western Pink Ling has not been found (Ward et al. 2001), differences in catch-rate trends, and size and age (Morison et al. 2013), indicate that there are either two separate stocks, or that exchange between eastern and western components of the Pink Ling stock is low and thus they are managed as separate stocks. AFMA has management arrangements in place to constrain catches of the eastern stock to the eastern catch limit, although total catches of Pink Ling are managed under a single TAC.

Pink Ling has been assessed using quantitative, model-based stock assessments since 2003. Although a number of versions of the model have been developed by different authors, the AFMA Slope Resource Assessment Group (SlopeRAG) agreed to use a model developed by Cordue (Cordue, 2013) as the base-case model for providing advice (Helidoniotis et al, 2017a). The Cordue (2013) assessment was most recently updated in 2015 (Cordue 2015). The updated assessment estimated the eastern stock biomass in 2015 to be 0.30 B_0. Thus, for the eastern stock there is evidence that the stock is highly likely to be above PRI, but limited evidence that the stock is at levels consistent with MSY.

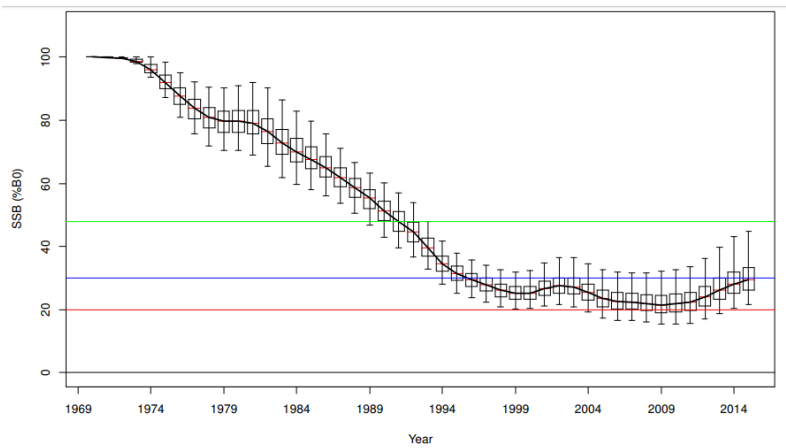

Figure 4: Estimated spawning stock biomass for eastern Pink Ling, 1970 to 2015 (Source: Cordue, 2015). The green line represents the SESSF target reference point ($B_{48\%}$); the red line is the SESSF limit reference point ($B_{20\%}$); the blue line is $B_{30\%}$.

Pink Ling – Western stock — LOW RISK

The updated assessment (Cordue, 2015) estimated the western stock biomass in 2015 to be 0.72 B_0. Accordingly, there is good evidence that the western stock is highly likely to be above the PRI and also above levels consistent with MSY.

Gemfish – Eastern stock — HIGH RISK

There are two distinct stocks of Gemfish in Australia, an eastern and western stock, separated by a boundary at the western end of Bass Strait (Colgan & Paxton 1997; Moore et al. 2016).

Catch of Gemfish in the eastern zone peaked at more than 6,000 t in 1978, and declined rapidly after 1987 (Helidoniotis et al, 2017a). The landed eastern zone catch in 2016-17 was 30.4t. An integrated stock assessment model for Eastern Gemfish was first developed in 2008 and was last updated in 2010 with data on catch and length frequency up to 2009 (Helidoniotis et al, 2017a). The estimates of spawning stock biomass did not differ greatly among years, with the base-case model estimating that the spawning stock biomass in 2009 was 15.6 per cent of the 1968 level (Figure 5). Helidoniotis et al (2017a) report that a preliminary tier 1 update on the 2010

assessment indicated that the spawning stock biomass in 2015 had decreased to 8.3 per cent (0.083SB_0), likely as a result of a lack of recruitment. Given the most recent assessment estimated the stock to be below the limit reference point, Helidoniotis et al (2017a) concluded the stock remains overfished.

On that basis, the stock does not meet the medium risk SG and we have scored this SI high risk.

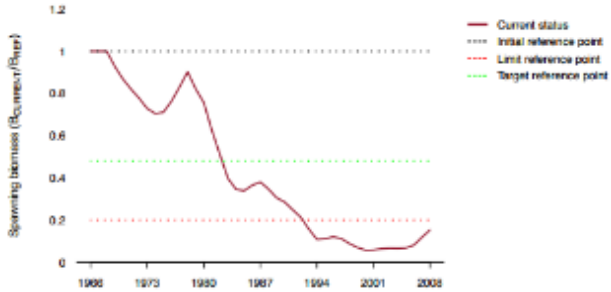

Figure 5: Estimated spawning stock biomass of Gemfish, eastern zone 1966 to 2008 (Source: Helidoniotis et al, 2017a)

Gemfish – Western stock

MEDIUM RISK

A total of 73.3 t of western Gemfish was landed in 2016–17 (Helidoniotis et al 2017a). Historically, a substantial catch of western Gemfish was taken within the SESSF Great Australian Bight Trawl Sector (GABTS), however in recent years catch has been very limited due to a cessation of targeting rather than declines in abundance (Helidoniotis et al 2017a).

Helidoniotis et al (2017a) report that the western Gemfish stock was assessed using both Tier 1 and Tier 4 assessments in 2016, using data from 1986 to 2015. The tier 1 assessment updated the 2014 assessment and included updated data from both the CTS and the GABTS. Data included catch-and-effort data, and age error data. The estimated spawning biomass depletion for the CTS and the GABTS combined from the tier 1 assessment was 43 per cent (Figure 6). Helidoniotis et al (2017a) noted that varying discard rate changes in fishing grounds and the potential for hyperstability are not explicitly accounted for in the standardisation and may bias results if not accurately indexing abundance. Nevertheless, they concluded that the stock was neither overfished, nor subject to overfishing.

Figure 6: Estimated spawning stock biomass of gemfish, western zone, 1985 to 2015, for the CTS and the GABTS (Helidoniotis et al, 2017a)

GABRAG (2017) noted that the Tier 1 assessment outcomes were highly uncertain and recommended exploration of alternate assessment approaches. A Tier 5 (catch-MSY) assessment has recently been undertaken though outputs were not available.

In the absence of a robust Tier 1 assessment, GABRAG (2016) agreed to take a weight of evidence based approach to its recommendations on RBCs/TACs. They noted that although there was insufficient data to assess the likelihood of the stock declining below the limit reference point, considering the CTS (and SHS) RBC was between the upper and lower estimates from the Tier 4 assessment, there was little risk of the stock declining below the limit reference point.

Accordingly, given the very limited harvest of the stock and the weight of evidence suggesting the stock is unlikely to decline below the limit reference point, is appears at least likely that the stock is above the PRI. Nevertheless, there is insufficient certainty in the information to indicate the stock is fluctuating at or around levels consistent with MSY. On this basis, we have scored this SI medium risk.

Gould's Squid

LOW RISK

Genetic studies support the hypothesis of a single biological stock of Gould's Squid throughout south-eastern Australian waters (Noriega et al, 2016).

Noriega et al (2016) report that "*no formal stock assessment is available for the Gould's Squid biological stock in Australia. Gould's Squid is short lived (less than 1 year), spawns multiple times during its life, and displays highly variable growth rates, and size and age at maturity[1]. These characteristics mean that the population can rapidly increase in biomass during favourable environmental conditions; it is therefore less susceptible to becoming recruitment overfished than longer-lived species. However, as the fishery targets individuals less than 1 year of age, there is potential for the population to be recruitment overfished if insufficient animals survive long enough to reproduce.*"

Emery and Bath (2017) report that:

- *In 2008, the Squid Resource Assessment Group analysed catch, catch rates and effort since 2000 for four regions in the SSJF. Only one region—the central region from Cape Otway in Victoria to Robe in South Australia—had levels of fishing that could cause substantial depletion. During the 2001 fishing season, high catch rates were reported for the central region, and the total jig fishery catch was the second highest on record. A preliminary depletion analysis of the central region using jig catch-and-effort data indicated that, despite the high catches, the stock was not overfished in that region in that year.*
- *ABARES conducted further depletion analyses for the central region of the SSJF for 1995 to 2006 (Barnes et al. 2015). The initial depletion curve results show declines in stock during most seasons, with escapement in five seasons estimated to be between 30 and 40 per cent. However, these results are for only one region of the fishery and do not indicate exploitation rates for the whole stock. Limited data are available on squid growth in this region. Interpretation of the depletion estimates is further complicated by the lack of an agreed estimate of natural mortality, the possible presence of multiple cohorts each year (as a result of multiple spawning events) and a lack of knowledge about squid movement in the region.*
- *Trawl catch rates from the CTS have been stable over the past 15 years, suggesting long-term stability in the availability, and perhaps biomass, of Gould's squid in the areas trawled. The 2012 average trawl catch rate for Gould's squid in the CTS was the highest reported in the past 20 years. The extent to which squid are targeted on trawl grounds is unclear.*
- *The high historical catches taken by foreign vessels in the late 1970s and 1980s indicate that a high annual harvest can be taken from the stock in years of high abundance without greatly reducing recruitment and biomass for subsequent seasons. The results of retrospective depletion analysis, stable catch rates in the trawl fishery over an extended period and high average catch rates (with the exception of the 2014 season, when effort declined) indicate that the stock has not yet been overfished in any season.*

On the basis of the above, they conclude that the stock is not overfished.

Although there is limited empirical evidence estimating a conventional B_{MSY} or proxies, the weight of available evidence suggests the stock is currently being fished at very low levels and probably highly likely to be above the point of recruitment impairment. The fact that overall catch and effort in recent years has been is substantially lower than in 2001 when a preliminary depletion analysis suggested the stock was not overfished, provides a plausible argument to suggest there is no reason why the stock is not capable of producing maximum sustainable yield based on environmental drivers.

Ocean Jacket **MEDIUM RISK**

The biological stock structure of Ocean Jacket is unknown, therefore it is assessed as a separate stock to that in the Great Australian Bight Trawl Sector (GABTS) (Helidoniotis et al, 2017a). The 'stock' comprises multiple species though is predominantly *Nelusetta ayraud.*

Ocean Jacket is a relatively short-lived species (~6 years), reaching maturity within two to three years. Large cyclical changes in abundance appear to have occurred off eastern Australia (Miller & Stewart 2009).

Helidoniotis et al (2017a) report that "*As a byproduct species, ocean jacket has not been the subject of formal stock assessments. A standardised CPUE series has been constructed in recent years, which shows a similar trend to landings, suggesting that abundance of ocean jacket increased after 2003 (Sporcic & Haddon 2016). Catch rates for ocean jacket from zones 10 to 50 have decreased only slightly (Sporcic & Haddon 2016). There continues to be uncertainty over discarding of this species in the CTS and the GHTS; thus, the effect of discarding on CPUE trends is unknown (Upston & Thomson 2015)*". Given standardised catch rates increased substantially between 2003 and 2007 and have remained high, they classified the stock as not overfished.

The available evidence indicates that the stock is at least likely to be above PRI, although there is no evidence to indicate it is fluctuating at or around B_{MSY}. Accordingly, we have scored this stock medium risk.

PI SCORE	**LOW RISK - Blue Grenadier, Orange Roughy – Cascade, Gemfish – Western, Gould's Squid**
	MEDIUM RISK – Blue-eye Trevalla, Orange Roughy – Eastern, Pink Ling – Eastern, Pink Ling – Western, Ocean Jacket
	HIGH RISK – Gemfish – Eastern

1B: Harvest Strategy

CRITERIA: (i) There is a robust and precautionary harvest strategy in place.

(a) Harvest Strategy

The CTS harvest strategy consists of:

- Limited entry;
- Catch controls through TACs and ITQs, set according to well-defined harvest control rules under the SESSF Harvest Strategy Framework (HSF; AFMA, 2017);
- Gear restrictions;
- Monitoring through logbooks and catch disposal records (CDRs);
- Monitoring through VMS;
- Monitoring through independent observers who provide estimates of discards; and
- Periodic assessments of stock status.

A harvest strategy framework (HSF) has been in place in the SESSF since 2005. The most recent version of SESSF Harvest Strategy was agreed in 2017 (AFMA, 2017a). The SESSF HS is designed to meet the objectives of the Commonwealth Fisheries Harvest Strategy

Policy 2007 (HSP), namely "*the sustainable and profitable use of Australia's Commonwealth fisheries in perpetuity through the implementation of harvest strategies that maintain key commercial stocks at ecologically sustainable levels, and within this context, maximise the economic returns to the Australian community*" (DAFF, 2007). To meet this objective, harvest strategies are designed to pursue an exploitation rate that keeps fish stocks at a level required to produce maximum economic yield (MEY) and ensure stocks remain above a limit biomass level (B_{LIM}) at least 90% of the time. Alternative reference points may be adopted for some stocks to better pursue the objective of maximising economic returns across the fishery as a whole (AFMA, 2017a).

The following summary of the HSF structure and processes is adapted from AFMA (2017a):

The HSF uses a three tier approach designed to apply different types of assessments and cater for different amount of data available for different stocks. The HSF adopts increased levels of precaution that correspond to increasing levels of uncertainty about stock status, in order to reduce the level of risk associated with uncertainty. Tier 1 represents the highest quality of information available (i.e. a robust integrated quantitative stock assessment).

Each Tier has its own harvest control rule (HCR) that is used to determine a recommended biological catch (RBC). The RBCs provide the best scientific advice on what the total fishing mortality (landings from all sectors plus discards) should be for each species/stock. For all Tier levels, once the RBC is determined from the results of the assessment and the application of the relevant HCR, a recommended total allowable catch (TAC) is calculated based on the TAC setting rules.

For Tier 1, the HCR is based on the following reference points:

- The limit biomass B_{LIM} –The default B_{LIM} proxy is B20 = 20% of the unfished spawning biomass;
- The B_{MSY} – the default B_{MSY} proxy is B40 = 40% of the unfished spawning biomass;
- The target biomass B_{TARG} (MEY) – B_{TARG} is generally equal to B_{MEY}, for which the default proxy is approximated by $1.2*B_{MSY}$. If the default B_{MSY} proxy is used, this results in B48 = 48% of the unfished spawning biomass.

The Tier 1 harvest control rule applies to species and/or stocks where there is a robust quantitative assessment that provides estimates of current biomass levels, and where estimates or appropriate proxies are available for B_{LIM}, B_{TARG} and F_{TARG}.

Tier 3 and Tier 4 assessments use other indicators (relating to fishing mortality and catch rates respectively) and reference points which are taken as proxies for the biomass reference points for Tier 1.

A Tier 3 stock assessment uses information available on the age structure of annual catches and annual total catch weight, as well as knowledge of basic biological parameters, e.g. natural mortality, length at age, weight at length, the stock recruitment relationship steepness, fecundity at age and selectivity at age. The catch control rule uses the ratio of the target exploitation rate to the actual exploitation rate as a multiplier on the current average catch to determine the RBC.

The Tier 4 assessment is based entirely on catch and CPUE. The Tier 4 analysis determines an RBC by selecting CPUE reference points that are taken as proxies for the estimated B_{LIM} and B_{TARG}. This is done by assuming that the CPUE is proportional to stock abundance, an assumption that is made in most SESSF assessments.

HCRs under each Tier of the HSF have been subject to robust simulation testing (e.g. Wayte, 2009) with results published in peer-reviewed journals (e.g. Little et al, 2011).

The status of fish stocks in the SESSF, and how they are tracking against the HSF, is reported to the relevant Resource Assessment Group (RAG), the relevant Management Advisory Committee (MAC) and AFMA Commission as part of the yearly TAC setting process. The data used for input into the stock assessment process are collected by the observer-based Integrated Scientific Monitoring Program (ISMP), AFMA logbooks and Catch Disposal Records (CDRs) and periodic trawl-based Fishery Independent Surveys (FIS). Otoliths from the biological sampling are provided to a private contractor for ageing. All sampling and age data are provided to stock assessment scientists for analysis or reporting. Stock assessment reports are produced by CSIRO or other contracted assessment specialists and discussed by the RAG. The outcomes of assessments are run against the HCRs in the HSF to produce recommended biological catch (RBC) amounts for each quota species. Other sources of mortality, including an estimate of future discards, catch taken by other jurisdictions (e.g. State and recreational sectors) and a research catch allowance, are subtracted from the RBC to produce a Commonwealth TAC.

Each stock is assessed under the appropriate Tier level as advised by the RAGs. In mid-December, AFMA produces a position paper with recommended TACs for quota species for the upcoming fishing season, based on the stock assessments and RAG advice. The paper is distributed to interested parties and undergoes a public comment period.

In early February, a South East Management Advisory Committee (SEMAC) TAC Setting meeting is held where TAC recommendations are made. The outcomes of RAGs and SEMAC together with the AFMA position paper and any public comments received, are then sent to the AFMA Commission to determine TACs for the upcoming fishing season in mid-February.

Blue Grenadier **LOW RISK**

Blue Grenadier is a Tier 1 stock under the HSF.

Helidoniotis et al (2017a) reported that "*blue grenadier was subject to multiyear TACs of 4,700 t for the 2009–10 to 2011–12 seasons, and 5,208 t for the 2012–13 and 2013–14 seasons. The 2013 assessment estimated a substantially increased three-year RBC of 8,810 t, starting in 2014–15. A 2014–15 TAC of 6,800 t was implemented, after considering industry's preference for a cautious approach to increasing the TAC, to promote economic stability (AFMA, 2014b). The multiyear TAC increased to 8,796 t in the 2015–16 season and to 8,810 t in the 2016–17 season*". In the 2016-17 fishing season, the landed catch and discards combined was 1,761.15 t, which is below the RBC of 8,810 t.

Based on the above, the harvest strategy is responsive to the state of the stock and all of the elements work together towards achieving the stock management objectives reflected in Criterion 1A (i).

Blue-eye Trevalla **LOW RISK**

Blue-eye Trevalla is classified as a Tier 4 species, using catch and-effort data for the auto-longline and dropline fisheries. SERAG (2017) note that RBCs for the Blue-eye Trevalla stock are taken from MSE-tested harvest control rules and that if the standardized CPUE

series is a reasonable index of relative abundance, the RBC will have a very low probability of causing a decline below the limit reference point.

The extent to which the existing harvest strategy is likely to maintain the stock at levels consistent with MSY or above is dependent on the extent of uncertainty in stock assessments. Ordinarily a 'discount factor' is applied to Tier 4 RBCs to account for uncertainty, although SERAG recommended no discount be applied to Blue-eye Trevalla due to the conservative estimate of the RBC (due in part to unaccounted orca predation) and protection afforded the stock by fishing closures (SERAG, 2017).

There are no significant discards or State catches (SERAG, 2017).

While uncertainty remains in assessments around discarding and hyperstability, assessments have been subject to continual improvement over time and SERAG considers the current assessment to be conservative. Well-defined HCRs exist, have been MSE-tested and aim to maintain stocks at a target level above B_{MSY}. In addition, clear tools are in place through the TAC/ITQ system to change levels of exploitation in response to changes in stock status. Accordingly, notwithstanding a decrease in standardised CPUE in the past two years, there is a reasonable basis to conclude that the harvest strategy is designed to be responsive to the state of the stock and all of the elements work together to achieve the stock management objectives reflected in criterion 1A (i).

We note that a workshop to consider a new report on stock structure is scheduled for early 2018 and may have implications for Tier 4 assessments. The outcomes of this work on the harvest strategy should be considered in future assessments

Orange Roughy – Cascade Plateau — LOW RISK

The Cascade Plateau Orange Roughy stock are currently managed as Tier 1 stock under the HSF.

In October 2006, Orange Roughy was listed as conservation dependent under the EPBC Act and placed under the Orange Roughy Conservation Programme (ORCP). The ORCP was replaced by the Orange Roughy Rebuilding Strategy (ORRS) in 2015 (AFMA 2014a), the primary objective of which is to return all Orange Roughy stocks to levels at which the species can be harvested in an ecologically sustainable manner that is consistent with the HSP. The ORRS allows limited, targeted fishing for Orange Roughy stocks that are above the limit reference point of 20 per cent of the unfished spawning biomass. Management actions to minimise fishing mortality and support rebuilding include deepwater closures, restricting of effort by limiting entry to existing fisheries, and ongoing research and monitoring to support stock assessments.

