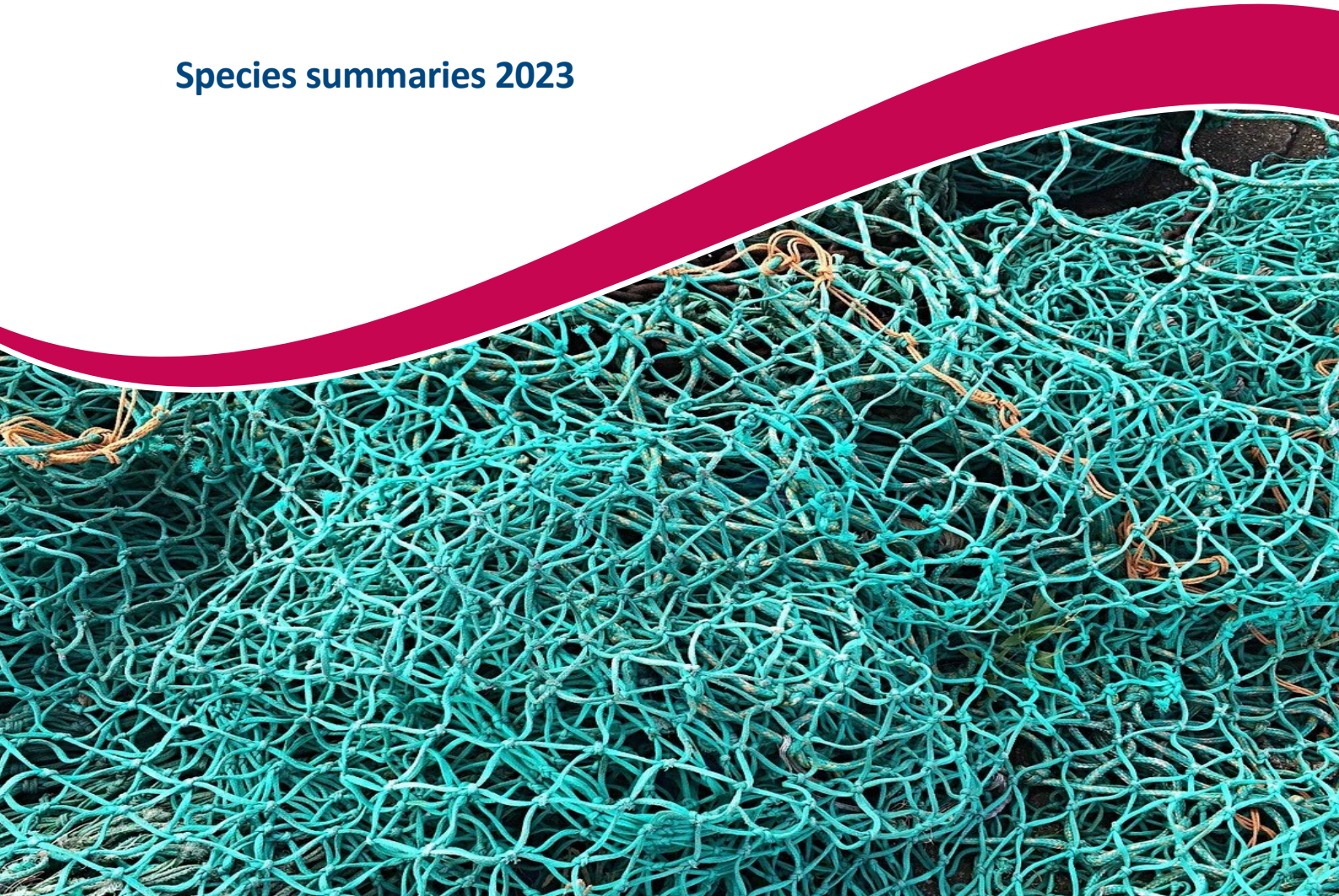
Australian Government

Australian Fisheries Management Authority

Southern and Eastern Scalefish and Shark Fishery (SESSF)

Species summaries 2023



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Summary of Total Allowable Catch (TAC)

Species	2022–23 agreed TAC (t)	2023-24 TAC (t) – AFMA recommendation	Change in TAC from 2022–23 (t)
Alfonsino	1,017	1,017	0
Bight redfish	890	959	+69
Blue eye trevalla	241	238	-3
Blue grenadier	18,275	17,084	-1,191
Blue warehou	50	30*	-20
Deepwater flathead	1,238	1,238	0
Deepwater shark (eastern)	24	24	0
Deepwater shark (western)	235	235	0
Elephant fish	114	114	0
Flathead	2,333	2,333	0
Gemfish (eastern)	100	100	0
Gemfish (western)	340	180	-160
Gummy shark	1,672	TBC	TBC
Jackass morwong	20	60	+40
John dory	60	60	0
Mirror dory	129	121	-8
Ocean perch	305	318	+13
Orange roughy (Albany and Esperance)	50	50	0
Orange roughy (Cascade)	397	397	0
Orange roughy (Eastern)	1,074	975	-99
Orange roughy (Southern) including Pedra Branca	113 (82 Pedra Branca, 31 incidental)	105 (74 Pedra Branca, 31 incidental)	-8
Orange roughy (Western)	60	60	0
Oreo, basket	137	TBC	TBC
Pink ling	1,568	1,565	-3
Redfish	30	30	0
Ribaldo	397	393	-4
Royal red prawn	651	628	-23
Sawshark	519	525	+6
School shark	225	TBC	TBC
School whiting	917	914	-3

Species	2022–23 agreed TAC (t)	2023-24 TAC (t) – AFMA recommendation	Change in TAC from 2022–23 (t)
Silver trevally	51	TBC	TBC
Silver warehou	350	350	0
Smooth oreo dory (Cascade)	150	150	0
Smooth oreo dory (other)	90	90	0

Purpose

These species summaries provide information on quota species assessed by the various Resource Assessment Groups (RAGs) for the Southern and Eastern Scalefish and Shark Fishery (SESSF) including the Great Australian Bight RAG (GABRAG); South East RAG (SERAG) and SharkRAG.

The summaries contain basic information on stock status, catch trends, assessment details, Recommended Biological Catch (RBC) recommendations from the relevant RAG, and preliminary AFMA advice for the 2023-24 SESSF fishing year, 1 May 2023 to 31 April 2024. The AFMA advice will be considered by the relevant Management Advisory Committees (MACs) and final recommendations from all sources to be considered by the AFMA Commission in making its decision in March 2023.

The summaries are designed to be a quick reference and should be read in conjunction with relevant RAG and MAC minutes and the applicable species stock assessments – links to the relevant documents are provided throughout where available.

The *SESSF Harvest Strategy Framework 2009* (the SESSF Harvest Strategy) provides the basis for TAC calculations. Other relevant considerations are included in this paper.

TAC considerations

Ecological considerations

Fishery Harvest Strategy (commercial & byproduct)

A new SESSF Harvest Strategy is currently being developed. This follows the introduction of the *Commonwealth Fisheries Harvest Strategy Policy 2009* (HSP) and in response to significant changes in the fishery since the current Harvest Strategy was implemented in 2009 including:

- structural adjustment reducing the numbers of boats in the fishery;
- changing fisher behaviour with fewer species being targeted;
- greater use of multi-year TACs (MYTAC); and
- environmental change.

In the interim, the SESSF will continue to operate under the current SESSF Harvest Strategy. Changes were incorporated in 2022 to:

- address technical and editorial errors throughout the document;
- enable multispecies considerations in setting TACs;
- include considerations about the process to undertake when a species' assessment extends past the MYTAC period;
- enable application of discount factors for lower tier assessments to be the default approach, and that exceptions are only made where the relevant resource assessment group is satisfied there are alternative, equivalent precautionary measures in place;
- include the use of the FishPath tool to determine 'preferred' Tier 5 methods; and,

- include further information about how recommended biological catches (RBCs) are calculated at each assessment tier level.

Ecological Risk Assessment results (bycatch & protected species)

Ecological Risk Assessments (ERAs) were undertaken between 2019 and 2021 for the sectors of the SESSF identified below, and were supported by the South East Management Advisory Committee (SEMAC) and Great Australian Bight MAC (GABMAC). The reports for the following sectors are available on the AFMA website:

- Commonwealth Trawl Sector (CTS) otter board fleet
- CTS Danish seine fleet
- Great Australian Bight Trawl Sector (GABTS)
- Gillnet Hook and Trap Sector (GHATS) Shark Gillnet fleet
- Gillnet Hook and Trap Sector (GHATS) Auto Longline fleet
- Gillnet Hook and Trap Sector (GHATS) Manual Longline fleet

Other relevant considerations

Non-recovering species

The prevalence of non-rebuilding stocks in the SESSF is strongly suggestive that the various versions of the SESSF Harvest Strategy used are not as robust to uncertainties as we thought. The single species Management Strategy Evaluation (MSE) that have been relied on to test the effectiveness of the various harvest control rules have apparently failed to capture the full effects of fishing and/or the impacts of other processes (including, but not limited to climate change) that have been important determinants of stock trajectories.

Discussions at RAG meetings so far have focussed on fishing mortality and climate change as the cause/solution for non-recovering stocks. While these are the obvious and significant drivers, what might be missing is an appreciation of the changes in ecosystem properties that might also be impeding recovery. For example, within the trophic structure of the ecosystem, these stressors might have non-intuitive ramifications such as release/increase of predation or competition that leads to non-recovery of a species. The stressors or drivers might be anthropogenic or “natural” causes – e.g. directly from extraction, climate change, rebuilding of higher trophic level predators to pre-exploitation levels (e.g. fur seals and whales) but now within a changed environment as a result of not only climate change, but also coastal development, aquaculture and associated activities.

Taking a broader cumulative ecosystem approach may explain the non-recovery of some species, and perhaps an acceptance of non-recovery or permanent change in state. To this end, ecosystem models are being produced which might allow exploration of various factors, including teasing apart the environmental factors from fishery driven factors, and determine which are most influential on stock dynamics. However, these are not used directly to inform the TAC setting process under the current SESSF Harvest Strategy.

Economic considerations

Commonwealth Trawl Sector (CTS) and Shark Hook Sector (SHS) (Source: ABARES)

The CTS and the Scalefish Hook Sector (SHS) contributed approximately 68% of total SESSF gross value of production (GVP) ($109.68 million) in 2020-21. From 2009–10 to 2012–13, real GVP for the 2 sectors

averaged $66.05 million (in 2020–21 dollars; Figure 2). Since 2013–14, GVP has fluctuated around $50 million per year; GVP increased to $74.21 million in 2020–21 mainly because of a large increase in the contribution to GVP from blue grenadier. Tiger flathead, pink ling, blue grenadier and orange roughy are the most valuable species, and together have accounted for about 56% of the GVP on average from 2014–15 to 2018–19, and 73% of GVP in 2020–21 as a result of the increasing contribution of blue grenadier

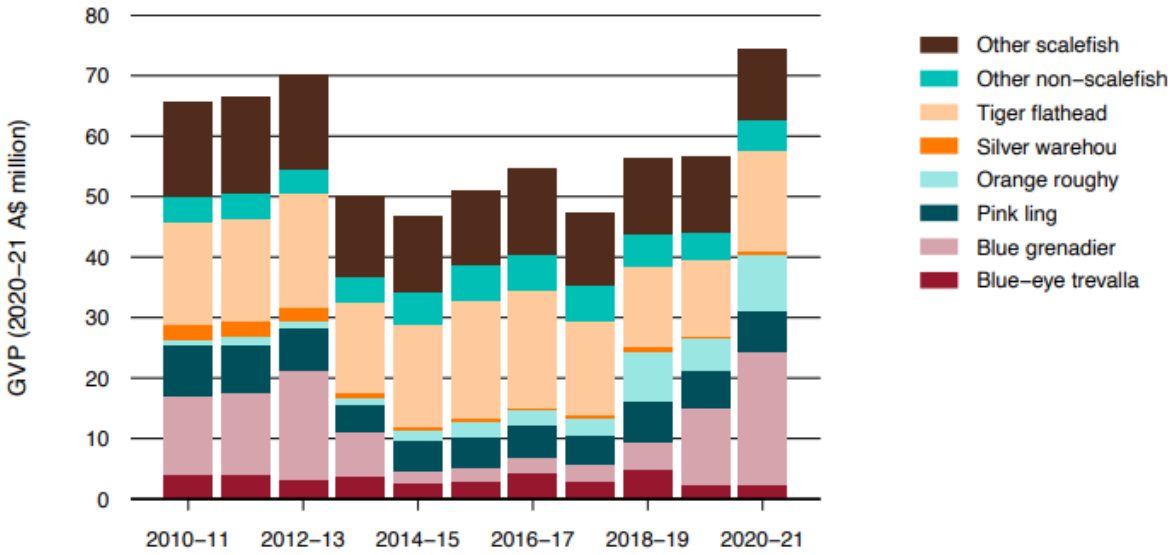


Figure 2: Real GVP, by key stocks, for the CTS and the SHS, 2010-11 to 2020-21 Note: GVP Gross value of production. 'Real' indicates that value has been adjusted for inflation.

Estimates of NER associated with scalefish catches for the CTS and the SHS combined are not available, because ABARES undertakes economic surveys of the CTS separately from the SHS (which is surveyed as part of the GHATS). However, with respect to value, the CTS accounts for most of the scalefish catch, so estimates of NER for the CTS are presented in this section.

The most recent ABARES economic surveys of the CTS illustrate a downward trend in NER (Figure 3). NER have fluctuated significantly since 2008–09, in part due to fluctuating terms of trade – that is, the relationship between input and output prices. The lowest estimated NER coincided with higher input prices and lower output prices.

Total factor productivity has been estimated for the CTS for the period 2002–03 to 2016–17 using ABARES survey data. During this period, as the size of the fleet decreased along with the catch, productivity has risen. This is because fishers have found ways to reduce input use by more than the reduction in catch.

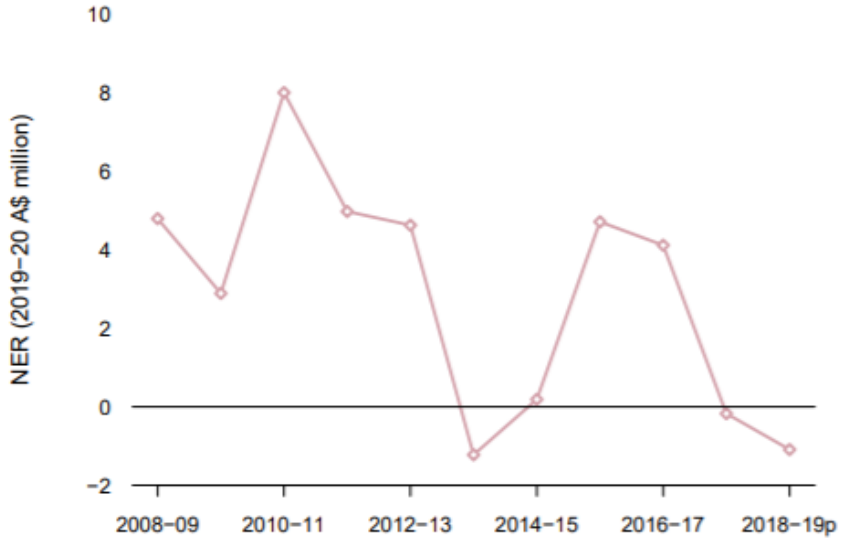


Figure 3: NER for the CTS, by financial year, 2008–09 to 2018–19. Note: NER Net economic returns. Results for 2017–18 and 2018–19 are preliminary, non-survey-based estimates

Great Australian Bight Trawl Sector (GABTS) (Source: ABARES)

Over the period 2010-11 to 2015–16, gross value of production (GVP) in the GABTS declined by 37% to $8.35 million. This reduction was largely attributed to a reduction in total landed catch volume. Since 2015–16, GVP has trended upwards, reaching $10.64 million by 2020–21. Changes in the sector's total GVP in recent years have been driven by changes in GVP of deepwater flathead, the sector's most valuable commercial species, following increases in the landed beach price for the species (Figure 4). Bight redfish, the second most valuable species caught in the sector, has maintained a stable GVP over the same period. Together, these 2 species have accounted for between 62% and 74% of the sector's annual GVP over the past decade.

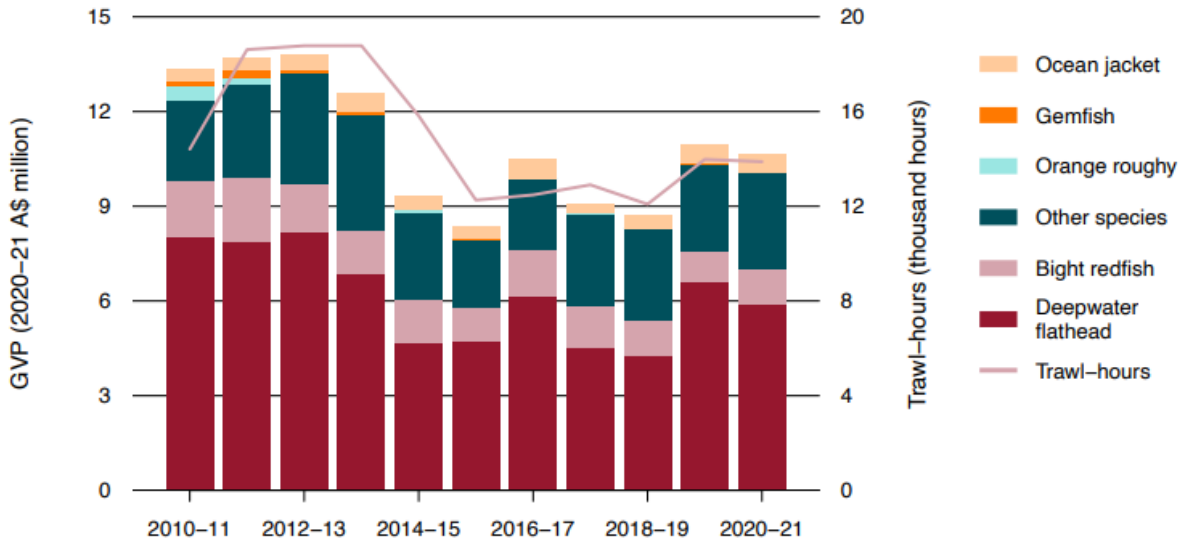


Figure 4: Real GVP for the GABTS of the SESSF, by key stock and trawl-hours, 2010-11 to 2020-21. Note: Trawl-hours do not include Danish seine effort. 'Real' indicates that value has been adjusted for inflation.

Trawling is the main method used. Overall, the number of hours trawled decreased by 20% during the past 10 years. Trawling is typically fuel-intensive, and fluctuations in the price of fuel are therefore likely to be a key driver of sector profitability. Since 2010-11, the Australian average off-road diesel price has

fluctuated, falling sharply from 2013–14 and trending upwards from 2015–16, and back down in 2019–20 and 2020–21.

There is a high and increasing level of quota latency for the two combined primary stocks caught in the sector, suggesting decreasing economic returns. Deepwater flathead represents around half of total landed catch annually in the GABTS, and the percentage of TAC remaining uncaught for this species has trended upwards during the past 10 years, averaging nearly 50% in the past five years. Quota latency for Bight redfish is higher, averaging 69% in the past five years, but trending downwards during the past decade. Market prices for Bight redfish are sensitive to supply (Kompas et al. 2012), so the high level of latency may be partly explained by fishers not wanting to land large volumes of Bight redfish that could drive down the market price.

Shark Gillnet and Hook Sectors (SGSHS) (Source: ABARES)

The real gross value of production (GVP) in the SGSHS for the four shark species taken in the GHATS trended up from a low of $17.7 million in 2013–14 to a $24.8 million in 2020–21 (Figure 5). This recent recovery is primarily the result of higher volumes and prices of gummy shark catch. Gummy shark accounts for the majority of GVP in the SGSHS (90% in 2020-21).

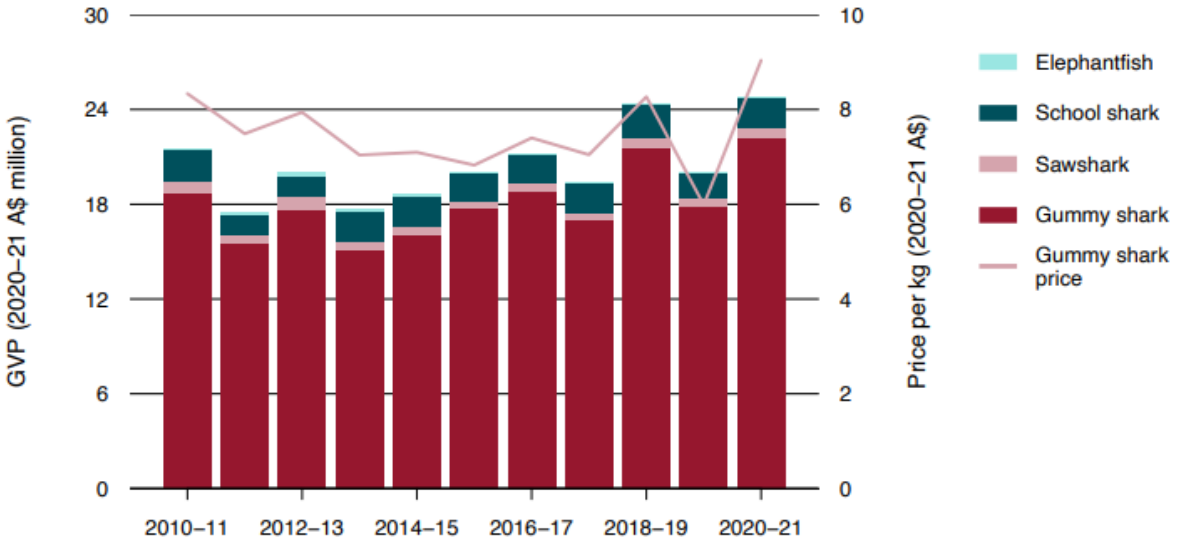


Figure 5: Real GVP for the SGSHS of the SESSF, by key species, and real price for gummy shark, 2010-11 to 2020-21. Note: 'Real' indicates that value has been adjusted for inflation.

The four shark species that make up the SGSHS – gummy shark, school shark, sawshark and elephantfish – accounted for around 79% of the GHTS GVP in 2020-21, with scalefish species making up the remainder.

Survey-based estimates of revenue, costs and net economic returns (NER) in the GHATS are available for 2016–17, and preliminary estimates are available for 2017–18 and 2018–19 (Figures 6 and 7). In 2017–18, non-survey-based estimates indicate that NER became negative (−$3.4 million), potentially as a result of lower catch volume of gummy shark and higher unit fuel prices. In 2018–19, non-survey-based estimates showed a strong recovery, with NER estimated to have reached $5.6 million, largely driven by a significant increase in fishing revenue from higher catch volumes and lower overall fishing costs.

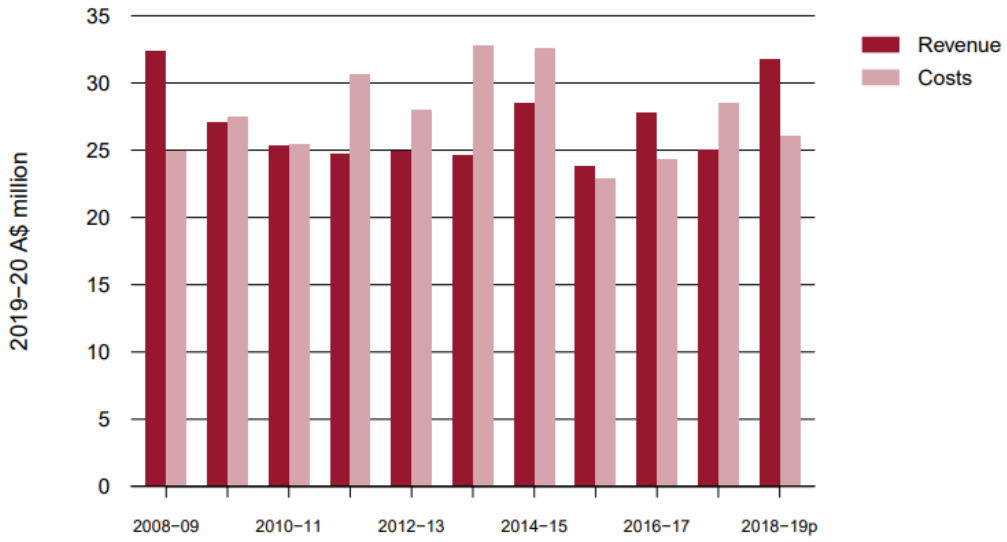


Figure 6: Real revenue and costs for the GHTS 2008-09 to 2018-19.

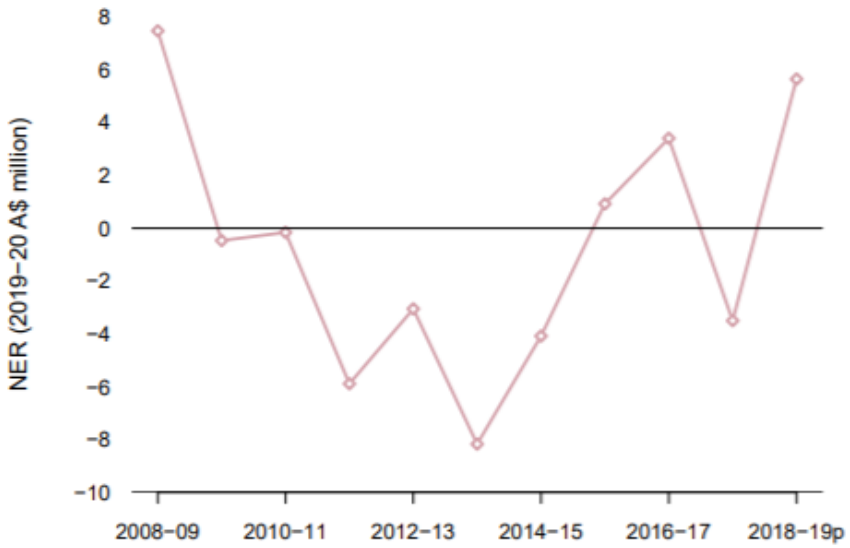


Figure 7: Real NER for the GHATS of the SESSF, 2008–09 to 2018-19. Note: NER estimates for 2018–19 are preliminary non-survey based estimates.

Significant spatial closures implemented in recent years have resulted in relocation of fishing intensity to other areas. Particularly affected were operators who had the full extent of their usual fishing grounds closed, and those who had to switch to use of hooks rather than gillnets in areas where gillnet closures are in place. Some South Australian gillnet fishers also operate in the South Australian Rock Lobster Fishery, which is considered to be profitable and could have supported some SGSHS operators affected by the closures. These changes would have reduced the profitability of gillnet operations in South Australia, contributing to the negative NER in the GHATS following the closures.

East Coast Deepwater Trawl Sector (ECDWTS) (Source: ABARES)

Estimates of net economic returns are not available for the ECDWTS and estimates of the sector's gross value of production are confidential. The long distance to fishing grounds for the CTS fleet and use of

trawl gear for targeting this species means that fuel costs are likely to make up a higher proportion of total fishing costs in the ECDWTS than for the key CTS fishing grounds. Higher expected profit in the CTS and other fisheries that permit holders operate in may be a key driver of low levels of activity in the ECDWTS.

Social considerations

In November 2017, a new objective was introduced in the *Fisheries Management Act 1991* requiring AFMA to have regard to the interests of commercial, recreational and Indigenous fishers and ensure these interests are taken into account.

Commonwealth fisheries are a shared resource that provide a range of benefits to the Australian community. With many groups accessing Commonwealth fisheries, sharing these resources fairly has been a priority for the Government and Australian fishers for many years. To address this priority, the Commonwealth Fisheries Resource Sharing Framework (the Framework) was released in 2020. The Framework outlines the Government's approach to sharing fisheries resources across commercial, recreational, and Indigenous fishing sectors and between the Commonwealth, the States and the Northern Territory. The Framework provides a principles-based approach to creating resource sharing arrangements to manage access and allocation issues in Commonwealth fisheries. No resource sharing arrangements have yet been developed that impact the SESSF sectors.

Commercial fishers' interests

SESSF operators have raised concerns about resource sharing between sectors and jurisdictions and the potential impact on Commonwealth TACs.

The concerns raised are in relation to the take of key Commonwealth managed species including gummy shark and school shark in South Australia (SA) and eastern school whiting in New South Wales (NSW). AFMA is working with SA to strengthen measures to ensure the catches of shark remain within SA's agreed allocation. AFMA has also worked closely with NSW to develop complementary management arrangements for shared stocks, including participating in meetings held by the NSW Department of Primary Industries (DPI) in relation to developing harvest strategies for relevant fisheries, including the NSW Trawl Whiting Sector. The NSW Trawl Whiting Harvest Strategy was published in May 2022 and is the first harvest strategy for the Trawl Whiting Fishery to be developed for NSW.

In March 2022, AFMA began consulting holders of relevant fishing concessions in the CTS regarding proposed closures to minimise fishing mortality of at-risk species, including jackass morwong, John dory and blue warehou.

The AFMA Commission then considered an analysis of catch and effort data in September 2022 to understand industry feedback received over 3 rounds of consultation. The Commission agreed to implement a set of spatial closures effective from 1 May 2023.

The final closure design includes 5 areas off the south-east coast from Eden, NSW, to Hobart, Tasmania covering an area of approximately 5,547 km2. All closures will apply to all CTS boats using otter trawl gear. Closure D (east of Flinders Island) will not apply to boats using Danish seine gear, subject to gear modifications being adopted across the Danish seine fleet that can be expected to offset catches of at-risk species that would otherwise have been caught in this area.

The October 2022 Budget provided $24 million for a structural adjustment package (managed by the Department of Agriculture, Fisheries and Forestry) to support industry through the implementation of management changes in the CTS.

Recreational fishers' interests

Recreational fishing members on SEMAC and SERAG contribute recreational fishing knowledge and expertise to committee deliberations, including the catch-setting processes.

The SESSF Harvest Strategy provides for recreational catches to be deducted from the RBC to produce a TAC, where recreational catches are known and included in the assessment.

Recreational catch information is listed in the relevant species summary below. Estimates for most species are currently uncertain and not available consistently through time. For species in this category, recreational catches have not been incorporated into the assessment and TAC calculations. Where reliable data is available, such as recreational survey information, it may be considered by the relevant RAG as a line of evidence when recommending RBCs and TACs and / or incorporated into the assessment.

There is a paucity of recreational catch data; particularly for recreationally important species such as gummy shark, school shark, blue-eye trevalla and silver trevally. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) continues to liaise with each of the state agencies to obtain all available state data and emphasise the need for regular and ongoing surveys to obtain reliable data to inform assessments and management decisions.

Indigenous fishers' interests

AFMA is in the process of establishing how best to consider Indigenous fishers' interests and ensure that they are taken into account appropriately. In 2012, the Fisheries Research and Development Corporation (FRDC) established an Indigenous Reference Group (IRG) to assist in working towards a Fisheries Research, Development and Extension (RD&E) plan for indigenous Australians.

In February 2020, the *Integrating indigenous fishing: extending adoption pathways to policy and management* project (FRDC 2019-168) commenced, which will identify impediments and opportunities for Indigenous engagement and adoption of IRG project outputs across fisheries management jurisdictions in Australia.

As at the date of this paper, no Indigenous fishers' interests have been identified that would impact on SESSF TACs for the 2022–23 fishing year.

Intersection with State and International fisheries

Where State catches are included in an assessment, estimates of State catches for the upcoming fishing year are deducted from the RBC to produce a Commonwealth TAC. Future State catches are estimated using a four-year weighted average of catches reported by the relevant State fisheries agency. However, the impact of management changes in State fisheries can be considered in forecasting the State catch in the upcoming fishing year.

In 2019, a NSW TAC was introduced for a range of species. Many of these species are also subject to a Commonwealth TAC[1]. When accounting for total mortality of a species in the stock assessment and then calculating the Commonwealth TAC, the key consideration is actual catches, not the NSW TAC. For this reason, the four-year weighted average for NSW catches is considered when making Commonwealth TAC recommendations in this paper for species where NSW State catches are deducted.

[1] This includes the following species relevant to the SESSF: big eye ocean perch, blue eye trevalla, gemfish, hapuku, pink ling, blue spotted flathead, eastern school whiting and stout whiting (combined), silver trevally and tiger flathead.

No developments in fisheries on the high seas or other countries' exclusive economic zones have impacted on these Commonwealth TAC recommendations.

Key fishery projects and developments relating to TACs

A number of research projects relevant to stock assessments and the TAC setting process are underway, many of which are interlinked and at various stages of completion. A summary of the relevant projects is provided below.

Climate change adaptation handbook

Adaptation of fisheries management to climate change handbook has been developed to help fishery managers understand the climate driven changes to ocean variables; the potential sensitivity of individual fisheries to that physical and ecological change; and if the fishery can easily and rapidly autonomously adapt. For example, whether fishers can change how they fish or their business practices to relieve the pressure on their business or the ecosystem, or a longer process is required that involves changing management plans and modifying management methods.

The impacts of climate change on SESSF species have been discussed in a number of different SESSF resource assessment groups in 2022 and a preliminary workshop using the adaptation handbook was held with SESSFRAG in mid-2022. Further discussions and workshops with RAGs and broader stakeholders are being planned for 2023.

Ecosystem structure and function indicators

The development of ecosystem structure and function indicators can assist ecosystem approaches to fisheries management. A working group, funded by CSIRO and the Lenfest Oceans Program, considered social, economic and ecological indicators (with a focus on ecological indicators). These indicators were tested in models but also explored using data from 4 case study regions around the world including the SESSF. For the SESSF this has involved looking at the fisheries data in ways not done in any depth before for the region.

The conglomeration of information provides an understanding of the ecosystem, including its resilience to any distortive pressure that might be applied on the ecosystem against the conditions the ecosystem has evolved to withstand. The next step (beyond the end of the current project) is working to take this understanding into operational management such as through harvest strategies. The understanding of the system derived from this analysis (and parallel analysis on Fishery Independent Survey (FIS) data) is being used to inform work on multispecies harvest strategies and work on the "biological parameters project".

Revisiting biological parameters

Revisiting biological parameters and information used in the assessment of Commonwealth fisheries: a reality check and work plan for future proofing (FRDC 2019-010) aimed to identify best practice methods for updating high risk and impact parameters and to develop a prioritised workplan for updating these parameters. The FRDC have expressed interest in maintaining the database of parameters that has been developed as a live resource that could be regularly updated and accessible to assessment scientists and fisheries managers.

Many assessment models rely on biological parameters that are now getting out-dated, have an unknown provenance, are based on datasets that are no longer accessible or useable, and/or use parameters that are borrowed from other species where information is not available. There is evidence that life histories of some fish populations have shifted in response to pressures caused by exploitation and changing

environmental conditions. The project focussed on data rich species which could be assessed with Tier 1 assessments. Some Tier 1 assessments account for uncertainties in biological parameters, but in around half of the parameters examined, a 4–20% difference with the value used in the stock assessment was expected. The reliance of current assessments on information that could be out-of-date or does not reflect the biology of the species being assessed leads to increased uncertainty in the information underpinning management decisions. Improving information accessibility and workflows, exploring uncertainties in stock assessments further, streamlining the determination of biological parameters and improving methods to change stock assessments will improve the use of biological parameters in the future.

Dynamic reference points and harvest strategies

Understanding factors influencing under-caught TACs, declining catch rates and failure to recover for many species in the SESSF (FRDC 2016-146) made a number of recommendations including incorporating the potential impacts of climate change on species abundance into assessments and developing an approach to determine if there has been a productivity change in a species. These issues are being further considered as part of the development of a new Harvest Strategy and a number of other initiatives.

Implementation of dynamic reference points and harvest strategies to account for environmentally-driven changes in productivity in Australian fisheries (FRDC 2019-036). This project is considering the use of dynamic reference points and will make recommendations on future stock assessment approaches, data requirements, harvest control rules and management approaches incorporating environmental indicators and dynamic productivity and dynamic reference points. The project uses four SESSF stocks[2] as the main case studies covering a variety of different recruitment patterns and historical trends in dynamic B_0.

RBC and TAC calculations explanations

RBC and TAC recommendations

For the relevant species summaries below, the way in which the RBCs are applied depends on the assessment tier and whether a MYTAC has been recommended, as follows:

- Tier 1: The RBC is based on modelled-projections from the most recent stock assessment, as either single-year or multi-year RBCs, for the year following the stock assessment through to the end of the recommended MYTAC period, if a MYTAC is recommended, or until the next scheduled assessment.
- Tier 4: The RBC is recommended based on the single-year RBC from the most recent stock assessment, for the following year through to the end of the recommended MYTAC period, if a MYTAC is recommended, or until the next scheduled assessment.
- Tier 5 and 'weight-of-evidence' approach: RBCs are based on the outputs of the 'preferred' Tier 5 methods identified using the FishPath tool. If harvest control rules cannot be specified using this approach, a weight-of-evidence approach may be used without an RBC being recommended. TACs are recommended either as single-year TACs or MYTACs.

[2] redfish, jackass morwong east, silver warehou and blue grenadier

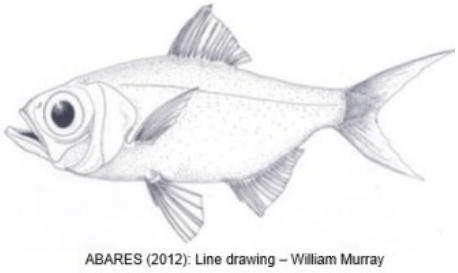
Where a MYTAC has been recommended, the RBC/TACs for that period are included in the tables below. Where a single-year TAC has been recommended, only the 2022 RBC/TAC is included in addition to the previous two years' RBC/TAC.

Discount factor

Consistent with the HSP, which establishes a more precautionary approach to harvest control rules for species subject to more uncertain assessments, the SESSF Harvest Strategy provides for application of a 15 per cent discount factor to RBCs derived from Tier 4 assessments, however exceptions may be considered where demonstrable alternative equivalent precautionary measures are in place. Detail relevant to the application of the discount factor is included in each of the individual species summaries below.

Discards, State and recreational catch and research catch allowance

When other sources of mortality arising from discarded catch, catch taken by States, recreational or research catch allowance are included in an assessment, they are subtracted from the RBC to produce a Commonwealth TAC.


ABARES (2012): Line drawing – William Murray

Alfonsino

Beryx splendens

Species summary

Common names	Golden-eye perch
Stock assessment	Tier 3 species - last assessed by SlopeRAG in 2013.
Stock structure	Little is known about the stock structure of alfonsino in the SESSF. It is acknowledged that it is a straddling stock between the Australian Fishing Zone (AFZ) and the high seas. This assessment summary pertains only to the ECDWT Sector, as this is the only resource under quota management.

Stock status against reference points (F_{48}/F_{20})

Tier	Assessment Year	$F_{current}$	F_{48}	F_{20}
3	2013	0.022	0.149	0.479
3	2010	0.025	0.149	0.479
3	2008	0.283	0.149	0.479

Stock trend and other indicators	There have been less than 4 t of Alfonsino caught per annum in the last two years (Sporcic, 2022). Catches remain well below the TAC as very few boats have been fishing the stock. When last assessed, the age structure indicated that the stock had not been greatly impacted by fishing. There has been very little fishing since then, with the first catch recorded in 2019 (~6 t) though not in a part of the fishery that requires quota, hence zero catch is recorded below under 'Cth Retained Catch'.

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
8th of 3-year	Maintain current MYTAC

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	1,017	1,119	-
2021-22	1,017	1,119	0
2020-21	1,017	1,119	0

Economics (Byproduct)

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2020-21	Confidential	Confidential	Confidential

East Coast Deepwater Trawl	2019-20	Confidential	Confidential	Confidential
	2018-19	Confidential	Confidential	Confidential
ABARES Status (2022 Report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Medium	20% decrease	Medium	Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	Tier 3 species use estimates of fishing mortality (F) that will reduce spawning biomass to a given level (reference points). The Tier 3 target reference point for alfonsino is the level of F that will produce a spawning biomass of 48% of unfished levels. The Tier 3 limit reference point for alfonsino is the level of F that will produce a spawning biomass of 20% of unfished levels.
Significant changes to data inputs	Calculation of the RBC only uses AFZ data, and so pertains only to the AFZ.
Data and RAG comments	Tier 3 assessments are no longer used under the SESSF Harvest Strategy, and there is little new data available due to lack of fishing for operational reasons.
Stock assessment information and RAG comments	In March 2018, SESSFRAG recommended delaying the next assessment until 2019 due to low catches and a lack of data. Catches have remained low and an assessment has not been updated. RBC calculations used to set TAC are taken from the AFZ only.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SlopeRAG (November 2013) recommended a 3-year MYTAC using the RBC of 1,070 t from the 2013 Tier 3 assessment.

In August 2020, SESSFRAG recommended continuing the MYTAC, with future assessment needs to be reviewed when catches increase.

In October 2022[3], SERAG recommended maintaining the existing TAC, noting low catches and a lack of new data.

[3] Minutes from this meeting are currently being finalised

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023-24	1,070*	No SERAG will continue to provide RBC advice on an annual basis.
	2022-23	1,070*	
	2021-22	1,070*	
	* High seas catch was deducted from the RBC (1,228 t, Tier 3 assessment 2013) resulting in an AFZ RBC of 1,070 t.		
Discount factor (t)	53.5	The default Tier 3 discount factor of 5 per cent continue to be applied	
State catch (t)	N/A	There are no estimates of State catch, rarely caught in State fisheries.	
Discards (t)	N/A	There are no estimates of discards.	
Recreational catch (t)	N/A	There are no estimates of recreational catches.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		1,017 t	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion, or bycatch species.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC at Feb 2023 SEMAC meeting	TBC at Feb 2023 SEMAC meeting	TBC at Feb 2023 SEMAC meeting	TBC at Feb 2023 SEMAC meeting

AFMA Advice				
AFMA Management recommends a TAC of 1,017 t for the 2023-24 fishing year, the ninth year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.				
2022–23 agreed TAC (t)	**2023–24 recommended TAC (t)**	**Overcatch & undercatch (%)**	**Determined amount (t)**	**Change in TAC (t)**
1,017	1,017	10	2	0

Bight redfish

Centroberyx gerrardi

Species summary						
Common names	Bight redfish, redfish, nannygai, golden snapper, red snapper, red squirrel-fish					
Stock assessment	Tier 1 Species - last assessed by GABRAG in 2022.					
Stock structure	Assessed as a single stock.					
Stock status against reference points (%B_0 in assessment year +1)	**Tier**	**Assessment Year**	**Biomass (from assessment year)**	**Biomass (revised in most recent assessment)**	**Target**	**Limit**
	1	2022	66	66	41	20
	1	2019	64	64		
	1	2015	62	60		
Stock trend and other indicators	Modelling suggests a slow decline in spawning biomass, consistent with the fish-down of a developing fishery to near the target in 2009. Annual catches peaked in the mid-2000s, before declining to 200-300 t p.a. which has resulted in a steady increase of the stock to an estimated biomass of 67% B_0 at the start of 2023-24. Depletion of the stock occurred more rapidly in the mid-2000s, when substantial fishing effort occurred, but the stock has never fallen below the Maximum Economic Yield (MEY) biomass target.					
Multi-Year TAC	**Year of MYTAC (2022-23)**				**MYTAC advice**	
	3rd of 3-year				GABRAG (Dec 2022[4]) recommend a 3-year MYTAC with the assessment to be updated in 2025.	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC (t)**		**TAC (t) after unders/overs**	**Cth Retained Catch**
	2022-23		890		979	-
	2021-22		893		982	215
	2020-21		893		953	202

[4] Meeting minutes are currently being finalised

Economics (Primary) Great Australian Bight Trawl	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2020-21	1.08	10.64	10.15
	2019-20	0.93	10.76	8.64
	2018-19	1.07	8.48	12.62

ABARES Status (2022 Report)	Fishing Mortality: Not subject to overfishing	Biomass: Not overfished

Climate sensitivity	Sensitivity	Preliminary projection	Confidence in projection	Comments
	Medium	Uncertain	Medium	↓20% through to ↑10%

Assessment summary

Key model technical assumptions/ parameters	Single stock (Zone 80). Two sex model. One fleet: Trawl (separated for different sources of length data – ISMP, Industry, GAB-FIS). Selectivity is allowed to vary between the GAB-FIS and the trawl fleet. Discards are minimal and not included in the assessment. Natural morality rate *(M)*: estimated at 0.1049 (well estimated, range 0.091-0.107). Recruitment deviations: estimated (1960-61 – 2007-08).
Significant changes to data inputs	The catches from South Australia were aggregated by financial year. The catch series was revised to include catches from southern Western Australia (535 t total). Male and female Bight redfish were assumed to have different growth parameters including growth coefficient, asymptotic length, and length at age-0.
Data and RAG comments	GABRAG (Dec 2022[4]) noted the following from Curin-Osorio & Burch (2022): The likelihood profile for natural mortality indicates that *M* is quite well estimated and similar to the 2019 assessment. The age data are most influential, with the index (higher mortality) and length data (lower mortality) showing some conflict. The estimated range (95% CI) is from 0.091 to 0.107 which is slightly lower than the 2019 assessment. The likelihood profile for steepness of the Beverton Holt stock recruitment relationship (*h*) suggests it is poorly estimated, flat, and uninformative. The likelihood profile shows *h* cannot be estimated and is therefore fixed at *h*=0.75 in the base case. The model is unable to fit the recent GAB-FIS indices and the recent trawl CPUE estimates between 2016-17 and 2021-22. Fits to length data are good and the length frequency data is relatively stable from year to year. The results from sensitivities were most sensitive to *M* and halve weighting on the GAB-FIS. - Changing weighting on length and age data resulted in small changes to stock status estimates.

	- Doubling and halving weighting on the GAB-FIS index resulted in large changes to total likelihood estimates but had minimal impact on stock status (65% and 68% of B_0). - All model sensitivities estimate the stock status to be at or above the target reference point of 41% The estimates of recruitment deviations have not varied to any substantial extent and show a fluctuating pattern about the mean. Since 1998-99 recruitment has been at or above the long-term average. Excluding the last 3 GAB-FIS data points had minimal impact on the fits to the trawl fleet CPUE series and GAB-FIS indices and the subsequent biomass. GABRAG noted inconsistencies with the 3 most recent GAB-FIS biomass estimates and the assessment outputs, with suggestions the GAB-FIS is influenced by external impacts such as stock availability and catchability. GABRAG noted the following: - The model has consistently shown poor fits to commercial CPUE and the GAB-FIS index. This is likely associated with the longevity of this species and modelled population dynamics are unable to reflect the more rapid changes observed in the CPUE and GAB-FIS indices. These are unlikely to be of concern as the stock is estimated to be well above the target reference point. - Future work is needed to understand why the recent GAB-FIS and commercial CPUE indices are at odds with the stock assessment. - GABRAG noted the importance of investigating the inverse relationship between availability of deepwater flathead and Bight redfish to the fishery.
Stock assessment information and RAG comments	The 2022 base case assessment estimated the unexploited female spawning stock biomass (B_0) to be 4,535 t, compared to 4,019 in the 2019 assessment. Average estimated length of females was estimated to be 42.54 cm and for males to be 38.98 cm. The length at one year old for females was estimated at 19.66 cm and males at 19.87 cm. The growth rate is estimated to be 0.07 cm for females and 0.08 for males. Spawning biomass declined from 2005-06 until 2009-10. From 2010-11 until 2021-22 there has been a reduction of fishing mortality with an increase in biomass to well above the target level. Fishing pressure was above the target from 2005-06 to 2008-09, however has since dropped below the target level over the last 13 years. Under the 20:35:41 harvest control rule, the 2023-24 recommended biological catch (RBC) is 1,056 t, with a 3-year average of 994 t and a long-term yield of 595 t per annum.
Projected biomass	The projected 2023-24 spawning stock biomass is estimated to be 67% SSB_0 (Figure 20 from Curin-Osorio & Burch (2022)), compared with 68% in the 2022 preliminary base case and 64% for 2020-21 in the 2019 assessment.

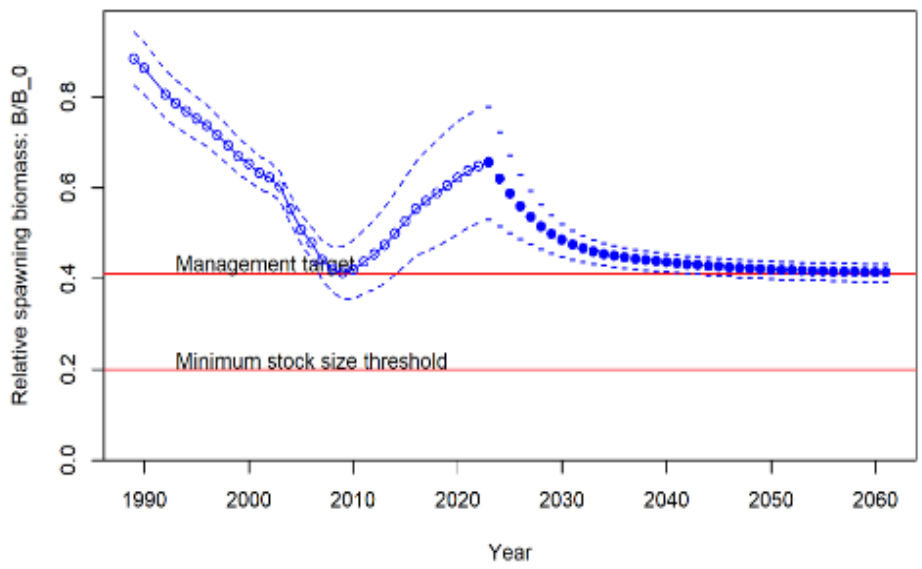


Figure 20 from Curin-Osorio & Burch (2022): The estimated time-series of relative spawning biomass for the 2022 base case assessment model for Bight redfish with projections applying the HCR to 2060.

Species specific research and priorities

GABRAG (Dec 2022[5]) identified the need to understand stock distribution and change in availability and catchability.

RAG Recommendations

GABRAG (Dec 2022[5]) recommended a 3-year MYTAC using the average RBC from the 2022 stock assessment.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2025-26	934	Yes 3-year MYTAC recommended
	2024-25	993	
	2023-24	1,056	
	3-year average	994	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	34.71	Estimates are from SA and southern WA state catches.	
Discards (t)	N/A	Estimates of discards are considered low and are not deducted from the RBC.	