Being the only Orange Roughy fishery to not be overfished, a requirement of the ORCP was to maintain the spawning biomass of Orange Roughy on the Cascade Plateau at or above 0.6 B_0. In 2014, it was agreed that the default settings of the SESSF HSF would be adopted, with the standard target reference point of 0.48 B_0 and the limit reference point of 0.2 B_0 (Helidoniotis et al, 2017a).

Spawning aggregations of Cascade Plateau Orange Roughy were assessed using acoustic survey abundance indices between 2003 and 2009 (Helidoniotis et al, 2017a). Modelled estimates of spawning biomass, combined with recent low levels of catch, suggest that the stock is currently likely to be above target levels. The acoustic measures of spawning abundance, combined with modelled estimates of biomass and tools to effect changes in fishing mortality (TAC, ITQs, HCR), suggest that the harvest strategy is responsive to the state of the stock and all of the elements work together towards achieving the stock management objectives reflected in Criterion 1A (i).

Orange Roughy – Eastern zone — LOW RISK

The Eastern Zone stock of Orange Roughy is managed as a Tier 1 stock under the HSF and in accordance with the ORRS (AFMA 2014a).

Following stock declines to 10% of initial biomass levels (0.10 B_0) after overfishing in the 1980s and 1990s, the stock has recovered to levels above the limit reference point (0.20 B_0) (SERAG, 2017). An integrated Tier 1 stock assessment is available which allows for estimations of current stock status and biomass projections in the context of reference points in the HSF (SERAG, 2017). Sensitivities are run to examine the implications of alternative input parameters to the model. RBCs calculated from model outputs are set to encourage the stock to move towards the BMEY based target reference point in the HSF. In recent years, the stock has been managed under a multi-year TAC of 465t. The most recent Tier 1 assessment resulted in an increased RBC of 1,345t (SERAG, 2017).

Given the close monitoring of stocks, the strong evidence that rebuilding has occurred in response to the implementation of the ORCP, and the implementation of the Rebuilding Strategy that only allows limited catches from fisheries above B20%, the harvest strategy appears to be responsive to the state of the stock and all of the elements work together towards achieving the stock management objectives reflected in Criterion 1A (i).

Pink Ling – Eastern — LOW RISK

The eastern Pink Ling stock is harvested by both the Commonwealth SESSF and the NSW Ocean Trap and Line Fishery (OTLF), with around 85% of the catch in 2015 being taken in the SESSF. To that end, the effectiveness of the harvest strategy on the stock is assessed at the whole-of-stock level. In this case, although catches in the OTLF are non-trivial, the main determinant of the overall effectiveness of the harvest strategy for the eastern Pink Ling stock is the effectiveness of the harvest strategy for the SESSF.

Pink Ling is a Tier 1 species under the HSF, meaning that a robust quantitative stock assessment is available. Both eastern and western Pink Ling stocks are managed under a single TAC, with catches of each stock monitored. Catches from all jurisdictions, including the OTLF, are included in the assessment of the eastern stock.

RBCs for Pink Ling are currently generated based on a model originally described by Cordue (2013). The model was most recently updated in 2015 and produced RBCs for the 2016–17 fishing season of 250 t for the east and 990 t for the west. Catch of eastern Pink Ling reported in logbooks in the 2015–16 fishing season was 230 t, which was below the 337 t TAC and the 250 t RBC. Projections from the 2015 stock assessment suggested that the stock could be rebuilt to the target reference point (B_{48}) within one mean generation time (8.8 years) with catches of up to 250t. If two mean generation times are allowed for rebuild, total removals could be 400–500 t per year. For the 2017-18 season, a combined eastern/western stock TAC of 1154 tonnes is in place, with eastern catches informally limited to 500t.

Additional controls to keep eastern catches under the RBC were introduced in 2014-15. These included a daily catch allowance for the eastern zone and a change in some concession conditions to restrict catch of pink ling from the eastern zone to 25 per cent of quota

holdings (Helidoniotis et al, 2017a).

In NSW, the OTLF harvest strategy currently consists of:

- Limited entry;
- Vessel restrictions;
- Gear restrictions;
- Monitoring through logbooks;
- Spatial and temporal closures;
- Periodic weight of evidence based assessments.

Limited entry is implemented through a share management scheme under which access to the fishery is limited to shareholders or their nominated fishers who hold sufficient shares to satisfy the minimum shareholding levels established for each share class in the *Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006* (the SMP) (DPI, 2017a). Two separate share classes exist for setline fishing: east and west of the 183m (100 fathom) depth contour. Numbers of shareholders in the two line fishing share classes have been progressively reduced over time, with shareholders in the western zone (within 183m) falling from 474 in July 2005 to 275 in December 2016 (DPI, 2017a). In the eastern zone (outside 183m), the number of shareholders has fallen from 111 in July 2005 to 73 in December 2016.

Vessel restrictions include a limitation on vessel size (DPI, 2017a). Gear restrictions includes limitation on the number of hooks used and the prohibition of automatic baiting machines. Additional gear limits are applied near critical Grey Nurse shark habitats.

Fishing closures specific to the OTLF that are authorised under the Act can be found on the NSW DPI website at www.dpi.nsw.gov.au/fisheries/info/closures/commercial. This includes a ban on the harvest of Pink Ling inside 3 nm from the coastline.

Notwithstanding the reduction over time in eligible shareholders, Stevens et al (2012) reported considerable levels of excess harvesting capacity in the OTLF. In the eastern line fishing sector, 25 shareholders out of 80 contributed 95% of the catch (or 69% latency). In the western line fishing sector, 137 out of 336 shareholders contributed 95% of the catch (or 59% latency). Accordingly, while shareholder numbers have been reduced since 2012, substantial additional harvesting capacity is likely to remain in the fishery.

Accordingly, while the harvest strategy overall is responsive to the state of the stock and could be expected to achieve the stock management objectives reflected in Criterion 1A (i), this is largely because of arrangements in place in the Commonwealth SESSF in which the majority of the catch is taken. Because State catches are deducted from RBCs under the SESSF HSF to produce TACs (and therefore State catches are accounted for), we have scored the overall harvest strategy for the eastern Pink ling stock low risk.

Nevertheless, in the OTLF, there is very limited evidence that the current harvest strategy is responsive to the state of the stock and it is not clear that all elements work together.

In order to address latency and other issues, the NSW Government is implementing a Commercial Fisheries Business Adjustment Program (the BAP) which will link shares to either catch or fishing effort (DPI, 2017a). In the OTLF, share linkage arrangements will include increases in the minimum shareholding requirements for most share classes and the introduction of catch quotas for line fishing (eastern zone). A catch quota for Pink Ling is expected to commence in December 2018 (DPI, 2017a).

Pink Ling - Western **LOW RISK**

The western stock of Pink Ling is harvested primarily by the SESSF and managed under the same 'global' TAC as that covering the eastern stock. Under the TAC, separate RBCs are calculated for each stock with additional catch controls applied to fishing on the eastern stock to constrain catch to a nominal eastern TAC. Catch controls include a daily catch allowance for the eastern zone and a change in some concession conditions to restrict catch of Pink Ling from the eastern zone to 25 per cent of quota holdings. These arrangements applied for the 2016–17 season, within an agreed TAC of 1,144 t (Helidoniotis et al, 2017a).

Cordue (2015) estimated RBC for the western stock at 990 t, with long-term yield is estimated at 530–950 t (95% CI). Stochastic projections show little or no risk to the stock in the next few years for total removals up to 900 t per year. Nominal TAC for the western stock in 2016-17 was set at 750t. Helidoniotis et al (2017a) report that western Pink Ling catches are below the western RBC levels. On that basis they conclude that the stock is not subject to overfishing.

Given the stock is subject to a robust Tier 1 assessment and RBCs/global TACs are set according to a well-defined HCR which aims to maintain the stock at levels above B_{MSY}, and there is evidence from recent assessments that the strategy is being implemented successfully, we have scored this SI low risk.

Gemfish - Eastern **HIGH RISK**

The integrated stock assessment model (tier 1) for Eastern Gemfish was last updated in 2010 (Little and Rowling, 2010), with spawning stock biomass estimates of 15.6% of the 1968 level (0.156 SB_0). The 2010 assessment provided biomass projections based on two scenarios: total catches of 0 and 100 t each year. The projection for zero catch suggested that the biomass might reach 0.20 SB_0 (the limit reference point, LRP) before 2020, while projections for annual catches of 100 t reached the LRP in 2025 (Little and Rowling, 2010).

The 2008 Eastern Gemfish rebuilding strategy adopted a time frame of nine years to reach the LRP, however given poor recent recruitment AFMA believed that this timeframe was unlikely to be met (AFMA, 2015a). The updated 2015 rebuilding strategy has adopted the rebuilding timeframe of one mean generation time plus 10 years (approximately 19 years from 2008), which is in line with the HSP. The rebuilding strategy aims to rebuild Eastern Gemfish to, or above, the limit reference point by 2027.

Once rebuilt to the limit reference point, the rebuilding strategy aims to rebuild the stock to the default B_{MSY} reference point of B_{40}, and then to the B_{MEY} reference point of B_{48} (AFMA, 2015a). No target timeline is provided for rebuilding to the B_{MSY} level.

The rebuilding strategy provides for zero targeted catch, but allows for an incidental take of 100t. The incidental take limit of 100t has been in place since 2002 (AFMA, 2015a). Additional fishing mortality may arise from discarding, which is estimated through observer coverage. The incidental catch TAC level is reviewed by SERAG annually and may be increased or decreased depending on information

about targeting behaviour or changes to fishing mortality and biomass.

Additional measures in the rebuilding plan which serve to limit exploitation include increasing codend mesh size (minimum of 90 mm mesh size), deepwater spatial closures (introduced to limit exploitation of upper slope dogfish species, but will also offer some protection to eastern Gemfish) and compulsory pre-reporting for fishers landing eastern gemfish during the species annual spawning migration (to allow for data collection) (AFMA, 2015a).

In addition to the rebuilding strategy, an industry Code of Practice is in place through the South East Trawl Fishing Industry Association (SETFIA), which encourages fishers to actively avoid catching eastern gemfish and highlights the importance of accurately recording data. The Code also includes a measure asking fishers to communicate the location of large shots of eastern Gemfish to others in an effort to increase avoidance and reduce incidental catches. The development of the Code saw a reduction in the total fishing mortality (catch and discards) by approximately a third between 2010 to 2011 (AFMA, 2015a).

SERAG (2016) notes that total fishing mortality (retained catch plus discards) in Commonwealth fisheries was below the incidental TAC in 2012, 2014 and 2015. Helidoniotis et al (2017a) also report that the total fishing mortality was 77.4t in the 2016-17 fishing year, which is below the incidental TAC. However, discards in 2013 were around 131t and, together with retained catches, meant the total fishing mortality was around double the incidental TAC. On the basis that recent catch history includes years when the incidental catch allowance was exceeded, indicating that management arrangements may not be sufficient to limit fishing mortality, Helidoniotis et al (2017a) classified the stock as 'uncertain if subject to overfishing'.

Eastern Gemfish are also taken by dropline fishers in the NSW Ocean Trap and Line Fishery (OTLF) (Chick, 2015). Fishers are subject to a 50kg/trip limit, with reported catches between 2009-10 and 2013-14 ranging from 10-20t. More recent commercial catch information was not found. Landings by recreational fishers have previously been estimated at 10t (Henry and Lyle, 2003), although no more recent estimate is available. Chick (2015) notes that the catch in the NSW charter boat sector is likely to be 'significant' although total catches are not provided. The charter sector is subject to a 10 fish per boat limit. AFMA (2015a) notes that recreational and NSW commercial catch have the potential to impact on recovery times, however estimates of catch from both of these sectors are unreliable and need improvement (AFMA, 2015a).

SERAG (2016) noted that despite a long period of management under the rebuilding strategy there is no evidence of any stock rebuilding. In practice, rebuilding appears to be constrained by poor recruitment. While a relatively strong recruitment event occurred in 2002, recruitments during the last 25 years have been relatively weak which contrasts with the 1970s when recruitment was variable, but generally higher (Little and Rowling, 2010).

In essence then, a harvest strategy is in place to recover the stock to the limit reference level (and then ultimately to the B_{MEY} target level). Assessment modelling indicates that, under average recruitment conditions and at a 100t catch, the stock should recover to the limit reference level by 2025. Catches within Commonwealth fisheries have been largely compliant with incidental catch limits, although there was a considerable overrun in one recent year. Catches in NSW fisheries are likely to be smaller but data are uncertain. Collectively, there is some probability that Commonwealth and State catches exceed the 100t allowance modelled in the most recent stock assessment. Little and Rowling (2010) cautioned that the projection of the stock recovering to the limit reference point by 2025 under the 100t catch limit noted that the "depends strongly on the average recruitment operating for the stock in the future (which has not occurred in recent years) and whether catches exceed the bycatch limit".

While there is some argument that the harvest strategy will achieve the stock management objectives reflected in criteria 1A(i) over time, there is uncertainty around whether the objectives will be achieved primarily as a result of poor recruitment, but also as a result of uncertainty in some catch data. Given the overfished state of the stock, we have scored this SI high risk. The UoA would be better placed with stronger information on total catches across the stock and some evidence of recovery.

Gemfish - Western — MEDIUM RISK

Management of the western Gemfish stock is complex with catches taken across multiple sectors. The SHS harvest is managed under the SESSF TAC, but may be taken in the Western Bass Strait (WBS) or the Great Australian Bight (GAB). The stock is also accessed by the Commonwealth Trawl Sector, whose catches are also managed within the SESSF TAC, but may only be taken within the WBS. The SESSF TAC for the 2016-17 fishing season was 247t. Catches are also taken in the GAB Trawl Sector (GABTS) for which there is no TAC. Whereas western Gemfish are targeted in the CTS, incidental catches in the GABTS are more common. Catches in GABTS are in addition to the SESSF TAC and are subject to a trigger point in the SESSF HSF which requires a full assessment to be undertaken if catch exceeds 1000 t over three years (AFMA 2017a).

Combined catches in Commonwealth fisheries in 2016-17 were 73.3t, with discards estimated at around 63t. This was well below the RBC of 247t.

The main uncertainties in the harvest strategy are the state of the stock itself given the uncertainty in assessments (GABRAG, 2017), and the potential for unconstrained catches in the GABTS to undermine the effectiveness of catch constraints in the CTS and SHS. Given the uncertainties over stock status, it is not clear that the harvest strategy is directly responsive to the state of the stock. Nevertheless, given catches across all sectors are closely monitored, catches in the GABTS are subject to a formal review if they exceed a predefined level and averaged only 29t between 2011 and 2015, and uncertainty is taken into account in recommending RBCs and TACs in the non-GABTS sectors, there is a plausible argument that the harvest strategy is expected to achieve the stock management objectives reflected in criterion 1A(i). Accordingly, we have scored this SI medium risk.

Gould's Squid — LOW RISK

The southern Australia biological stock of *N. gouldi* is harvested by a range of fisheries including:

- The Commonwealth Southern Squid Jig Fishery (SSJF);
- The Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) (Commonwealth Trawl Sector – CTS – and Great Australian Bight Trawl Sector – GABTS);
- The Tasmanian Scalefish Fishery (TSF); and
- Recreational fisheries.

Catches in the two Commonwealth fisheries have historically dominated total landings, however substantial catches were taken in the TSF in 2012-13 (Figure 7). Recreational catches in Tasmania were estimated at 21t in 2012-13 (Noriega et al, 2016).

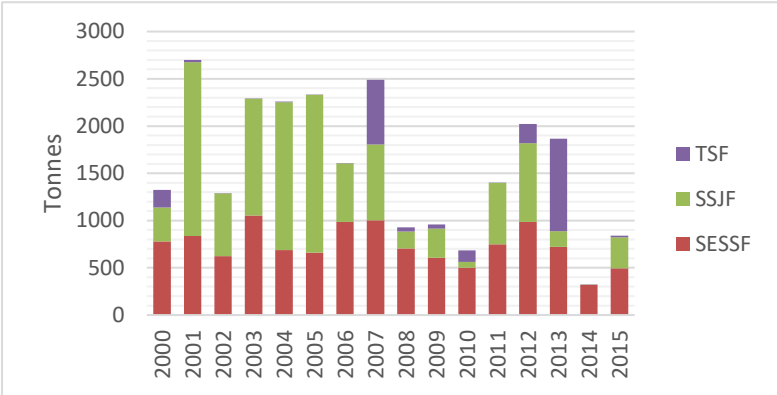

Figure 7: Australian Gould's squid commercial catches between 2000 and 2015.

The SSJF and SESSF are subject to management arrangements specified in the Arrow (Gould's) Squid Fishery Harvest Strategy. This harvest strategy details processes for monitoring and conducting assessments of the biological and economic conditions of the fishery. The harvest strategy covers the SSJF as well as sectors of the SESSF and other Commonwealth fisheries which may take Gould's squid in the Australian Fishing Zone. The Arrow (Gould's) Squid Fishery Harvest Strategy was implemented on 1 January 2008.

In the absence of biomass estimates, the harvest strategy uses suites of intermediate and limit catch and effort triggers based on recent catch history, with values well below historical high catch levels. A series of defined actions are associated with each trigger (e.g. re-assess the fishery using depletion analysis if a trigger of 5,000t from the SSJF or 6,000t overall is reached). These do not specify catch reductions (or increases) but are consistent with the existing lightly-exploited nature of the fishery (Anon, undated). Under the current SSJF Management Plan, advice will be provided by a Southern Squid Jig Fishery Resource Advisory Group (SquidRAG) on an appropriate management response, should any of the trigger catch levels be reached.

The TSF uses jigs and is subject to limited entry, vessel restrictions (<20m) and spatial and temporal closures. There were 12 active vessels in the TSF in 2015, and the number of automatic squid jigging licenses is limited to 7 in 2016-17 [1].

Notwithstanding larger catches in 2011-12 and 2012-13, catch remains well below historical levels. The harvest strategy in the Commonwealth sectors, which have dominated catches except for 2012-13, is responsive to the state of stock and the elements work together towards achieving the stock management objectives reflected in Criterion 1A(i). Catches in the TSF should continue to be monitored in the context of ensuring effective management arrangements across the full range of the stock.

Ocean Jacket MEDIUM RISK

There are no species-specific management arrangements for Ocean Jacket in the SESSF. As a byproduct species, the 'harvest strategy' consists of limiting overall effort in the fishery through the application of TACs on quota-managed species, limited entry, gear restrictions, spatial closures, together with ongoing catch and effort monitoring and periodic assessment. Catch and effort for the stock are reported through commercial logbooks, verified through observer data and the stock is subject to periodic standardized CPUE based assessments.

Total catch of ocean jacket remained stable in the CTS, at around 50 t, between 1986 and 2001. Since then, ocean jacket has been an important non-quota byproduct species in the SESSF, with current catch levels exceeding those of many quota species (Helidoniotis et al, 2017a). The ERA suggested that leatherjackets (including Ocean Jacket) were at medium risk (Wayte et al. 2007).

This scoring issue is ranked as medium risk on the basis that regular assessments of stock status are made, there appears to be no immediate risk to the stock, the species is largely taken as opportunistic bycatch and tools are available to management agency to reduce exploitation should indicators suggest the stock is approaching PRI. The current broader harvest strategy arrangements appear to be sufficient to achieve the stock management objectives in Criterion 1A(i) under current effort levels, and additional tools are available (e.g. daily/trip catch limits) to reduce exploitation should stock indicators decline.

(b) Shark-finning

NA

CRITERIA (ii): There are well defined and effective harvest control rules (HCRs) and tools in place.

(a) HCR Design and application

Well-defined HCRs are set out for each Tier 1-4 species covered by the SESSF HSF (AFMA, 2017a). HCRs are designed to achieve the objectives set out in the HSF which in turn has been designed to meet the Commonwealth HSP (DAFF, 2007).

Under the HSF, for Tier 1 stocks the target fishing mortality rate F_{TARG} represents the fishing mortality rate that would result in a spawning biomass of B_{TARG} (equal to B_{MEY}). The default value for F_{TARG} is F_{48}, the value of F corresponding to a B_{TARG} of B_{48}. Alternative reference points may be adopted for some stocks to better pursue the objective of maximising economic returns across the fishery as a whole. The recommended maximum fishing mortality rate for Tiers 3 and 4 is F_{MSY} (the default proxy for which is F_{40}). This represents the fishing mortality rate that would cause the spawning biomass to decline to its maximum sustainable biomass B_{MSY} (the default proxy for which is B_{40}). The breakpoint, or HCR inflection point, in the overfishing line occurs at a biomass corresponding to

[1] http://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/scalefish-fishery/commercial-scalefish

B_{MSY}. If $B<B_{MSY}$ or $F>F_{MSY}$, the TACs should be reduced to limit fishing effort and the fishing mortality rate. For Tier 1, the recommended maximum fishing mortality rate and HCR inflection point occurs at a proxy of F_{35}.