[5] Meeting minutes being finalised

Recreational catch (t)	N/A	Estimates of recreational catch available for SA, 19 t in 2014, and Western Australia (WA), 13.3 t in 2008. Recreational catch is not included in the assessment and are not deducted from the TAC.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		959 t

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion and bycatch species.
MAC advice and any dissenting views	**2023-24 TAC recommendation** 959 – first of a 3-year MYTAC **GABMAC advice and any dissenting views** GABMAC supported the 2022 Tier 1 stock assessment at their December 2022 meeting. GABMAC supported GABRAG's recommendation to move from a 5-year to a 3-year MYTAC.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	959

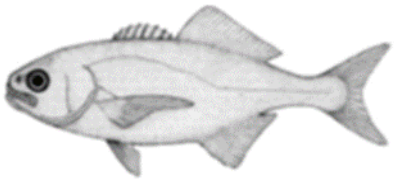
AFMA Advice

AFMA Management recommends a TAC of 959 t for the 2023-24 fishing year, the first year of a 3-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
890	959	10	2	+69

Blue-eye trevalla

(Hyperoglyphe antarctica)



ABARES (2012): Line drawing – FAO

Species summary

Common names	Bluenose, big-eye, blue-eye, blue-eye cod, bluenose warehou, deep sea trevalla, sea trevally
Stock assessment	Tier 4 assessment for slope stock was considered by SERAG in 2022. Catch-Maximum Sustainable Yield (MSY) and age-structured stock reduction analyses for the seamount stock were considered by SERAG in 2018 and 2021.
Stock structure	Variation in age and growth, otolith chemistry and potential larval dispersal, indicate there is likely to be one stock on the continental slope (from which most of the catch is taken) which is separate from the stock(s) found on the east coast seamounts. Fish on the seamounts are assumed to be reproductively isolated from the slope stock. Potential stock structure among the seamounts is not clear. Separate RBCs were determined for the slope and seamount stocks for the first time in 2018, however - a single, combined TAC continues to be set for blue-eye trevalla.

SLOPE

Stock status against reference points (C_{Lim}/C_{Targ})

Tier	Assessment Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2022	0.7917	1.2286	0.5119
4	2021	0.901	1.2287	0.512
4	2020	0.7656	1.2321	0.5134

SEAMOUNT

Stock status against reference points ($\%B_0$)

Tier	Year	Stock status	Target	Limit
5	2021	33*	48	20
5	2018	33*	48	20

No assessment prior to 2018.

*Current depletion for the seamount stock was estimated to be about $0.33B_0$ although the uncertainty about that value is extreme. SERAG (November 2021) considered the available data and agreed there was no basis on which to revise the outputs of the 2018 catch-MSY analysis.

Stock trend and other indicators	Total blue-eye trevalla catches have declined from 652 t in 2004 to 204 t in 2021. Zone 20-30 – Annual standardized CPUE has been below average since about 1996 and shows a relatively flat trend (Sporcic, 2022). Zone 40-50 – Annual standardized CPUE has been mostly below average since about 1996 while the trend has been mostly flat. CPUE are consistent from 1988 - 1991 (i.e., before the

	introduction of quotas in 1992) but are double that following the introduction of quota. Relatively very few vessels now contribute to significant catches (Sporcic, 2022). Seamount Catch from the seamounts has been less than 40 t for the past 3 years.

Multi-Year TAC	Year of MYTAC (2022-23)	MYTAC advice
	Single year TAC (slope) 1st of 3-year MYTAC (seamount)	Continue with 2022 assessment for the slope and maintain the seamount MYTAC.

Catch and TAC (t)	SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
	2022-23	241	247	-
	2021-22	241	283	243
	2020-21	448	493	225

Economics (Primary) Commonwealth Trawl and Scalefish Hook	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2020-21	2.48	64	3.87
	2019-20	2.21	51.34	4.30
	2018-19	4.65	49.47	9.40

ABARES Status (2022 Report)	Fishing Mortality: Not subject to overfishing	Biomass: Not overfished

Climate sensitivity	Sensitivity	Preliminary projection	Confidence in projection	Comments
	Medium	↑ up to >50+%	Medium	Decline more in east, may increase in Bonney upwelling area.

Assessment summary

Key model technical assumptions/ parameters	
	The Tier 4 assessment assumes there is a linear relationship between standardised CPUE and exploitable biomass, and that the character of the estimated CPUE has not changed significantly since the reference period to the end of the most recent year. Both assessments assume that biomass was unfished prior to 1985 (when fishing started). Seamount *Catch-MSY* The catch-MSY assessment is a data-poor approach which makes assumptions about unfished biomass as well as a range of other assumptions around carrying capacity, intrinsic growth,

	maximum harvest rate, and current stock status, and requires a time series of known catches that have not been impacted by management. *Age-structured stock reduction analysis* Noting that not all seamounts would be fished in a given year, the model has assumed that harvest rates do not exceed 50 per cent in a single year. This adds constraints to the analysis and assumes that there must have been at least twice the biomass relative to what was caught in any year. Known biological parameters (length at age, length at maturity, weight at length) are used and plausible ranges are assumed for steepness, natural mortality, unfished stock size and current stock status.
Significant changes to data inputs	Slope The catch-time series used in this assessment was based on Sporcic and Day (2021), except for the Commonwealth records (see 'CWTH' in Table 9; Sporcic and Day 2021), which incorporated estimates of Catch Disposal Records (CDRs) that were categorized into slope for the first time (Althaus *et al.* 2022). This series was subsequently endorsed by SESSFRAG (August 2022) for use in this assessment (Sporcic 2022c). Differences in the catch series between this and the 2021 assessment are due to the CDR slope split. As requested by SERAG in both 2020 and 2021, the standardized CPUE series in this assessment was based on data corresponding to SESSF zones 20-50 and the Great Australian Bight (GAB) (Sporcic 2022c). The DayNight factor has been updated to account for additional auto-line records (i.e., to include records identified as 'ALL' and 'LLA' in addition to 'AL') that have both start and end times to estimate an average time fished for specific gear types and fishery, which are used in this year's DayNight calculation for the first time. This CPUE series was subsequently endorsed by SESSFRAG (August 2022) for use in this assessment (Sporcic 2022c). Seamount The 2021 update to both data-poor methods included catches from the Tasmantid seamounts plus the Lord Howe Rise whereas the 2018 assessment did not include the Lord Howe Rise.
Data and RAG comments	Slope In 2020, revised NSW annual catches were provided from 1986 onwards, noting the assessment used catches from only 1997 onwards. There remains some uncertainty in the early catch series with regards to state catches which need to be resolved. Early records of high discards are likely from trawl. There are no significant recent discards and as such are not included in the Tier 4 assessment. SERAG supported the modifications to logbooks to require longline operators to routinely report the presence of orcas and evidence of depredation, to allow for this issue to be accounted for in future assessments. Seamount Catch data were provided by NSW fisheries and the Commonwealth logbooks. Discard rates are negligibly low. SERAG (2021) agreed that data should be collected to move this stock out of the Tier 5 assessment method, noting that the Close Kin Mark Recapture scoping project currently underway may provide a reasonable avenue to do this.
Stock assessment information and RAG comments	Slope The CPUE analysis assumes there is mixing throughout the stock, however the stock is understood to be broadly distributed but localised. The 2022 RBC was approximately 249.08 t, corresponding to a 100.24 t decrease compared to the 2021 RBC, i.e., 349.32 t. This 28.7% decrease in RBC between consecutive assessments

	can be mostly attributed the use of the new standardized CPUE series which resulted in a lower most recent four-year average compared with the corresponding average standardized CPUE from the previous assessment. The scaling factor of approximately 39% which is applied to the target catch reflects this RBC decrease. The 2022 estimated RBC (i.e., for the 2023 fishing season) is greater than the reported catch of approximately 204.1 t in 2021 for this species (Sporcic, 2022d). Seamount *Catch-MSY Analysis (2021)* Without an index of relative abundance, results can only be presented for a wide range of possible parameter values and these include current stock status. The 2018 Tier 5 assumed initial stock status of 50%B_0 – 97.5%B_0 and current status of 5%B_0 – 50%B_0. The 2021 work also presented alternative assumptions of 80%B_0 – 100%B_0 initial and 5%B_0 – 100%B_0 current stock status. For all other assessments, SERAG would typically use parameter set that has greatest support from the data (the maximum likelihood estimate) in generating RBC advice, however data-poor methods are not fitted to data and there is no Maximum Likelihood Estimate (MLE) estimate. All possible results therefore have equal weight of evidence. Dr Haddon suggested treating the median as a summary rather than the 'best estimate' of stock status. While highly uncertain, the catch-MSY analysis generates an MSY of about 45-60 t but note that MSY is a sustainable level of catch only if stock status is above BMSY (50% for the C-MSY model). *Age-structured stock reduction analysis (2021)* SERAG (November 2021) considered more recent catch data and supported including catches from the Lord Howe rise, which were not included in the 2018 assessment. Including this additional catch in the Catch-MSY resulted in a lower range of estimated depletion, with 4% and 27% falling below the limit reference point for the two alternative selectivity curve scenarios. The assumptions made by the 2018 modelling work were varied: an alternative selectivity curve that allows capture of younger fish was used, and initial and current depletion ranges were altered. An alternative growth curve was also used, but this had little influence on the results. A Tier 1 like HCR was used to calculate an RBC for every biomass trajectory calculated (across the ranges of assumed parameter values, stock status, and maximum harvest rates) and the resulting RBC estimates were plotted as histograms for alternative catch time series, and for each assumed selectivity curve. RBCs ranged from zero to almost 200t with several histograms showing peaks in the 50-100t range. While several plots also showed large numbers of zero RBCs, especially for the selectivity curve that takes younger fish, an annual catch in the range of 30-40 t appears likely to be sustainable, even conservative. SERAG agreed the current TAC of 36 is within the range of RBCs produced when a harvest control rule is applied to the outputs of the SRA and that there was no basis for revising the previous TAC advice. Because blue-eye trevalla seem likely to suffer from localised depletion, it was advised that catches be spread across seamounts rather than concentrated in a small area.
Projected biomass (Tier 5)	The Tier 5 assessment suggested that constant catches of 36 t would maintain stock stability or slow stock changes.
Species specific research and priorities	
Blue-eye trevalla close-kin scoping study (funded)	

Blue-eye trevalla is one of the few target species not assessed at a Tier 1 level. A close kin mark-recapture feasibility study was conducted to determine how this method could be used for assessment and to determine population characteristics and provide more certainty to the advice underpinning management. The study will provide a sample design and costing for a sampling close-kin mark-recapture sample of blue-eye trevalla. The study has been completed and the outcomes are being incorporated into a broader project to understand the scope of close-kin mark-recapture approaches across the SESSF.

RAG Recommendations

SERAG (October 2022[6]) recommended a 249 t RBC from the 2022 Tier 4 slope assessment. This is to be combined with the 36 t MYTAC from the Seamount 2021 assessment. SERAG (October 2022[7]) also recommended the discount factor be applied to the 2022 tier 4 assessment.

SERAG have agreed to develop a workplan which will address CPUE concerns such as developing close-kin sampling protocols.

	Year	RBC (t): Slope	RBC (t): Seamount	Is a MYTAC recommended?
Recommended Biological Catch (t)	2023	249	36	No SERAG recommended a single-year TAC to ensure the slope CPUE series is closely monitored.
	2022	349	36	
	2021	227	36	
Discount factor (t)	37 t (applied to Tier 4 RBC)	SERAG (October 2022[7]) supported the application of the 15 per cent discount factor to the Tier 4 slope stock RBC. Regarding the seamount stock, in comparing the outcomes of the SRA to the current TAC, SERAG considered that the current TAC is "adequately precautionary", in effect amounting to implementing an appropriate discount factor		
State catch (t)	10.1	Mostly NSW catches – declining in recent years.		
Discards (t)	N/A	Estimates of discards are considered to be low and are not used in assessment. As such, they are not deducted from the RBC.		
Recreational catch (t)	N/A	There are no records of recreational catch.		

[6] Minutes from this meeting are currently being finalised

Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		238 t

MAC Recommendations

Commercial fishers' interests	Industry have previously noted that the seamount stock of blue eye trevalla is an episodic fishery with high operating costs given the travel time.
Species specific management (target, companion and bycatch)	Auto longline operators catch pink ling and blue-eye trevalla together. There may be implications for pink ling catches due to changes in blue-eye trevalla TAC. Trigger to be implemented for the seamount stocks, with no more than 54 t to be taken in any fishing year. SSIA manage an industry agreement under which seamount catches are tracked and monitored.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

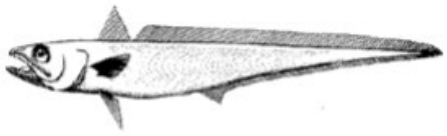
AFMA Advice

The decline in stock status for some SESSF stocks on the east coast is an ongoing cause for concern. AFMA Management recommends a TAC of 238 t for the 2023-24 fishing year – a single year TAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
241	238	10	2	-3

Blue grenadier

Macruronus novaezelandiae



ABARES (2012) Line drawing - Rosalind Poole

Species summary

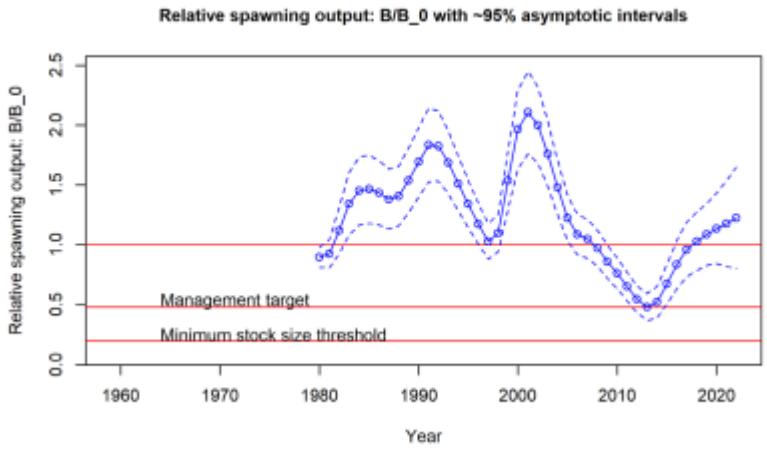
Common names	Hoki, blue hake, whiptail					
Stock assessment	Tier 1 Species - last assessed by SERAG in 2022.					
Stock structure	Blue grenadier is assessed as one stock, however there is some evidence of separate stocks occurring across the SESSF. There are two defined sub-fisheries, the spawning fishery dominated by catches off western Tasmania and the widely spread catches of the non-spawning fishery.					
Stock status against reference points ($\%B_0$ in assessment year +1)	**Tier**	**Assessment Year**	**Biomass (from assessment year)**	**Biomass (revised in most recent assessment)**	**Target**	**Limit**
	1	2022	124	124	48	20
	1	2021	155	123		
	1	2018	122	109		
Stock trend and other indicators	Annual standardized CPUE were below average between 1993 – 2013 for the non-spawning stock, with two apparent cycles, each peaking in 1999 and 2008 respectively. Between 2014 to 2015, these indices were above average. Also, there has been a consistent and above average increase between 2018-20, despite the decrease in 2021 (Sporcic, 2022).					
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**		
	Single-year MYTAC			Continue with 2022 assessment		
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**	
	2022-23		18,275	19,217	-	
	2021-22		12,183	13,040	10,958	
	2020-21		12,183	13,316	11,891	
Economics (Primary)	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**	
	2020-21		21.86	64	34.16	
	2019-20		12.47	51.34	24.29	

Commonwealth Trawl and Scalefish Hook	2018-19	4.55	49.47	9.20
ABARES Status (2022 Report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate Sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	Uncertain	Medium	↓15% through to ↑60%. Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	2 sex model, age-structured Steepness (h) is fixed at 0.75 Recruits estimated between 1974 and 2018 Maturity: 50% female maturity at 63.7 cm The base case estimates natural mortality for females to be M_f = 0.23 and males M_m = 0.24
Significant changes to data inputs	The base case specifications agreed by the SERAG in 2021 were maintained into the preliminary base case. The main difference between the assessment model of 2021 and 2022 is the inclusion of 2020 and 2021 acoustic survey estimates of biomass. This was recommended due to the high degree of uncertainty in the 2021 assessment.
Data and RAG comments	The assessment has been updated since the previous full assessment by including recent length-composition and conditional age-at-length data from the spawning and non-spawning fisheries; updated standardized CPUE series (Sporcic, 2022a), the total mass landed and discarded, and updated age-reading error matrices. Acoustic estimates of spawning biomass (2003–2010; 2020–2021) and estimates of the female spawning biomass in 1994 and 1995 from egg surveys (Bulman et al., 1999) are included. Data were formulated by calendar year, as in previous models (Tuck and Bessell-Browne, 2022). SERAG (October 2022[7]) noted adding the new data did not affect the assessment history greatly and reduced uncertainty in the estimate of biomass, however, there has been a downward revision to recruitment estimates.
Stock assessment information and RAG comments	Results of the base case show reasonably good fits to the length-composition data, conditional age at length, egg and discard mass. Fits to the newly included 2020 and 2021 acoustic survey biomass estimates are reasonable but with a preference for the higher 2020 survey point. As has been noted in previous blue grenadier assessments, the fit to the standardized non-spawning CPUE index is generally poor; the model is unable to fit to the high early catch rates and over-estimates catch rates during the early 2000s. More recent catch rates fit reasonably well, with a reduction in recent estimated catch rates coinciding with a decrease in the observed catch rate value in 2021 (Tuck and Bessell-Browne 2022). The estimated virgin female spawning biomass (B_0) is 35,680 tonnes (compared to 37,445 tonnes in the 2021 assessment) and the projected 2023 spawning stock biomass is 124% of virgin female spawning biomass (projected assuming 2021 catches in 2022), compared to

[7] Minutes are currently being finalised

	155% at the start of 2022 from the 2021 assessment. The reduction in estimated relative spawning biomass is likely due to the reduced 2021 catch rate, the inclusion of the acoustic survey points and updated composition data leading to slightly reduced estimates of recent recruitment (Tuck and Bessell-Browne 2022). The likelihood profiles reinforce that initial biomass is uncertain, as is the estimate of current stock status. The stock status uncertainty has reduced somewhat when compared to the broader estimates of the 2021 assessment, which may reflect the inclusion of more recent survey estimates of biomass. All model sensitivities showed current relative biomass being well above the target and likely to be above virgin biomass levels. There continues to be strong estimates of recent recruitment (the most recent nine years are above average) which is a positive sign for the fishery. As has been observed in previous assessments of blue grenadier, the fit to the non-spawning fleet CPUE, especially in the early years, is poor. Further refinement of the model should consider alternative GLM models for CPUE standardisation, or potential changes to model structure to account for the poor fit. The assessment shows retrospective patterns of concern for recruitment. This result suggests that there could be some misspecification in the assessment with a time varying factor that may not be accounted for in the assessment. Further investigation of these patterns in future assessments is warranted (Tuck and Bessel-Browne 2022). At SERAG (October 2022[9]) Industry members noted that this fishery is well suited to cope with recruitment-driven fluctuations in biomass. Freezer boats are unlikely to fish when TACs are low. SERAG (November 2022[8]) noted that the recent high RBC's have resulted from consecutive strong recruitment pulses into the fishery, possibly influenced by environmental drivers such as westerly winds.
Projected biomass	 **Figure 10 from Tuck and Bessell-Browne 2022: The estimated time-series of blue grenadier relative spawning biomass.** The stock is expected to reach the target reference point by 2043 if RBCs are fully caught.
Species specific research and priorities	
An acoustic survey proposal has been supported by SERAG (November 2022) for 2023. Acoustic surveys through the 2023 winter spawning aggregation (together with historical surveys conducted during 2003-2010 and 2019-	

[8] Minutes from this meeting are currently being finalised

2022) will provide a comprehensive view of the fishery and estimates of biomass as an input to stock assessments for supporting management decisions.

RAG Recommendations

SERAG (December 2022) recommended an external review of the assessment be completed in 2024/25 and another assessment in 2025/26. If additional time is required to refine the model, the assessment can be pushed back to 2026/27 and revisit the RBC advice for the additional years.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2025	14,590	Yes. Using the 3-year average RBC
	2024	17,182	
	2023	20,168	
	3-year average	17,313	
Discount factor (t)	N/A	A discount factor was not applied.	
State catch (t)	N/A	State catches are negligible and not included in the assessment.	
Discards (t)	240 t (2023) 225 t (2024) 222 t (2025) 3 year average 229 t	Model estimated discards in 2023.	
Recreational catch (t)	N/A	There are no estimates of recreational catch.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		17,084 t	

MAC Recommendations

Commercial fishers' interests	The proportion of the TAC caught in recent years is due to factory freezer boats fishing the winter spawning aggregation.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion or bycatch species.

MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 17,084 t for the 2023-24 fishing year, the first year of a 3-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
18,275	17,084	10	2	-1,191

Blue warehou

Seriolella brama

ABARES (2012): Line Drawing – Rosalind Poole

Species summary					
Common names	Black trevally, sea bream, snotty trevalla				
Stock assessment	Tier 4 Species - last assessed by ShelfRAG in 2013.				
Stock structure	There is good evidence that there are two stocks of blue warehou, east and west of the Bass Strait; however the stock is managed under a single TAC.				
East **Stock status against reference points (C_{Lim}/C_{Targ})**	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2013	0.1861	2.0717	0.8287
	4	2012	0.2214	2.0055	0.8022
	4	2011	0.2219	1.939	0.7756
West **Stock status against reference points (C_{Lim}/C_{Targ})**	**Tier**	**Assessment Year**	**Biomass**	**Target**	**Limit**
	4	2013	0.2681	1.9249	0.7699
	4	2012	0.307	1.8679	0.7472
	4	2011	0.349	1.8175	0.727
Stock trend and other indicators	The last agreed Tier 1 assessment in 2006, estimated the eastern stock to be depleted below the limit reference point. In 2013, blue warehou was assessed as a Tier 4 species and was assessed as being below the limit reference point. In contrast, the western stock was thought to be above the limit reference point and close to the biomass maximum sustainable yield (B_{40}) level. However, the 2006 assessment predicted that the western stock will have dropped below the limit reference point by 2007 if the landed catches remained high and if recruitment was average. Biomass trend Zone 10-30 – Annual standardized CPUE trend is flat since 1992 and consistently below average since 1999 (Sporcic, 2022). Zone 40-50 – Annual standardized CPUE trend is flat since 1992 and mostly below average. Catch rates prior to the introduction of quotas are highly variable both within years and between years. At that time blue warehou data was mixed with silver warehou data so this early data is less trustworthy. Data are now so sparse that the analysis results can no longer be trusted to represent the stock (Sporcic, 2022). Catch against TAC				

	Since the implementation of the blue warehou Rebuilding Strategy in 2008, the TAC has decreased from 365 t in 2008-09, to an incidental bycatch TAC of 183 t in 2009-10 and 2010-11, 133 t in 2011-12, 118 t in 2012-13 and then 50 t in 2021-22. Commonwealth catches have always been less than the incidental TAC, with the TAC being 8 per cent caught in 2021-22.

Multi-Year TAC	**Year of MYTAC (2022-23)**	**MYTAC advice**
	N/A – Rebuilding species	N/A

Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23	50	50	-
	2021-22	50	50	4
	2020-21	118	118	24

Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.01	64	0.02
	2019-20	<0.01	51.34	<0.02
	2018-19	0.17	49.47	0.34

ABARES Status (2022 Report)	**Fishing Mortality: Uncertain**	**Biomass: Overfished**

Climate Sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Medium	↓ 15%	Low-medium	N/A

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year. Due to low catches and avoidance behaviour, CPUE is no longer considered a reliable index of abundance for this species.
Significant changes to data inputs	N/A
Data and RAG comments	Logbook catch and effort data is the only information available for this species – age and length data are not collected.

	SERAG (November 2018) noted a significant increase in estimated discards in 2017 for the eastern stock – 91 per cent and 216 t. This was influenced by a single observed Danish seine trip where large amounts of small fish were discarded. While the 2018 estimate was 65 per cent (28 t), and the 2020 estimate was 73 per (6 t), the 2021 estimate was 97 per cent (43 t). Blue warehou were only reported in 0.4% of Danish seine logbooks shots in 2021 compared to 43% of observed shots. Similarly, blue warehou were only reported in 0.9% of board trawl shots, compared to approximately 20% of observed shots. This suggests there is a large amount of unreported blue warehou discards across the fleet. While the average observed discarded weight per shot is only 7 kg for Danish seine and 33 kg for board trawl in the main strata, the discard rate is high – 97%. Once the proportion of observed shots containing blue warehou is applied and then scaled to the total number of shots in the strata (~7,500 shots for Danish seine and ~9,000 shots for board trawl) the estimate of discards is 42.9 t. Once applied to State catches, the total estimate of discards across all jurisdictions is 284.8 t. This was not considered by SERAG at its Dec 2022 meeting.
Stock assessment information and RAG comments	An alternative primary index of abundance needs to be developed as a high priority for use in future stock assessments, and this species should be considered as a candidate for application of close-kin genetics assessments. SERAG (Dec 2020) considered the review of the Blue Warehou Rebuilding Strategy and noted there is no reliable data with which to assess the status of the stock or inform rebuilding timeframes. The focus of the revised Blue Warehou Rebuilding Strategy is to establish a reliable index of abundance and consider available information with which to update expected rebuilding timeframes. SERAG (Nov 2021) considered a companion species analysis which investigated the link between target species catch and the associated level of unavoidable bycatch of recovering species. The analysis incorporated a range of factors such as area, depth fished and gear type – also known as metiers. Using logbook data from 2019 and 2020, and expected 2022-23 TACs for the main companion species, the estimated unavoidable bycatch of blue warehou for 2022 was 11.4 t, with a range between 7.0 and 17.6 t. SERAG (Nov 2022) noted the closures being implemented in 2023 will influence fishing behaviour and undermine the outputs of an updated metier analysis. In the absence of an updated metier analysis, SERAG were unable to provide updated advice on bycatch TACs. SERAG noted the revised Blue Warehou Rebuilding Strategy had been completed and uploaded to AFMA website.
Projected biomass	N/A

Species specific research and priorities

Blue warehou have been identified as a species for application of Close-Kin Mark-Recapture (CKMR) to establish an abundance of index and monitor the status of the stock.

RAG Recommendations

In the absence of an updated metier analysis, SERAG (Dec 2022) suggested that the current bycatch TAC remains appropriate within the context of the Blue Warehou Rebuilding Strategy 2022. SERAG did not recommend any change to the bycatch TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	0	No. Rebuilding species.
	2022	0	
	2021	0	
Discount factor (t)	N/A	Discount factor not applied to incidental bycatch TAC.	
State catch (t)	East = 4.5 West = 2.1	State catches are not deducted from the bycatch TAC.	
Discards (t)	East = 158.2 West = N/A	There are no estimates of discards in the west. Discards are not deducted from the bycatch TAC. The high weighted average discard estimate is driven by observed discard rates in 2021 applied across Commonwealth and State catches (see "Data and RAG Comments")	
Recreational catch (t)	N/A	Tasmanian recreational catch estimates are available for 1997 (101.9 t), 2001 (19.5 t), 2008 (11.9 t), 2010 (32.5 t), 2013 (15.4 t) and 2018 (0.8 t).	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		0 t - Incidental bycatch TAC.	

MAC Recommendations

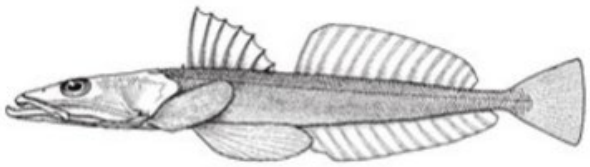
Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	This species is managed under the Blue Warehou Stock Rebuilding Strategy.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice				
AFMA Management recommend reducing the bycatch TAC to 30 t for the 2023-24 fishing year, noting retained catches have reduced in recent years, and are likely to reduce further with the introduction of closures in 2023.				
2022–23 agreed TAC (t)	**2023–24 recommended TAC (t)**	**Overcatch & undercatch (%)**	**Determined amount (t)**	**Change in TAC (t)**
50	30	10	2	-20

Deepwater flathead

Neoplatycephalus conatus



Species summary

Common names	Deepwater flathead, deep sea flathead, trawl flathead					
Stock assessment	Tier 1 Species - last assessed by GABRAG in December 2019.					
Stock structure	Assessed as a single stock.					
Stock status against reference points (%B_0 in assessment year +1)	**Tier**	**Assessment Year**	**Biomass (from assessment year)**	**Biomass (revised in most recent assessment)**	**Target**	**Limit**
	1	2019	45	45	43	20
	1	2016	45	34		
	1	2013	45	38		
Stock trend and other indicators	While remaining above target, estimated spawning biomass suggests a gradual decline toward the target since 2012-2013. The spread of recent age data indicates the stock is responding to a reduction in fishing effort. Annual standardized CPUE has been cyclical in the early years following the increases and decreases in catches (prior to 2007) and relatively flat and mostly below average since 2005. The most recent catch of 385 t in 2021 is the lowest since after 1989 (Sporcic, 2022).					
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**		
	3rd of 3-year			The assessment has been deferred from 2022 to 2023 to allow for Bight redfish to be updated. GABRAG 2022 recommended extending the MYTAC for another year.		
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**		**TAC after unders/overs**	**Cth Retained Catch**	
	2022-23	1,238		1,362	-	
	2021-22	1,238		1,362	701	
	2020-21	1,238		1,349	629	
Economics	**Financial year**	**Species GVP ($m)**		**Fishery GVP ($m)**	**% Fishery GVP**	

(Primary) Great Australian Bight Trawl	2020-21	5.92	10.64	55.64
	2019-20	6.52	10.76	60.59
	2018-19	4.14	8.48	48.82
ABARES Status (2022 Report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate Sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Medium	Uncertain	Medium	↓20% through to ↑10%

Assessment summary

Key model technical assumptions/ parameters	Single stock (Zone 80) Two sex model One fleet: Trawl (separated for different sources of length data – ISMP, Industry, GABFIS) Selectivity allowed to vary between GABFIS trawl fleet Discards: minimal (ignored) *M*: estimated at 0.263 Recruitment: estimated 1980 to 2013 (previously 2011)
Significant changes to data inputs	Final year 2018, add catch to 2018-19 Add GABFIS indices for 2017-18 Update CPUE to April 2019 Update length frequency data to 2018-19 Add updated age error matrix, age-at-length data to 2017-18 and GABFIS age-at-length data Final year of recruitment estimation changed to 2013 Retune using latest tuning protocols, including Francis weighting on lengths and ages.
Data and RAG comments	Danish seine catches are included in the base case assessment as part of the trawl catch. A sensitivity was conducted to include a separate Danish seine fleet, with catches, age and length data from the Danish seine boats. This increased the estimates of biomass over time. However, there is not enough length data for this to be considered as a new base case; and the changes in biomass needed further exploration. GABRAG had previously noted that it would be useful to undertake a meta-analysis to better understand the value for natural mortality (*M*) in the assessment. The 2019 assessment shows a likelihood profile suggesting a plausible range between 0.233 and 0.3, with the model estimating *M* at 0.263. Industry noted that catch rates in October and November 2019, are the best they've seen in a long time and reflect catches in 2016.

	Industry have observed that deepwater flathead appear to be shifting to shallower depths. There also appears to have been a temporal shift in the spawning season for deepwater flathead.
Stock assessment information and RAG comments	GABRAG (November 2019) suggested that more data is required before Danish seine can be included as a separate fleet; and should remain as a sensitivity. Bridging analysis: adding catch, CPUE and GABFIS indices made very little difference to the estimate of biomass. Adding age and length data to 2018 resulted in a lower estimate of biomass trend over time. There is a divergence in the estimate of biomass from about 2012, when age data was added, which is likely driven by the influence of age estimates on recruitment. The updated tuning protocol returns the Spawning Stock Biomass (SSB) trajectory to near target levels. Model fits to ages and lengths are good, and both improved once tuned. Fits to CPUE are good, whereas the fits to the GABFIS estimates are poor for the last two survey points. The GABFIS and commercial CPUE data shows a recent decrease in catch rates, however, the age and length data are more positive. The model does not fit the most recent GABFIS or CPUE points, which is likely due to a conflict in the data with ages and lengths. Catches of deepwater flathead have decreased since 2012; the last two years catches are the lowest since 1999. The decrease in 2014 was attributed to the seismic survey that was also conducted that year. Recruitment deviations show poor recruitment for the period 2008-2011, however, recruitments in 2012 and 2013 have recovered to just below, and just above average recruitment, respectively. While it is based on the estimate of 2018 biomass, likelihood profiles suggest biomass is not well determined; with a broad range of SSB_{2018} (2,250–5,000 t), with the most likely value 3,350 t. GABRAG (November 2019) expressed concern that the assessments are not impacted by the recent GABFIS abundance estimates and the latest catch data; both of which are indicating that the stock is declining. GABRAG (October 2021) noted GABFIS biomass estimates of deepwater flathead (5,225 t, CV 0.08) and, particularly Bight redfish (3, 447 t, CV 0.21) show continued decline (2021, 2018, 2015) relative to estimates provided from surveys from 2005−2011. However, 2021 estimates for deepwater flathead are more than 50 per cent greater than 2018 estimates (3,396 t, CV 0.06) (Knuckey et al, 2021).
Projected biomass	The 40-year projection depends on the RBC being caught each year, which GABRAG noted was unlikely due to the low number of boats operating in the fishery (Figure 10 from Tuck, Day and Burch 2019).

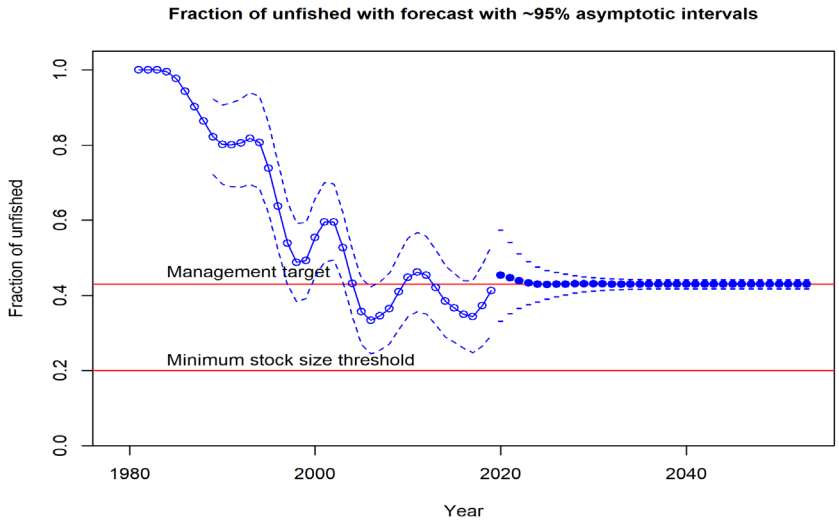


Figure 10: The projected relative spawning biomass trajectory for the deepwater flathead assessment (Tuck et al. 2019).

Species specific research and priorities

There are no species-specific research priorities identified.

RAG Recommendations

GABRAG (October 2022[9]) recommended maintaining the current RBC of 1,238 t for deepwater flathead for the 2022-23 fishing year, extending the MYTAC for one year. GABRAG also recommended scheduling the next stock assessment for 2023, noting their advice to not undertake the GABFIS in 2023-24.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	1,214	Yes. GABRAG recommended extending the MYTAC into a 4th year using 3-year average of 1,238 t.
	2022	1,224	
	2021	1,238	
	2020	1,253	
	3-year average (2020-2022)	1,238	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	There are no estimates of State catches.	
Discards (t)	N/A	Discards are considered low (at 1.5 t), and are not included in the RBC.	

[9] Meeting minutes are currently being finalised.

Recreational catch (t)	N/A	There are no estimates of recreational catch.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		1,238 t

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	GABRAG noted that deepwater flathead effort contributes to catches of other commercial species in the GAB (I.e. Bight redfish).
MAC advice and any dissenting views	**2023-24 TAC recommendation** 1,238 t **GABMAC advice and any dissenting views** GABMAC adopted GABRAG's RBC recommendation for the 2023-24 fishing season.

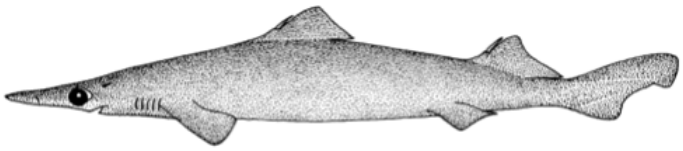
Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	1,238

AFMA Advice

AFMA Management recommends a TAC of 1,238 t for the 2023-24 fishing year, extending the MYTAC for one year, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,238	1,238	10	2	0

Deepwater shark basket - east



Species summary					
Common names	Dogfish (*Centroscyllium* sp.), sleeper shark (*Centroscymnus* sp.), kitefin shark (*Dalatias* sp.), rough-skin shark (*Deania* sp.), lantern shark (*Etmopterus* sp.) The deepwater shark basket quota includes multiple mid-slope species of deepwater sharks: brier shark (*Deania calcea*), platypus shark (*Deania quadrispinosa*), Plunket's shark (*Centroscymnus plunketi*), roughskin shark (*Centroscymnus* and *Deania* spp), pearl shark (*D. calcea and D. quadrispinosa*), black shark (*Centroscymnus* spp), lantern shark (*Etmopterus* spp), dogfish family squalidae and other sharks.				
Stock assessment	Last assessed by SERAG in 2022 using weight of evidence – a Tier 4 approach will be developed for 2023.				
Stock structure	Little is known about the stock structure of deepwater sharks. They are bentho-pelagic species that have been sampled in oceanic environments over the abyssal plains and are distributed widely across ocean basins and along the middle and lower continental shelves. The eastern management area extends from NSW around the Tasmanian east coast and up the Tasmanian west coast to approximately 42°S, including to the centre of Bass Strait to 146°22'E.				
Stock status against reference points (C_{Lim}/C_{Targ})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	Weight of Evidence	2022	SERAG re-considered available indicator data and noted there were no immediate risks to stock sustainability. A Tier 4 assessment will be completed for *Deania* spp. in 2023.		
	Weight of evidence	2021	SERAG considered available indicator data and noted there were no immediate risks to stock sustainability.		
	4	2018	0.5332	1.1592	0.4830
Stock trend and other indicators	Catches for eastern Deepwater Sharks with closures declined steadily from 1996 to a low in 2007 when the 700 m closure was introduced. Standardized CPUE in the open area exhibits a relatively flat trend and below the long-term average since 2010 for the eastern deepwater sharks (Sporcic, 2022a).				
Multi-Year TAC	**Year of MYTAC (2022-23)**		**MYTAC advice**		
	Single-year TAC		Continue with 2022 review of data		
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		24	26	-
	2021-22		24	26	17

	2020-21	24	25	18
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	Not Available	64	Not Available
	2019-20	Not Available	51.34	Not Available
	2018-19	Not Available	49.47	Not Available
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**		**Biomass: Uncertain**	
Climate Sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	There is currently no available information regarding climate change sensitivity for deepwater sharks.			

Assessment summary

Key model technical assumptions/ parameters	N/A
Significant changes to data inputs	N/A
Data and RAG comments	Species catch composition varies over time and between logbooks, Catch Disposal Records (CDRs) and observer records. Recent observer records show most of the catch is made up of the two Deania species - brier shark (*Deania calcea*) and platypus shark (*Deania quadrispinosa*) – which comprise most of the landed catch and are also often recorded in logbooks and CDRs as pearl sharks. Length frequency information is only available for brier shark, and there is no obvious trend over time. Various research survey data (Kapala, Southern Surveyor, Soela) are available but there are no obvious trends.
Stock assessment information and RAG comments	Fishery indicators were revisited by SERAG (Nov 2022) noting the following: • Catches are low relative to past but increasing. • Commercial CPUE is increasing. • Lengths (*D. calceus*) not showing a trend and large females are still present. • Research surveys not showing trend, (except in a past survey Kapala on the upper shelf). • Species composition is variable but not alarming (Thomson *et al.* 2022). Thomson *et al.* 2022 found any quantitative assessment, up to an including a Tier 1-style age-structured assessment model could be applied, albeit with unavoidable uncertainty regarding catches and catch-per-unit-effort (CPUE), particularly during 1985–1996 as well as likely unrepresentativeness of length composition data due to spatial population structure. A Tier 4 assessment is a possibility for *Deania spp*., with the new 'dynamic Tier 4' (if MSE testing shows it to be reliable) likely to be an improvement on the traditional Tier 4

	because it will estimate depletion during the reference period. It also identified further work that might be done to refine the estimated catch and CPUE time series, as well as to better understand the spatial structuring of the population through characterisation of habitat preferences by *Deania calceus*. Better understanding of habitat would improve understanding of the level of protection provided by the spatial closures. Declining catches between 1997 and 2000, and a significant reduction in FRV Kapala survey catch rate for *Deania spp*. (in 200–605 m depth off New South Wales, NSW) caused concern in the past, but current indicators of stock health (rising catches and catch rates, noisy but stable length frequencies) show no cause for concern in recent years (but do not provide a measure of *Deania spp*. abundance on the NSW upper slope, specifically) (Thomson *et al.* 2022). SERAG (November 2022) supported the recommendations from Thomson *et al*. (2022) to continue with a tier 4 assessment in 2023, however noted there are several caveats and data gaps to be overcome.
Projected biomass	

Species specific research and priorities

A deepwater shark working group will reconvene in 2023. Dr Robin Thomson to investigate including the identification of targeted shots that could improve the accuracy of the commercial CPUE standardization, the standardization of survey CPUE data, perhaps along with commercial data (where mesh size is the same), might extend the time series and an initial investigation on how hard it would be to get the full survey data set (shot by shot, catch and effort data).

RAG Recommendations

SERAG (November 2022) recommended maintaining the 2022-23 TAC for the 2023-24 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	N/A	No. SERAG recommended a single year TAC.
	2022	N/A	
	2021	10	
Discount factor (t)	N/A	SERAG recommended not applying a discount factor given the protection afforded to the stock by closures.	
State catch (t)	0.4	A small amount of deepwater shark is caught in NSW waters.	
Discards (t)	N/A	There are no reliable estimates of discards for the eastern species basket.	
Recreational catch (t)	N/A	There are no estimates of recreational catch.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	

Provisional TAC under the Harvest Strategy	24 t – carried over from the 2022-23 fishing year.

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	A large proportion (>54%) of the catch (east and west combined) was previously taken in waters >700m and most of these areas are now closed (AFMA report 2008-836).
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

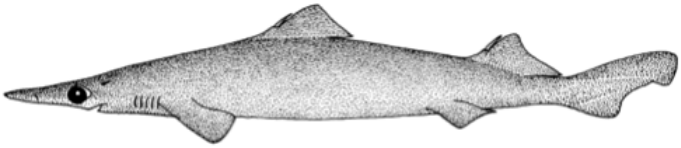
AFMA Advice

AFMA Management recommends maintaining the 2022-23 TAC of 24 t for the 2023-24 fishing year, a single year TAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

Further work is scheduled for 2023 to support the TAC setting process for the 2024-25 fishing year.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
24	24	10	2	0

Deepwater shark basket - west



Species summary					
Common names	Dogfish (*Centroscyllium* spp.), sleeper shark (*Centroscymnus* spp.), kitefin shark (*Dalatias* spp.), rough-skin shark (*Deania* spp.), lantern shark (*Etmopterus* spp.) The Deepwater Shark Basket quota includes multiple species of deepwater sharks: brier shark (*Deania calcea*), platypus shark (*Deania quadrispinosa*), Plunket's shark (*Centroscymnus plunketi*), roughskin shark (*Centroscymnus* and *Deania* spp), pearl shark (*D. calcea and D quadrispinosa*), black shark (*Centroscymnus* spp), lantern shark (*Etmopterus* spp.), dogfish family squalidae and other sharks.				
Stock assessment	Last assessed by SERAG in 2022 using weight of evidence – a Tier 4 approach will be developed for 2023.				
Stock structure	Little is known about the stock structure of deepwater sharks. They are bentho-pelagic species that have been sampled in oceanic environments over the abyssal plains and are distributed widely across ocean basins and along the middle and lower continental shelves. The western management area extends from the Tasmanian west coast Latitude 42^{o} S (approximately Strahan), around to WA.				
Stock status against reference points (C_{Lim}/C_{Targ})	Tier	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	Weight of Evidence	2022	SERAG re-considered available indicator data and noted there were no immediate risks to stock sustainability. A Tier 4 assessment will be completed for *Deania* spp. In 2023.		
	Weight of evidence	2021	SERAG considered available indicator data and noted there were no immediate risks to stock sustainability. A Tier 5 approach will be developed for 2022.		
	4	2018	0.5332	1.1592	0.4830
Stock trend and other indicators	Catches of western Deepwater Sharks with closures decreased from a high in 1997 and 1998 to a low in 2007 after the introduction of the 700 m closure, picking up again after the modifications in 2009 and 2016, with a mean of ~91 t over the last five years. The 102 t catch in 2019 was the highest recorded since 2004 (i.e., for the period after 2004). Standardized CPUE of western Deepwater Sharks in open areas has been approximately cyclic since about 2007 with lows over 2012-2014 period, and since then, there has been an overall increasing trend reaching the long-term average in 2018, based on 95% confidence intervals (Sporcic, 2022a).				
Multi-Year TAC	**Year of MYTAC (2022-23)**		**MYTAC advice**		
	Single-year TAC		Continue with 2022 review of data		
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**	

	2022-23	235	258	-
	2021-22	235	250	81
	2020-21	235	252	96
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	Not Available	64	Not Available
	2019-20	Not Available	51.34	Not Available
	2018-19	Not Available	49.47	Not Available
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**		**Biomass: Uncertain**	
Climate Sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	There is currently no available information regarding climate change sensitivity for deepwater sharks.			

Assessment summary

Key model technical assumptions/ parameters	N/A
Significant changes to data inputs	N/A
Data and RAG comments	Species catch composition varies over time and between logbooks, CDRs and observer records. Recent observer records show most of the catch is made up of the two *Deania* species - brier shark (*Deania calcea*) and platypus shark (*Deania quadrispinosa*) – which comprise most of the landed catch and are also often recorded in logbooks and CDRs as pearl sharks. Length frequency information is only available for brier shark, and there is no obvious trend over time. Various research survey data (Kapala, Southern Surveyor, Soela) are available but there are no obvious trends.
Stock assessment information and RAG comments	Species catch composition varies over time and between logbooks, Catch Disposal Records (CDRs) and observer records. Recent observer records show most of the catch is made up of the two *Deania* species - brier shark (*Deania calcea*) and platypus shark (*Deania quadrispinosa*) – which comprise most of the landed catch and are also often recorded in logbooks and CDRs as pearl sharks. Length frequency information is only available for brier shark, and there is no obvious trend over time. Various research survey data (Kapala, Southern Surveyor, Soela) are available but there are no obvious trends.

Projected biomass	Fishery indicators were revisited by SERAG (Nov 2022) noting the following: • Catches are low relative to past but increasing. • Commercial CPUE is increasing in both the east and west. • Lengths (*D. calceus*) not showing a trend and large females are still present. • Research surveys not showing trend, (except in a past survey Kapala on the upper shelf). • Species composition is variable but not alarming (Thomson *et al.* 2022). Thomson *et al.* 2022 found any quantitative assessment, up to an including a Tier 1-style age-structured assessment model could be applied, albeit with unavoidable uncertainty regarding catches and catch-per-unit-effort (CPUE), particularly during 1985–1996 as well as likely unrepresentativeness of length composition data due to spatial population structure. A Tier 4 assessment is a possibility for *Deania* spp., with the new 'dynamic Tier 4' (if MSE testing shows it to be reliable) likely to be an improvement on the traditional Tier 4 because it will estimate depletion during the reference period. It also identified further work that might be done to refine the estimated catch and CPUE time series, as well as to better understand the spatial structuring of the population through characterisation of habitat preferences by *Deania calceus*. Better understanding of habitat would improve understanding of the level of protection provided by the spatial closures. Declining catches between 1997 and 2000, and a significant reduction in FRV Kapala survey catch rate for *Deania* spp. (in 200–605 m depth off New South Wales, NSW) caused concern in the past, but current indicators of stock health (rising catches and catch rates, noisy but stable length frequencies) show no cause for concern in recent years (but do not provide a measure of *Deania* spp. abundance on the NSW upper slope, specifically) SERAG (Nov 2022) supported the recommendations from Thomson *et al*. (2022) to continue with a tier 4 assessment in 2023, however noted there are several caveats and data gaps to be overcome.

Species specific research and priorities

A deepwater shark working group will convene in 2023. Dr Robin Thomson is to investigate including the identification of targeted shots that could improve the accuracy of the commercial CPUE standardization, the standardization of survey CPUE data, perhaps along with commercial data (where mesh size is the same), might extend the time series and an initial investigation on how hard it would be to get the full survey data set (shot by shot, catch and effort data).

RAG Recommendations

SERAG (Nov 2022) recommended maintaining the 2022-23 TAC for the 2023-24 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	N/A	No. SERAG recommended a single year TAC.
	2022	N/A	
	2021	235	
Discount factor (t)	N/A	SERAG recommended not applying a discount factor given the protection afforded to the stock by closures.	

State catch (t)	0.5	Previously recorded by SA however there are no recent catches,
Discards (t)	N/A	There are no reliable estimates of discards for the eastern species basket. Discards were not used in the previous Tier 4 assessment because they are poorly estimated and as such were not deducted from the RBC.
Recreational catch (t)	N/A	There are no estimates of recreational catch.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		235 t – Carried over from the 2022-23 fishing year.