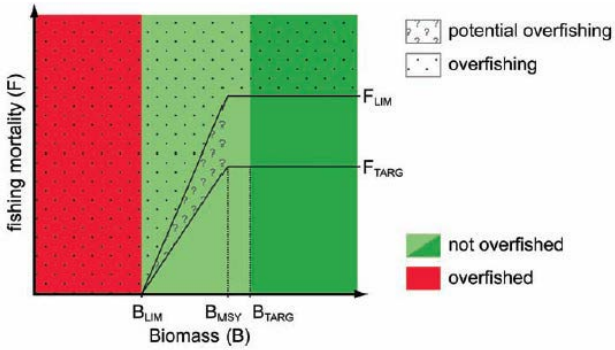

Figure 8: Schematic representation of a harvest control rule, showing key reference points (Source: AFMA, 2017)

Recommended Biological Catch (RBC) is calculated according to the following (AFMA, 2017a):

Tier 1

The formula for calculating F_{TARG} is as follows:

F_{TARG}	**Biomass level**
$F_{TARG} = F_{48}$	where $B_{CUR} > B_{35}$
$F_{TARG} = F_{48} * (B_{CUR}/B_{20} - 1)$	where $B_{35} > B_{CUR} > B_{20}$
$F_{TARG} = 0$	where $B_{CUR} < B_{20}$

The RBC is calculated by applying FTARG to the current biomass BCUR to calculate the total catch (including discards) in the next year, using the agreed base case assessment model:

$$RBC = Catch[F_{TARG} \rightarrow B_{CUR}]$$

At Tier 1, B_{LIM} = B20, the maximum value for F_{TARG} = F48 and the breakpoint in the HCR occurs at B_{35}. Alternative reference points may be adopted for some stocks to better pursue the objective of maximising economic returns across the fishery as a whole.

The HCRs are robust to the main uncertainties (SI(b)) as they have been developed over a period of time involving world leading scientists, underpinned by publications in peer-reviewed journals. There is substantial evidence that the HCRs have been successfully implemented across a diverse range of gear types and species of Commonwealth fisheries (SI(c)). Additional HCRs are also applied for specific fisheries or species where necessary, developed through the Resource Assessment Group, and applied and monitored by AFMA.

Tier 3

The Tier 3 HCR applies to species and/or stocks that do not have a quantitative stock assessment, but where estimates of fishing mortality and other biological information are available (AFMA, 2017a). Yield per recruit calculations are used to calculate *F* values that will reduce the spawning biomass to 20% (F_{20}), 40% (F_{40}) and 48% (F_{48}) of the unexploited level.

Recommended biological catch CRBC is calculated according to the following formula:

$$C_{RBC} = \frac{(1-e^{-F_{RBC}})}{(1-e^{-F_{CUR}})} C_{CUR}$$

where F_{CUR} is the estimated current fishing mortality, and F_{RBC} is the selected *F* for the recommended biological catch from the control rule. The estimate of fishing mortality is limited to be no less than 0.1 of natural mortality.

Tier 4

The Tier 4 control rule is of the form:

$$RBC = C^* \max\left(0, \frac{\overline{CPUE} - CPUE_{lim}}{CPUE_{targ} - CPUE_{lim}}\right)$$

where:

$CPUE_{targ}$	is the target catch per unit effort (CPUE) for the species
$CPUE_{lim}$	is the limit CPUE for the species
$\overline{CPUE}$	is the average CPUE over the most recent *m* years
C^*	is a catch target derived from a historical period that has been identified as a desirable target in terms of CPUE, catches and status of the fishery

A range of considerations are then taken into account in translating the RBC into a TAC. For Tier 4 species a 'discount factor' of 15% is applied to account for greater levels of uncertainty in these stocks. Other sources of mortality including state catches, discards and

any research catch allowance are then subtracted from the RBC to produce a Commonwealth TAC.

Multi-year TACs are to be applied for all Tier 1 and Tier 4 species where suitable. Where the RBC is zero, an incidental bycatch TAC may be set after considering a range of circumstances including the impact of incidental catches on rebuilding of the stock.

Blue Grenadier **LOW RISK**

Blue Grenadier is managed as a Tier 1 stock under the HSF, with RBCs and TACs are set consistent with the 20:35:48 HCR. The 2013 assessment estimated a three-year RBC of 8,810 t, starting in 2014–15, which was an increase on the previous three year RBC of 5,208t for the 2012-13 and 2013-14 years. The 2013 assessment took into account a large recruitment event in 2010. A 2014–15 TAC of 6,800 t was implemented, after considering industry's preference for a cautious approach to increasing the TAC, to promote economic stability, followed by increases to 8,796 t in the 2015–16 season and to 8,810 t in the 2016–17 season. The 2013 assessment estimated a <10% probability that the TAC would result in the stock declining below the limit reference point (AFMA, 2013). Accordingly, well-defined HCRs and tools are in place which ensure exploitation is reduced as PRI is approached and are expected to keep the stock fluctuating at target levels consistent with MSY or above.

Blue-eye Trevalla **LOW RISK**

Blue-eye Trevalla is categorised as a Tier 4 stock under the SESSF HSF. HCRs for the stock have been subject to management strategy evaluation (MSE) and shown to be consistent with the Commonwealth HSP (Wayte, 2009) which aims to maintain stocks at target levels consistent with MEY. Despite its Tier 4 status, SERAG recommended no discount be applied to RBCs due to the conservative estimate of the RBC (due in part to unaccounted orca predation) and protection afforded the stock by fishing closures. Tools in the form of quota adjustments are in place to ensure exploitation can be reduced as PRI is approached. Accordingly, well-defined HCRs and tools are in place which ensure exploitation is reduced as PRI is approached and are expected to keep the stock fluctuating at target levels consistent with MSY or above. Uncertainty is considered by the RAG in recommending RBCs/TACs.

Orange Roughy – Cascade Plateau **LOW RISK**

The Cascade Plateau stock of Orange Roughy is managed as a Tier 1 stock under the HSF, with RBCs and TACs designed to maintain the stock at the target reference point of B_{48} consistent with the HSF and ORRS. Helidoniotis et al (2017a) report that the most recent formal stock assessment for orange roughy on the Cascade Plateau, in 2009, predicted that, if the 315 t long-term RBC was fully caught by 2011, the spawning biomass of the stock would be at $0.64SB_0$ in 2011 (Morison et al. 2012). Taking into account the lower catch levels of 2007 and 2008, the assessment suggested that a TAC of 500 t would maintain the stock at $0.63SB_0$ in 2011. AFMA has maintained a TAC of 500t since that time, although catches have consistently been <2t since 2013. New assessments have been postponed due to low catches. Given ongoing very low catches, the existing HCRs and tools under the HSF and ORRS appears sufficient to ensure exploitation is reduced as PRI is approached and are expected to keep the stock fluctuating at target levels consistent with MSY or above.

Orange Roughy – Eastern Zone **LOW RISK**

The HCRs in place for the Eastern Zone Orange Roughy stock are the same as those described above for the Cascade Plateau stock. There is evidence of the HCRs being applied successfully, with the stock recovering to levels above the limit reference point and stock trajectory trending upwards (SERAG, 2017).

Pink Ling – Eastern **LOW RISK**

In the SESSF, Pink Ling stock is managed as a Tier 1 stock under the HSF. In practice, the eastern and western stocks of Pink Ling are managed under a common TAC, with additional management measures introduced in recent years to limit catches of eastern Pink Ling to its nominal share of the overall TAC (e.g. daily catch allowance for the eastern zone and a change in some concession conditions to restrict catch of pink ling from the eastern zone to 25 per cent of quota holdings). Since 2014-15, multi-year TACs have been set taking into account the outcomes of probabilistic stock projections from the Cordue (2013) base case assessment.

According to projections from the 2015 stock assessment, there is little risk to the stock over the next few years of removals up to 550 t per year. The base-case projections suggested that the stock could be rebuilt to the target reference point (B_{48}) within one mean generation time (8.8 years). If two mean generation times are allowed for the rebuild, total removals can be 400–500 t per year (Cordue, 2015). Nominal TAC for the eastern Pink Ling stock in 2016-17 was set at 404t. Catch of eastern Pink Ling reported in logbooks in the 2016–17 fishing season was 338 t.

While there are well-defined HCRs for the Commonwealth component of the catch under the SESSF HSF (AFMA, 2017a), there are no specific HCRs for the OTLF sector. The closest approximation to a HCR is the framework of trigger points set out in the Fishery Management Strategy (FMS) for the OTLF (DPI, 2006) which require a review to be undertaken of the likely causes for the trigger and a review report outlining the remedial actions recommended in response to trigger point trips to be provided to the Minister within six months of the trigger point being tripped. Pink Ling is not listed as a primary or key secondary species under the FMS, so the main relevant trigger appears to be the monitoring of total annual landings of all secondary species to detect changes in targeting behaviour. While triggering this indicator may result in a review to assess the impact of any increase in Pink Ling catches, it is not clear that the framework requires that exploitation be reduced as PRI is approached. We note that even for primary and key secondary species, action is required only after the species is categorised as 'overfished' or 'recruitment overfished' (DPI, 2006).

The status of Pink Ling is assessed annually by NSW DPI according to generic stock status categories (e.g. 'fully fished', 'overfished', 'uncertain') (e.g. Stewart et al, 2015). Status is determined based on the Commonwealth stock assessment and relevant NSW information. The status of Pink Ling in NSW has been listed as 'uncertain' in the 2013-14 and 2014-15 assessments (Stewart et al, 2015; DPI, 2017b). Accordingly, while some ongoing monitoring of stock status is in place and generic tools are available to limit exploitation (e.g. trip limits are used for other NSW species that are shared with Commonwealth fisheries), there is no well-defined or generally understood HCR to limit exploitation as PRI is approached.

Nevertheless, at the whole of stock level, the HCRs in place for the SESSF take into account State catches in the calculation of TACs and

appear robust to the main uncertainties. The HCR is structured to ensure that exploitation is reduced as the PRI is approached and is expected to keep the stock fluctuating at a target level above B_{MSY}. Accordingly, we have scored this SI low risk.

We note the stock as a whole would be better positioned with the introduction of HCRs and tools complementary to Commonwealth fisheries which effectively limited exploitation as PRI is approached and aimed to maintain the stock at level around B_{MSY}. The planned introduction of a quota system for Pink Ling in December 2018 may facilitate the introduction of a well-defined HCR.

Pink Ling - Western **LOW RISK**

RBCs and TACs for the western Pink Ling stock are set taking into account the probabilistic stock projections of the Tier 1 stock assessment and reference points in the HSF. Cordue (2015) estimated RBC for the western stock at 990 t with a 95% CI of 640–1590 t. Long-term yield is estimated at 530–950 t (95% CI). Stochastic projections show little or no risk to the stock in the next few years for total removals up to 900 t per year. Nominal TAC for the western stock in 2016-17 was set at 750t. Tools are in place to constrain catch through the TAC and catches in recent years have been below the nominal TAC. Accordingly, well-defined HCRs and tools are in place which ensure exploitation is reduced as PRI is approached and are expected to keep the stock fluctuating at target levels consistent with MSY or above.

Gemfish – Eastern **MEDIUM RISK**

The eastern stock of Gemfish is currently below the limit reference point and subject to a formal rebuilding strategy. The strategy aims to recover the stock to the limit reference point of B_{20} by 2027 (one mean generation time plus 10 years), and from there ultimately to the target reference point of B_{48} (AFMA, 2015a). The stock is formally listed as a Tier 1 stock under the HSF. The most recent stock assessment was completed in 2010, with targeted catch set at zero consistent with the Tier 1 HCR. Key uncertainties in the operation of the HCRs are the capacity to undertake robust Tier 1 assessments given recent catch rates cannot be used as a reliable index of abundance due to avoidance behaviour of operators (SERAG, 2016), and the appropriateness of current limits under lower than average recruitment conditions which have been persistent in recent years. The HCR also does not include State catches which are uncertain. While a well-defined HCR exists and serves to control exploitation, it is not clear that it is robust to these main uncertainties. Accordingly, we have scored this SI medium risk.

Gemfish – Western **MEDIUM RISK**

There are effectively two types of HCR which apply to Commonwealth fisheries accessing the western Gemfish stock: the Tier 1 HCR applying to TACs for the CTS and SHS and the catch trigger applying to the GABTS. While the Tier 1 HCR is a well-defined HCR which ensures that exploitation is reduced as PRI is approached and could be expected to keep the stock fluctuating around levels consistent with MSY, Tier 1 assessments of the western Gemfish stock are currently highly uncertain (GABRAG, 2017). In practice, a weight of evidence based approach taking into account the outcomes of Tier 1 and Tier 4 assessments and recent catch history has been used to recommend RBCs and TACs (GABRAG, 2016). In the GABTS, the current trigger point in HSF is more consistent with a generally understood HCR which is available to the management agency. While tools are available to the management agency to reduce exploitation in the GABTS (e.g. quota), these are not yet in place. Accordingly, we have scored this SI medium risk.

Gould's Squid **LOW RISK**

The Commonwealth Arrow (Gould's) Squid Fishery Harvest Strategy uses a system of within-season monitoring against catch triggers for the jig and trawl sectors that signal the need for formal assessment. The main harvest strategy control rules are outlined in Table 2. Due to relatively low effort in the last few years, these triggers have far exceeded the catch and effort in the fishery.

Table 3: Harvest controls for the SSJF (Source: AFMA, 2009).

Fishery	Trigger	Control rule - Management response
Jig fishery	3000t catch or 30 active vessels	Fishing continues. Requires a depletion analysis and increased investment in fishery monitoring and biological data collection. If there is no indication of impact (depletion) fishing may continue to the next trigger limit.
	5000t catch or 45 active vessels	Further catches are suspended pending another depletion analysis. If there is no indication of depletion a further, higher trigger may be considered. If there is impact, catch or effort may be capped. Fishing beyond this trigger will require more rapid realtime monitoring of the fishery.
Combined trawl sector	2000t	Fishing continues. Decision rules require depletion analyses equivalent to those required for the jig fishery rules. Catch limits may be set depending on the outcome of the analyses.
Combined jig fishery and trawl sector	4000t	The combined jig and trawl catch triggers the decision rules at this level are equivalent to those applying to the 3000t intermediate jig catch trigger however assessment would involve depletion analysis for both fisheries.
	6000t	Decision rules are equivalent to the 5000t jig catch trigger however assessment will involve depletion analysis using data for both fisheries and any changes to catch triggers will require agreement from both the SSJF and the SESSF resource assessment groups.

Although the Commonwealth HCRs do not apply to the TSF, given the historically low levels of catch and the greater potential for fishing effort in the Commonwealth sectors, these rules are likely to ensure that exploitation is reduced as the PRI is approached.

Ocean Jacket **MEDIUM RISK**

Ocean Jacket is not a quota managed species in the SESSF, and is therefore not covered under the SESSF HSF (AFMA, 2017a). Nevertheless, while no formal HCR exists, stock status is assessed annually based on updated standardised CPUE trends and recent indications are that the stock is neither overfished nor subject to overfishing (Helidoniotis et al, 2017a). Given the apparent health of the stock, regular monitoring and the overarching framework of the HSP, the species could be considered to have 'generally understood' HCRs in place and tools that are 'available' consistent with medium risk. However, the UoA would not be eligible for these considerations if evidence suggested the stock was in decline. The UoA would be better positioned with a formal HCR in place and pre-agreed decision rules which serve to limit exploitation as PRI is approached.

PI SCORE	**LOW RISK – Blue Grenadier, Blue-eye Trevalla, Orange Roughy – Cascade, Orange Roughy – eastern, Pink Ling – Eastern and Western, Gould's Squid**
	MEDIUM RISK – Gemfish –Western, Ocean Jacket
	HIGH RISK – Gemfish - Eastern

1C: Information and Assessment

CRITERIA: (i) Relevant information is collected to support the harvest strategy.

(a) Range of information

Comprehensive information on fleet composition, catch and other fishery-wide indicators is collected through the monitoring programs described in AFMA (2017A). In 2016-17 fishing season there were 57 trawl vessels in the CTS, although only 34 were active (Helidoniotis et al, 2017a). Catch data are collected through compulsory logsheets and catch disposal records.

Blue Grenadier **LOW RISK**

There is comprehensive information available on the life history, stock structure, fishing fleet composition, catch data and other data to support the harvest strategy for Blue Grenadier.

A recently completed stock structure study using otolith chemistry and otolith shape from Australian specimens (Hamer et al. 2009) has provided evidence that there is more than one stock of Blue Grenadier being fished within the SESSF. Specifically, the otolith indicators provided support for separate stocks of Blue Grenadier being fished by the Great Australian Bight Trawl (GABTS) and Commonwealth Trawl Sector (CTS) of the SESSF. Hamer et al. (2009) also indicated that Blue Grenadier from the western Tasmanian and eastern Bass Strait regions of the CTS were unlikely to be part of one highly mixed south eastern Australian stock.

Other sources of regular monitoring are summarised in AFMA (2017a). Overall, sufficient relevant information on stock structure, stock productivity fleet composition and catch data are available to support the harvest strategy.

Blue-eye Trevalla **LOW RISK**

For assessment purposes, it is assumed that there is one Australian Blue-eye Trevalla stock separate from the New Zealand stock(s). A new report on stock structure was finalized in 2017 (Williams et al, 2017) and will inform a stock structure workshop scheduled for March 2018 (SERAG, 2017).

The biology of Blue-eye Trevalla is well understood and is summarised in two FRDC reports (Baelde 1995; Paulovics and Williams 1995). As with all other Commonwealth fisheries, the composition of the fleet and the distribution of the catch are also well understood.

Notwithstanding the historical difficulties associated with understanding the impact of orca depredation and spatial closures on commercial CPUE, there is sufficient relevant information available for Blue-eye Trevalla to support the harvest strategy.

Orange Roughy – Cascade Plateau **LOW RISK**

Orange Roughy within the Australian Fishing Zone form a single genetic stock (Gonçalves da Silva et al. 2012; in Helidoniotis et al, 2017a) However there is sufficient differentiation between regions that the fishery is managed and assessed as a number of discrete regional management units. The biological traits of Orange Roughy are well understood (summarised in AFMA, 2014a). Orange Roughy mainly occur between the depths of 700-1400 m, where they form dense spawning and feeding aggregations over rugged topographic features such as the edge of the continental shelf and seamounts. They also disperse more widely over smooth and rough bottom. The species is benthopelagic, generally occurring on the bottom but at times rising 50-100 m off the bottom to feed or spawn (Kailola et al., 1993, Branch, 2001).

Spawning aggregations of Cascade Plateau Orange Roughy have been assessed using acoustic survey abundance indices since 2003 (Helidoniotis et al, 2017a). Available information has been adequate to support a Tier 1 stock assessment, which produced a long term RBC of 315t. Although low levels of effort has meant there is limited data to update the assessment, strong monitoring of catch in the context of long term RBC estimates indicates there is sufficient information available to support the current harvest strategy.

Orange Roughy – Eastern Zone **LOW RISK**

Information on stock structure, stock productivity and fleet composition for the eastern zone stock of Orange Roughy appears adequate to support the harvest strategy. An assumption used in the eastern stock assessment model is based on a single stock covering the entire eastern zone, plus orange roughy from the Pedra Branca seamount in the southern zone, because a proportion of southern zone orange roughy are hypothesised to migrate to the main spawning grounds in the eastern zone (St Helens Hill or St Patricks Head) to spawn in winter (Helidoniotis et al, 2017a). Acoustic surveys are run periodically which, together with catch, effort and other data, support updated Tier 1 assessments (e.g. SERAG, 2017). In the most recent assessment, initial analysis indicated that some key productivity parameters (natural mortality, steepness) may be lower than initially assumed and alternate runs using different input parameters were undertaken to test model sensitivity (SERAG, 2017). Models produce stock projections according to HCRs in the HSF. The available information appears sufficient to support the harvest strategy in place.