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	A large proportion (>54%) of the catch (east and west combined) was previously taken in waters >700m and most of these areas are now closed (AFMA report 2008-836).
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends maintaining the 2022-23 TAC of 235 t for the 2023-24 fishing year, a single year TAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

Further work is scheduled for 2023 to support the TAC setting process for the 2024-25 fishing year.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
235	235	10	2	0

Elephant fish

Callorhinchus milii

Ken Graham DPI Fisheries (1984)

Species summary

Common names	Ghost shark, elephant shark, whitefish, plownose chimaera				
Stock assessment	Last considered by SharkRAG in 2020 using a weight of evidence approach.				
Stock structure	Little is known about stock structure from an assessment and management perspective. Their biology suggests some potential for regional management of stocks. However, it is currently assessed as a single stock.				
Stock status against reference points (C_{Lim}/C_{Targ})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE/F_{Target}$**	**$CPUE/F_{Limit}$**
	Weight of evidence approach	2020	$F<F_{MSY}$	$F_{MSY} = 0.13$	$F_{LIM} = 0.19$
	4	2018	0.8656	0.844	0.422
	4	2015	1.0257	0.9750	0.3901
Stock trend and other indicators	Following the advice from the SESSFRAG Technical Working Group (TWG), SESSFRAG (August 2019) recommended assessing elephant fish using a 'weight of evidence approach' recognising issues with the Tier 4 assessment due to high discard rates. This method sets a TAC based on the existing TAC, subject to sustainability concerns of SharkRAG and consideration of whether the TAC is restricting catches of that species or any other species. The SESSFRAG TWG recommended this method be used as an interim approach pending the outcomes of the multi-species harvest strategy project. SharkRAG (January 2020) suggested utilising recreational catch data as a potential source of information when considering future TACs. Annual standardized CPUE using gillnet has remained below the long-term average since 2014, with a slight increase in 2018 (relative to 2017) followed by a decrease in 2019 and slight increases in the last two years (Sporcic, 2022b).				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	2nd of 3-year MYTAC			Maintain current MYTAC	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		114	125	-
	2021-22		114	124	38

	2020-21	114	123	37
Economics (**Byproduct**) Gillnet, Hook and Trap	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.07	24.84	0.28
	2019-20	0.06	19.67	0.31
	2018-19	<0.10	23.66	<0.42
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate Sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	High	↓ 30%	Low	Decline more in the northern extent of the fishery

Assessment summary

Key model technical assumptions/ parameters	N/A - Tier 4 Model no longer used.
Significant changes to data inputs	N/A - Tier 4 Model no longer used.
Data and RAG comments	At its February 2018 meeting, SharkRAG considered that neither Tier 4 assessment presented (including or excluding discards) were suitable for providing RBC advice. SharkRAG rejected the assessments because of concerns about the: • lack of a recent and reference period discard information, and how discard rates are estimated; • ability to factor discarding appropriately into CPUE; and • uncertain estimates of recreational catch, which are a significant proportion of either RBC. SharkRAG felt that in the application of either Tier 4 method, a prohibitively low TAC would be driven by the assumptions about discards and recreational catch, whereas the CPUE itself suggests that stocks are stable at or above target levels. At its October 2018 meeting, SharkRAG was asked to provide 2019-20 RBC advice for elephant fish. SharkRAG deferred updating the 2017 Tier 4 assessment until the SESSF TWG had provided advice on species identified as 'difficult to assess'.
Stock assessment information and RAG comments	Recognising issues with the Tier 4 assessment, SESSFRAG (August 2019) recommended setting the 2020-21 TAC for elephant fish using a weight of evidence approach, including recent catches and the outcomes of the most recent Ecological Risk Assessment (ERA). Considering the outcomes of the most recent ERA, SharkRAG (January 2020) recommended a 3-year MYTAC of 114 t. At its January 2020 meeting, SharkRAG noted the "low risk" status of elephant fish from the ERA for the shark gillnet sub-fishery 2012-2016. However, SharkRAG expressed

	concerns regarding their ability to make a justified recommendation based on limited data other than the ERA results for the species.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SharkRAG (January 2020) recommended maintaining the TAC at the current level of 114 t for 3-years, noting limited sustainability concerns and after consideration of whether the TAC is restricting catch of the species.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	N/A	Yes. 3-year MYTAC using annual TAC of 114 t.
	2022	N/A	
	2021	N/A	
Discount factor (t)	N/A	A discount factor is not applied as the TAC is set based on a weight of evidence approach.	
State catch (t)	N/A	The weighted average state catches are estimated to be 3 t. These are considered as part of the weight of evidence approach but are not deducted from the TAC.	
Discards (t)	N/A	Discards are considered to be high, 114 t. These are considered as part of the weight of evidence approach but are not deducted from the TAC.	
Recreational catch (t)	N/A	The only estimates of recreational catch are 45 t for Victoria in 2008. These are considered as part of the weight of evidence approach but are not deducted from the TAC.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		114 t	

MAC Recommendations

Commercial fishers' interests	SharkRAG industry members have previously expressed that a precautionary long-term TAC should be set for elephant fish, as the TAC level does not influence landings. Industry members have noted that the landed value of elephant fish is less than the cost of leasing quota.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion, and bycatch species.

MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends maintaining the 2022-23 TAC of 114 t for the 2023-24 fishing year, the third year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
114	114	10	2	0

Flathead

Neoplatycephalus richardsoni

Species summary

Common names	King flathead, trawl flathead, deep-sea flathead
Stock assessment	Tier 1 Species - last assessed by SERAG in 2022.
Stock structure	For management purposes a single continuous stock has been assumed throughout all zones of the SESSF.

Stock status against reference points (%B_0 in year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2022	40	40	40	20
1	2019	34	33		
1	2016	42	34		

Stock trend and other indicators

Otter board trawl CPUE in Zone 30 (east coast of Tasmania) - The annual standardized CPUE trend was noisy and flat between 1986 - 2001, and after a transitional period between 2002 - 2006 during which catches surged, is noisy and flat from 2007 to 2021. Annual catches have increased again in more recent years. The catch in 2021 (~205 t) was the lowest since after 2014 (Sporcic, 2022).

Otter board trawl CPUE in Zones 10 and 20 – Annual standardized CPUE appears cyclical above and below average, has remained below average in 2017-2018 and increased to the long-term average in 2019, 2020 and 2021, based on the 95% confidence intervals. The structural adjustment had a profound effect upon the influence of the vessel factor reducing the standardized trend well below the nominal geometric mean CPUE (Sporcic, 2022).

Danish seine in Zone 20 and 60 – Annual standardized CPUE appears cyclical above and below average and has remained below average since 2012. There has also been an overall decrease in standardized CPUE over the 2007-2020 period and a significant increase in CPUE in 2021 relative to the previous year (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
3rd of 3-year MYTAC	Continue with 2022 assessment

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	2,333	2,483	-
2021-22	2,333	2,361	2,143

	2020-21	2,010	2,236	2,183
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	17.06	64	26.66
	2019-20	12.96	51.34	25.24
	2018-19	13.16	49.47	26.60
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	

	Sensitivity	**Preliminary projection**	**Confidence in projection**	**Comments**
Climate sensitivity	Low	uncertain	High	While ↑10-15% possible (especially in short term), if the environment continues to change declines are possible as suitable habitats are lost (but not for a few decades).

Assessment summary

Key model technical assumptions/ parameters

The current 2022 assessment assumes a single growth curve for the whole stock, an assumption also made in previous assessments.

Tiger Flathead constitute a single stock within the area of the fishery, from zone 10 (NSW), through zone 20 (eastern Bass Strait), zone 60 (Bass Strait) and zone 30 (eastern Tasmania). While alternative stock structures have been previously suggested, with the eastern Tasmanian stock potentially a separate stock (Cui et al. (2004); Punt (2005a); Punt (2005b); Klaer (2006); Klaer (2009); Klaer (2010)), this is the current stock structure agreed to by the SERAG.

The stock is assumed to be unexploited at the start of 1915 when the steam trawl fishery commenced. Catches prior to this time are thought to have been minimal.

The CVs of all abundance indices (including the FIS) were initially set to the root mean squared deviation from a loess fit to the fleet specific indices (Sporcic, 2022), and then tuned to match the model-estimated standard errors by estimating an additional variance parameter within SS.

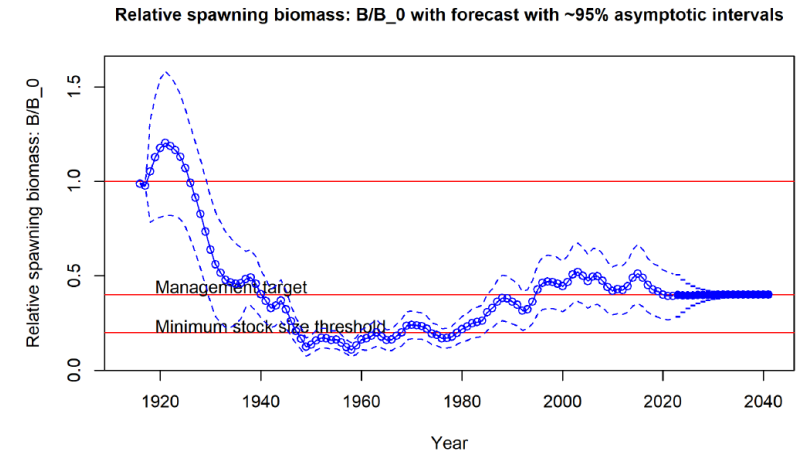
Six fishing fleets are modelled.

Selectivity is assumed to vary among fleets, but the selectivity pattern for each separate fleet is modelled as length-specific, logistic and mostly time-invariant. The selectivity for Danish seine is allowed to change in 1978, and that of the East trawl is changed in 1985. The two parameters of the selectivity function for each fleet are estimated within the assessment.

Retention is also defined as a logistic function of length, and the inflection and slope of this function are estimated for the 3 fleets where discard information is available (Danish seine, East trawl and Tas trawl). Retention for the Steam trawl fleet was implicitly assumed to be independent of length as no length frequency composition data is available on discards for this fleet.

The sample sizes for length and age frequencies were tuned for each fleet so that the input sample size was approximately equal to the effective sample size calculated by the model.

	Before this retuning of length frequency data was performed, any sample sizes with a sample size greater than 200 shots or trips were individually down-weighted to a maximum sample size of 200. Samples with fewer than 100 measured fish were excluded from the analysis. This is because the appropriate sample size for length frequency data is more closely related to the number of shots or trips sampled, rather than the number of fish measured (Bessell-Browne 2022).
Significant changes to data inputs	The following were included in the updated 2022 assessment: Steepness (h) was fixed at 0.75. rather than estimated in the base case. This change resulted from likelihood profiles in the 2019 assessment and 2022 preliminary base case highlighting that there was limited information in the available data to inform estimation of this parameter. This meant that each time the assessment was conducted, h was estimated to be higher (0.62, 0.72 and 0.85 in 2016, 2019 and 2022 respectively), resulting in undesirable retrospective patterns. Fixing h at the SESSF default value of 0.75 resolved this problem, however, future work should investigate whether another fixed value of h may be more suitable for tiger flathead (Bessell-Browne 2022). The maximum length bin was extended from 59 cm to 65 cm. This change was made because there was a large proportion of measured lengths, in both the East trawl and Tas trawl fleets, in the 59 cm plus group over the past 10 years. Extending the plus group to 65 cm removed the large peak of measured fish in the maximum length bin and allows more accurate estimation of growth parameters (Bessell-Browne 2022).
Data and RAG comments	SERAG (Oct 2022) agreed to add an additional sensitivity to the standard model runs which excludes the Tasmanian trawl CPUE series so that SERAG can examine its effect on the flathead RBC. SERAG (Oct 2022) agreed to *h* (0.75), B_{Target} (0.4) and *M* (0.27) noting there was no basis to change the base case parameters and that CSIRO would include an examination of the interactions between the parameters in the final report.
Stock assessment information and RAG comments	There are poor fits to the end of the Danish seine CPUE index from 2013 onwards, where the model is overestimating the input values, this trend was also apparent in the 2019 assessment (Day, 2019). While sensitivities have shown that this is not due to fitting the Tas trawl CPUE series further investigation into the cause of this misfit would benefit future assessments (Bessell-Browne 2022), SERAG (Nov 2022) supports this investigation. Discard proportion was showing cycler patterns in all fleets while the input data was remaining relatively flat. The RAG hypothesised this was perhaps due to smaller fish coming through the fishery. The RAG noted the increase in estimated stock status was in-part influenced by the new age and length data. Likelihood profiles have demonstrated there is conflict between different data sources in the assessment when estimating key parameters. The profile on M suggests higher parameter values are preferred by the model and this is also supported by sensitivity results. The preference of the model to estimate higher values of M has been evident since the 2010 assessment and investigating this alternative parameter space and its feasibility should be a focus of future work (Bessell-Browne 2022). The 2019 assessment and the 2022 preliminary base case identified a very flat likelihood profile for h, suggesting that there is insufficient data in the assessment to allow estimation of this parameter. This led to fixing this parameter at 0.75, the default value used in the SESSF, for this assessment. As likelihood profiles on h are not available for assessments prior to 2019 it is difficult to determine whether earlier assessments were able to accurately estimate h, or whether similar issues persisted. There is a likelihood profile on h that was conducted in Punt et al. (2014), which revealed a minimum log likelihood was obtained at h values around 0.6, suggesting that earlier assessments may have had adequate information in the data to inform estimation of this parameter. Given this estimated value of around 0.6 and the 2010 stock assessment h estimate of 0.62, these informed values would be a better choice to base the pre-specified value rather than the

	default value of 0.75, which has no specific relation to Tiger Flathead (Bessell-Browne 2022). SERAG (Nov 2022) noted this should be considered in future assessments. The assessment estimates that the projected 2023 stock status will be 40% of unfished spawning stock biomass ($SSB0$), assuming 2021 catches are maintained in 2022. Under the 20:35:40 HCR, the 2023 recommended biological catch (RBC) is 2,838 t, while the long-term yield is 2,867 t. The average RBC over the 3-year period 2023-2025 is 2,831 t. Exploration of model sensitivity showed a variation in spawning biomass from 28% to 68% of $SSB0$ in 2022, which occurred when natural mortality (M) was fixed (M = 0.22) and estimated (M = 0.37), respectively. For the other standard sensitivities, the variation in spawning biomass was narrower, ranging between 33% and 45% of $SSB0$ (Bessel-Browne 2022).
Projected biomass	 **Figure 24 from Bessell-Browne 2022: The estimated time-series of flathead relative spawning biomass.**

Species specific research and priorities

SERAG (Dec 2022) recommended an examination of the interactions between key assessment parameters be included in the next assessment.

RAG Recommendations

SERAG (Nov 2022) recommended a 3-year MYTAC using the average RBC of 2,831 t. It is premature to deviate from the base case agreed at SERAG 1 (Oct 2022) which used a fixed steepness value (0.75), fixed natural mortality of 0.27 and a target of B_{40}.

SERAG recommends extra work should be undertaken on estimating growth parameters, developing an informative prior on h, investigating the different trends apparent between CPUE series between fleets and whether these are indexing abundance, and the preference of the model to estimate higher values of M. The results should be presented as advice before the next scheduled Tier 1 flathead assessment commences.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2025	2,828	Yes. Using the 3-year average value as fluctuations are minor.
	2024	2,827	
	2023	2,838	

	3-year average	2,831	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	122.1	Mostly NSW catches – NSW maintained the 2019-20 TAC of 166.9 t for the 2022-23 fishing year, which was set at the maximum annual catch during the 8-year individual allocation period.	
Discards (t)	213 t (2023) 214 t (2024) 215 t (2025)	The 3-year average modelled discards for the period 2023-2025 are deducted from the 3-year average RBC.	
Recreational catch (t)	N/A	Assessment only considers tiger flathead, which are not considered a key recreational species.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		2,495 t	

MAC Recommendations

Commercial fishers' interests	Operators in the SESSF have reported declines in catch rates of flathead in the Bass Strait area.
Species specific management (target, companion and bycatch)	Flathead are a companion species for jackass morwong in the CTS. A companion species analysis considered by SERAG at their Nov 2021 meeting estimated unavoidable catch of eastern jackass morwong for 2022 between 100–118 t, based on assumed catches of flathead of 2,000 t and 2,400 t, respectively. Trawl closures will be implemented on 1 May 2023 to reduce catches of at-risk species in the CTS which account for approximately 342 t, or 16%, of recent flathead catches. The Department of Agriculture Fisheries and Forestry (DAFF) has also commenced a structural adjustment program which is expected to reduce the number of trawl boats in the CTS before the start of the 2023-24 fishing year.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

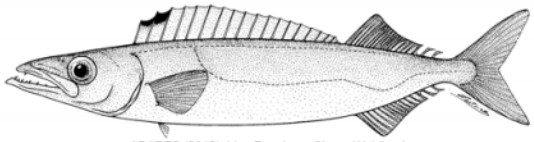
AFMA Advice

AFMA management recommends maintaining the 2022-23 TAC of 2,333 t for the 2023-24 fishing year until the impact of spatial closures and the structural adjustment program are known with regards to catches of jackass morwong – a key companion species for flathead.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
2,333	2,333	10	2	0

Gemfish east

Rexea solandri


ABARES (2012): Line Drawing – Shane Weidland

Species summary

Common names	Barraconda, common gemfish, deepsea kingfish, hake, king barracouta, king couta, silver gemfish, silver kingfish
Stock assessment	Tier 1 Species - last assessed by ShelfRAG in 2010.
Stock structure	There are considered to be two stocks of *R. solandri* in Australia, an eastern and a western stock bordered by a boundary in the south west of Tasmania (west of 146°22'E, north of 42°43'S). The current assessment is based solely on eastern gemfish, caught south of Latitude 43° south off western Tasmania, and east of longitude 146° 22`.

Stock status against reference points (%B_0 in year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2010	15.6		48	20
1	2008	16.5			
1	2007	10			

Stock trend and other indicators

Non spawning stock- Following a large spike in standardized CPUE in the late 1980s, which coincided with a large spike in catches, the annual standardized CPUE trend dropped rapidly despite large reductions in catches and, since 1995 has been relatively flat and below average although with what appears to be a 14 - 15-year cycle of rise and fall. The most recent estimate has significantly increased relative to the previous year. There have been efforts to actively avoid eastern Gemfish for the last few years and this may have been reflected in the change apparent in the depth of fishing. It means that the most recent CPUE, from about 2013, will not be representative of even the depleted stock state (Sporcic, 2022).

Spawning stock- Annual standardized CPUE trend has declined since 2010 and remained below average since 2011. This reflects what appears to be a longer-term cycle of CPUE values, which suggests that CPUE values would soon be expected to rise, which occurred in 2019, 2020 and 2021. However, the relatively low catches since the past eight years indicate that industry avoidance strategies are effective, and this means the recent CPUE may not provide an unbiased representation of relative stock status (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-2023)	MYTAC advice
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	100	100	-

	2021-22	100	100	74
	2020-21	100	99	56

Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.16	64	0.25
	2019-20	0.04	51.34	0.08
	2018-19	0.09	49.47	0.18

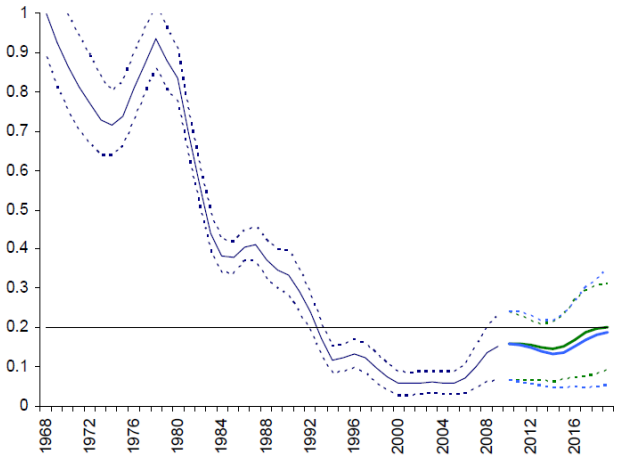
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**	**Biomass: Overfished**

Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	Uncertain	Medium	↓20% through to ↑10%. Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	The data in the model is divided into four fleets: - A non-trawl fleet (1993 – 2009); - A fleet targeting the winter spawning run (1975 – 2000 and inclusion of the results of the 2007 and 2008 surveys); - A non-spawning (summer) season fleet (1975 – 2009); and - A recent (spawning season) winter bycatch fleet (2000 – 2009).
Significant changes to data inputs	N/A
Data and RAG comments	SERAG (December 2020) noted the non-spawning CPUE index has increased over the last 3-years, which is consistent with industry reports of higher catch rates in 2019 and 2020. Total Commonwealth landings for 2019 were 72 t, more than double the 2018 catch of 34 t.
Stock assessment information and RAG comments	The stock assessment has not been formally updated since 2010 due to a paucity of data, and the main index of abundance is no longer considered reliable due to avoidance behaviour. Model fits to the non-spawning trawl fleet in the 2010 Tier 1 stock assessment were good. While not as valuable as the winter spawning index, it could be considered as an alternative index of abundance. CSIRO will clarify what is required to update the assessment, including whether the non-spawning CPUE index can be used as an index of abundance.

	Fixed catch projections from the 2010 Tier 1 assessment estimate catches of up to 100 t will allow for recovery under average recruitment. However, catch projections should be treated with caution given the failure of this species to recover since the 2010 stock assessment. SERAG has previously pointed out the eastern gemfish stock may now be at a new equilibrium and the stock may not rebuild under current conditions. Recent research by (Ovenden, et al., 2020) identified genetic drift and divergence as potential factors influencing the ability of gemfish stocks to rebuild. SERAG (December 2020) noted that total mortality for the 3 years immediately after the 2010 stock assessment were higher than those expected to allow for rebuilding of the stock. While the projections are based on landed catches of 100 t, the discard proportion for those years was high, between 55 and 67 per cent, resulting in total mortality of nearly double the projected catches. Total mortality from 2014 to 2018 was less than 100 t, and recent increases in CPUE are consistent with the modelled predicted increase in biomass when total mortality is less than 100 t. Eastern gemfish was scheduled for a Tier 1 stock assessment in 2022. The main index of abundance from the spawning stock is not thought to be reliable because of avoidance behaviour, so completing a new assessment might not be possible. However, SERAG recommended at least updating the 2010 stock assessment to include catches up to 2020, and projecting forward using various fixed catches and recruitment scenarios. SERAG (Nov 2021) considered a targeting analysis for eastern gemfish as part of the 2021 annual review of the rebuilding strategy and noted: - While catches in the northern part of the fishery have reduced, there is no apparent shift in the spatial distribution of catches. - There is no evidence of boats targeting eastern gemfish. - There are higher catches in the automatic longline hook sector in 2020, however these need to be understood before any advice around targeting or indicators of stock status can be resolved. - Standardised spawning and non-spawning CPUE has increased over the last 3 years, but without an assessment it isn't possible to determine whether this is indicative of an increase to biomass. - There is still some uncertainty around whether total mortality is sufficiently low to allow rebuilding – this will need to be resolved as part of updating the stock assessment in 2022. SERAG (Nov 2021) considered a companion species analysis which investigated the link between target species catch and the associated level of unavoidable bycatch of recovering species. The analysis incorporated a range of factors such as area, depth fished and gear type – also known as metiers. Using logbook data from 2019 and 2020, and expected 2022-23 TACs for the main companion species (blue-eye trevalla, pink ling and blue grenadier) the estimated unavoidable bycatch of eastern gemfish for 2022 is 88.7 t, with a range between 68.9 and 111.9 t.

Projected biomass	Projections from the 2010 stock assessment indicate that with average recruitment the stock would recover to the limit reference point by 2023 which is within the rebuilding timeframe specified in the HSP. However, there is currently no reliable data with which to update the stock assessment and monitor the recovery of the stock.  **Figure 1: Time-trajectories of spawning biomass depletion with projections under 0 t TAC (green) and 100 t TAC (blue), 0.05 and 0.95 percentile respectively**

Species specific research and priorities

Eastern gemfish have been identified as a candidate for application of CKMR analyses in order to establish an alternative index of abundance. A research priority has also been included in the SESSF 2022-23 Research Statement to develop a non-extractive method for establishing an index of abundance for eastern gemfish, however AFMA did not receive any research proposals for this priority.

RAG Recommendations

SERAG (Nov 2022) noted the absence of metier analyses to inform bycatch TACs due to the significant structural changes occurring next year. The RAG is not recommending any changes to the bycatch TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2022	0	No. Rebuilding species
	2021	0	
	2020	0	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	State catches, 2 t, are not deducted from the bycatch TAC but should be considered as a source of mortality.	
Discards (t)	N/A	Projections from the 2010 Tier 1 assessment are based on landed catch, and so estimates of discards (23.1 t) not deducted from the bycatch TAC but should be considered as a source of mortality.	

Recreational catch (t)	N/A	There are no estimates of recreational catch.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy	0 t – Incidental bycatch TAC	

MAC Recommendations

Commercial fishers' interests	A code of conduct has been developed by SETFIA. The code includes move-on and reporting obligations to assist operators in avoiding incidental catches. SETFIA and AFMA are progressing a training course that will cover this code as well as others. The hook sector has reported increased catches in the east associated with blue-eye trevalla and pink ling catches. This is consistent with a recent increase in the CPUE series
Species specific management (target, companion and bycatch)	The species is managed under the Eastern Gemfish Stock Rebuilding Strategy 2015. A review of the Eastern Gemfish Stock Rebuilding Strategy is expected to commence in 2022.
MAC advice and any dissenting views	**2022-23 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

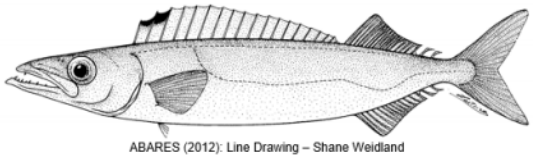
AFMA Advice

AFMA Management recommends maintaining the 2022-23 bycatch TAC of 100 t for the 2023-24 fishing year, a single year bycatch TAC, with undercatch and overcatch provisions set at zero per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
100	100	0	2	0

Gemfish west

Rexea solandri


ABARES (2012): Line Drawing – Shane Weidland

Species summary

Common names	Barraconda, common gemfish, deepsea kingfish, hake, king barracouta, king couta, silver gemfish, silver kingfish.
Stock assessment	Tier 4 Species - last assessed by SERAG in 2022
Stock structure	There are considered to be two stocks of *R. solandri* in Australia, an eastern and a western stock bordered by a boundary in the south west of Tasmania (west of 146°22'E, north of 42°43'S). Recent genetic research has revealed evidence of genetically different populations between the east and west (with no gene flow), with a mixing (overlap) of the two stocks in western Bass Strait, through to Portland. Both eastern and western gemfish migrate towards opposite ends of their distributions and spawn six months apart; which is likely to be the major contributor to the genetic differentiation seen.

Stock status against reference points (C_{Lim}/C_{Targ})

Tier	Assessment Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2022	1.0459	1.0289	0.4287
4	2019	1.0418	0.9942	0.4143
4	2016	0.9378	1.1816	0.4923

Stock trend and other indicators

Zones 40 and 50 – Annual standardized CPUE are noisy and flat since 1992 and consistently mostly below average since 2001. However, there has been an overall increase in CPUE (to the long-term average) since 2007, with estimates in the last two years above the long-term average (Sporcic, 2022).

Zones 40 and 50 in the GAB – Annual standardized CPUE has been consistently below average and flat since 1999, with small overall increases in annual estimated CPUE (to the long-term average) in 2020 and to above the long-term average in 2021. However, the CPUE from 1986 - 1994 is more representative of zone 50 than of the GAB. Given recent evidence that the stocks of western Gemfish in the GAB and most of zone 50 are different biological stocks it is doubtful that these data should be combined (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
3rd of 3-year MYTAC	Continue with 2022 assessment

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	340	371	-
2021-22	343	372	73

	2020-21	300	317	84
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.04	64	0.06
	2019-20	Not Available	51.34	Not Available
	2018-19	0.21	49.47	0.42
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	There is currently no available information regarding climate change sensitivity for western gemfish.			

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed in significant ways through the period from the start of the reference period to the end of the most recent year. It also assumes the reference period provides a good estimate of the stock when it was at a depletion level of 48%B_0 and that historical catch records are accurate.
Significant changes to data inputs	N/A
Data and RAG comments	The CPUE series has been increasing for the most recent 4 years in the 2022 assessment. SERAG (Nov 2022) noted a very high discard estimate for 2013.
Stock assessment information and RAG comments	GABRAG previously considered a Tier 1 assessment, a Tier 4 assessment (no discards) and a Tier 4 assessment (discards). These analyses identified deficiencies in the data which prevented precise estimates of stock status being made, and a weight of evidence approach was adopted to set an RBC of 200 t for 2019. This species is now assessed as a Tier 4 species only, based on advice from SESSFRAG, using CPUE from Zone 50 in the CTS. The 2022 estimated RBC was approximately 221.37 t, an approximate 201.69 t decrease compared to the 2019 estimated RBC (423.06 t; Sporcic 2019). The decrease in RBC of approximately 202 t can be mostly attributed to a decrease in the most recent CPUE (including discards) and hence the mean of the most recent four-year average which is used to calculate the RBC. The 2022 RBC is greater than the reported catch of approximately 75.1 t (75.5 t including estimated discards) in 2021 for this stock (Sporcic 2022).
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (Nov 2022) recommended a 3-year MYTAC using the RBC of 221 t from the 2022 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2025	221	Yes. 3-year MYTAC using the RBC of 221 t from the 2022 Tier 4 assessment.
	2024	221	
	2023	221	
Discount factor (t)	33	The default Tier 4 discount factor of 15 per cent is applied.	
State catch (t)	N/A	State catches are not included in the assessment and are considered low.	
Discards (t)	8.1	Weighted average, noting discard estimates for recent years were 2.67 t (2018), 6.34 t (2019), 22.62 t (2020) and 0.40 t (2021).	
Recreational catch (t)	N/A	Recreational catch is not significant and not considered in the assessment.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		180 t	

MAC Recommendations

Commercial fishers' interests	There is a small amount of western gemfish caught in the GABTS. These catches are managed under triggers described in the SESSF Harvest Strategy and are not deducted from the RBC.
Species specific management (target, companion and bycatch)	While western gemfish are known to occur throughout the GABTS and into CTS Zones 40 and 50, it is only under quota in the CTS and the Tier 4 assessment only includes Zone 50. The GABTS component of the stock is managed under triggers described in the SESSF Harvest Strategy.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)

TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 180 t for the 2023-24 fishing year, the first year of a 3-year MTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
340	180	10	2	-160

Gummy shark

Mustelus antarcticus

Fisheries Research & Development Corporation (2012)

Species summary

Common names	Gummy shark.
Stock assessment	Tier 1 Species - last assessed by SharkRAG in December 2020.
Stock structure	Gummy shark is endemic to southern Australia. It is considered a single genetic stock across the SESSF extending from Bunbury in WA to Jervis Bay in NSW. The single genetic stock is assessed as 3 separate sub-stocks within broad regions on the continental shelf of Bass Strait, Tasmania and SA.

Bass Strait

Stock status against reference points ($\%B_0$ in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2020	48	48	48	20
1	2016	59	49		
1	2013	>48	48		

Tas

Stock status against reference points ($\%B_0$ in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment	Target	Limit
1	2020	68	68	48	20
1	2016	83	67		
1	2013	>48	70		

SA

Stock status against reference points ($\%B_0$ in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment	Target	Limit
1	2020	67	67	48	20
1	2016	69	61		

	1	2013	>48	56		

Stock trend and other indicators

Spawning biomass:

Pup production is used as a proxy for spawning biomass; this is the number of pups, on average, expected to be produced each year by the stock's mature females. Pup depletion is the pup production in any year compared the unfished pup production and is the value used in the harvest control rule.

Estimated pup production shows an increasing trend in recent years in SA and is steady in Bass Strait and Tasmania. The base case model (CAL2019c) indicates pup depletion is well above the 48% target reference point in SA and Tasmania (66% and 69% respectively). For the Bass Strait, the base case model estimates depletion at the target (48%). Pup depletion is above the 20% limit reference point for all stocks and all sensitivity models.

South Australia:

Standardized CPUE in the gillnet sector exhibits a positive trend from 2012 to 2017 and above the long-term average. Since then, it has deceased to the long-term average in 2019 and to below the long-term average in 2020. The most recent estimate is at the long-term average based on 95% confidence intervals. In the trawl sector, overall, the annual standardized CPUE has increased and above the long-term average since 2012, despite the decrease in the most recent year (2020) (Sporcic, 2022b).

Bass Strait:

CPUE in the gillnet sector is cyclical over the series, increased in 2016 (relative to 2015), dropped just below the long-term average in 2017 and increased thereafter. In the trawl sector, annual standardized CPUE has been mostly flat above the long-term average since 2008, despite the increases in the last two years. For the Danish seine sector in Bass Strait and Victoria, the annual standardized CPUE has been mostly increasing and has been above the long-term average between since about 2010 (Sporcic, 2022b).

Tasmania:

Standardized CPUE (including corresponding 95% confidence intervals) in the gillnet sector has been mostly flat and at the long-term average since 1999 and slightly below the long-term average in 3 years (i.e., 1998, 2014 and 2015). In the trawl sector for the period of 1966-2021, the annual standardized CPUE has been mostly noisy and flat and has increased above the long-term average since 2019, based on the 95% confidence intervals. Annual catches between 1996 and 2001 are small (between approximately 1 t to 4 t), therefore another series was analysed from 2002 onwards. For the 2002-2021 series, the annual standardized CPUE has mostly increased since about 2014 and has been above the long-term average since 2016 (accounting for the 95% confidence intervals) (Sporcic, 2022b).

All stocks

Annual standardized CPUE has been noisy and mostly flat since the start of the time series (Sporcic, 2022b).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
2nd of 3-year MYTAC	Maintain current MYTAC

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	1,672	1,666	-

	2021-22	1,672	1,647	1,651
	2020-21	1,775	1,854	1,874

Economics (Primary) Gillnet, Hook and Trap	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	22.25	24.84	89.57
	2019-20	17.60	19.67	89.48
	2018-19	20.94	23.66	88.50

ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**	**Biomass: Not overfished**

Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Medium	↑ up to 5%	High	N/A

Assessment summary

Key model technical assumptions / parameters

Base case model (CAL2019c):

- Age-Structured Integrated Analysis model
- Three sub-stocks – Bass Strait, SA and Tasmania. WA and NSW are not included. Sub-stock boundaries are somewhat arbitrary;
- Seven fleets - trawl, shallow line, deep line and gillnets (6, 6.5, 7, 8 inch mesh sizes). Selectivity estimated for all but gillnets.

Data

- Catch by fleet by stock (fixed)
- CPUE (fitted) - trawl by sub-stock; shallow line, sub-stocks combined; gillnets (all mesh sizes combined) by sub-stock; old and new time series stitched together;
- Length compositions (fitted):1970-2019;
- Age compositions (fitted): 1986-7, 1990-93, 1995-7, 2002-03, 2007-8;
- Conditional age-at-length (fitted): 1995-7, 2002-3, 2010-2019;
- Historical tag data (fitted): to 2005;
- Proportion-mature-at-age (females);
- Pups-per-female-at-age;
- Growth (length-at-age), variability;
- Weight-at-age.

Parameters

- Density dependence shared - M (0-30y) by 1+ biomass;
- Gear saturation per sub-stock;
- Unfished biomass (B_0) per sub-stock;
- Natural mortality (M) shared;
- Pup survival deviation / recruitment per sub-stock per year;
- Gear selectivity per sub-stock.

Significant changes to data inputs	In addition to the inclusion of new data for 2016-2020, SharkRAG (September 2020) recommended the following changes for the base case model: - use a gillnet CPUE series based on net length; - use 3 trawl CPUE series, one for each sub-stock; the trawl series for Bass Strait should be split before 2005, and after 2008; - include age data, where length data are also available, as conditional-length-at-age rather than as age compositions; - not include Danish Seine data; - the best way to represent uncertainty with the model is via a series of sensitivities as per the last stock assessment; a sensitivity of effort saturation for gillnets should be investigated.
Data and RAG comments	SharkRAG (Nov 2020) recommended for the next assessment in 2023: - review the use of the effort (gear) saturation parameter; - CSIRO to investigate why estimated pup depletion is very different in the models where density dependence is affected by 0-2 and 0-4 year olds; - SharkRAG to discuss the method of data weighting in the model; - Danish seine fleet to be included in the next assessment. SharkRAG (Nov 2021) agreed to a workplan to update the gummy shark assessment model in 2022, prior to the assessment being updated in 2023. SharkRAG (Oct 2022[10]) recommended using the estimated discard rate in 2019 of 29.7% for gummy shark.
Stock assessment information and RAG comments	SharkRAG (December 2020) noted that when the stock was last assessed (2016), it was found to be well above the target reference point, and given this, the RBCs that were recommended would fish down towards the target over the subsequent 3-year period. As this additional component of the stock has now been fished down, future RBCs have been reduced to fish the stock at a level to maintain the stock around the target. SharkRAG discussed the RBC calculations shown in Figure 12. The Bass Strait sub-stock is estimated to be slightly under the 48% target so catches are lower at first, until the sub-stock rebuilds to the target. Similarly, Tasmania is above the target (69%) so catches are high initially and reduce as the target is neared. SA, which is initially above the target (66%), is complicated by a period of relatively low recruitment around the year 2000 so that catches are high initially, drop in response to lower adult biomass and therefore lower potential pup production, and then increase in response to assumed average recent and future recruitments. The algorithm that calculates annual RBCs is not sophisticated enough to anticipate the drop in pup production when it sets the initial high catch. All sub-stocks remain well above the 20% limit reference point throughout the time series.

[10] Minutes from this meeting are currently being finalised

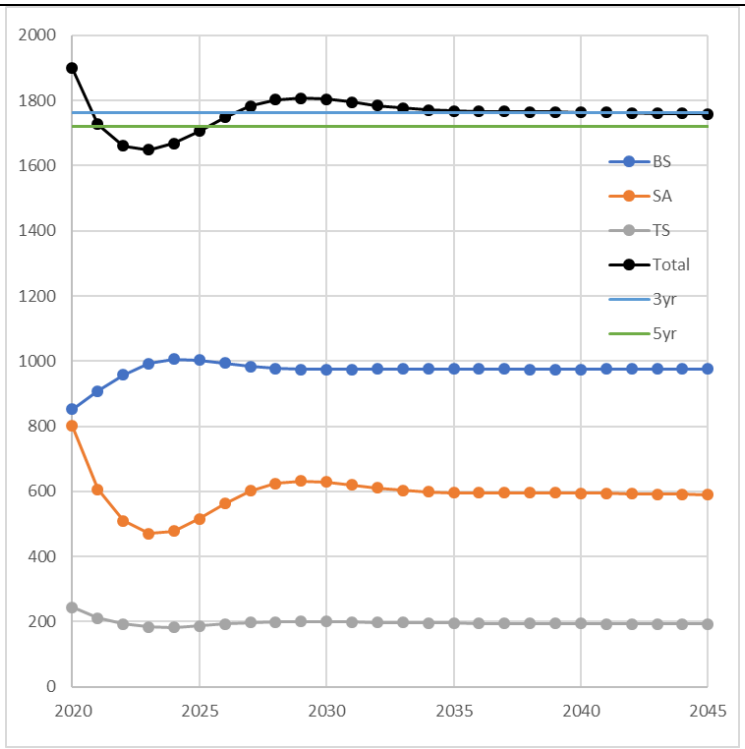


Figure 12: This figure shows the RBC calculations based on the base case model (CAL2019c). The annual RBC is calculated separately for each of the 3 sub-stocks and is then summed across the 3 (black line). The 3-year average and five year average RBCs are also shown. Source: Presentation by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Gummy shark assessment update for 2020: Choosing the base case*.

Projected biomass

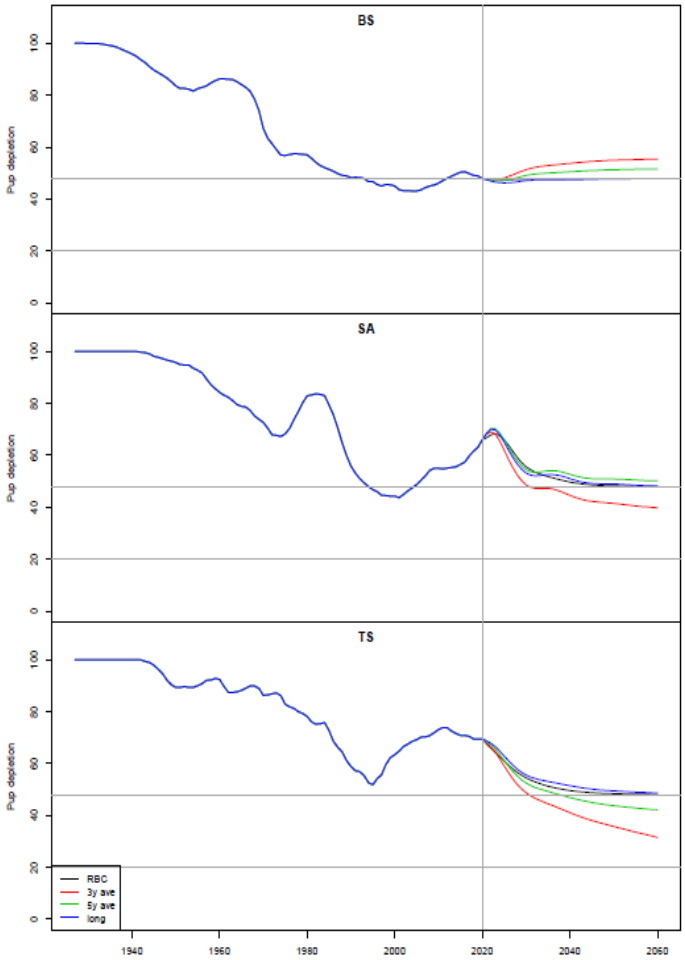


Figure 13: Pup depletion for the three3 sub-stocks showing future projections using annual RBC (RBC), the average over the most recent three RBCs (3y ave) and the most recent five (5y ave) as well as the long-term RBC (long). A vertical grey line marks the year 2020, and horizontal grey lines mark the 20% and 48% reference points (Thomson 2020).

SharkRAG (December 2020) discussed the pup production projections shown in Figure 13 (below).

Estimated pup production shows an increasing trend, in recent years, in SA and is steady in Bass Strait and Tasmania. The base case model indicates pup depletion is well above the 48% target reference point in SA and Tasmania (66% and 69% respectively). For the Bass Strait, the base case model estimates depletion at the target (48%). Pup depletion is above the 20% limit reference point for all stocks and all sensitivity models.

Species specific research and priorities

GHAT CPUE calculation methodology (proposed, not funded)

CPUE for gillnet-caught species was previously calculated on a kilogram per shot basis. Given the change to net length restrictions, SharkRAG supported moving from catch by shot to catch by metres of net set to better account for zero shots. Ongoing work to clarify the relationship between CPUE and net length has been identified as a research priority.

Improving CPUE standardisations for sharks (proposed, not funded)

Improve standardisations: a) Clarify relationship between CPUE and net length, b) Effects of Sea Lion and other closures on CPUE, and c) Account for changing dynamics of fleet with new entrants.

RAG Recommendations

SharkRAG (December 2020) provided four RBC options noting all are appropriate for a multi-year RBC, on the basis that they meet harvest strategy requirements. Furthermore, none of the four RBC options pose a risk of breaching the 20% limit reference point. In making this recommendation SharkRAG noted none of the four RBC options is likely to result in increased school shark catches. SharkRAG further noted that this RBC recommendation is based on the current structure of the fishery. If there is substantial change in the dynamics of the fishery (e.g. gear or location), SharkRAG recommends that the RBC be revisited.

SESSFRAG (August 2021) considered the indicators and supported maintaining the MYTAC.

The TAC for gummy shark set for the 2022-23 fishing season did not follow the step down expected under the MYTAC approach. SharkRAG (October 2022[11]) advised that, despite this, their previous MYTAC advice remains but that greater than anticipated catches would carry increased risk to the stock. SharkRAG noted that they are not in a position to update their advice without considerable work and would work on updating the model to be able to provide a robust scientific advice for next year.

RBC Option	Bass Strait	SA	Tasmania	Total
Annual	2021 – 853 t 2022 – 909 t 2023 – 958 t	2021 – 802 t 2022 – 606 t 2023 – 510 t	2021 – 244 t 2022 – 212 t 2023 – 194 t	2021 – 1,899 t 2022 – 1,727 t 2023 – 1,662 t
3-year average	907 t	639 t	217 t	1,763 t
5-year average	944 t	574 t	203 t	1,721 t
Long term	976 t	588 t	192 t	1,757 t

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	Annual – 1,662 t 3-year – 1,763 t 5-year – 1,721 t Long term – 1,757 t	Yes 3-Year MYTAC using one of the options provided above. SharkRAG (December 2020) recommended if there is substantial change in the dynamics of the fishery (e.g. gear or location), the RBC be revisited. SEMAC (February 2021) and the Commission (March 2021) supported and determined the 'Annual' TAC based on the 'Annual' RBC option. The Commission in 2022 maintained the TAC from 2021 which was greater than the TAC based on the annual
	2022	Annual – 1,727 t 3-year – 1,763 t 5-year – 1,721 t Long term – 1,757 t	
	2021	Annual – 1,899 t 3-year – 1,763 t	

[11] Minutes from this meeting are currently being finalised

		5-year – 1,721 t Long term – 1,757 t	RBC option following the MYTAC approach.
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	77.8 t	The 2018-2021 weighted average of State catches is to be deducted from the RBC, excluding NSW. Previously the State allocations agreed under the shark memorandum of understanding with SA, and Victoria have been deducted from the RBC. However, SharkRAG (2018) recommended deducting the weighted average State catch from the RBC, as is the case for other SESSF species. There is no allocation for Tasmania, rather, catches are limited in Tasmania through bycatch trip limits and NSW catches are not included in the assessment.	
Discards (t)	89.6 t	A weighted average of discards is deducted from the RBC, based on the last 4 years of annual discard estimates. SharkRAG (Nov 2021) agreed based on a comparative analysis of logbook and EM data, that logbook data for discarded gummy shark from gillnet and hook (manual and auto longline) methods is robust enough to use in the discard calculation. Discards from trawl methods will continue to be estimated following the Berg method.	
Recreational catch (t)	N/A	Estimates of recreational catches are available from South Australia in 2001 and 2008, but are considered uncertain and as such are not included in the assessment or deducted from the RBC.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		1,494 t – Using 'annual' RBC recommended by SharkRAG (1,662 t for 2023).	

MAC Recommendations

Commercial fishers' interests	Reported catch rates are high and TACs have been constrained by the TAC. The TAC was fully caught in 2020-21 and 2021-22 – quota availability has become an issue.
Species specific management (target, companion and bycatch)	The gillnet sector interacts with Australian Sea Lions in waters off SA. ASL interactions are managed through the ASL Management Strategy, which sets trigger limits that close spatial zones for 18 months if interaction numbers exceed the triggers. Dolphin interactions are managed through the GHAT Dolphin Strategy, which sets performance criteria for individual operators. To prevent targeting of school shark, GHAT operators (excluding scalefish hook which are subject to 100 kg trip limits) must limit their total school shark catch to 20% of their gummy shark catches, based on overall quota holdings. SharkRAG

	(December 2020) noted none of the four RBC options is likely to result in increased school shark catches.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA maintained the 2021-22 TAC of 1,672 t for the 2022-23 fishing year on the basis that:

- industry continues to report high catch rates, positive economic conditions, and have raised concerns about the impact of decreasing TACs;
- all three gummy shark stocks are assessed as being at or above the target reference point (the proxy target 48%B_0), and maintaining the TAC is not expected to adversely impact the sustainability of the stock;
- the gummy shark Tier 1 assessment is considered a 'bespoke' model and undertaking a partial update in 2022 to elicit further advice from SharkRAG on the risk of maintaining the TAC would require considerable resources, taking away from other work identified as a priority, namely planned upgrades to the gummy shark assessment model in preparation for the 2023 assessment.

AFMA have further considered total catches relative to the RBCs for each region (South Australia, Bass Strait and Tasmania). Predicted pup depletions for the three gummy shark stocks were projected in the 2020 stock assessment using the combined long-term RBC (1,757 t) assuming the 2019 proportional catch splits between gears. Projections estimate that the South Australian and Tasmanian stocks will remain above 60%B_0, whereas the Bass Straight stock would likely reduce to 46.3%B_0 by 2023. Comparatively, total mortality in 2021 was 1,730 t, comprising 1,624 t of landed catch and 105.6 t of discarded catch across Commonwealth and State fisheries (excluding NSW).

AFMA Management will seek advice from SEMAC in February 2023 on the TAC options for the 2023-24 fishing year, the third year of the previously advised 3-year MYTAC. In doing so, AFMA notes the following:

- where TACs are determined that are greater than the previously advised step-down MYTAC, higher than expected catches carry an increased risk to the stock, including increased risk to the stock in the Bass Strait area where catches have previously exceeded the RBC for this region;
- projections from the 2020 stock assessment predict the status of the Bass Strait stock would reduce to 46.3% if the long-term RBC were to be caught (assuming proportional catch splits remain the same), which is close to but below the target reference point;
- total mortality in 2021 across the three stocks was below the combined long-term RBC and is likely to be similar in 2022 (logbook catches to the end of November are lower in 2022 than they were in 2021 though the TAC is likely to be fully caught); and
- the South Australian and Tasmanian stocks are likely to remain well above the target reference point.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,672	TBC at Feb 2023 SEMAC meeting	10	2	TBC

Jackass morwong

Nemadactylus macropterus

Species summary

Common names	Sea bream, jackass fish, perch, silver perch, squeeker perch, deepsea perch, mowie.
Stock assessment	Tier 1 Species (East), weight of evidence (West) - last assessed by SERAG in 2021.
Stock structure	For assessment purposes it is assumed there are separate stocks of jackass morwong in the Eastern and Western Zones.

West

Stock status against reference points ($\%B_0$ in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2018	68	68	48	20
1	2015	69	61		
1	2011	67	38		

East

Stock status against reference points ($\%B_0$ in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2021	15	15	48	20
1	2018	35	15		
1	2015	37	17		

Stock trend and other indicators

Zone 30 – Annual standardized CPUE has been below the long-term average since about 2001. More recently, the relative CPUE trend has been flat since at least 2015 (i.e., not statistically different from each other over the last eight years). The recorded catch of 54 t in 2019 was the highest since after 2013 (102.9 t). By contrast, the recorded catch (14.4 t) in 2021 was the lowest in the series (Sporcic, 2022).

Zone 10-20 – Annual standardized CPUE has been below the long-term average since about 2000 with apparent periodicity. Both the recorded catch (38.8 t) and number of records (877) in 2021 were the lowest in the series (Sporcic, 2022).

Zone 40-50 – Since 2007, standardized CPUE has been below the long-term average, with the most recent estimate increased relative to the previous year. The recorded catch (7.9 t) and number of records (129) in 2020 was the lowest since 2016 (i.e., after 2015) (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
Single-year TAC	N/A – bycatch TAC

Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23	20	65	-
	2021-22	463	507	98
	2020-21	468	514	98
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.33	64	0.52
	2019-20	0.20	51.34	0.39
	2018-19	0.64	49.47	1.29
ABARES Status (2022 report)	**Fishing Mortality: subject to overfishing**		**Biomass: overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	↓ up to 20%	High	Patchy, but decline more in the northern extent of the fishery

Assessment summary

Key model technical assumptions/ parameters	**West (2018)** Single sex model and single stock in Zones 40 and 50 One fleet: trawl Natural mortality (M) fixed at 0.15 (agreed by SERAG) Recruitment is estimated from 1989 to 2012 **East (2021)** Single sex model and single stock in Zones 10, 20 and 30 Six fleets: eastern trawl (Zones 10 and 20), Danish seine, Tasmanian trawl (Zone 30), steam trawl (1915-1961), early Danish seine (1929-1967), Mixed (DS + trawl) (1968-1985). Natural mortality fixed at 0.15 (agreed by SERAG) Recruitment is estimated from 1945 to 2015.
Significant changes to data inputs	There were no significant changes to data inputs from the 2018 assessment.