Pink Ling – Eastern and Western **LOW RISK**

There is sufficient information available on stock structure, productivity and fleet characteristics to support the harvest strategy. Pink Ling are found in temperate latitudes of southern Australia and New Zealand in depths 200–900 m (more commonly at 300–550 m), although ocean currents may carry larvae into shallow shelf waters and inshore (Kailola et al., 1993). Fishers have reported spawning aggregations in relatively shallow waters off western Tasmania (Strahan), and in waters at approximately 230 m off the east coast of Australia (Everard canyon near Lakes Entrance and Gabo Island) (Tilzey, 2000). Sexual maturity occurs at 4–5 years (60–72 cm TL) and longevity is about 28 years. Natural mortality of Pink Ling has been calculated, although there is a paucity of data available on the natural variability of natural mortality and the factors affecting spawning success.

Although genetic variation between the eastern and western parts of the pink ling population has not been found (Ward et al. 2001), clear and persistent differences are seen between the eastern and western areas in catch-rate trends, and size and age which indicates that there are either two separate stocks, or that exchange between eastern and western components of the stock is low (Helidoniotis et al, 2017a). As a result, they have been assessed as separate stocks east and west of longitude 147°E since 2013.

Helidoniotis et al (2017a) report that Pink Ling are under-reported in logbooks, although catches can be scaled up using AFMA's catch disposal records for stock assessment purposes. The available information has been sufficient to undertake a number of Tier 1 stock assessments (e.g. Cordue, 2013; Cordue, 2015), to calculate RBCs based on the HCRs in the SESSF HSF, and to monitor catches against formal and informal (East/West) catch limits.

In 2015-16 fishing season there were 15 active fishers in the OTLF. While public information does not define how many of these used setline, gear-type data are collected. Fishers in the OTLF eastern zone are required to provide daily catch and effort information including catch position, hooks set and retained catch[2]. This information is likely to be sufficient to calculate State catches for the purposes of deducting from the SESSF RBC. A short term observer program was conducted between 2007 and 2009 (Macbeth and Gray, 2016), which provided information on rates of discarding (100% of Pink Ling were retained while using setline gear), although this is not ongoing.

Gemfish – Eastern **MEDIUM RISK**

There is sufficient information to suggest there are two biologically distinct stocks of Gemfish in Australia: an eastern stock and a western stock, separated by a boundary at the western end of Bass Strait (Colgan & Paxton 1997; Moore et al. 2016). Eastern Gemfish are distributed from Cape Moreton, southern Queensland, along the east coast to Bass Strait and the waters off Tasmania. Western Gemfish are distributed from Ningaloo Reef and Geraldton through the Great Australian Bight (AFMA 2015a). Eastern Gemfish are mesopelagic and inhabit waters from 100 m to 700 m but are generally found at 250 m – 500 m deep. They are generally caught close to the sea floor but the fish are likely to move into mid-water at times (Kailola et al. 1993; Pogonoski et al. 2002). Their life history characteristics are well understood and are summarised in the 2015 Eastern Gemfish Rebuilding Strategy (AFMA 2015a).

The composition of the fleet and the distribution of the catch are very well understood, particularly for Eastern Gemfish in recent years when efforts to reduce potential targeting have required scrutiny of catch and effort data to the vessel level.

The current harvest strategy is based around limiting fishing mortality to a 100t incidental mortality limit to allow the stock to rebuild to the limit reference point by 2027 (AFMA, 2015a). While catches and discards in Commonwealth fisheries are relatively well understood, AFMA (2015a) notes that information on catches from NSW commercial and recreational fisheries are unreliable and require improvement. Given the sensitivity of rebuilding targets to constraining catches with the bycatch limit, we have scored this SI medium risk on the basis that current information may not be sufficient.

[2] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/753146/New-South-Wales-Department-of-Primary-Industries-Catch-and-Effort-Logbook.pdf

Gemfish – Western MEDIUM RISK

Good information exists on stock structure and fleet composition for the western Gemfish stock. Catches and effort are estimated across the main fleets and some information on discarding is available through the ISMP. However, GABRAG (2016) noted considerable uncertainty exists in the CPUE data and discarding and there have been challenges in collecting representative data in the GABTS to support stock assessments given the very low levels of effort. These have meant that Tier 1 assessments are unreliable. Moreover, Tier 4 assessments are highly senstive to the inclusion of discards. Accordingly, while some information is available to support the harvest stratgey, consistent with medium risk, at this stage information is insufficient to support the Tier 1 HCR.

Gould's Squid LOW RISK

Notwithstanding difficulties in estimating biomass, sufficient information on stock structure, stock productivity and fleet composition are available to support the harvest strategy (see for example Jackson et al, 2003a,b; Virtue et al, 2011; Noriega et al, 2016; Emery and Bath, 2017, and references therein).

Ocean Jacket MEDIUM RISK

The stock structure of Ocean Jackets is unknown, and as a result the CTS is managed independently of the GABTS of the SESSF. Some information is available on the biological characteristics of the stock (see Helidoniotis et al, 2017a), and there is very good information on the composition and characteristics of the fleet in the CTS. Stock abundance is assessed using standardised CPUE, although the level of discarding is uncertain and the effects of discarding on CPUE trends are unknown (Helidoniotis et al, 2017a). Annual Fishery Independent Surveys (FIS) provide an alternative index of abundance (e.g. Knuckey et al, 2015). Accordingly, some relevant information is available to support the harvest strategy, consistent with medium risk, but important uncertainties remain.

(b) Monitoring and comprehensiveness

Generic monitoring arrangements in place for the SESSF are described in the HSF (AFMA, 2017a). These include:

Logbooks and catch records

AFMA requires fishers to record catch and effort information in logbooks at sea, and in catch disposal records (CDRs) which record the actual landed catch at port. CDRs are considered more accurate than logbook records. Data recorded for each fishing operation includes: the port and date of departure and return; gear type and fishing method; number of fish kept and discarded; and resultant catch and product form (e.g. trunked, gutted, filleted, whole).

The Integrated Scientific Monitoring Program (ISMP)

A key component of the ISMP is the sampling and recording of catches at ports and on board fishing vessels using fishery-independent observers. The purpose of the ISMP is to provide reliable, verified and accurate information on the fishing catch, effort and practice of a wide range of vessels operating inside and, periodically, outside the Australian Fishing Zone. Biological and environmental data are collected on: catch composition including size and weight; amount and type of incidental catch; number of fish kept and discarded; fate of target and non-target species; interactions with TEP species; and fishing effort.

Fishery Independent Surveys (FIS)

The FIS is an industry-based fishery-independent resource survey which provides a timeseries of relative abundance indices for key target species (e.g. Knuckey et al, 2015). A FIS has been conducted for key target species in the SESSF since 2008. Biological and environmental data are collected such as: target species; catch rate (kg/shot); fishing method; and fishing depth. Information which provides a relative abundance index of other main byproduct and incidental catch species is also obtained.

Stock abundance is monitored through models of varying sophistication based on data availability for Tier 1, 3 and 4 species. All UoA removals, including state catches and discards, are estimated in TAC decision making.

Accordingly, for all Tier 1-4 species stock abundance and UoA removals are regularly monitored at a level of accuracy and coverage consistent with the HCR and there is good information on all other removals from the stock.

Blue Grenadier LOW RISK

Stock abundance is monitored through a Tier 1 stock assessment. The asessment was last updated in 2013 and incorporates data to the end of 2012, as well as estimates of spawning biomass from industry-based acoustic surveys (2003 to 2010) and egg survey estimates of female spawning biomass (1994 to 1995) (Helidoniotis et al, 2017a). Catch and effort is monitored through compulsory commercial logbooks and CDRs. Estimates of discards are provided through the ISMP. These data are monitored consistent with the Tier 1 HCR in the HSF.

Blue-eye Trevalla LOW RISK

For Blue-eye Trevalla, stock abundance is regularly monitored consistent with the Tier 4 HCR (e.g. SERAG, 2017). Abundance is assumed to be proportional to standradised CPUE from the dropline and autolongline fisheries. There are a number of sources of uncertainty in the index of abundance including the effects of orca depredation and the impact of fishing closures introduced to protect gulper shark stocks. However, SERAG considers the outcomes of the assessment conservative (SERAG, 2017).

Blue-eye Trevalla is also taken in the CTS and good information exists on stock removals. There are no significant State catches or discards.

Orange Roughy – Cascade Plateau LOW RISK

The Cascade Plateau stock of Orange Roughy is managed according to the 20:35:48 Tier 1 HCR in the HSF. Spawning aggregations of Cascade Plateau orange roughy have been assessed using acoustic survey abundance indices since 2003 (Helidoniotis et al, 2017a). A Tier 1 stock assessment was last updated in 2009 which allowed for the estimation of a long term RBC. Although the assessment has not been updated since 2009, given the very long lived nature of Orange Roughy and the very low levels of effort in recent years, the

existing assessment is arguably sufficient to support the existing HCR.

Orange Roughy – Eastern Zone **LOW RISK**

Stock abundance is monitored through a Tier 1 assessment last updated in 2017 (SERAG, 2017). The assessment includes a new acoustic survey index from 2016, a revised acoustic survey estimate for 2013, catches from eastern zone and Pedra Branca, male and female age composition and abundance indices from acoustic sampling (SERAG, 2017). Catch and effort is monitored through compulsory commercial logbooks and CDRs. Estimates of discards are provided through the ISMP. These data are monitored consistent with the Tier 1 HCR in the HSF.

Pink Ling – Eastern **LOW RISK**

At the Commonwealth level, stock abundance has been monitored through Tier 1 integrated stock assessments since 2003. Assessments are informed by a number of indices including standardised CPUE, length frequency data by method (trawl, line), zone, sampling type (port, onboard), and depth stratum (0-300 m, 300-500 m, 500+ m), and age-frequency data (Cordue, 2015). Monitoring of removals from the SESSF occurs through compulsory catch and effort logbooks and catch disposal records (CDRs), with verification through at sea observer coverage. Industry-based fishery-independent resource surveys have also been run since 2008, which provide a timeseries of relative abundance indices for key target species, including Pink Ling. While the available information is sufficient to support an effective harvest strategy, it is worth noting there is evidence that Pink Ling are under-reported in logbooks (Helidoniotis et al, 2017a). Information from catch disposal records are used to correct logbook catches for stock assessments.

In the OTLF, stock removals are monitored through a daily catch and effort logbook that is submitted monthly. A three year scientific observer program commenced in September 2007, with a final report published in 2015 (Macbeth and Gray, 2016).

For the Commonwealth component of the stock, assessments are undertaken consistent with the HCR and there is good information on removals from the stock. In the OTLF, there is no formal HCR, but assessments of generic status are undertaken annually (e.g. Stewart et al, 2015) and removals from the stock are monitored. Together with periodic Commonwealth stock assessments, monitoring (particularly that occurring in Commonwealth fisheries) is likely to be sufficient to support an effective HCR.

Pink Ling – Western **LOW RISK**

Arrangements for the western stock of Pink Ling are similar to those described above for the Commonwealth components of the eastern Pink Ling stock.

Gemfish - Eastern **MEDIUM RISK**

The Tier 1 HCR in place for Eastern Gemfish under the HSF means the target catch levels have been set at zero, with a 100t incidental catch allowance. This is consistent with the rebuilding strategy. Stock abundance has not been monitored regularly because recent catch rates cannot be used as a reliable index of abundance due to avoidance behaviour of operators (SERAG, 2016). Nevertheless, one at least one indicator (catch) is monitored in the context of previous stock assessment results indicating the stock should rebuild to the limit level by 2025 at 100t catch. In Commonwealth fisheries, removals from the stock (retained and discards) are monitored against the incidental catch allowance. Nevertheless, information on commercial and recreational catches in NSW is less comprehensive (AFMA, 2015a). Accordingly, there is not good information on all other removals from the stock and we have scored this SI medium risk.

Gemfish - Western **MEDIUM RISK**

Stock abundance in the western Gemfish stock has been monitored through periodic Tier 1 and Tier 4 assessments, although there is considerable uncertainty in the outputs (GABRAG, 2016; 2017). Much of the available information support stock assessments comes from the CTS; catches are low in the GABTS so catch rate analysis is generally not informative. Existing assessment outputs have insufficient certainty to support either Tier 1 or Tier 4 HCRs, so a weight of evidence based approach has been used to set TACs, taking into account the outcomes of both Tier 1 and Tier 4 assessments and recent catch history (GABRAG, 2016). Removals from the main sectors (CTS, SHS, GABTS) are monitored, including estimates of total discards. Given some estimate of relative risk to the stock has been assessed in the context of the requirements of the SESSF HSF, and removals are monitored, we have scored this SI medium risk.

Gould's Squid **LOW RISK**

Given the highly variable nature of the stock, the need for abundance monitoring and other assessments (e.g. depletion analysis) is determined by monitoring catch against trigger points in the Commonwealth Arrow (Gould's) Squid Fishery Harvest Strategy. Where effort and catch remain at low levels, no specific abundance monitoring is required (other than nominal CPUE/catch). In Commonwealth fisheries, removals from the stock are monitored using daily catch and effort logbooks, catch disposal records and occasional observer coverage. Removals from the stock by the TSF are monitored through compulsory catch and effort logbooks. In the Commonwealth sector, monitoring arrangements are consistent with the HCR.

Ocean Jacket **MEDIUM RISK**

Monitoring arrangements for Ocean Jackets are similar to those described for Tier 1-4 stocks above. There is no formal HCR for Ocean Jacket, although abundance is monitored through standardised CPUE and fishery-independent surveys (Helidoniotis et al, 2017a). Uncertain levels of discarding of Ocean Jackets mean that CPUE may not be a robust index of abundance. Nevethless, removals from the stock are monitored and at least one indicator of abundance (fishery independent trawl surveys) is monitored with sufficient frequency to support the introduction of catch controls if the stock is deemed to be approaching PRI.

CRITERIA: (ii) There is an adequate assessment of the stock status.

(a) Stock assessment

Blue Grenadier **LOW RISK**

The assessment uses a population dynamics model and includes two sub-fisheries – the spawning sub-fishery that operates during winter (June – August inclusive) off western Tasmania (zone 40), and the non-spawning subfishery that operates during other times of the year and in other areas throughout the year (Tuck, 2008). The model is sex disaggregated. However, male and female fish are assumed to grow at the same rate. Parameter uncertainty is examined through the use of sensitivity tests and by applying the Markov Chain Monte Carlo (MCMC) algorithm (Hastings, 1970; Gelman et al., 1995; in Tuck, 2008). The stock assessment was updated in 2013 (Tuck, 2013), incorporating data to the end of 2012, as well as estimates of spawning biomass from industry-based acoustic surveys (2003 to 2010) and egg survey estimates of female spawning biomass (1994 to 1995). The assessment model included data on catches in the Great Australian Bight Trawl Sector (GABTS) (only 10 t in 2010/11), and there is negligible take of this species by other commercial sectors. Recreational take is also negligible.

The assessment is appropriate for the stock and estimates stock status relative to reference points that are appropriate to the stock and can be estimated.

Blue-eye Trevalla **LOW RISK**

The assessment for Blue-eye Trevalla is a Tier 4 assessment and is based on standardized commercial CPUE data (Helidoniotis et al. 2017a). The assessment assumes one blue eye trevalla stock across the entire SESSF. While the assessment is considered adequate to assess stock trends, there has historically been some uncertainty associated with the impacts that orca depredation and spatial closures for dogfish have had on CPUE trends in recent years. The standardized CPUE was re-assessed in 2015 using a revised catch per hook metric in the Tier 4 analysis in place of the previously used catch per record/day (AFMA, 2015b). SlopeRAG considered the updated analysis to be a better reflection of CPUE in the early part of the fishery. The updated analysis confirmed that the previous Tier 4 assessment was conservative in nature, and that Blue-eye Trevalla are likely to be less depleted than the 2014 assessment indicated (SERAG, 2017). Tier 4 assessments do not assess the probability of being below the reference point. However, the RAG considers the current assessment to be conservative.

Tier 4 species use CPUE targets as a proxy of biomass targets (AFMA, 2017a). The Tier 4 target reference point is the level of CPUE assumed to produce a spawning biomass of 48 per cent of unfished levels. The limit reference point is 20 per cent of unfished levels. Based on this information, the stock assessment appears to be appropriate for the stock and it is assessed against reference points that are appropriate for the stock and can be estimated.

Orange Roughy – Cascade Plateau **LOW RISK**

Separate models have been developed for the Cascade Plateau and Eastern Zone Orange Roughy stocks. Both models are underpinned by estimates of spawning biomass from acoustic surveys. Spawning aggregations, and thus acoustic survey results, appear to be strongly impacted by the environment on the Cascade Plateau (Helidoniotis et al, 2017a). As a consequence, the largest survey result rather than the average, from surveys conducted between 2003 and 2009 were used for modelling purposes. To offset this increased uncertainty, the relatively light scale and intensity of the catch history, combined with the optimistic model projections that are well above target levels, provides confidence that the stock assessment is appropriate for the stock and is assessed against reference points that are appropriate for the stock and can be estimated.

Orange Roughy - Eastern Zone **LOW RISK**

In contrast, the Eastern Zone fishery was heavily fished historically, with biomass estimates declining as low as 0.1 B_0 in the 1990s. There is evidence that compensatory factors in the life history of this stock have aided recovery to levels above the limit reference point (0.2 B_0). Given the Orange Roughy Rebuilding Strategy (AFMA 2014a) allows for some fishing of stocks above 0.2 B_0, there has been considerable effort afforded to modelling of the Eastern Zone stock. This includes a Markov chain Monte Carlo (MCMC) analysis of the probabilities around various model outcomes (e.g. Upston et al. 2014). The assessment was most recently updated in 2017 and incorporates new a ageing error matrix, new age data for 2012 and 2016, a new acoustic survey index from 2016, a revised acoustic survey estimate for 2013, catches from eastern zone and Pedra Branca, male and female age composition and abundance indices from acoustic sampling (SERAG, 2017). An alternate case of the model was run to test sensitivity to alternate assumptions of natural mortality and steepness (SERAG, 2017). Notwithstanding relatively wide confidence intervals around median stock estimates, the model appears appropriate to the stock and estimates status relative to reference points in the HSF. SERAG used the outputs of the model to recommend RBCs in 2017 (SERAG, 2017).

Pink Ling – Eastern and Western **LOW RISK**

Pink Ling has been assessed using quantitative, model-based (Tier 1) stock assessments since 2003. Annual integrated, age-structured assessments using catch-at-age data and standardised CPUE abundance indices were run using Stock Synthesis software from 2006 to 2012. The 2012 Stock Synthesis model produced by Punt et al. (2012) was updated again in 2013. The Cordue (2013) model was taken through to full MCMC probability analysis for the eastern stock to provide estimates of probabilities around results. SlopeRAG agreed to use this as the base-case model for providing advice. Results of the CASAL model indicated the biomass of the western stock of Pink Ling to be stable at around 0.58 B0, ranging from 0.41 to 0.86 B0 in MCMC analyses. The biomass of the eastern stock of Pink Ling was estimated to be around 0.25 B0, ranging from 0.17 to 0.38, and trending upwards. The Cordue (2013) CASAL based model was updated in 2015 (Cordue, 2015). Changes to the model structure and data inputs are summarised in AFMA (2015b) and included further analysis of eastern selectivity and estimates of natural mortality (M) following MCMC runs.

The assessments are appropriate for the stock and estimates of stock status relative to reference points are appropriate to the stocks of Pink Ling, and these estimates are available.

Gemfish - Eastern **MEDIUM RISK**

Eastern Gemfish is managed as a Tier 1 species with an integrated stock assessment model last updated in 2010 (Little and Rowling, 2010). Spawning stock biomass was estimated at 0.156 SB_0, with biomass projections based on a scenario of zero catch and 100 t

catch per year. The assessment is appropriate for the stock and estimates status relative to reference points in the HSF. Nevertheless, the age of the assessment model (i.e. 2010) means there is some uncertainty around the extent to which the outcomes reflect current stock status. Moreover, given changes in the characteristics of the fishery (e.g. avoidance behaviour by fishers and low levels of catch) there is uncertainty around the usefulness of some previously used indices (e.g. CPUE). Nevertheless, the exitsing model together with other information (e.g. incidental catch levels) has been sufficient to assign a status relative to generic reference points (e.g. overfished/not overfished). Accordingly, this SI is scored as medium risk.

Gemfish - Western MEDIUM RISK

An integrated stock assessment model (tier 1) was developed for western Gemfish in the CTS and the GABTS in 2011, and was last updated in 2016 (GABRAG, 2016). The model was run using the most recent version of Stock Synthesis and incorporated new CPUE, age and length data. GABRAG noted the CPUE data used to inform the assessment was unreliable and there were a range of other uncertainties (e.g. length frequency sampling is unrepresentative, the small volume fish being caught in the GABTS is likely to be unrepresentative of the western Gemfish resource in the GAB) (GABRAG, 2016). Standardised CPUE-based Tier 4 assessments have also been completed for the stock although these are highly sensitive to the inclusion of discards. Given the uncertianties in current assessments, a Tier 5 assessment was explored in 2017 although outputs were not presented (GABRAG, 2017).

In light of the uncertainties in Tier 1 and Tier 4 assessments, GABRAG (2016) used a weight of evidence based approach to assess the generic risk of current levels of fishing mortality on the stock and concluded that there was little risk of the stock declining below the limit reference point. To that end, notwithstanding uncertainties in the available assessments, the existing information has been sufficient to estimate status against generic reference points which appropriate to the stock. Accordingly, we have scored the stock medium risk. Nevertheless, we note the UoA would be substantially better placed against this SI with a more reliable assessment.

Gould's Squid MEDIUM RISK

No formal stock assessment exists for this stock (Noriega et al, 2016). AFMA (2009) note that given the high natural variability of arrow squid, the standard stock assessment techniques used for fish such as teleosts or chondrichthyans are not appropriate. Current knowledge of the southern squid resource is insufficient to allow biomass or suitable proxies for reference points to be estimated. Nevertheless, Noriega et al (2016) and Emery and Bath (2017) use alternative empirical indicators including catch rates and total catch to estimate stock status using a weight of evidence approach. This approach estimates stock status relative to generic reference points appropriate to the species category.

Ocean Jacket MEDIUM RISK

As a bycatch species, Ocean Jacket has not been the subject of formal stock assessments. Stock status is assessed using standardised CPUE, although there are acknowledged uncertainties in the assessment relating discarding and differences in catch rate across different areas of the CTS (Helidoniotis et al, 2017a). An independent index is available through the fishery-independent surveys (e.g. Knuckey et al, 2015). Notwithstanding the uncertainties, the available information is sufficient to assess status relative to historical levels and make a judgement of likely status against generic reference points (e.g. overfished/not overfished; Helidoniotis et al, 2017a).

(b) Uncertainty and Peer review

Stock assessments for all Commonwealth managed stocks are subject to peer review and judgement (i.e., ability to reject the assessment) in the relevant Resource Assessment Group (RAG) and the South East Management Advisory Committee (SEMAC).

Blue Grenadier LOW RISK

The assessment identifies and discusses the main sources of uncertainty (e.g. discards, natural mortality, large fluctuations in CPUE in the winter spawning fishery; Tuck, 2008), has taken advice from external experts in its development and is subject to review through the AFMA SERAG.

Blue-eye Trevalla LOW RISK

Blue eye trevalla is assessed using standardised CPUE only. Considerable uncertainties have been identified in the historical CPUE time series (e.g. the impact of orca depredation, spatial closures for dogfish, changes in fisher behaviour and gear type; SlopeRAG, 2015), however some of the main uncertainties (e.g. influences of 'catch per record' CPUE) were addressed through the recent move to catch per hook based standardisation (AFMA, 2015b). Other key uncertainties (e.g. orca depredation) were assessed under alternative Tier 4 analyses. Under these analyses, loss of catch due Orca interactions was treated as a discard (AFMA, 2015b). The Tier 4 with Orca-influenced catch rates suggested that the stock is more productive than the base case analysis that used non-whale affected catch rates. The RAG recommended that Orca-influenced catch rates not be applied to the Tier 4 analysis used to set the RBC. The RAG noted that the RBC will be a conservative estimate because these data are omitted. However, if depredation rates have declined exponentially that could explain the CPUE increase observed without any change in stock abundance. On this basis, it is arguable that uncertainties are taken into account, and the assessment is subject to a form of peer review through SERAG.

Orange Roughy – Cascade Plateau LOW RISK

Orange Roughy assessments rely on acoustic surveys of spawning biomass. Uncertainty in the impacts of environmental drivers on acoustic survey results have been incorporated into the assessment for the Cascade Plateau stock. Assessments are reviewed through the relevant RAG.

Orange Roughy – Eastern Zone LOW RISK

The most recent assessment identifies a number of key uncertainties including values of natural mortality and steepness (SERAG, 2017). Alternative model runs are conducted to test sensitivity, with outputs from alternate runs presented alongside RBCs from the

base case model. Model structure, inputs and outputs are reviewed through SERAG.

Pink Ling – Eastern and Western **LOW RISK**

The assessment identifies and takes into account the main sources of uncertainty (Cordue, 2015). Stock assessments are subject to peer review and judgement (i.e., ability to reject the assessment) in the SERAG.

Gemfish - Eastern **MEDIUM RISK**

Eastern Gemfish are subject to a Rebuilding Strategy that requires annual assessment and review. The Eastern Gemfish stock assessment identifies and takes into account the main sources of uncertainty, albeit that the assessment is now eight years old. Key uncertainties in more recent data (e.g. avoidance behaviour by fishers is likely to mean catch rate data is unreliable) are identified in generic assessments of stock status (i.e. overfished/not overfished) but have not been taken into account in a more recent assessment.

Gemfish - Western **MEDIUM RISK**

Uncertainties in the existing Tier 1 and Tier 4 stock assessments have been identified, but not yet taken into account. A Tier 5 assessment was explored in 2017 (GABRAG, 2017).

Gould's Squid **LOW RISK**

The main uncertainties are taken into account in the weight of evidence approach used by Noriega et al (2016). Although not a formal assessment, their conclusions are subject to external assessment.

Ocean Jacket **MEDIUM RISK**

Uncertainties in the informtaion underlying assessments of stock status are identified (e.g. uncertain levels of discarding), but not yet accounted for. Methods of standardising CPUE and outputs are subject to review through SERAG.

PI SCORE	**LOW RISK – Blue Grenadier, Blue-eye Trevalla, Orange Roughy – Cascade, Orange Roughy – Eastern, Pink Ling – Eastern and Western, Gould's Squid**
	MEDIUM RISK – Gemfish – Eastern and Western, Ocean Jacket

COMPONENT 2: Environmental impact of fishing

2A: Other Species

CRITERIA: (i) The UoA aims to maintain other species above the point where recruitment would be impaired (PRI) and does not hinder recovery of other species if they are below the PRI.

(a) Main other species stock status **MEDIUM RISK**

The intent of this scoring issue is to examine the impact of the fishery on 'main' other species taken while harvesting the target species. 'Main' is defined as any species which comprises >5% of the total catch (retained species + discards) by weight in the UoA, or >2% if it is a 'less resilient' species. The aim is to maintain other species above the point where recruitment would be impaired and ensure that, for species below PRI, there are effective measures in place to ensure the fishery does not hinder recovery and rebuilding.

In this assessment, because the impact of the fishery have been comprehensively assessed for each non-target species occurring in the fishery, main other species are assessed as those species that:

1. constitute > 5% of the catch (by weight) or constitute > 2% of the catch and are 'less resilient'; or
2. were assessed as at least precautionary high risk during the Level 3 SAFE ERA (Zhou et al. 2012).

Species that constitute >5%, and >2% of the catch

Observer data indicates that otter trawlers directly interact with 533 species, 360 of these are teleosts, 39 are skates/rays and 63 are sharks (Walker et al., 2006). However, the fishery regularly retains around 30 target species and over 100 byproduct species. Knuckey and Upston (2013) report that "*varying, but significant, levels of the catch (up to 50% by weight of quota and non-quota species combined) are caught and discarded in the "market" fishery. Although some commercial species are discarded, most of the discards are comprised of small fish species with little or no commercial value*".

Average annual retained catch in the CTS (inclusive of the Danish seine sector) during the three year period between 2013 and 2015 was 10,604t, based on catch disposal records. Species accounting for >5% of the retained catch, and not assessed here as target species, include Tiger Flathead (24.1%) and Eastern School Whiting (6.3%). Others which account for >2% of the retained catch include Silver Warehou (4.4%) and Mirror Dory (2.5%), although neither of these are likely to be considered 'less resilient' and both have recently been classified as neither overfished, nor subject to overfishing (Helidoniotis et al, 2017a). Eastern School Whiting are caught almost entirely by the Danish Seine sector of the CTS and thus do not need to be assessed here. Accordingly, we have assessed Tiger Flathead as a main other species, noting that all other species have been assessed through the SESSF ERA process discussed below.

<u>Flathead</u>

For SESSF management purposes, 'flathead' refers to a group of at least eight flathead species consisting predominantly of tiger

flathead (*Platycephalus richardsoni*), but sand flathead (*P. bassensis*), southern flathead (*P. speculator*), bluespot flathead (*P. caeruleopunctatus*) and gold-spot or toothy flathead (*P. aurimaculatus*) are also caught regularly. Tiger flathead remains the dominant species in the catch and is the only species assessed in stock assessments at this stage. Data from onboard observers support catch data and indicates that *P. richardsoni* comprises over 95% of the SESSF catch of flathead (Morison et al. 2013); the results of aproductivity-susceptibility analysis suggest that the productivity of Tiger Flathead is not significantly different to the other five species regularly encountered. It is therefore reasonable to assume they won't be disproportionately impacted by stock management arrangements directed at tiger flathead.

The most recent assessment of flathead estimated spawning stock biomass in 2014 to be 11 572 t or 50 per cent of the unfished (1915) level (Day & Klaer, 2014). The spawning biomass that supports maximum sustainable yield of Tiger Flathead was estimated to be 32 per cent of the unfished biomass. The biological stock is not considered to be recruitment overfished (Helidoniotis et al, 2017a). The available evidence indicates that the stock is highly likely to be above PRI.

Species assessed as at least precautionary high risk during the Level 3 SAFE ERA (Zhou et al. 2012).

Seventeen species or species groups were assessed as at least precautionary high by Zhou *et al.* (2012). A subsequent analysis demonstrated that the SAFE assessment significantly overestimated the risk to Bight skate, with the risk reduced from Extreme High Risk to Medium risk following an improved, data-intensive methodology (Zhou *et al.* 2013). However, given that some uncertainty still remains on the stock status of 16 other species, the measures in place to ensure the UoA does not hinder recovery or rebuilding are considered here.

It is worth noting that this assessment evaluates 'other species' across the CTS as a whole. Future assessments may benefit from greater depth and spatial separation of other species to account for the differences in other species catch composition across different areas and depth zones in the fishery.

AFMA employs an Ecological Risk Assessment for the Effects of Fishing (ERAEF) process for each Commonwealth fishery to determine risks posed by fishing to individual species. These outcomes are used here as a proxy for status of main other species in relation to PRI. Under the assessment framework used for this risk assessment, where there is evidence that a species/stock may be below PRI, measures must in place that are expected to ensure that the UoA will not hinder recovery and rebuilding for the UoA to meet the medium risk SG.

The AFMA ERAEF is a four step process:

- Level 1 analysis (SICA – Scale Intensity Consequence Analysis)
- Level 2 analysis (PSA – Productivity Susceptibility Analysis)
- Level 2 analysis (Residual risk PSA)
- Level 3 analysis (SAFE - Sustainability Assessment for Fishing Effects)

The first SAFE assessment was conducted in 2007 (Zhou *et al.* 2007). From this and previous Level 1 and Level 2 analyses, a Level 2 Residual Risk Assessment (AFMA 2012a) was published. In 2012, an updated SAFE assessment was completed (Zhou *et al.* 2012) for the CTS that identified a suite of additional species, including main other species, as precautionary high risk or greater risk. In 2014, residual risk guidelines were applied to the outcomes of the 2012 SAFE assessment for all teleost and chondrichthyan species (AFMA, 2014b).

At the completion of this process, a final list of 9 non-ETP species were identified as priorities to be treated through the SESSF Ecological Risk Management (ERM) Strategy 2015 (AFMA, 2015c) (Table 4).

Table 4: Priority species for the CTS identified through the ERA process (AFMA, 2015c).

Common name	Species name	Highest level of Assessment	Risk rating
Dipturus australis	Common Skate	Level 3 SAFE	Extreme High Risk
Squalus mitsukurii	Green-Eyed Dogfish	Level 3 SAFE	(Greeneye spurdog listed as Extreme High Risk)
Azygopus pinnifasciatus	Righteye Flounder	Level 3 SAFE	Precautionary Extreme High Risk
Dipturus canutus	Grey Skate	Level 3 SAFE	Precautionary Extreme High Risk
Urolophus sufflavus	Yellow-backed Stingaree	Level 3 SAFE	Precautionary Extreme High Risk
Hydrolagus lemurs	Bight Ghost Shark	Level 3 SAFE	High Risk
Trygonorrhina fasciata	Eastern Fiddler Ray	Level 3 SAFE	High risk
Centrophorus squamosus	Nilson's Deepsea Dogfish	Level 3 SAFE	Precautionary High Risk
Ventrifossa nigrodorsalis	Rattail	Level 3 SAFE	Precautionary High Risk

While there is uncertainty about the current status of the high-risk species in relation to PRI, the CTS has a number of measures in place to monitor, assess and manage impacts. These are outlined in the SESSF Ecological Risk Management (ERM) Strategy (AFMA, 2015c). These include:

- Overall effort limitations through TACCs on main target species (Pitcher et al [2015] estimated around 6% of the continental shelf and slope area in the South East Marine Region [SEMR] was exposed to trawl effort annually);
- Spatial closures through both fisheries and marine parks legislation - in 2007, a network of 13 marine protected areas was declared in the South-east marine region, with reserves that cover an area of 388,464 km^2 across a depth range of 40m - 4600m;
- Species specific measures including:

- Upper-Slope Dogfish Management Strategy which includes:
    - a prohibition on the take of Harrisson's dogfish and southern dogfish (ETP species);
    - area closures (see AFMA, 2012b, 2015c);
    - monitoring obligations through observers or electronic monitoring;
    - a limit for bycatch of Harrisson's and southern dogfish when undertaking permitted types of line fishing in specific areas: and
    - handling practices to improve post capture survival for released sharks.
- Shark and Ray Handling Practices: A Guide for Commercial Fishers in Australia - the shark handling guide was developed by AFMA to improve the handling of non-target shark species and to provide background material on fisheries related injuries and research on survivability.
- National Plan of Action for the Conservation and Management of Sharks

- Fishery-specific spatial closures - AFMA (2015c) list 5 fishery-specific area closures for dogfish, and a further 11 closures for protection of: school and gummy shark habitats and breeding stock, Orange Roughy stocks, white sharks, Australian Sea Lions, juvenile scalefish, various endemic species and important habitats; and
- Periodic ecological risk assessments of all non-quota species taken in the fishery.

Accordingly, while there remains some uncertainty on the status of nine non-ETP species assessed as high risk or greater by AFMA (2014b) in relation to PRI, the fishery has measures in place that could be expected to ensure the UoAs do not hinder recovery and rebuilding if necessary. The strong recent history of the management agency in taking action to address known high risk areas (e.g. dogfish closures, nil TACs, etc) provides some confidence that the outcomes of the ERA process will be acted on. Further, ongoing improvements in the ERA methodology have resulted in the downgrading of risk ratings to at least some species (e.g. Bight skate) as more information is known, and application to other high risk species may produce similar results (Zhou et al, 2013). On this basis, the UoAs meet the medium risk SG.

CRITERIA: (ii) There is a strategy in place that is designed to maintain or to not hinder rebuilding of other species.

(a) Management strategy in place — LOW RISK

AFMA has a comprehensive strategy in place to manage the impacts of the fishery on both target and non-target species.

The *SESSF Management Plan 2003* sets out clear objectives for the management all species impacted by the fishery (i.e. that the fishery is "*conducted in a manner consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle and, in particular, the need to have regard to the impact of fishing activities on non-target species and the long-term sustainability of the marine environment*"), as well as actions by which the objectives will be achieved. In relation to non-target species these include:

- *Monitoring through a structured program, the impact of fishing on fish species, any other species that are caught as by-catch, ecologically-related species and the marine environment, analysing the impacts and implementing any strategies necessary to ensure: (i) the sustainability of those species and the marine environment; and (ii) that by-catch limitations are not exceeded;*
- *periodically checking the accuracy and consistency of information kept in relation to the fishery*

For commercially-important species managed under quota, a HSF is applied which establishes evidence-based catch limits according to a clear framework of reference points and harvest controls rules (AFMA, 2017a). Evidence-based RBCs and TACs are set based of regular stock assessments, with additional precaution built into the TAC setting process for stocks for which information is limited. Flathead is managed as a Tier 1 species under the HSF. The strategy is expected to maintain the stock at levels which are highly likely to be above the PRI.

For all other species, AFMA assesses the potential impact of the fishery through the application of the ecological risk assessment process described under criterion 2A(i)(a) above. In addition, in the SESSF, the level 3 SAFE assessment was extended by Zhou *et al.* (2013) to provide a greater understanding of the cumulative risk posed by multiple fisheries accessing the same species. A Residual Risk Assessment was also undertaken on the Level 3 SAFE outcomes (AFMA, 2014b).

Species identified as high risk through the ERA process are subject to specific management measures to better understand or limit impacts under the SESSF ERM Strategy (AFMA, 2015c). In the future, measures to manage impacts on non-target species will be guided by the AFMA Bycatch Strategy 2017-2022 (AFMA, 2017b).

Measures in place to monitor and manage impacts on non-target species in the CTS include:

- Limited entry;
- Catch controls through TACs and ITQs;
- Gear restrictions (e.g. >90mm single mesh twine);
- Bycatch reduction devices;
- Monitoring through logbooks and catch disposal records (CDRs);
- Monitoring through VMS;
- Observer coverage through the ISMP;
- Spatial closures; and
- Depth closures (although they are currently in review).

The harvest strategy framework, the ERA process, and the implementation of on-water actions through the SESSF ERM Strategy is likely to be considered as at least a partial strategy that is expected to maintain or to not hinder rebuilding of the main other species at/to levels which are highly likely to be above the PRI.

(b) Management strategy evaluation — MEDIUM RISK

For flathead, Tier 1 assessments estimating the stock to be above target levels provide an objective basis for confidence that the

strategy in place will work.

For species identified as high risk through the ERA process, the SESSF ERM Strategy 2015 (AFMA 2015c) provides the framework for addressing impacts. These measures have been developed in consultation with SEMAC and other experts (e.g. CSIRO) as necessary. The measures are considered likely to work based on plausible argument, and therefore meet the medium risk SG, although for many there is yet to be an objective basis for confidence that the strategy will work and is being implemented successfully.

(c) Shark-finning **LOW RISK**

Shark finning at-sea is illegal in Commonwealth fisheries. All fisheries are subject to Fisheries Management Regulation 9ZO that makes it an offence for the caudal lobe, caudal fin, pectoral fin and dorsal fin to be removed from the shark at sea before it is in the possession of a fish receiver. Existing levels of observer coverage (129 days in 2016-17) and compliance monitoring is probably sufficient to verify the absence of shark finning to low risk levels.

CRITERIA: (iii) Information on the nature and amount of other species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage other species.

(a) Information **LOW RISK**

The CTS is a multi-species fishery with numerous target species. AFMA's ERA process, in addition to information provided through daily catch and effort logbooks, catch disposal records, protected species reporting, observer monitoring and VMS monitoring provides quantitative information to assess the UoA related mortality on other main species, and to support a management strategy. Observers collect detailed information on boat activity catch composition, as well as collection of data and samples for research programs and monitoring compliance of the boat with its fishing concession. Observer coverage rates are developed by AFMA in association with the RAGs. In 2016-17, observer coverage was 129 sea days, allocated across different geographical regions and times of the year (Helidoniotis et al, 2017a).