Data and RAG comments	A western stock assessment was not conducted in 2021 due to limited data, poor data quality, concerns about the adequacy of the CPUE series to index the stock abundance and repeated concerns about the inability of previous western stock assessments to fit to the CPUE series. There has been an increase in discarding in the eastern trawl fleet in 2019 and 2020.
Stock assessment information and RAG comments	**West** The 2015 Tier 1 assessment (Tuck et al, 2015) estimated a 2016 spawning stock biomass of 69%B_0. The 2018 assessment estimated the biomass had fallen below the target reference point between 2006 and 2014, increasing to a 2019 spawning stock biomass of 68%B_0. The initial western stock assessments were considered "preliminary" and then later classified as "increasingly uncertain" with concerns expressed about limited sampling effort, unrepresentative sampling, conflict between different data sources (highlighting potential unrepresentative sampling), very low catches and problematic retrospective patterns (Day et al, 2021). The results should be treated with considerable caution due to the limited data quality and quantity. SERAG (October 2021) noted there were no concerns in the few available indicator data, and on the basis that there had been very little recent catch, there was no reason to deviate from the previous management advice. **East** Bridging from 2018 assessment: estimates of absolute and relative spawning biomass in the early part of the time series were revised downwards, especially during the step where recruitment deviations were extended from 2015 to 2018, and the projected increase in biomass from 2015-2019 in the 2018 assessment now shows a flat to declining trend in the same time period. Recruitment has been below the long-term average since 2004. There has been a downward revision to the recruitment estimates from the 2018 assessment for the period 1998-2012, and the recruitment deviations in 2013 and 2014 are the lowest on record. The 2018 assessment estimated biomass trajectory has an increase at the end of the series, which has been revised down in the 2021 assessment. The fit to the CPUE at the end of the series in the 2021 assessment is better than it was in the 2018 assessment. SERAG agreed to project low recruitment (from 2016 onwards) in the base case (a 'low recruitment base case'), on the basis that recruitment has been below average for the last 12 years in which it was estimated (2004-2015), and that projections should be based on a low recruitment scenario using the mean recruitment deviation of the most recent 10 years (2006-2015). Retrospective analyses show the estimated value of virgin biomass declines as each year of recent data is added to the model, as do recruitment deviations. There appears to have been a steady decline in productivity since around 1990, suggesting the 'stepped' shift in productivity accepted in 2011 was inappropriate. Under a dynamic B_0, stock status first drops below B_{48} in the late 60's and is just above the limit reference point in 2020. Under static B_0, the stock status dropped below the target in 2003 and has been below the limit reference point since 2013. Under the 'low recruitment' base case, the time series of relative spawning biomass has shifted lower in recent years with a minimum stock status of 14% in 2020, which was projected to be 36% from the 2018 assessment, however this was based on average

	recruitment, which has proven to be optimistic. The stock is estimated to be 15% in 2022. See projected rebuild timeframes under '**projected biomass'** below. SERAG considered a companion species analysis which investigated the link between target species catch and the associated level of unavoidable bycatch of recovering species, incorporating a range of factors such as area, depth fished and gear type – also known as metiers. Using logbook data from 2019 and 2020, and expected 2022-23 TACs for the main companion species (mostly flathead), the estimated unavoidable bycatch of eastern jackass morwong for 2022 ranged between 100-118 t, depending on assumed catches of flathead.
Projected biomass	**West** The 2018 tier 1 assessment projected the stock to reach 48%B_0 by 2045 assuming average recruitment. **East** Under the low recruitment base case, the eastern stock is projected to rebuild to the limit reference point by 2026 under the harvest control rule catch of 0 t, however it is not expected to recover to the target reference point at any point if the low recruitment base case is projected forward – the model estimates stock status will plateau at 26.5% from around 2049. Fixed annual catch scenarios were explored to provide estimates of rebuilding timeframes to the limit reference points (20%). - Catches up to 50 t allow the stock to rebuild to rebuild by 2028 - Catches up to 100 t allow the stock to rebuild by 2049 - The stock status continues to decline with catches up to 150 t, and will be fully depleted by around 2057.

Species specific research and priorities

Jackass morwong have been identified as a candidate for application of CKMR assessment approaches.

RAG Recommendations

SERAG (Nov 2021) recommended that the western jackass morwong RBC of 223 t (3-year average from the 2018 stock assessment) be maintained for the 2022-23 fishing year.

The eastern stock is assessed to be below the limit reference point, and SERAG recommended a 0 t RBC, consistent with the requirements of the SESSF Harvest Strategy. Noting the requirement in the *Commonwealth Harvest Strategy Policy* to rebuild a stock to the limit reference point within T_{MIN}[12], or up to $2xT_{MIN}$ after assessing the trade-off between costs and benefits of alternative recovery trajectories, SERAG recommended restricting total mortality to 50 t.

Recovery projections are based on landed catches of 50 t with discards estimated to be 2.5 t in addition to landed catch. This is consistent with the requirement under the HSP to rebuild the stock to the limit reference point within ten years ($2xT_{MIN}$).

SERAG (Nov 2022) noted trawl closures will be implemented on 1 May 2023 to reduce catches of at-risk species in the Commonwealth Trawl Sector which account for approximately 60 t of recent eastern jackass morwong catches. The Department of Agriculture Fisheries and Forestry (DAFF) has also commenced a structural

[12] The minimum time that would be taken to rebuild in the absence of any commercial fishing

adjustment program which is expected to reduce the number of trawl boats in the CTS before the start of the 2023-24 fishing year.

The bycatch TAC was set at 20 t for the 2022-23 fishing year to account for expected carry-over of uncaught quota (undercatch) from the 2021-22 fishing season. The 'available' TAC for 2022-23 is 65 t, of which 13 t has been caught as of the end of November 2022.

A metier analysis was not completed in 2022 because fishing effort will be impacted by closures and the structural adjustment. In the absence of a metier analysis, SERAG considered a bycatch TAC of 60 t would be sufficiently low to allow some catch in the west, whilst constraining catches in the east.

	Year	RBC (t): East	RBC (t): West	RBC (t): Total	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2024	0	-	-	No The eastern stock is assessed as overfished, and as such jackass morwong will be subject to a global bycatch TAC which must be reviewed annually.
	2023	0	-	-	
	2022	0	-	-	
	3-year average	0	223[13]	-	
Discount factor (t)	N/A	SERAG did not recommend applying a discount factor on the basis that an incidental bycatch TAC in the east will require a global TAC well below the western RBC.			
State catch (t)	East = 7.5 West = 0.4	Four-year weighted average - mostly NSW catches. These are not deducted from the Commonwealth bycatch TAC but should be considered as a source of total mortality.			
Discards (t)	N/A	Modelled discards in the east depend on the level of catch permitted under an incidental bycatch TAC. Discards in 2023 are estimated to be 2.5 t under an incidental bycatch TAC of 50 t (total mortality of 52.5 t), and 5.1 t under 100 t (total mortality of 105.1 t).			
Recreational catch (t)	N/A	A recreational survey in 2000 estimated that a total of 294 t of jackass morwong was caught across NSW, Victoria, Tasmania, SA and WA. A survey in 2013 estimated Tasmanian catches of 18 t. There have been no additional surveys and recreational catches are not considered in the assessment.			
Research Catch Allowance (t)	N/A				

[13] RBC from 2018 Tier 1 assessment

Provisional TAC under the Harvest Strategy	0 t – Incidental bycatch TAC to be considered.

MAC Recommendations

Commercial fishers' interests	Industry have previously noted that catches were patchy and jackass morwong are a very temperature-dependant species. Industry observations in the east are consistent with the outputs of the 2021 stock assessment – there has been a decline in catches and catch rates.
Species specific management (target, companion and bycatch)	Jackass morwong is a companion species to flathead. In addition to measure such as closures, consideration should also be given to reductions in companion species TACs to promote reduced catches of jackass morwong in the east. Trawl closures will be implemented on 1 May 2023 to reduce catches of at-risk species in the Commonwealth Trawl Sector which account for approximately 60 t of recent eastern jackass morwong catches. The Department of Agriculture Fisheries and Forestry (DAFF) has also commenced a structural adjustment program which is expected to reduce the number of trawl boats in the CTS before the start of the 2023-24 fishing year.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

The introduction of trawl closures on 1 May 2023 are intended to reduce total mortality of eastern jackass morwong to 50 t. The structural adjustment program being run by DAFF is expected to further reduce effort in the CTS and complement the closures. The extent to which total mortality is reduced will not be known until at least mid-2024 when catch and effort from 2023 which is analysed.

Noting the bycatch TAC for 2022-23 was set at 20 t account for carry-over from 2021-22, AMFA Management recommend a bycatch TAC of 60 t for the 2023-24 fishing year, a single year bycatch TAC, with undercatch and overcatch set at zero per cent, and a determined amount of 2 t. AFMA consider this sufficiently low to allow some catch in the west, whilst constraining catches in the east.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
20	60	0	2	+40

John dory

Zeus faber

Species summary					
Common names	St Peter's fish				
Stock assessment	Last assessed as a Tier 4 by SERAG in 2021.				
Stock structure	For management purposes, a single stock is assumed for the SESSF.				
Stock status against reference points (C_{Lim}/C_{Targ})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2021	0.4695	1.464	0.7320
	-	2020	N/A – Weight of evidence		
	3	2017	F_{CUR} = 0.036	F_{MSY} = 0.126	F_{LIM} = 0.198
Stock trend and other indicators	Catches and catch rates have declined since the early part of the time series – 1970. The status of the stock during the default reference period is uncertain for the purpose of estimating a current depletion level, however standardised catch rates show a continued long-term decline. The CPUE fluctuated around the limit reference point between 2002 and 2009 and has been below the limit since 2010. Zone 10-20 – Standardized CPUE has been below the long-term average since 1997. Also, there has been a gradually declining trend since at least 1996, with a small increase in CPUE in the last two years relative to 2019. The total catch in 2021 is the lowest in the series (Sporcic, 2022).				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	Single year TAC			N/A – bycatch TAC	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		60	60	-
	2021-22		60	104	50
	2020-21		452	491	63
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21		0.58	64	0.91
	2019-20		0.49	51.34	0.95

	2018-19	0.50	49.47	1.01
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**		**Biomass: Overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	↓ 40%	Low-medium	N/A

Assessment Summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between standardised CPUE and exploitable biomass, and that the character of the estimated CPUE has not changed significantly since the reference period to the end of the most recent year. The assessment assumes the biomass was around the target reference point proxy of 48%B during the reference period 1986-1995.
Significant changes to data inputs	This is the first Tier 4 completed for this species.
Data and RAG comments	The average of discard rate estimates from 1998-2006 have been used to backfill discard proportion estimates pre-1998. This is consistent with estimates that NSW DPI have on record. Forward fill missing discards in the time series repeating 2019 discard data in 2020. The catch time series used was derived in Sporcic and Day (2021), which incorporated the July 2021 revised NSW estimates and was endorsed by SERAG (28-29 September 2021) (Sporcic, 2021d). Based on the results of the 2020 catch-MSY and SPM assessment for 1970 – 2019, and assuming that productivity has remained unchanged over the history of the fishery, the John dory stock is estimated to have been at a 40%B_0 target in about 1985 (catch-MSY) or 1990 (SPM). This would indicate that the conventional reference period for SESSF Tier 4 assessments of 1986-1992 could be appropriate, assuming that productivity has not changed (Penney, 2020).
Stock assessment information and RAG comments	SERAG (October 2021) considered a Tier 4 assessment (Sporcic, 2021d) for the purpose or providing RBC advice for the 2022-23 fishing year and noted the following: - The recent CPUE (0.4695) is below the CPUE limit (0.732) and has been since 2010 on the basis of the Tier 4 assessment. - There was insufficient catch in zone 30 to inform a revised CPUE series to account for the suspected southerly shift in catch. - John dory discards were estimated to be 8 t in 2020. - The dynamics of the fishery have changed over time and John dory are not a targeted component of the fishery. SERAG considered the 'alternative' CPUE series (requested by SESSFRAG) which excluded catch and effort from boats that are no longer a major part of the fishery – this made very little difference to the CPUE series. SERAG noted that the application of the default reference period and assumed stock status (48%B_0 during the period 1986-92) assumes there has been no change in productivity. There is the potential for a change in productivity, in which case the CPUE

	series would be compromised, however there is little current evidence to support this and the RBC advice should be based on the outputs of the Tier 4 assessment. On the basis of the outputs of the Tier 4 assessment, SERAG recommended an RBC of 0 t. SERAG noted it is unlikely that fishing is driving the decline in abundance, and as a non-targeted species, total mortality is unlikely to be constrained by TACs. SERAG (November 2021) considered a companion species analysis which investigated the link between target species catch and the associated level of unavoidable bycatch of recovering species. The analysis incorporated a range of factors such as area, depth fished and gear type – also known as metiers. Using logbook data from 2019 and 2020, and expected 2022-23 TACs for the main companion species (trawl caught flathead) the estimated unavoidable bycatch of John dory for 2022 is 61.3 t, with a range between 56.5 and 66.4 t. This is close to the 60 t MSY value from the 2020 Surplus Production model. SERAG (Dec 2022) noted trawl closures will be implemented on 1 May 2023 to reduce catches of at-risk species in the Commonwealth Trawl Sector which account for approximately 50-60 t of recent yearly John dory catches. The Department of Agriculture Fisheries and Forestry (DAFF) has also commenced a structural adjustment program which is expected to reduce the number of trawl boats in the CTS before the start of the 2023-24 fishing year.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (Nov 2022) noted the absence of a metier analyses to inform bycatch TACs due to the impending significant structural changes, and did not recommend any changes to the bycatch TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	0	No. Bycatch TAC to be implemented for 2023-24.
	2022	0	
	2021	N/A – weight of evidence	
Discount factor (t)	N/A	A discount factor is not applied to the bycatch TAC.	
State catch (t)	N/A	Four-year weighted average – mostly NSW catch. State catches are not deducted from a bycatch TAC but should be considered as a source of mortality.	
Discards (t)	N/A	Discards were estimated to be 5.6 t in 2021. Discards are not deducted from a bycatch TAC but should be considered as a source of mortality.	
Recreational catch (t)	N/A	There are no estimates of recreational catch.	

Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		0 t - Bycatch TAC to be considered.

MAC Recommendations

Commercial fishers' interests	Industry have previously advised this species is no longer targeted but, because of the good market price, is generally landed when caught.
Species specific management (target, companion and bycatch)	Trawl closures will be implemented on 1 May 2023 to reduce catches of at-risk species in the CTS which account for approximately 19 t of recent John dory catches. The Department of Agriculture Fisheries and Forestry (DAFF) has also commenced a structural adjustment program which is expected to reduce the number of trawl boats in the CTS before the start of the 2023-24 fishing year.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

There were no undercatch provisions determined for John dory for the 2022-23 fishing year. As such, determining a bycatch TAC of 60 t for the 2023-24 fishing year ensures the available TAC is constrained to 60 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
60	60	0	2	0

Mirror dory

Zenopsis nebulosus

A Mirror Dory, Zenopsis nebulosa. Source: Australian National Fish Collection, CSIRO. License: CC by Attribution-Noncommercial

Species summary

Common names	Deepsea dory, mirror perch, trawl dory, silver dory				
Stock assessment	Tier 4 Species – last assessed by SERAG in 2022.				
Stock structure	An eastern and western stock is currently assumed for assessment purposes. However, mirror dory is managed under a global TAC.				
East **Stock status against reference points (C_{Lim}/C_{Targ})**	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2022	0.7170	1.1842	0.493
	4	2021	0.6543	1.178	0.4908
	4	2020	0.729	1.1808	0.492
West **Stock status against reference points (C_{Lim}/C_{Targ})**	**Tier**	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2022	0.6374	1.0244	0.4268
	4	2021	0.6655	1.018	0.4242
	4	2020	0.6798	1.0054	0.4189
Stock trend and other indicators	Zones 10 - 30 exhibits large scale, apparently cyclical changes in CPUE. It appears that as catches decline so does CPUE, and as catches increase so does the CPUE. This is unexpected as the intensity of fishing is usually expected to be negatively correlated with CPUE. It may be the case that catches and CPUE change relative to availability of the stock rather than the influence of the fishery on the stock. Better evidence is needed to make such an assertion with confidence. Over the period when CPUE was lower than average (about 1995 - 2004) there was an increase in small shots of < 30 kg, which is suggestive of either low availability or high levels of small fish. Standardized CPUE has declined on average from 2009 to 2016. It differs from unstandardized CPUE early in the fishery (1986 - 1990), in the second half of the fishery (2000 - 2007), over the 2014 - 2017 period and over the last three years. The most recent changes appear strongly correlated with changes in the average depth of fishing with a shift to more relatively shallow water fishing, compared to the second half of the fishery. Standardized CPUE increased in 2021 relative to the previous year and has been below the long-term average and relatively stable for the past four years (Sporcic, 2022). Zones 40-50 – Mirror Dory catches in the west appear to be episodic with peaks in 1997, 2001 - 2003, and 2010 and 2011, which roughly coincides with minor peaks in CPUE in a manner similar to that observed in the east, although with a more rapid cycle and less extreme variation. As on the east coast in the last few years, there has been an increase of reported catches in waters of 200 m, which is unusual for Mirror Dory in the west. The amount of catch remains minor until about 1995 after which the amount of				

<table>
<tr><td></td><td colspan="4">catch and the number of records remains at levels that permit usable analyses, with relatively tight precision levels around the mean estimates to be made. From 1990 the CPUE trend for Mirror Dory in the west appears to be relatively periodic and noisy around the long-term average with periods above and below (Sporcic, 2022).</td></tr>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="2">Year of MYTAC (2022-23)</td><td colspan="2">MYTAC advice</td></tr>
<tr><td colspan="2">Single year TAC</td><td colspan="2">Continue with 2022 assessment</td></tr>
<tr><td rowspan="4">Catch and TAC (t)</td><td>SESSF fishing year</td><td>Agreed TAC</td><td>TAC after unders/overs</td><td>Cth Retained Catch</td></tr>
<tr><td>2022-23</td><td>129</td><td>140</td><td>-</td></tr>
<tr><td>2021-22</td><td>144</td><td>154</td><td>107</td></tr>
<tr><td>2020-21</td><td>137</td><td>155</td><td>102</td></tr>
<tr><td rowspan="4">Economics
(Secondary)
Commonwealth Trawl and Scalefish Hook</td><td>Financial Year</td><td>Species GVP ($m)</td><td>Fishery GVP ($m)</td><td>% Fishery GVP</td></tr>
<tr><td>2020-21</td><td>0.50</td><td>64</td><td>0.78</td></tr>
<tr><td>2019-20</td><td>0.47</td><td>51.34</td><td>0.92</td></tr>
<tr><td>2018-19</td><td>0.37</td><td>49.47</td><td>0.75</td></tr>
<tr><td>ABARES Status
(2022 report)</td><td colspan="2">Fishing Mortality: Not subject to overfishing</td><td colspan="2">Biomass: Not overfished</td></tr>
<tr><td rowspan="2">Climate sensitivity</td><td>Sensitivity</td><td>Preliminary projection</td><td>Confidence in projection</td><td>Comments</td></tr>
<tr><td>Low</td><td>↓ 15%</td><td>Medium</td><td>N/A</td></tr>
<tr><td colspan="5">Assessment summary</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td colspan="4">The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.</td></tr>
<tr><td>Significant changes to data inputs</td><td colspan="4"><u>East</u>

For any year where discard estimates are not available after 1998, the average of the years for which there are estimates available are used to ‘fill’ estimates for those years. The same average is applied to all years pre-1988. The Mean Proportion Discarded (MPD) for Mirror dory east increased to 0.1940 in the most recent assessment, up from 0.1925 in the 2021 tier 4.

The catch time series used in this assessment was derived from Sporcic and Day (2021), which incorporated the July 2021 revised NSW estimates and endorsed by SERAG</td></tr>
</table>

	(September 2021). Discard estimates were based on revised Althaus et al. (2022) and modifications requested by SERAG in 2020 (Sporcic, 2021d). **West** The catch time series used was derived from Sporcic and Day (2021).
Data and RAG comments	**East** Most of the catch is from Zone 10. A significant drop in discard estimates from 2017 to 2018 and relatively consistent since. **West** The CPUE series is quite noisy for this stock, though relatively flat over the long-term.
Stock assessment information and RAG comments	**East** The most recent catch and standardized CPUE has increased relative to the previous year. Revised estimates of NSW State catches included in the previous assessment were also included in this assessment. Discard estimates used for Mirror Dory East were based on both Althaus et al. (2022) and Deng et al. (2022). The coefficient of variation (CV) of the 2018 discard estimate was originally greater than 100 % (i.e., ~189 %; Table 2 in Althaus et al., 2020). Therefore, as agreed by SESSFRAG (meeting 20-22 August 2019), it was replaced with the 2017 estimate (0.02; CV: 52 %) and repeated this year (Sporcic, 2022e). The 2022 estimated RBC was 137.77 t, an increase of 24.84 t compared to the 2021 estimated RBC (112.93 t; Sporcic 2021). The increase in RBC of approximately 25 t can be mostly attributed to an increase in the most recent CPUE (including discards) and hence the mean of the most recent four-year average which is used to calculate the RBC. The 2022 RBC is greater than the reported catch of approximately 77.6 t (135 t including estimated discards) in 2021 for this stock. Also, the CPUE in 2021 is above the CPUE limit based on the Tier 4 Harvest Control Rule (0.49) compared to the previous CPUE (in 2020) which is at the CPUE limit (Sporcic, 2022e). **West** With the fishery only beginning to report significant catches from about 1996 onwards the reference period used is relatively recent. Nevertheless, there are now 12 years between the reference period and the start of the most recent four years used to denote the current state of the fishery (Sporcic, 2022e). The 2022 estimated RBC was 48.72 t, a decrease of 7.46 t compared to the 2021 estimated RBC (56.18 t; Sporcic 2021). The decrease in RBC of approximately 7.5 t can be attributed to a decrease in the mean of the most recent four-year average CPUE which is used to calculate the RBC. The 2022 RBC is greater than the reported catch of approximately 29 t in 2021 for this stock (Sporcic, 2022e).
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (Oct 2022) recommended a single year TAC using a combined east and west RBC of 186.5 t for the 2023-24 SESSF fishing year.

	Year	RBC (t)		Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	East: 137.77 West: 48.72	Total: 186.5	No. Single year TAC.
	2022	East: 112.9 West: 56.18	Total: 169.1	
	2021	East: 145.7 West: 61.7	Total: 207.4	
Discount factor (t)	28	The default Tier 4 discount factor of 15 per cent is applied.		
State catch (t)	East: N/A West: N/A	There are no estimates of State catch for mirror dory (west).		
Discards (t)	East: 38 West: N/A	Discards are considered low for the west and are not included in the Tier 4 assessment. Estimated discard rates in the east increased from 11% (8.8 t) in 2020 to 42.6% (57.5 t) in 2021 resulting in an increase to the weighted average discards.		
Recreational catch (t)	N/A	Recreational catches are not considered in assessment and are assumed to be low.		
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.		
Provisional TAC under the Harvest Strategy		121 t		

MAC Recommendations

Commercial fishers' interests	Some operators have previously raised concerns about the TAC not responding quickly enough to changes in stock availability.
Species specific management (target, companion and bycatch)	Restrictions on pink ling catches have likely contributed the decrease in mirror dory catch in the east.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 121 t for the 2023-24 fishing year, a single year TAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
129	121	10	2	-8

Ocean perch (basket)

Offshore ocean perch (*Helicolenus barathri)*

Inshore ocean perch (*Helicolenus percoides)*

Species summary

Common name	**Offshore:** Bigeye ocean perch **Inshore:** Reef ocean perch, Jock Stewart
Stock assessment	Tier 4 Species – Offshore last assessed by SERAG in 2020. Inshore last assessed by SERAG in 2017.
Stock structure	The ocean perch basket is made up of two species; offshore ocean perch (*Helicolenus barathri*) and inshore ocean perch (*Helicolenus percoides*). A single basket TAC is set based on the Tier 4 assessment for offshore ocean perch.

Inshore

Stock status against reference points (C_{Lim}/C_{Targ})

Tier	Assessment Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2017	0.9669	0.3255	0.1628
4	2013	1.769	1.0553	0.5065
4	2012	0.8538	1.3056	0.5222

Offshore

Stock status against reference points (C_{Lim}/C_{Targ})

Tier	Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2020	1.0765	0.9273	0.4637
4	2017	0.9668	0.9283	0.4642
4	2013	0.9381	1.1456	0.4582

Stock trend and other indicators

Offshore

Zone 20-30 – Annual standardized CPUE has been below average and relatively flat between 1995 and 2006. The trend from 2007 has also been relatively flat and mostly just above average, apart from the last four years which have increased and above average. Also, standardized CPUE has increased since 2015 (Sporcic, 2022).

Zone 10-50 – Annual standardized CPUE has been below average and relatively flat between 1995 and 2006. The trend from 2007 to 2010 has also been relatively flat and on average, below average and flat between 2011 to 2016 and increasing to either on average or above average since 2017, based on 95% confidence intervals. Also, CPUE has increased since 2015 (Sporcic, 2022).

Inshore

Zone 10-20 – Annual standardized CPUE has been relatively flat in the last six years based on the 95% confidence intervals (Sporcic, 2022).