The risks that the otter trawl sub-fishery of the CTS poses to the sustainability of the marine ecosystem have been assessed through the application of a progression of risk assessment methodologies listed below:

- 2008 - ERA for effects of fishing completed to Level 2 Productivity Susceptibility Analysis (PSA) for non-teleost and non-chondrichthyans, habitats and communities, and to Level 3 Sustainability Assessment of Fishing Effects (SAFE) for all teleost and chondrichthyan species.
- 2010 - Application of residual risk guidelines to Level 2 PSA results for all non-teleost and non-chondrichthyan species.
- 2012 - Re-assessment by application of residual risk guidelines to Level 2 PSA results for non-teleost and non-chondrichthyan species; re-assessment of Level 3 SAFE for all teleost and chondrichthyan species.
- 2014 - Application of residual risk guidelines to Level 3 SAFE results for all teleost and chondrichthyan species.

Further information is available in the SESSF ERM Strategy (AFMA, 2015c).

Notwithstanding uncertainties around the population status of some high risk species, these monitoring programs provide qualitative and some quantitative information that is adequate in most cases to assess the impact of the UoAs on other species and to detect increases in risk. The main uncertainties, currently being addressed through the SESSF ERM Strategy, is the absence of information on some precautionary extreme high risk and high risk species.

PI SCORE	LOW RISK

2B: Endangered Threatened and/or Protected (ETP) Species

CRITERIA: (i) The UoA meets national and international requirements for protection of ETP species.
The UoA does not hinder recovery of ETP species.

(a) Effects of the UoA on populations/stocks

Blue Grenadier, Blue-eye Trevalla, Pink Ling – eastern, Gould's Squid, Ocean Jacket **PRECAUTIONARY HIGH RISK**

Orange Roughy – Cascade, Orange Roughy – Eastern, Gemfish – Eastern and Western, Pink Ling - Western **MEDIUM RISK**

At least 219 ETP species are thought to occur in the area of the CTS, including: three species of sharks, 74 species of seabirds, 51 species of marine mammals, 10 species of marine reptiles and 81 species of bony fish. (AFMA, 2015c). Protected species interactions are reported on the AFMA website: http://www.afma.gov.au/managing-our-fisheries/environment-and-sustainability/protected-species/.

For all ETP species, the risk that the fishery poses has been assessed through the application of the ecological risk assessment process described under criterion 2A(i)(a) above. Species identified through the ERA process as high risk are subject to specific risk treatment under SESSF ERM Strategy 2015 (AFMA, 2015c). These species are:

1) Australian fur seal (*Arctocephalus pusillus doriferus*);
2) Albatrosses – multiple species

A further five species are listed as 'conservation dependent' under the EPBC Act and therefore could be considered 'recognised' under national environmental legislation (MSC, 2014). These include:

3) Eastern Gemfish (*Rexea solandri*);

4) Blue Warehou (*Seriolella brama*);
5) Orange Roughy (*Hoplostethus atlanticus*);
6) School Shark (*Galeorhinus galeus*);
7) Harrison's Dogfish (*Centrophorus harrisoni*); and
8) Southern Dogfish (*C. zeehaani*).

Orange Roughy is assessed here as a target species and is not taken while targeting other species assessed here as target species. Accordingly, it is not considered further.

Pinnipeds (Low risk)

The areas fished by the SESSF overlap with the distributions of the Australian fur seal (*Arctocephalus pusillus doriferus*), New Zealand fur seal (*A. forsteri*) and Australian sea lion (*Neophoca cinerea*). Fur seal populations have recovered substantially following heavy harvesting in the 18th and 19th centuries, with conservative best estimates of current abundance of 87,424 (S.E. 10,415) published in 2016 (Mackay et al. 2016). Australian sea lions are currently listed under the EPBC Act as vulnerable and there is a formal recovery strategy in place under the EPBC Act (DSEWPC, 2013). Only the Australian fur seal was identified as high risk from the CTS sector.

There is a potential for interactions with Australian fur seals (AFSs) in the CTS wet-boat sector (wet-boats being non-freezer operations) as identified by the ERA process. Early studies suggested that more than 700 seals may be caught annually in the wet-boat sector of the CTS (Stewardson and Aust. 2007). Helidoniotis et al (2017b) report that "*in 2016, 136 pinniped interactions were reported in CTS and GHTS logbooks: 18 with Antarctic fur seals, 2 with Australian sea lions, 6 with New Zealand fur seals, 71 with Australian fur seals and 39 with seals of unknown species. This is a slight increase from the 134 interactions reported in 2015. Of the 136 reported pinniped interactions, 14 of the Antarctic fur seals, 1 Australian sea lion, 5 of the 6 New Zealand fur seals, 65 of the 71 Australian fur seals and 33 of the 39 unspecified seals were reported to be dead*". Of the interactions in the CTS in 2016, 89% were in the demersal trawl sector, with the remaining interactions in the Danish seine or mid-water trawl sectors.

Mackay et al. (2016) estimated Potential Biological Removal (PBR) which is, conceptually, the maximum number of anthropogenic mortalities a marine mammal population can sustain while still allowing that "stock" to reach or maintain its optimum sustainable population. The method is sensitive to a range of recovery factors (RF) with estimates of PBR ranging from 2,623 to 4,721 for RF values of 0.5 to 0.9, respectively. In other words, the population could sustain human induced mortalities of at least 2,600 seals annually with a high degree of confidence in this measure.

Koopman et al. (2014) examined the potential for the use of shortened cod-ends to reduce interactions. They report that "*interactions with a total of 44 AFSs were recorded during the 1,117 fishing operations conducted by the Western Alliance during 14 February 2013 to 17 August 2014. This information is valuable as it the single-most long-term verifiable reporting of TEP interactions of a vessel in the CTS. Of the total of 44 AFSs, 9 were recorded as released alive, while 35 were dead*". Extrapolation of these figures to total trawl effort suggests that the annual level of seal interactions would be around 500. While this rate of interaction suggests there is a discrepancy with logbooks, the level of mortality is well below the estimated PBR for the species. Therefore, the direct effects of the fishery on the species are known and are highly likely to not hinder recovery of the species.

Cetaceans (Low risk)

In 2016, one interaction with a dolphin was reported in the CTS (Helidoniotis et al, 2017b). Dolphin mortalities are a rare event and this is verified by independent observers. Accordingly, it is highly likely the fishery is not preventing the population from recovering.

Seabirds (Medium risk)

For trawl fisheries, seabirds are vulnerable to injury as a result of striking the trawl warps during fishing operations, and this occurs predominantly when offal are being discarded (e.g. Favero et al. 2011). Phillips et al. (2010) analysed observer data from the CTS in 2006 which indicated that 31 shy albatross and 9 black-browed albatross were "captured" from 856 observed trawls. One of the limitations of assessing sea bird mortalities from warp strikes is that it is difficult to determine the proportion that survive. Phillips et al. (2010) chose to include all heavy interactions with the warp wire as "captures" even if the bird initially survived the interaction, due to uncertainty in post-interaction mortality, potentially resulting in over-estimation of the mortality rate. However, it was also noted that the observer data were not collected with the explicit aim of recording seabird interactions and thus some interactions were likely to have been missed. Phillips et al. (2010) concluded that "*if the numbers observed in the 2006 calendar year are typical of other years, then reducing the seabird mortality in trawl fisheries (namely the CTS) should be a priority for the development of mitigation measures.*"

Phillips et al. (2010) also highlighted a discrepancy between the reporting of seabird interactions in commercial logbooks compared to the rates reported by observers. This issue remains, with Helidoniotis et al (2017b) reporting that "*seabird interactions are probably under-reported for numerous reasons, including that it may be difficult to constantly observe seabirds interacting with fishing gear and vessels, and that seabirds may not have visible injury after interactions such as warp strikes*."

In 2012, a Residual Risk Assessment of the Level 2 ERA was conducted (AFMA 2012a) that included assessments for seabirds. The two species assessed by Phillips et al. (2010), shy albatross and black-browed albatross, were both assessed as medium risk. Several other albatross species were identified as high risk from the initial PSA and were reduced to medium risk in the residual risk assessment taking into account the impacts of management measures introduced for these species. The group "Albatrosses – species unidentified" was assessed as high risk after the PSA and remained high risk after the residual risk assessment. The justification for retaining the high risk was "*Twelve Albatrosses (species unidentified) were caught or interacted with in 2010 and 16 in 2011; all except one animal were deceased. It has been considered that it is a TEP species and the number of interactions that have occurred and no guidelines were applied which means the risk rating remains the same*." Thus, the key outcome from the Level 2 Risk Assessment was that the group of 'unidentified albatrosses' were the only high risk category. It should be noted that this analysis did not include the new gear technologies that significantly reduce the probability of interaction.

Since 2010, AFMA and SETFIA have led several research projects on various approaches to mitigate the impact on seabird populations, and in the last two years several new devices have significantly and sequentially reduced the level of seabird interactions. In 2017, two new technologies (water sprayers and bird bafflers) have been legislated that are expected to result in >90% reductions in seabird interactions (and by extension mortality). Given that the only high risk species are the "unknown" group, the issue remains one of a

lack of information rather than known risks to these species. In the absence of this information, at this time it cannot be argued that the fishery is highly likely to not hinder recovery of all the albatross species. However, given the low numbers of annual mortalities in the unknown category, and the recently improved gear technologies that have been and are about to be implemented, there is a plausible argument that the CTS is likely to not hinder recovery of these unknown species and thus this SI is assessed as medium risk.

Upper-slope Dogfishes (Gulper sharks) (Medium risk)

Upper-slope dogfish (or 'gulper sharks') were targeted in the SESSF, GABTF and NSW trawl fisheries in the 1980s and 1990s and this resulted in the stocks being substantially depleted. Targeted fishing appeared to have effectively ceased in 2002 due to declining catch rates (Wilson et al. 2009), but very small quantities are still taken as byproduct (within trip limits).

Given the depleted state of the species (estimated to be <5–10 per cent of unfished levels on the upper slope off New South Wales, and unknown in other areas) the level of fishing mortality was considered too high to enable rebuilding, and three species of upper-slope gulper sharks (Harrison's, Southern and Endeavour dogfish) were nominated for listing under the EPBC Act in 2008. The Endeavour Dogfish was found to be ineligible for listing in 2011 however, in 2013, Harrison's and Southern Dogfish were listed as 'conservation dependent' after meeting the eligibility criterion for the 'endangered' listing. A rebuilding strategy is a requirement of the listing.

The Upper Slope Dogfish Management Strategy 2012 forms the basis of the rebuilding strategy and is designed specifically to rebuild the populations of Harrisson's Dogfish and Southern Dogfish above a limit reference point (B_{LIM}) of B_{25} (25% of unfished biomass) (AFMA, 2012b). The recovery time to B_{25} is estimated at around 86 years for Harrisson's Dogfish, and 62 years for Southern Dogfish. The Strategy relies on a new network of spatial closures supplemented by a range of operational measures including regulated handling practices, 100% monitoring, move-on provisions and no retention of gulper sharks. The new closure network will provide protection, across the depth range, of 25% of the carrying capacity weighted core habitat of the continental slope stock of Harrisson's Dogfish, 16.2% of the east stock of Southern Dogfish and 24.3% of the central stock of Southern Dogfish, in AFMA-managed waters. This closure network also protects 25% for Harrisson's Dogfish, 25.9% for eastern Southern Dogfish, and 20.1% for central Southern Dogfish of core habitat area. The development of the strategy was supported by an Upper-Slope Dogfish Scientific Working Group which provided expert scientific advice on specific scientific questions to inform management and recovery of upper-slope dogfish species, as well as the normal AFMA consultative structure.

Despite gulper sharks being a no-take multispecies stock under the Strategy, reported landings for the trawl fishery were 0.3 t in the 2016–17 season (Helidoniotis et al, 2017a). Helidoniotis et al (2017a) suggest that this may reflect reporting errors. Nevertheless, they also note that "*there is potential for unreported or underestimated discards, based on the large degree of overlap of current fishing effort with the core range of the species. Low levels of mortality can pose a risk for such depleted populations*".

The analysis undertaken during the development of the strategy provides some objective basis that the measures will work, although it is not clear at this point that the measures are being implemented successfully (there is no evidence yet of recovery) and there remains uncertainty over whether overfishing is occurring (Helidoniotis et al, 2017a). Accordingly, this SI is scored medium risk.

School shark (Medium risk)

While the school shark stock is overfished, catch from the otter trawl fishery is not likely to hinder recovery of the species. School shark catch from the otter trawl sub-fishery was 16 t on average for the last 3 years. This is less than 10% of the total catch of the species in the south east. Mortality from the UoA is considered within the Rebuilding Strategy, and current total commercial fishing mortality is within the limits set by the revised Strategy (AFMA 2014c).

Syngnathids (Low risk)

Syngnathids are taken as bycatch in the CTS in otter-trawl and Danish-seine nets but they are generally small and difficult to observe among large catches of fish. The ERAEF noted that 61 syngnathids have the potential to interact with the fishery and of these, only one was classified as high risk. However, when these risks were elevated to the Level 3 SAFE assessment conducted by Zhou et al. (2012), there were no syngnathids identified as high risk. On the basis of this outcome, it is expected that impacts on syngnathids are known and direct effects of the fishery are highly unlikely to hinder recovery.

Blue Warehou (Medium risk)

Blue Warehou has been classified as overfished since 1999 (Helidoniotis et al, 2017a). In February 2015, the species was listed as conservation dependent under the EPBC Act 1999. Two stocks of Blue Warehou exist: eastern and western. The stocks are managed under the SESSF tier 4 HSF and assessed using standardised CPUE to determine RBCs.

The 2008 rebuilding strategy for Blue Warehou was revised in 2014 (2014d) with the aim to prevent targeted fishing for Blue Warehou, minimise incidental catches and improve knowledge of stock status. The objective of the strategy is to rebuild the stock to its limit reference point (B_{20}) by no later than 2024, and from there ultimately to the B_{MEY}-based target reference point of B_{48}. The strategy sets the targeted TAC at zero and allows for a limited bycatch TAC to cover incidental catches. The incidental TAC is currently set at 118t, consistent with CSIRO analysis of 'unavoidable' catch in 2010 (ShelfRAG, 2015). In the context of this SI, the incidental catch limit could be considered a 'national limit'. The landed catch for 2016–17 was 16 t, and the weighted average discards were 8.68 t. The catch and discards combined was 24.68 t.

ShelfRAG (2015) examined progress towards achieving the objectives of the rebuilding strategy in 2015. They noted that catches have been small and over the last few years and below the incidental TAC, although as a consequence of low catches there are little data with which to assess recovery. They also noted that the number of shots containing more than 250 kg of Blue Warehou had declined over the previous 10 years with the most recent year being the lowest on record, catches of Blue Warehou by the top 10 boats had declined from 116 tonnes to less than two tonnes, and there was some evidence of range contraction.

Using projections from the Tier 1 stock assessment for the western stock, Haddon (2015; in ShelfRAG, 2015) projected that under recent catch conditions and using the highest average observed recruitment the stock should have rebuilt to 80% of the its original biomass; under average recruitment observed between 1987 and 2005 the stock should be at B_{38}; and under the lowest average recruitment the stock should be at B_{20}. On that basis, he concluded that the failure of the stock to recover seems unlikely to be due to excessive current incidental catches. A change in recruitment success could offer an explanation for the lack of observed rebuilding, as could a change in reproductive productivity although there is no mechanism to evaluate if this is the case (ShelfRAG,

2015).

Based on the available evidence, ShelfRAG (2015) concluded that current catches, even with low recruitment, should not be impeding recovery and catches would have to be substantially underestimated to have any effect.

Although level of fishing mortality that will allow the stock to rebuild is uncertain, recent catches in the CTS are estimated to have been substantially below the incidental catch limit, modelling suggests the failure of the stock to recover is unlikely to be due to excessive incidental catches and the relevant RAG has concluded that current catches should not be impeding recovery. On that basis, there is a plausible argument that the known direct effects of the CTS are unlikely to be hindering recovery consistent with the medium risk SG. Nevertheless, the fishery would be better placed against this SI with some evidence of actual recovery.

Eastern Gemfish (Precautionary high risk)

Note: Because it is both a target species and an ETP species, Eastern Gemfish is assessed in Component 1 and here in Component 2 (i.e. Eastern Gemfish would be considered an ETP species for UoAs in which Eastern Gemfish is taken incidentally while targeting other species).

Eastern Gemfish is currently assessed as overfished. The integrated stock assessment model for Eastern Gemfish was last updated in 2010 with data on catch and length frequency up to 2009 (Little & Rowling 2010). The 2010 estimate of spawning stock biomass in 2009 was 15.6 per cent of the 1968 level.

The 2010 assessment included projections of Eastern Gemfish biomass based on average historical recruitment that examined two catch scenarios: total catches of 100 t each year and zero catches each year. The projection for zero catch indicated that the point estimate of biomass might reach 0.2SB before 2020. Projections for annual catches of 100 t suggested recovery to 0.2SB by 2025 (Morison et al, 2012). A full assessment has not been completed since 2010 due to a paucity of useful additional datasets. Nevertheless, an assessment of spawning potential ratio (SPR) was conducted to examine whether current levels of fishing represented overfishing of the stock (Little, 2011; in AFMA, 2015a). The SPR analysis showed that the ratio was high until the late 1970s when there were high recruitments and spawning biomass; SPR decreased starting in the mid-late 1970s reaching the lowest point in 1988 corresponding to high catches and thereafter has increased to earlier levels.

A stock recovery plan is in place with an incidental TAC of 100 t that aims to prevent targeting and promote recovery of the stock to a level above the limit reference point by 2027 (AFMA, 2015a). In the context of this SI, the 100t incidental TAC could be considered to be a national limit.

Although discards were high in 2013, and meant total fishing mortality (retained catch plus discards) was around double the incidental TAC, SERAG (2016) reports that total fishing mortality in Commonwealth fisheries was below the incidental TAC in 2012, 2014 and 2015. Moreover, Helidoniotis et al (2017a) report that the total fishing mortality in the 2016-17 fishing year was below the incidental TAC (77.4t in total).

While total mortality from the CTS has been below the incidental catch limit in most of the past five years, the main uncertainty is the extent to which existing catches may be hindering recovery under the low recruitment conditions experienced over recent years. Morison et al (2012) noted that stock recovery projections predicting the stock would recover to B_{LIM} by 2025 depend strongly on average recruitment (also acknowledged in the rebuilding plan; AFMA, 2015a). However, Little and Rowling (2010) estimated that most of the recruitments during the last 25 years have been relatively weak. On that basis, while current catches in the CTS could be expected to not hinder recovery under average recruitment conditions, the extent to which they may hinder recovery under low recruitment conditions is unclear. Accordingly, we have scored this SI precautionary high risk.

Other listed species

Sharks (Low risk)

A number of other shark species are listed on international conventions to which Australia is a member and are therefore recognised under the EPBC Act. These include Longfin Mako (*Isurus paucus*), Shortfin Mako (*Isurus oxyrinchus*) and Porbeagle (*Lamna nasus*) sharks - listed on the EPBC Act in January 2010 after their inclusion on Appendix ii of the Convention of Migratory Species (CMS) – and Scalloped Hammerhead Shark *(Sphyrna lewini),* Great Hammerhead Shark (*Sphyrna mokarran*), Smooth Hammerhead Shark (*Sphyrna zygaena*) and Oceanic Whitetip Shark (*Carcharhinus longimanus*), included on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in September 2014. Porbeagle sharks were also included on CITES Appendix II at the same time.

Catches of each of these species is small or non-existent in the CTS. An average of 1.9t of retained catch of Shortfin Mako was reported during 2013 to 2015. Relative to catches in other fisheries (Clarke, 2011, notes that median estimates by number of mako sharks recorded by observers in South Pacific longline fisheries were between 50,000-250,000 individuals in 2006), it is highly unlikely that the marginal impact of catches in the CTS are hindering recovery. Of the remaining species, an average of 68kg of Smooth Hammerhead Shark was retained between 2013 and 2015, 32kg of Porbeagle was retained in 2014 and no retained catches of the other species were reported.

Scoring

Of the ETP species assessed above, the eastern stock of Gemfish received the highest risk rating of precautionary high risk. Target species UoAs likely to interact with this stock are therefore scored precautionary high risk and include: Blue Grenadier, Blue-eye Trevalla, the Pink Ling – eastern stock, Gould's Squid and Ocean Jacket. The remaining stocks are scored medium risk.

CRITERIA: (ii) The UoA has in place precautionary management strategies designed to:

- meet national and international requirements; and
- ensure the UoA does not hinder recovery of ETP species.

(a) Management strategy in place **LOW RISK**

AFMA has a comprehensive framework of measures in place to manage the impacts of the fishery on ETP species.

The *SESSF Management Plan 2003* sets out clear objectives for the management all species impacted by the fishery (i.e. that the fishery is "*conducted in a manner consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle and, in particular, the need to have regard to the impact of fishing activities on non-target species and the long-term sustainability of the marine environment*"), as well as actions by which the objectives will be achieved. In relation to non-target species these include:

- *Monitoring through a structured program, the impact of fishing on fish species, any other species that are caught as by-catch, ecologically-related species and the marine environment, analysing the impacts and implementing any strategies necessary to ensure: (i) the sustainability of those species and the marine environment; and (ii) that by-catch limitations are not exceeded;*
- *periodically checking the accuracy and consistency of information kept in relation to the fishery*

The impacts of the fishery on all ETP species in the fishery area have been assessed through the ERA framework described in 2A(i). For those species identified as high risk, measures to mitigate risks are set out in the SESSF ERM Strategy (AFMA, 2015c). Key measures in place which serve to mitigate risks include:

- Limited entry;
- Catch controls (e.g. zero targeted TACs and incidental catch trip limits);
- Gear modifications such seal excluder devices (SEDs) and bird scaring devices;
- Extensive spatial closures under fisheries legislation (e.g. deepwater shark closures);
- Extensive spatial closures to trawling under the South East Marine Protected Area network (388,464 km^2 with a depth range of 40m - 4600m).

All interactions with ETP species are required to be reported in compulsory logbooks. Interactions are also reported by observers under the ISMP.

In addition to the measures above, a framework of species-specific conservation measures apply. These include:

<u>'Conservation dependent' species</u>

Fishing restrictions have been imposed on all overfished stocks listed under the EPBC Act as *'conservation dependent'*. These restrictions are to promote the rebuilding of the stock to a level above the target reference limit within an allocated timeframe. AFMA develops stock rebuilding strategies in consultation with the fishing industry, the Department of the Environment, the Department of Agriculture and the relevant management advisory committee and resource assessment group.

Rebuilding strategies are reviewed every five years to monitor the progress of rebuilding and ensure the continued effectiveness of management arrangements which have been implemented.

Specific management plans have been compiled for the following ETP species[3]:

- School shark Rebuilding Strategy 2015
- Orange Roughy Rebuilding Strategy 2014
- Upper Slope Dogfish Strategy 2012
- Eastern Gemfish Rebuilding Strategy 2015
- Blue Warehou Rebuilding Strategy 2014

These instruments are likely to be considered a strategy that is expected to ensure the UoA does not hinder recovery. The main uncertainty for several species is the extent to which measurable recovery has occurred (e.g. Eastern Gemfish, Blue Warehou), and the extent to which recovery will occur under recent recruitment conditions.

<u>Pinnipeds</u>

SEDs have been compulsory for freezer boats in this component of the SESSF since 2005, and modifications to fishing practices seem to have substantially reduced the incidence of seal bycatch in the midwater nets of factory vessels (Helidoniotis et al, 2017b). Trials of SEDs in the wet-boat sector have achieved positive results (Knuckey, 2009), and industry has adopted a code of conduct that includes voluntary measures to minimize interactions. Seal bycatch (alive or dead) must be formally reported to SEWPaC and AFMA within 24 hours of the time of capture. Helidoniotis et al (2017b) report that "*trials of a flexible SED design suitable for use in smaller nets have been reasonably successful (Knuckey, 2009), but reliably estimating and reducing the level of interactions between seals and wet-boats remain difficult. A trial using a shortened codend to reduce seal bycatch was completed in late 2014. The trial found no definitive proof that short trawl nets had lower interaction rates with seals, caught fewer seals or resulted in lower mortality rates of caught seals (Koopman et al. 2014).*" Historically, there have been concerns about under-reporting of pinniped interactions.

The framework of measures in place through the SESSF Management Plan, ERA/ERM processes, independent monitoring through observers, targeted research and species specific measures to limit interactions (e.g. SEDs) are likely to be considered a strategy that is expected to ensure the UoA does not hinder recovery for high risk pinnipeds.

<u>Seabirds</u>

In response to the detection of seabird interactions with trawl gear in the SET and GAB sectors of the SESSF, AFMA has worked in conjunction with industry and seabird experts to develop and implement Seabird Management Plans (SMPs) on all SESSF otter board trawl vessels (Helidoniotis et al, 2017b). Seabird management plans were introduced in the CTS in 2011.

Seabird management plans are tailored to individual fishing boats and identify the main threats posed to seabirds by that boat. Each plan identifies the physical mitigation measures to stop seabirds from interacting with the warp wires and other fishing gear. They also include measures dealing with the discharge of biological waste from vessels to reduce seabird attraction and interaction. Further

[3] http://www.afma.gov.au/sustainability-environment/protected-species-management-strategies/

'common-sense' measures are employed by fishers to help reduce the risk of interactions, including reducing the time the nets are on the surface of the water and cleaning the net of fish when re-setting. This reduces the likelihood of seabirds using the nets as a food source and consequently getting entangled. Seabird Management Plans set out a variety of proven mitigation measures that are tailored to each vessel in each fishery. Trawl fishers must use 'warp deflectors' or pinkie devices. These are pink buoys that sit alongside the trawl gear as a visual deterrent. The buoys also act as a physical barrier between birds and fishing gear.

Recently, the South East Trawl Fishing Industry Association (SETFIA) led a research project to trial other alternative seabird mitigation devices, which resulted in sea trials for two new devices: water sprayers and bird bafflers (Boag, 2016). Sprayers were found to reduce interactions by 92% while bafflers reduced interactions by 96%. AFMA have approved both approaches for use as seabird mitigation devices within vessels' seabird management plan (as a condition on the fishing permit). From 1 May 2017, all CTS trawl vessels must use one of these two devices or continue with pinkies and not discharge offal while towing. As it is not economical to retain offal, it is probably reasonable to assume that from May 2017, uptake of the new devices is likely to be high. SETFIA have also recently introduced a Code of Conduct and an E-Learning programme to attempt to improve seabird avoidance measures and seabird interaction reporting.

CTS vessels are also subject to the measures in the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPC, 2011).

The framework of measures in place through the SESSF Management Plan, ERA/ERM processes, independent monitoring through observers, targeted research and species specific measures to limit interactions (e.g. seabird mitigation devices) are likely to be considered a strategy that is expected to ensure the UoA does not hinder recovery for seabirds.

(b) Management strategy implementation **MEDIUM RISK**

There is an objective basis for confidence for some species groups (e.g. mitigation approaches for seals and seabirds have followed international best practice approaches) that the management measures are likely to work, however in the case of Eastern Gemfish, Blue Warehou and Upper Slope Dogfish there is currently insufficient evidence to suggest that the strategy is being implemented successfully. As such this SI is assessed as medium risk on the basis that a plausible argument exists that the measures are likely to work.

CRITERIA: (iii) Relevant information is collected to support the management of UoA impacts on ETP species, including:

- information for the development of the management strategy;
- information to assess the effectiveness of the management strategy; and
- information to determine the outcome status of ETP species.

(a) Information **MEDIUM RISK**

A range of quantitative and qualitative information is available on ETP interactions which has been adequate to assess UoA related mortality for most species.

The primary sources of information on ETP species interactions include compulsory commercial fisher reporting in logbooks, observer coverage through the ISMP and targeted studies on specific species (e.g. school sharks, upper slope dogfishes, Australian fur seals). Catch and effort information is also available for commercially important 'conservation dependent' listed species (e.g. Eastern Gemfish, Blue Warehou, gulper sharks).

To assist fishers accurately identify protected species, AFMA has produced the following guides:

- Protected species identification guide
- Shark and Ray eBook
- Seabird identity guide

A summary of interactions with commonwealth fisheries is available online at:

http://www.afma.gov.au/environment/eco_based/reporting.htm#reports.

In 2016-17, observer coverage was 129 sea days, allocated across different geographical regions and times of the year (Helidoniotis et al, 2017a). Although the ISMP was not developed to evaluate ETP species interaction, ISMP data has been used to validate logbook data. Onboard cameras are being trialled in some SESSF fisheries as a way of monitoring bycatch of ETP species and may be used to gather information; however this work is subject to further trials.

Information available on the distribution of ETP species within the fishery area, together with information on their biological characteristics and rates of interaction through logbooks and the ISMP, has allowed an assessment of the likely impacts on ETP species through ecological risk assessments described in PI 2A (e.g. AFMA, 2012a).

For several ETP species, detailed quantitative information is available modelling population dynamics, current status and likely recovery times (e.g. Australian Fur Seals, School Sharks, Eastern Gemfish, Upper Slope dogfish).

The main uncertainty exists around some of the species listed as conservation dependent under the EPBC Act. For Blue Warehou, information has been adequate to support measures to manage impacts though the impact of current catches from the CTS (in terms of whether overfishing is occurring is currently uncertain). For Eastern Gemfish, both quantitative and qualitative information is available to support a strategy to manage impacts, though the extent to which current catches may hinder recovery under low recruitment conditions experienced in recent years is unclear. Accordingly, we have scored this SI medium risk.

PI SCORE	**MEDIUM RISK – Orange Roughy – Cascade, Orange Roughy – Eastern, Gemfish – Eastern and Western, Pink Ling - Western**
	PRECAUTIONARY HIGH RISK - Blue Grenadier, Blue-eye Trevalla, Pink Ling – eastern stock; Gould's Squid; Ocean Jacket

2C: Habitats

CRITERIA: (i) The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area(s) covered by the governance body(s) responsible for fisheries management

(a) Habitat status — LOW RISK

Demersal otter-trawl gear is considered a potentially highly damaging gear-type, and the detrimental effect on habitat structure that comes into contact with trawl gear is well documented (e.g. Poiner et al, 1999; Kaiser et al. 2006; Althaus et al. 2009; Clark et al. 2012).

Recent modelling of the spatial extent of effort in the CTS suggests the fishery has a relatively small footprint across the South East Marine Region shelf and slope areas. Pitcher et al (2015) modelled the effects of fishing for 15 spatially unique species assemblages and 10 habitat forming benthos taxa types that had been predicted and mapped from survey data. They reported that:

- Simulation of the bottom trawl fishery from ~1985, when consistent logbook records were available, showed that all 10 benthos taxa types declined in abundance in trawled areas until the mid-2000s. At this time fishing effort decreased due to economic pressures and licence buybacks, and large areas were closed to trawling. A complex picture emerged, with patterns and responses varying spatially according to the distribution of benthos taxa types, trawling distribution, and type of management action;
- The lowest total regional abundance (status) of habitat-forming benthos taxa types across the SEMR was ~80–93% of pre-trawl status, after effort peaked during 2000–2005. Subsequently, all taxa were predicted to recover by varying extents (~1–3%) in the following decade. Had none of the management actions been implemented, benthos status was predicted to stabilise or recover slowly, and with all management actions in place, the rate and magnitude of recovery was greater. Reductions in trawl effort universally improved the status of habitat-forming benthos, with the larger 2006 licence buy-back leading to greater improvements than the 1997 buy-back;
- In some cases, spatial management that excluded trawling, particularly deepwater fishery closures, led to improved status of some benthos taxa types. Most fishery closures and Commonwealth Marine Reserves (CMRs) had little detectable influence on status. However, there were cases where closures worsened the status of some taxa in some locations, because displaced trawling moved to areas where such taxa were more abundant.

Overall, they reported that around 6% of the shelf and slope area was exposed to trawl effort annually, with around 23% of the SEMR region exposed across the life of the study (Table 5). Of the habitat forming tax types, the maximum level of exposure was 9%.

Table 5: Inclusion of benthic biodiversity in Commonwealth Marine Reserves and fishery closures, and exposure to human uses (Pitcher et al, 2015)

	Coverage of SEMR shelf and slope	Coverage of 15 spatially unique assemblages (by area)	Overlap with habitat-forming benthos taxa types (by abundance)*
CMRs	~9% (excluded 1.1% of historical trawl effort)	0–41%	7–19%
Trawl closures	~39% (excluded 5.5% of historical trawl effort)	1–81%	33–60%
CMRs and closures together	~44% (excluded 6.2% of historical trawl effort)	1–83%	40–63%
Exposure to trawl effort since 2007	~6% of seabed trawled annually (spread over ~23% of the region)	0–43% The exposed portions of the three most exposed assemblages were trawled 2–3 times yearly on average, making exposure by swept-area 0–77%.	1–9% The exposed portions of the more exposed taxa were trawled ~2 times yearly on average. The annual impact of trawling was ~1–8%.

Based on this it appears highly unlikely that the UoA will reduce habitat structure and function to the point of serious or irreversible harm. We also note that the MSC assessment for the Blue Grenadier sub-fishery of the CTS (SCS 2013) assessed habitat status as a score of SG80, but it must be noted that this fishery is predominately mid-water trawl with only a small component of benthic otter trawl. In summarising the available habitat information SCS (2013) stated: "*There is good understanding of the main habitat types in the area of the fishery and information is available to broadly understand the main impacts of the gear. However, there is limited new information available on the marine habitat structure on a scale relevant to the fishery. Demersal trawl fishing is generally not expected to cause serious or irreversible harm to any habitats although concerns remain about the impacts on the upper slope areas (200 to 700m deep) where much of the fishing is concentrated. Current closed areas are comprehensive, adequate and representative such that serious or irreversible harm is not expected on a broad regional scale.*"

CRITERIA: (ii) There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.

(a) Management strategy in place — LOW RISK

The measures in place to manage impacts of trawling on habitats in the CTS area include:

- Spatial closures through fisheries and Commonwealth marine parks legislation;
- Indirect limits on fishing effort through target species TACs;
- Monitoring of the location and intensity of fishing effort through logbooks and VMS;
- Assessment and treatment of priority risks through the ERA and ERM process.

Spatial closures

Approximately 86 per cent of trawl grounds have been closed within the CTS, including large areas of Bass Strait and coastal areas in South Australia (Figure 9). Trawling that does occur tends to be over grounds that have been trawled historically, i.e. the trawling footprint is not expanding (AFMA, 2015c). Closures have been introduced for a range of reasons including the protection of depleted species (Table 6 and Table 7), however all will serve to limit the direct impact of trawling on benthic habitats.

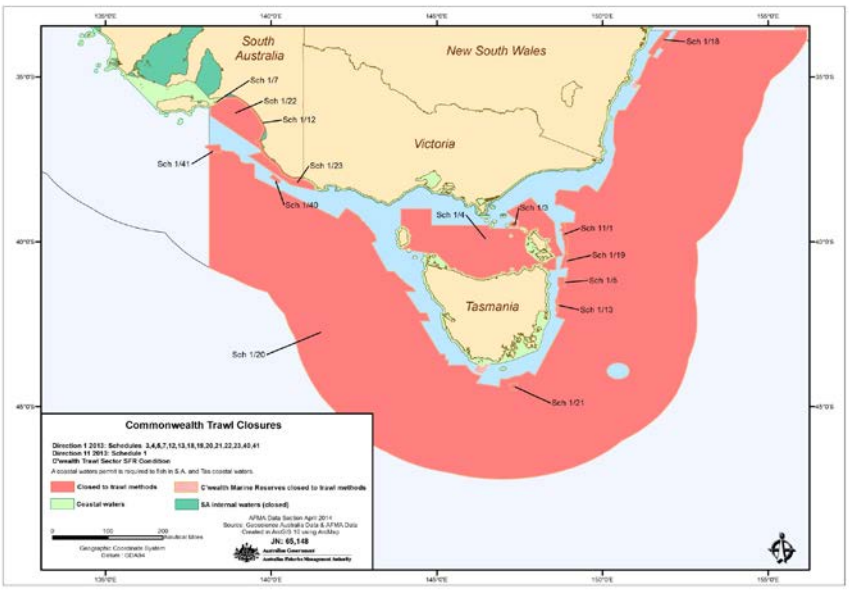

Figure 9: Spatial closures within the Commonwealth Trawl Sector area (AFMA, 2015c)

Table 6: Closures relevant to the CTS under the Upper Slope Dogfish Management Strategy (AFMA, 2015c)

Spatial Closures	Details	Complementary management arrangements where fishing is permitted inside closures
Extended Endeavour Dogfish Closure off Sydney	Extended closure to all methods of fishing across the core depth range	Fishing is not permitted so complementary measures are not applicable.
Extended closure in the Flinders Research Zone (FRZ)	Extended closure to range from 200m to 1000m for all methods. The extended FRZ incorporates the existing Babel Island and Cape Barren Closures and one area of the existing 700m line closure	If night time closures are negotiated in future, all fishing will be subject to 100% monitoring*
Extended Port MacDonnell Closure	Extended closure to all methods of fishing across the core depth range	Fishing is not permitted, so complementary measures are not applicable.
Murray Dogfish closure	Closed to trawling Open to hook methods	Line fishing subject to regulated handling practices, interaction limit per boat and 100% monitoring* Vessel interaction limit of three[1] gulper sharks which if reached the closure will be closed to that boat for 12 months
Harrisson's Dogfish Closure	Will remain closed to all fishing methods in an amended depth range (200 m to 1000 m) which reflect the depth range of Harrisson's Dogfish and Southern Dogfish.	Fishing is not permitted, so complementary measures are not applicable.

[1] An interaction limit has been developed as a conservative number by AFMA reviewing the possible boats to fish in the closure as the maximum gulper sharks that AFMA consider should be taken from an area.
*100% monitoring by an approved AFMA method

Table 7: Spatial closures which have implemented to protect ETP and high risk species in the CTS (AFMA, 2015c)

Closure Area	Reason For Closure
Kent Group National Park	Marine Protected Area
Bass Straight Trawl Closure (Otter Only)	Protect School and Gummy Shark habitat
St Helens Hill Closure	Protect Orange Roughy stocks
Pages Island	Protect ASLs and White Sharks
ECDT Sector Exclusion Zone	Protect Benthic Habitats
Kangaroo Island Shark Closure	Protect breeding School Shark and ASLs
Victor Harbour to Victoria Border	Protect breeding School Shark and ASLs
South East Trawl 700m Closure	Orange Roughy Stocks
Tasmania Seamounts Marine Reserve	Various endemic species
Eastern South Australian Trawl Closures	Juvenile Scalefish and protected habitat
Portland Trawl Closure	Juvenile Scalefish and protected habitat

In addition to closures under fisheries legislation, in 2007 a network of 14 marine protected areas was declared in the South-east marine region (Figure 10). The South-east Commonwealth Marine Reserves Network stretches from the south coast of New South Wales, around Tasmania and Victoria and west to Kangaroo Island off the South Australian Coast. The reserves cover an area of 388,464 km^2 with a depth range of 40m - 4600m. The reserves include a range of ecosystems, habitats and biological communities. The zoning within the South-east network does not permit otter trawling. The magnitude and placement of the marine park network does provide some permanent protection to representative samples of marine habitats within the area of the fishery.

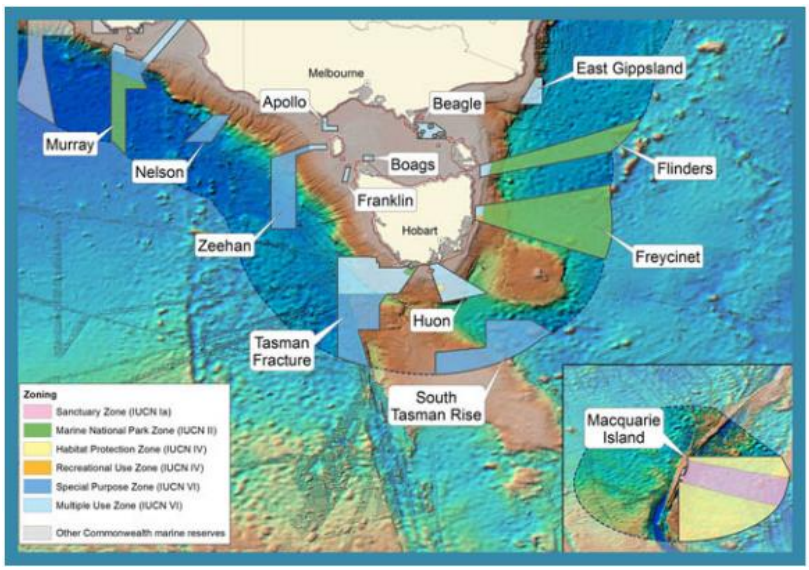

Figure 10: Commonwealth south east region marine reserve network[4].

ERAs/ERM

AFMA has undertaken detailed ecological risk assessments (ERAs) for all major Commonwealth managed fisheries as a key part of the implementation of the ecosystem based fisheries management. ERAs assess the risks that fishing poses to the ecological sustainability of the marine environment by considering the impact of fishing on all components of the marine environment, including risks to habitats. The main purpose of ERAs is to prioritise the management, research, data collection and monitoring needs for each fishery.

The fishery has been subjected to Level 1 and Level 2 risk assessments for habitats (Wayte *et al.* 2007). Hobday *et al.* (2011) provide a framework to move habitat assessment toward Level 3 assessments, including a Level 2 residual risk assessment, which will move the process from the ERA to the Ecological Risk Management (ERM) framework.

Together, these measures and the ongoing ERA process are likely to be considered at least a partial strategy to ensure the UoAs do not cause serious and irreversible harm to habitats.

(b) Management strategy implementation **LOW RISK**

The work of Pitcher et al (2015) provides some objective basis that the strategy will work, and some quantitative evidence that the strategy is being implemented successfully.

CRITERIA: (iii) Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.

(a) Information quality **LOW RISK**

[4] http://www.environment.gov.au/topics/marine/marine-reserves/south-east

There are considerable data on the nature, distribution and vulnerability of the main habitats of the CTS. Habitat information in the SESSF has been collected by Bax & Williams (2001) and Williams *et al.* (2006), the latter report integrating fisher knowledge with scientific data to provide an assessment of 516 "fishing grounds". The ERA process (Wayte *et al.* 2007) identified and ranked risks to 156 separate habitats in the fished area. Spatial closures include the Commonwealth Marine Reserve Network and fishery-specific spatial closures. All trawl tracks are recorded by VMS. More recently, Pitcher et al (2015) examined the spatial extent of the fishery in relation to unique assemblages and habitat forming taxa. These data are relevant to the scale and intensity of the fishery and as such this criterion is assessed as low risk.

(b) Information and monitoring adequacy **LOW RISK**

Information is broadly adequate to understand the main impacts of gear on the main habitats and this has been assessed through the ERA process (Wayte et al, 2007). There is also reliable information on the spatial extent of interaction through VMS records. Pitcher et al's (2015) analysis provides information on the spatial overlap of trawl effort with vulnerable habitat types. As a result, we have scored this SI low risk.

PI SCORE	LOW RISK

2D: Ecosystems

CRITERIA: (i) The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.

(a) Ecosystem Status **LOW RISK**

Serious or irreversible harm in the ecosystem context should be interpreted in relation to the capacity of the ecosystem to deliver ecosystem services (MSC, 2014). Examples include trophic cascades, severely truncated size composition of the ecological community, gross changes in species diversity of the ecological community, or changes in genetic diversity of species caused by selective fishing.

The risks that the SESSF poses to the sustainability of the marine ecosystems in which it operates have been investigated through the AFMA ERA process involving:

- Level 1 analysis (SICA – Scale Intensity Consequence Analysis)
- Level 2 analysis (PSA – Productivity Susceptibility Analysis)
- Level 2 analysis (Residual risk PSA)
- Level 3 analysis (SAFE - Sustainability Assessment for Fishing Effects)

In the case of the SESSF, residual risk assessment guidelines have also been applied to the outcomes of the Level 3 SAFE assessment.

The ERAEF is employed for all elements of the fishery including species (target, byproduct, discard and ETP), habitats and ecosystems. Wayte *et al.* (2007) assessed the following number of ecological units for the CTS fishery: 28 target, 95 by-product, 276 discard, 201 ETP, 158 habitat and 33 community.

For the CTS, 600 species in total were assessed at the Level 2 (Productivity and Susceptibility Analysis; PSA) stage. Of these 600, 159 species were classified as high risk; the majority of the high-risk species were chondrichthyans or teleosts. The Level 3 SAFE reduced the number of high-risk species to 23. During the residual risk process, new information was identified that allowed the total number of high-risk species to be reduced to 10. These species include several low-productivity, deepwater sharks, several seabirds and the Australian fur seal. The SAFE assessment was re-evaluated in 2012 (Zhou *et al.* 2012) and additional species were included as high risk for further examination. Residual risk assessment guidelines were applied to the outcomes of the updated SAFE assessment in 2014 to arrive at a final list of 11 species deemed to be at either high or precautionary high risk which require treatment in the SESSF ERM Strategy 2015. These processes provide some confidence that the fishery is not causing serious or irreversible harm to these elements of the ecosystem.

The original ERA (Wayte *et al.* 2007) did not address community units at the Level 2 PSA. Hobday *et al.* (2011) aimed to "*complete the development of the ERAEF Level communities (ecosystems) approach".* The key outcomes from this FRDC project with regard to ecosystem status were described by following excerpt from Hobday et al. (2011): *"a set of attributes that represent the productivity and susceptibility of an ecological community were determined and a scoring system for these attributes devised. The methods were then tested on the CTS. A set of 27 benthic communities were identified, and each one scored using the five productivity attributes and seven susceptibility attributes for potential risk as a result of the CTS. A total of six communities were identified as potential high risk, including two off Western Tasmania, and one off south-east Victoria. Overall, the results for the SESSF case study showed that the communities that might be intuitively considered to be at higher risk due to known fishing patterns, such as the South Eastern 110-250m (general concentration of effort) and the Western Tasmanian Transition 250-565m (targeting of certain species such as spotted trevalla [warehou]), were also ranked as high risk in the community PSA. Targeting of Blue Grenadier and Orange Roughy (and high reported catches) in the deeper Tasmanian communities resulted in only medium risk to the communities in this assessment. Communities where fishery effort was relatively low were generally ranked as low to medium risk*." The assessment of risks from fishing at the community level have not passed beyond these published results.

An ecosystem model termed "Atlantis" has also been developed for the fishery (Fulton *et al.* 2007). While the model has been used for MSE evaluations, its capacity to deliver outputs that help to define the status of the ecosystems in South-East Australia is limited (Fulton *et al.* 2007).

Although neither the ecosystem model nor the ERAEF process provide direct evidence that the fishery is not affecting the ecosystem, there is sufficient knowledge of the key elements of the ecosystem that when considered in combination with the management measures in place (significant spatial closures, limited spatial footprint, reductions of 60% in trawl effort, and gear limitations including

legislated bycatch exclusion devices) and the largely positive stock status of the main target species, provide sufficient confidence that the CTS is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

CRITERIA: (ii) There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.

(a) Management Strategy in place **LOW RISK**

The fishery has in place measures that can be considered at least a partial strategy to ensure that the fishery does not impact on the ecosystem to cause serious and irreversible harm. The strategy is underpinned by harvest strategies which aim to maintain targeted stocks at levels higher than that consistent with MSY and the ERA framework which assesses all the key elements of the ecosystem as described previously. Key impacts on species have been assessed to the Level 3 stage, with outcomes documented through the various risk assessment reports culminating in the SESSF ERM Strategy (AFMA, 2015c). Hobday *et al.* (2011) documented the first Level 2 community assessment for a Commonwealth fishery using the CTS as a case study.

To address risks identified through the ERA process, AFMA and industry have developed various implementation strategies including:

- Harvest strategy to limit catches of target stocks (and hence total effort);
- Recovery strategies for overfished stocks;
- Bycatch Action Plans (target stock and bycatch);
- Gear modification requirements (to mitigate capture of juvenile target species and bycatch);
- Use of seal exclusion devices on mid-water trawl nets;
- Introduction of spatial closures (including Marine Protected Areas);
- Ongoing monitoring (observer coverage and logbook assessment);
- Research and modelling into the trophic ecology of south-eastern Australia.

(b) Management Strategy implementation **LOW RISK**

The extensive assessment and treatment of ecological impacts through the ERA/ERM process, stock assessment and modelling results for the main target species, which form the bulk of the overall catch and are largely in positive positions against reference points, successful measures to recover overfished species (e.g. Orange Roughy eastern zone) and minimize impacts of ETP species (e.g. SEDs; seabird mitigation devices), together with habitat modelling showing the fishery is likely to cover ~6% of the slope and shelf area of the SEMR annually provide some objective basis for confidence that the partial strategy will work and some quantitative evidence that the measures are being implemented successfully.

CRITERIA: (iii) There is adequate knowledge of the impacts of the UoA on the ecosystem.

(a) Information quality **LOW RISK**

There has been significant investment in research for the fishery in all elements of the ecosystem, including species (target, byproduct, ETP), habitats and ecosystems. While these information sources vary in detail and progression of knowledge, they have been collected in a manner that provides a sound understanding of these key ecosystem elements and allows for detection of changes in risk.

Critical data sources include but are not limited to: catch and effort logbooks, VMS data, observer data, fishery-independent survey data, and habitat mapping data.

(b) Investigations of UoA impacts **LOW RISK**

The main impacts of the UoA on the ecosystem are well understood and most of them have been studied in significant detail. Target species are assessed and quotas determined on an annual basis. Impacts on bycatch species have been evaluated through the ERA process utilising data from various studies that provide fishery-dependent and fishery-independent data sources (e.g. Zhou et al 2012). ETP species have been studied extensively through the ERA process and species specific research programs (e.g. Mackay et al, 2016. Habitats have been examined thoroughly through several studies (e.g. Bax & Williams 2001, Williams et al. 2006, Wayte *et al.* 2007; Pitcher et al, 2015). Ecosystem impacts have been examined through the Atlantis model, albeit that the interpretation of results was limited to Management Strategy Evaluations (Fulton et al 2007). This is sufficient to assess this criterion as low risk.

PI SCORE	LOW RISK

COMPONENT 3: Management system

3A: Governance and Policy

CRITERIA: (i) The management system exists within an appropriate and effective legal and/or customary framework which ensures that it:

- Is capable of delivering sustainability in the UoA(s); and
- Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or

livelihood.

(a) Compatibility of laws or standards with effective management **LOW RISK**

Relevant Australian Commonwealth Acts, subsidiary legislation and cooperative instruments, including the EPBC Act 1999, Fisheries Management Act (FMA), Fisheries Administration Act (FAA) provide an effective legal framework for the purposes of delivering management outcomes consistent with Components 1 and 2. The FMA takes account of the United Nations Fish Stocks Agreement and FAO's Code of Conduct for Responsible Fisheries.

(b) Respect for Rights **LOW RISK**

The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood. The Commonwealth Native Title Act 1993 formally commits to the rights of indigenous people who can demonstrate their customary rights to fish in a particular area. This legislation provides a mechanism for the making of binding decisions about native title rights to areas of land and water and thereby ensures access to fish resources for people who depend on fishing for their food. AFMA's jurisdiction typically begins three nautical miles offshore, thus, there is usually no overlap between Commonwealth commercial fishing and customary fishing activity. However, for some fisheries, consideration of customary fishing is largely made through interaction between AFMA's management and the Native Title Act 1993. Where AFMA modifies an act, a direction or other legislative instrument in a way that may affect native title, that change triggers the 'future act' provision of the Native Title Act 1993. In situations where a future act provision could possibly be triggered, AFMA provides the opportunity for relevant native title bodies to be consulted and provide comment. In addition, Fisheries Legislation Amendment (Representation) Bill 2017 is currently before the Commonwealth parliament. The Bill provides for explicit recognition of recreational and Indigenous fishers in Commonwealth legislation and requires AFMA to have regard to ensuring that the interests of all fisheries users are taken into account in Commonwealth fisheries management decisions[5].

Given the above, the management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood.

CRITERIA: (ii) The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.

(a) Roles and Responsibilities **LOW RISK**

The roles and responsibilities of the main people (e.g. Fisheries Minister, AFMA Commissioners) and organisations (AFMA) involved in the Australian Commonwealth fisheries management process are well-understood, with relationships and key powers explicitly defined in legislation (e.g. FMA, FAA) or relevant policy statements (e.g. AFMA Fisheries Management Paper 1 – Management Advisory Committees). There is a Management Advisory Committee (SEMAC) and Resource Assessment Group (SERAG) providing advice on the management of the fishery.

(b) Consultation Process **LOW RISK**

The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.

Resource Assessment Groups (RAGs) are the bodies responsible for providing scientific advice to the Management Advisory Committees (MACs) and the AFMA Commission on the status of fish stocks, sub-stocks, species (target and non-target), and the impact of fishing on the marine environment. They coordinate, evaluate and regularly undertake fishery assessments, and provide recommendations on issues such as the setting of total allowable catches, stock rebuilding targets, and biological reference points. Membership of the RAGs comprises representatives from the areas of fisheries management, research, industry, fisheries economics and conservation. The broad membership ensures that, in addition to scientific information on each fish stock, industry knowledge and developments in management strategies, market prices and the costs of harvesting are also taken into account.

MACs are the main advisory bodies to AFMA. They provide advice on a variety of issues including fisheries management arrangements, research, and compliance/management costs. The MACs also provide a link between AFMA and those with an interest in the fishery, with membership generally comprising members from commercial industry, fisheries management, the scientific community, the environment/conservation sector and, in some instances, the State governments.

Under the FMA, 'plans of management', or fisheries management plans (FMPs) as they are known, are the way arrangements are set for each fishery. The FMA requires consultation with the public on draft FMPs and provides for ministerial oversight. Under the Act AFMA must set out in writing a FMP for each fishery or, likewise in writing, explain why one is not needed and provide draft plans for public display so interested persons can make representations.

CRITERIA: (iii) The management policy has clear long-term objectives to guide decision making that are consistent with the outcomes expressed by Components 1 and 2, and incorporates the precautionary approach.

(a) Objectives **LOW RISK**

The long term objectives of the management system are specified in the FMA and the EPBC Act, and further defined in the Commonwealth Fisheries Harvest Strategy Policy and Guidelines. The objectives and policy guidance are consistent with Components 1 and 2 and explicitly require application of the precautionary principle. The fishery is also subject to the Commonwealth EPBC Act which requires periodic assessment against the *Guidelines for the Ecologically Sustainable Management of Fisheries.* These Guidelines are consistent with the MSC Principles and encourage practical application of the ecosystem approach to fisheries management.

[5] http://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/bd/bd1617a/17bd090

PI SCORE	LOW RISK

3B: Fishery Specific Management System

CRITERIA: (i) The fishery specific management system has clear, specific objectives designed to achieve the outcomes expressed by Components 1 and 2.

(a) Objectives **LOW RISK**

Well defined and measurable short and long term objectives, which are demonstrably consistent with achieving the outcomes expressed by Components 1 and 2, are explicit within the fishery's management system. The SESSF Management Plan 2003 (amended in 2009) reinforces the objectives of the FMA as the objectives of the Plan. These are consistent with Australia's obligations under international arrangements, national legislation and specifically require application of the precautionary principle. Fishery specific objectives can be identified in the Harvest Strategy and the SESSF ERM Strategy.

CRITERIA: (ii) The fishery specific management system includes effective decision making processes that result in measures and strategies to achieve the objectives.

(a) Decision making **LOW RISK**

Australia's Commonwealth fisheries decision making process is well established and set out explicitly in relevant legislation (e.g. FMA, FAA) and policy documents (e.g. Looking to the Future, Commonwealth Harvest Strategy Policy). The decision making processes by AFMA based on advice from SEMAC, working with SESSFRAG, are transparent with feedback provided by the Commission directly to SEMAC and to stakeholders through media such as the regular AFMA Update and through the Annual public meeting of both the MAC and AFMA. There are numerous examples in the last decade of the CTS management system responding to serious and other matters (e.g. TACC adjustments based on the harvest strategy, ERM reports based on the outcomes of ERAs, deepwater shark closures etc).

(b) Use of the Precautionary approach **LOW RISK**

The objectives and policy guidance of the SESSF explicitly require application of the precautionary principle and there is generally very good evidence that a precautionary approach is applied. For example, the HSF explicitly increases the level of precaution as uncertainty increases (e.g. through discount factors in TAC setting for lower Tier stocks) (AFMA, 2017a). The ERA methodology also accounts for uncertainty by being precautionary (e.g. through the classification of species as 'precautionary high risk' where sufficient uncertainty exists). There is some uncertainty around whether the rebuilding plan for eastern Gemfish is sufficiently precautionary in the context of persistent low recruitment conditions experienced in recent years.

(c) Accountability and Transparency **LOW RISK**

The AFMA website contains an extensive list of evaluations, research reports and assessments, and evidence exists within the SEMAC and the RAG that decisions respond to these findings. South East MAC (SEMAC) meeting minutes are also available online[6]. AFMA provide monthly and annual reports, which outline program outcomes and, provide a means for measuring success.

CRITERIA: (iii) Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.

(a) MCS Implementation **LOW RISK**

AFMA's framework for its National (Domestic) Compliance and Enforcement Program is set out in the AFMA National Compliance Operations and Enforcement Policy (AFMA, 2015d). The policy is compliant with the Australian Fisheries National Compliance Strategy 2010-15 and aims to "effectively deter illegal fishing in Commonwealth fisheries and the Australian Fishing Zone". Compliance activities are informed by risk assessments undertaken in accordance with the international standard for risk management (ISO 31000:2009) across all major Commonwealth domestic fisheries (AFMA, 2015d). Compliance operations are supported through a centralised structure with separate Intelligence, Planning and Operations units.

More specific annual compliance priorities and risk treatments are set out in AFMA's National Compliance and Enforcement Program 2016 -17 (AFMA, 2015e). Key priorities for 2016-17 include (i) failure to have a Vessel Monitoring System (VMS) or Electronic Monitoring (emonitoring) system operating at all times, (ii) quota evasion and (iii) bycatch mishandling, which has been identified as an emerging risk. Risks are treated through a program of general deterrence (i.e. inspections and patrols designed to target identified high risk ports, boats and fish receivers), and other targeted measures – e.g. physical and technical surveillance, standard investigative activity, intelligence gathering, and media strategies. Compliance Risk Management Teams (CRMTs) may be formed to help address priority risks (e.g. VMS/electronic monitoring offences; quota evasion).

These measures constitute a system which has demonstrated an ability to enforce management measures.

(b) Sanctions and Compliance **LOW RISK**

[6] e.g. http://www.afma.gov.au/wp-content/uploads/2014/08/SEMAC-December-2014-meeting-minutes.pdf

A framework of sanctions for non-compliance is set out in the FMA, Maritime Powers Act 2013 and Fisheries Management Regulations 1992. These include powers to issue warnings, cautions, directions, Observer Compliance Notices, Commonwealth Fisheries Infringement Notices (CFINs), amend fishing concession conditions, suspend or cancel fishing concessions and prosecute offenders through the courts (AFMA, 2015d). Some evidence exists that fishers comply with the management system including providing information of importance to the effective management of the fishery. Across all years between 2011-12 and 2015-16, no action was required in >90% of boat inspections in Commonwealth fisheries (total inspections 879) (AFMA, 2015e). A 2013 audit of the management of the AFMA Domestic Compliance system did not highlight systematic non-compliance (ANAO, 2013).

CRITERIA: (iv) There is a system for monitoring and evaluating the performance of the fishery specific management system against its objectives.
There is effective and timely review of the fishery specific management system.

(a) Evaluation coverage **LOW RISK**

Performance of all stocks against the SESSF Harvest Strategy are assessed annually through the RAG and MAC process. TACs are adjusted annually based on updated stock assessments and RAG/MAC/AFMA advice. Periodic updates of ERAs evaluate performance against environmental objectives and guide management priorities. Fishery Status Reports produced annually by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) provide an independent evaluation of key parts of the management system (e.g. stock status, overfishing status). In addition, two Australian National Audit Office reviews have been undertaken into the domestic compliance program (2009, 2013). Accordingly, the fishery has measures in place to evaluate key parts of the management system.

(b) Internal and/or external review **LOW RISK**

The fishery-specific management system is subject to regular internal review through the SEMAC process, which tracks performance of the fishery against the objectives in the Management Plan. AFMA is also required to report in its Annual Report on overall performance against the legislative objectives, statutory requirements and financial reporting, the effectiveness of internal controls and adequacy of the Authority's risk management processes.

The fishery is subject to regular external assessment through the ongoing assessment for export approval under the EPBC Act against the *Guidelines for the Ecologically Sustainable Management of Fisheries*. Moreover, ABARES reports on the ecological and economic sustainability of fisheries managed by AFMA and the Australian National Audit Office undertakes periodic reviews of aspects of AFMA's performance (e.g. ANAO, 2013).

PI SCORE	LOW RISK

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