Multi-Year TAC	Year of MYTAC (2022-23)	MYTAC advice

	2nd of 3-year		Maintain current MYTAC	
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23	305	330	-
	2021-22	304	323	178
	2020-21	239	262	189
Economics (Secondary) Commonwealth Trawl and Scalefish Hook sectors	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.44	64	0.68
	2019-20	0.65	51.34	1.27
	2018-19	0.43	49.47	0.87
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	There is no additional information regarding climate sensitivity for ocean perch.		

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	The average discard proportion for years after 1998 are used to 'backfill' the estimates pre-1998. Previously reported NSW annual catch was used for the period 1986-97 inclusive. However, revised NSW estimates were used for the period 1998- 2019 inclusive (Sporcic, 2020a).
Data and RAG comments	The assessment uses catch rates from Zones 10 and 20 – most catch comes from Zone 10.
Stock assessment information and RAG comments	The average CPUE has increased since the last assessment, resulting in an increased RBC of 421.2 t from the 2020 assessment compared to 344.7 t from the 2017 assessment. This was also driven by an increase in C_{Targ} because of the addition of historical discard estimates (Sporcic, 2020a).
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (December 2020) recommended a 3-year MYTAC using the RBC of 421.2 t from the 2020 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	421.2	Yes. 3-year MYTAC using the RBC from the 2020 Tier 4 assessment.
	2022	421.2	
	2021	421.2	
Discount factor (t)	63.2	Applying the default Tier 4 discount factor of 15 per cent.	
State catch (t)	9.8	Offshore ocean perch only – mostly NSW catches.	
Discards (t)	29.9	Estimates of discards have been variable and ranged between 21 t in 2021 and 75 t in 2013. Only offshore ocean perch discards.	
Recreational catch (t)	N/A	Estimates of recreational catch available for Tasmania in 2013, 1.1 t. Recreational catches are not included in the assessment and are not deducted from the TAC.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		318 t	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	Inshore ocean perch are not considered an economically important species and are generally discarded.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

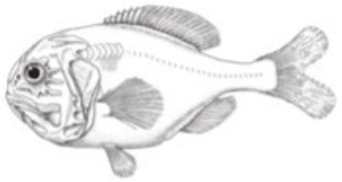
AFMA Advice

AFMA Management recommends a TAC of 318 t for the 2023-24 fishing year, the third year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
305	318	10	2	+13

Orange roughy Albany and Esperance

Hoplostethus atlanticus



ABARES (2012): Line Drawing – Rosalind Poole

Species summary

Common names	Slimehead, deep sea perch, red roughy, orange ruff.
Stock assessment	No quantitative assessment undertaken to date.
Stock structure	The stock structure of orange roughy in the AFZ remains unresolved. Based on the existing data fishery dynamics multiple regional stocks of orange roughy are assumed. Orange roughy in the GAB are managed as a non-target, bycatch only species.

Stock status against reference points ($\%B_0$)

Tier	Assessment Year	Biomass	Target	Limit
-	-	-	-	-

In 2006, the SESSF (including the GAB and excluding the Cascade Plateau) was closed to targeted orange roughy fishing, due to stocks being below the limit reference point

Biomass was uncertain but predicted to be below $20\%B_0$ based on depletion of other orange roughy stocks.

Stock trend and other indicators	There is no formal stock assessment for orange roughy in the GAB because catches and consequently data are sporadic and spatially scattered (Knuckey et al., 2010).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	50	50	-
2021-22	50	50	0
2020-21	50	50	0

Economics

(Primary)

Great Australian Bight Trawl

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2020-21	0.002	10.64	0.01
2019-20	-	10.76	-
2018-19	-	8.48	-

ABARES Status (2022 report)	Fishing Mortality: Not subject to overfishing		Biomass: Uncertain	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	High	Uncertain	High	↓40% through to ↑10-60% (dependent on trophic interactions and oceanography). Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	N/A
Significant changes to data inputs	N/A
Data and RAG comments	N/A
Stock assessment information and RAG comments	No quantitative stock assessment has been conducted for orange roughy in the GAB (including in the Albany & Esperance Quota Zones), as the available data are spatially and temporally dispersed, with no recent surveys or representative catch-trend data available to determine stock abundance. Albany & Esperance orange roughy are subject to an incidental bycatch TAC, implemented under the Orange Roughy Rebuilding Strategy.
Projected biomass	N/A

Species specific research and priorities

GABT Orange Roughy Research Plan

The GABT Orange Roughy Research Plan has been in place since 2007 and aims to collect robust scientific information, including biological data, to update the understanding of the status of the GAB orange roughy stock and determine sustainable harvest levels for commercial fishing under the SESSF Harvest Strategy.

RAG Recommendations

GABRAG (October 2022[14]) recommended maintaining the Albany & Esperance orange roughy incidental bycatch TAC at 50 t for the 2023-24 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?

[14] Meeting minutes are currently being finalised

Recommended Biological Catch (t)	2023	0	No. Rebuilding species.
	2022	0	
	2021	0	
Discount factor (t)	N/A	Discount factors are not applied to the incidental bycatch TAC	
State catch (t)	N/A	There are no estimates of State catches.	
Discards (t)	N/A	There are no estimates of discards.	
Recreational catch (t)	N/A	There are no known recreational catches for orange roughy.	
Research Catch Allowance (t)	200	Research catch allocated under GABT Orange Roughy Research Plan	
Provisional TAC under the Harvest Strategy		50 t - Incidental bycatch TAC	

MAC Recommendations

Commercial fishers' interests	Two scientific permits were allocated during the 2022-23 fishing year to fish under the GABT Orange Roughy Research Plan.
Species specific management (target, companion and bycatch)	This species is managed under the Orange Roughy Rebuilding Strategy 2022.
MAC advice and any dissenting views	**2023-24 TAC recommendation** 50 t – bycatch TAC **GABMAC advice and any dissenting views** There were no dissenting views at the GABMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
0	0	2	50

AFMA Advice

AFMA recommend a single year bycatch TAC of 50 t for the 2023-24 fishing year, with no undercatch or overcatch provisions and a determined amount of 2 t.

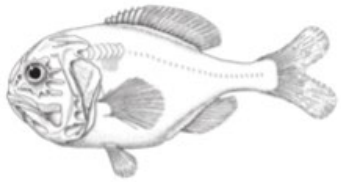
AFMA also recommend a Research Catch Allowance of 200 t during the 2023-24 fishing year to support data collection under the Great Australian Bight Orange Roughy Research Program.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)

50 – bycatch TAC 200 – Research Catch Allowance	50 – bycatch TAC 200 – Research Catch Allowance	0	2	0

Orange roughy Cascade Plateau

Hoplostethus atlanticus



ABARES (2012): Line Drawing – Rosalind Poole

Species summary

Common names	Slimehead, deep sea perch, red roughy, orange ruff
Stock assessment	Tier 1 Species - last assessed by DeepRAG in 2009.
Stock structure	The stock structure of orange roughy in the AFZ remains unresolved. Based on the existing data fishery dynamics multiple regional stocks of orange roughy are assumed. The Cascade Plateau, however, holds orange roughy with distinct morphometrics, parasite populations, size and age composition, and which also have a distinct spawning time from other adjacent stocks. For assessment and management purposes they are regarded as a separate stock.

Stock status against reference points ($\%B_0$)

Tier	Assessment Year	Biomass	Target	Limit
1	2009	64	48	20
2	2006	73		
2	2005	30-60		

Stock trend and other indicators	There are no recent data to assess the biomass trend. Catches have remained below the RBC since the assessment and the stock likely remains above the target reference point.

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
Single year TAC	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	397	447	-
2021-22	500	550	266
2020-21	500	550	211

Economics (Primary)

Commonwealth Trawl and Scalefish Hook

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2020-21	Not Available	64	Not Available
2019-20	Not Available	51.34	Not Available

	2018-19	0	49.47	0
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	High	Uncertain	High	↓40% through to ↑10-60% (dependent on trophic interactions and oceanography). Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	N/A
Significant changes to data inputs	N/A
Data and RAG comments	Low levels of fishing has resulted in insufficient data being available to update the assessment.
Stock assessment information and RAG comments	The first quantitative stock assessment of the Cascade Plateau orange roughy population was produced in 2004 (Wayte, 2004). The 2004 assessment used catch records, biological data collected over the previous 6 years, and the 2003 acoustic biomass estimate. The 2004 stock assessment estimated the orange roughy biomass at Cascade Plateau to be between 7,000 and 18,700 t and the long-term sustainable catch to be 300-400 t. In 2006, the assessment was again updated, using the acoustic biomass estimate from the 2005 winter spawning aggregation which was about three times larger than previous estimates. The 2006 assessment estimated the stock to be about 20,000 t and the current biomass as 72-73% of the unfished biomass (B_0) approximately 20% higher than the target reference point and 12% higher than the target under the Conservation Program. At the DeepRAG meeting in 2009, DeepRAG requested a re-run of the assessment using an alternative 2005 acoustic biomass estimate of 18,400 t, instead of the 31,600 t estimate used in the 2006 assessment. Using these data the assessment estimated a female spawning stock status of 64%B_0, and produced an RBC of 492 t under the 20:35:48 harvest control rule, or a long term RBC of 397 t. There were low levels of fishing on the Cascade Plateau (<1% of TAC caught) during 2011 and 2012. An update to the assessment was due for 2012 but this was deferred due to the lack of new data and a higher priority being assigned to other species. SERAG (September 2021) Recent studies into target strength estimates from acoustic biomass surveys of large orange roughy indicates that 2003-05 acoustic biomass estimates should be revised. When all other inputs are unchanged this would result in a decrease to the estimate of biomass. However, there have been multiple revisions to model assumptions and model techniques used in the 2009 assessment which would likely result in an upwards revision of the RBC if the assessment were updated. The annual TAC has been set at 500 t based on the 2009 stock assessment, however there has been very little fishing on the Cascade Plateau since then. There have been no catches in most years, and they have only increased recently with 211 t in 2020 and 266 t in 2021. SERAG (November 2022)

	A hull-mounted acoustic survey was completed for orange roughy (Cascade Plateau) in 2021 and 2022. A towed body acoustic optical survey (AOS) was identified as a research priority to support a potential stock assessment in 2024. However, the unpredictable nature of the aggregation on the Cascade Plateau, evident through the lack of catch in 2022, means there is a risk that an AOS will not provide useful data. SERAG noted it was not ready to give a recommendation on assessment options until the presentation of the fish ageing data collected from the most recent fishing events. There isn't a lot of strength in current information to form a decision and this highlights the need to gather up to date information. SERAG noted SESSFRAG will consider a CSIRO paper in April 2023 to discuss alternative assessment approaches as well as comparisons of fish-length/otolith weight ratios. SERAG recommended maintaining the 397 t TAC for 2023-24 on the basis that it promotes data collection, however urged caution about setting the TAC for another year without information.
Projected biomass	N/A

Species specific research and priorities

Acoustic biomass estimates and monitoring of Cascade Plateau orange roughy

Following a high level of research input in the early days of this fishery, the information flow has essentially all but ceased since 2006 due to a combination of low catches and fishing effort. The need for an updated stock assessment is apparent to inform appropriate TAC levels into the future.

RAG Recommendations

Noting the low levels of catch since 2009, SERAG did not have any concerns regarding the sustainability of the stock, however noted the need to update the assessment to inform future TACs.

SERAG recommended a TAC of 397 t for Cascade orange roughy for the 2023-24 fishing year. This TAC is based on the long-term RBC from the 2009 stock assessment, noting there is reduced confidence in the outputs given the assessment was completed in 2009.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	397	No. SERAG (2022) recommended that the RBC be set at 397 t again for a single year, which was the long-term RBC from the 2009 stock assessment.
	2022	397	
	2021	500	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	There are no State catches.	
Discards (t)	N/A	There are no estimates of discards.	
Recreational catch (t)	N/A	There are no known recreational catches for orange roughy.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	

Provisional TAC under the Harvest Strategy	397 t

MAC Recommendations

Commercial fishers' interests	Two boats have fished the Cascade Plateau in recent years.
Species specific management (target, companion and bycatch)	This species is managed under the Orange Roughy Stock Rebuilding Strategy.
MAC advice and any dissenting views	**2022-23 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

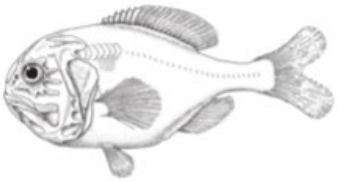
AFMA Advice

AFMA Management recommends a TAC of 397 t for the 2023-24 fishing year, a single year TAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
397	397	10	2	0

Orange roughy Eastern Zone

Hoplostethus atlanticus



ABARES (2012): Line Drawing – Rosalind Poole

Species summary

Common names	Slimehead, deep sea perch, red roughy, orange ruff
Stock assessment	Tier 1 Species - last assessed by SERAG in 2021.
Stock structure	Based on the existing data and fishery dynamics, multiple regional stocks of orange roughy are assumed and the fishery is managed and assessed as a number of discrete regional stocks. Recent genetic studies indicate little genetic diversity between all South East Australian stocks. However, they may be demographically separate. For assessment purposes the eastern stock (primarily St. Helens Hill and St. Patricks Head) is assumed to also include catches taken from the Pedra Branca area in the Southern Zone.

Stock status against reference points (%B_0 in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2021	30	30	48	20
1	2017	33	26		
1	2014	26	24		

Stock trend and other indicators	Stock status: The most recent assessment (2021) indicates that the stock is above the limit reference point, and is estimated to be at 30% of unfished biomass (B_0) in 2021, and projected to be at 30%B_0 at the beginning of 2022 (Burch et al, 2021). Biomass trend: the 2021 stock assessment indicates that biomass is continuing to increase, however revisions to the model have resulted in an overall downward revision to the estimate of relative biomass – see 'Biomass revised in most recent assessment' above. Recent acoustic surveys (1999, 2006, 2010, 2012, 2013, 2016 and 2019) undertaken at St. Helen's Hill and St. Patricks' Head have estimated an increase in abundance, which supports the estimated increase in abundance from the Tier 1 stock assessments.

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
1st of 3-year	Maintain current MYTAC

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	1,074	1,187	-

	2021-22	1,277	1,569	1451
	2020-21	1,276	1,628	1319
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	9.27	64	14.48
	2019-20	5.01	51.34	8.74
	2018-19	7.15	49.47	14.45
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	

Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	High	Uncertain	High	↓40% through to ↑10-60% (dependent on trophic interactions and oceanography). Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	The model assumptions include the single stock structure hypothesis; Eastern Zone spawning roughy and Pedra Branca non-spawning roughy. The biomass is assumed to have been unfished at the start of 1979. Plus group age was set at 120 years. Recruitment deviations (1905-1986) Natural mortality (M) estimated at 0.0393 Steepness fixed at 0.75 Recruitment variability fixed at 0.7
Significant changes to data inputs	Age data and acoustic biomass data from the 2019 eastern survey were included in the 2021 assessment.
Data and RAG comments	The 2017 eastern orange roughy assessment used natural mortality of 0.04. For the 2021 assessment, M was estimated in the model to be 0.0393.
Stock assessment information and RAG comments	2021 Estimating M – The 2017 Eastern Zone Orange Roughy assessment highlighted the model was highly sensitive to the fixed value of natural mortality (M) used in the assessment. For the 2021 assessment CSIRO was asked to develop a process to account for uncertainty in M. A working group recommended estimate M using an informative prior developed from New Zealand Orange Roughy stocks. Age data was re-processed to provide models with 80, 100 and 120 age classes, and the ageing error for the model with 120 age-classes was used for assessments with 100 and 120 age classes. Natural mortality was estimated using the log-normal informative prior for 80, 100 and 120 age-classes. The number of age classes in the model was influential on the estimated value of M, with MPD estimates ranging from M=0.0344 for 80 classes, M=0.0373 (95%CI: 0.0326 – 0.0454) for 100

age classes and M=0.0386 (95%CI: 0.0331 – 0.0452) for 120 age classes. There was little information in the analyses to separate the models with 100 and 120 age classes - SERAG recommended the model with 120 age classes be adopted as the base case.

Likelihood profiles for natural mortality show a conflict between age data, which prefers a higher estimate of M (~0.038), and the acoustic index data, which prefers a lower M (~.025). The likelihood profile on M was consistent with the estimated value of M.

MCMC analysis

SERAG (Nov 2021) requested using 12.5% and 87.5% quantiles of the estimated value of natural mortality from MCMC analysis as sensitivities to the base-case. The MPD estimates of current stock status (SSB_0/SSB_{2022}) for the low (M=0.0358) and high (M=0.0432) natural mortality scenarios are 29.7% and 37.0% respectively, compared with the MPD estimate from the base-case of 32.4%.

The status from the median of the MCMC was lower than the MPD estimate, and the selectivity width parameter was quite uncertain. The working group recommended that the MCMC analysis that estimates the width parameter of the logistic selectivity function should be retained and used to provide advice in setting RBCs, not the MPD.

The MCMC model estimates stock status in 2021 to be 30%B_0 and produces a 2022 RBC of 681 t, or a 3-year average of 737 t. The working group also requested several constant catch projections to understand the uncertainty in future stock status (See 'projected biomass').

Undercatch

A sensitivity to the base case (not the MCMC) was undertaken to understand the impact of allowing 100% undercatch from the 2021-22 fishing year to be caught in the 2022-23 fishing year – the biomass in 2022 is expected to be 32.32%B_0 if undercatch is fully caught, compared to 32.46%B_0 if it were not caught. SERAG were supportive of the current undercatch provisions to remain in place, noting there is very little impact on the estimate of relative biomass.

Projected biomass

Estimated female spawning stock biomass (SSB), stock status and the probability of being below the limit reference point in 2024 and 2031

Catch Scenario	SSB 2024	SSB 2031	Status 2024	Status 2031	Prob<LRP 2024	Prob <LRP 2031
HCR	12,269	12,831	0.3162	0.3295	<0.001	<0.001
550	12,378	13,609	0.3165	0.3481	<0.001	<0.001
650	12,325	13,364	0.3152	0.3419	<0.001	<0.001
737	12,279	13,149	0.3139	0.3363	<0.001	<0.001
850	12,215	12,887	0.3129	0.3294	0.001	0.001
950	12,123	12,583	0.3115	0.3230	0.003	0.002
Industry Proposal	12,041	12,504	0.3093	0.3208	0.004	0.002

Species specific research and priorities

Orange roughy acoustic survey 2023

This research has been identified as a priority and will provide an acoustic based biomass estimate for orange roughy (Eastern) for the 2023-24 fishing year. It also includes the collection of biological samples including length, weight, sex, spawning stage and otolith extraction.

RAG Recommendations

SERAG recommended a 3-year MYTAC for orange roughy east using the outputs of the MCMC analysis. If a TAC greater than the RBC were to be set in the east, the constant catch scenarios and associated risk profiles should be used as basis for determining the TAC.

The orange roughy Pedra Branca area 3-year MYTAC will constitute 7 per cent of this RBC apportioned to the eastern zone.

SERAG recommended maintaining the current undercatch provisions.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2025	772 (93% of 830)	Yes. (93% of the Eastern Zone Tier 1 stock assessment, with 7% apportioned to the Pedra Branca area of the Southern Zone.)
	2024	734 (93% of 789)	
	2023	688 (93% of 740)	
	2022	633 (93% of 681)	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	There are no estimates of State catches.	
Discards (t)	6.3	Estimated discards (four year weighted average 2018-2021).	
Recreational catch (t)	N/A	There are no known recreational catches for orange roughy.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		682 t – using 3-year average RBC	

MAC Recommendations

Commercial fishers' interests	See South East Trawl Industry Association (SETFIA) letter explained in SEMAC advice below.
Species specific management (target, companion and bycatch)	Noting that the eastern stock estimated to be at 30%B_0, the species is managed under the Orange Roughy Stock Rebuilding Strategy. Specific management, agreed by industry and AFMA, applies in the spawning period from 1 June to 31 August each year in the Eastern Orange Roughy Management Area (Eastern ORMA) including: • Observer requirements • Minimum quota holdings (entry and stop fishing requirements)
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting

	SEMAC (Feb 2022) advice and any dissenting views SEMAC (Feb 2022) noted the assessment process in 2021 involved revisions to the estimates of natural mortality (M) and the undertaking of a Markov-Chain Monte-Carlo (MCMC) analysis, which in combination resulted in a decrease to the recommended biological catch (RBC) from 1,279 in 2021 to 633 in 2022. SEMAC were presented with a constant catch table to understand the risk associated with total catches higher than the RBC produced by the harvest control rule (HCR). The projections estimate there is little risk to the stock in the short term of total catches up to 950 t. SEMAC considered a letter from SETFIA to SEMAC and the AFMA Commission proposing an even step-down TAC approach, whereby TACs are set based on a total mortality (RBC) of 1,166 t, 1,055 t and 950 t over the 3-year MYTAC to accommodate the large decrease in the TAC. The proposed step down allows forward sales to be made in what has become a very difficult market for Australian orange roughy given: • the orange roughy (eastern) "threatened" listing meant cancelation of MSC certification - sales difficult into Europe and the USA; • a trade dispute between China and Australia; and • large TAC reductions that spook the market. While industry was supportive of the change in M because it removes uncertainty and likely better fits the ages of fish present, the SETFIA letter proposed that the TAC be set based on the risk of the stock falling below B20 in the medium term, points supporting this included: • Despite significant investment in research, uncertainty in the Tier 1 assessment remain high. • Five iterations of the Acoustic Optical Survey (AOS) shows mature biomass of up to c40,000 t – (Tier 1 assessment c24,000 t). • Industry cannot afford AOS surveys under the SERAG recommended RBC of 633 t. • The introduction of an MCMC was a new process and has resulted in a further reduction to the RBC. • The HCR which is trying to accelerate the stock back to MEY is actually reducing TACs. For a highly aggregating stock like orange roughy (eastern) there is no catch efficiency to be had at higher biomasses. • For such a long-lived species, movements in TAC seem implausible and do not invite investment in catching, processing, or selling. In providing its advice, SEMAC Feb (2022) considered the following: • the eastern stock continues to be managed under the Orange Roughy Rebuilding Strategy, which relies on the HCR to rebuild the stock towards the target reference point. Setting a higher TAC would slow down the recovery, although only marginally and in the short term; • a reduction in the TAC may result in a shift of effort elsewhere in the fishery, including the east coast where catches of jackass morwong are an issue; • there is little risk to the sustainability of the stock of setting catches up to 950 t (noting that this was the highest catch for which risk projections were provided) compared to the TAC produced by the HCR; the spawning stock biomass in 2024 is estimated to be 12,123 t compared to 12,279 t, and only a 0.03% chance of the stock falling below the limit reference point in the next ten years;

	• reducing the 2022-23 TAC to 674 t (almost half the 2021-22 TAC) would have significant economic impacts on the fleet; • with 2 months of fishing remaining, there is approximately 120 t of undercatch from the 2021-22 fishing year expected to carry over to the 2022-23 fishing year. SEMAC (Feb 2022) considered and was sympathetic to the merits of a step-down approach, however, did not have the information at hand to understand the risk associated with catches higher than 950 t. SEMAC recommend a TAC of 873 t for the 2022-23 fishing year, the first of a 3-year MYTAC. This is based on an RBC of 950 t minus discards and a seven per cent allocation to the Pedra Branca area. SEMAC were also supportive of the AFMA Commission considering the step-down approach proposed by industry, subject to the projections table being updated to include these catch figures. **SEMAC (2023) advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

After detailed consideration, the AFMA Commission (Mar 2022) decided to implement a step-down in the TAC for this stock, as follows:

• 2022-23 – 1,074 tonnes (TAC)

• 2023-24 – 1,055 tonnes (Recommended Biological Catch - RBC)

• 2024-25 – 950 tonnes (RBC)

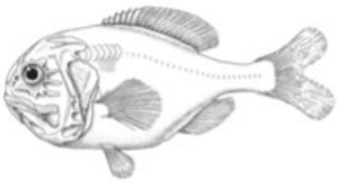
As per standard practice, 7% of the total RBC for each year would be available as a targeted TAC for the Pedra Branca area of the Southern Zone. The revised TACs represent a significant reduction in catch and thus GVP over the 3-year period. In reaching this decision, the Commission noted that SEMAC and AFMA Management recommended a lower TAC, but that the MAC had also supported the Commission considering the proposed step-down approach subject to the projections table being updated to include this approach. The Commission considered those new projections and noted that the risk of breaching the limit reference point remains very low (0.4%), and that the stock will continue to rebuild under this level of catch, albeit negligibly slower than it would under the recommendation from the MAC and AFMA Management (spawning stock biomass status in 2024 of 30.93%, rather than 31.15%). The Commission took the decision on that basis and that a step-down approach mitigates some of the economic impacts of a significant reduction in the TAC. The Commission agreed that this is an appropriate balance of AFMA's core objectives.

AFMA Management recommends a TAC of 975 t for the 2023-24 fishing year (93% of the 2023 RBC minus discards), the second of a 3-year step-down TAC, with undercatch determined at 100 per cent, overcatch determined at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,074	975	Undercatch – 100 Overcatch - 10	2	-99

Orange roughy Southern Zone

Hoplostethus atlanticus



ABARES (2012): Line Drawing – Rosalind Poole

Species summary

Common names	Slimehead, deep sea perch, red roughy, orange ruff
Stock assessment	Tier 1 Species – Southern Zone last assessed by SlopeRAG in 2000 Pedra Branca has been assessed as part of the Eastern Zone Tier 1 stock assessment since 2002 and was last assessed by SERAG in 2021.
Stock structure	Based on the existing data and fishery dynamics multiple regional stocks of orange roughy are assumed and the fishery is managed and assessed as a number of discrete regional stocks. Recent genetic studies indicate little genetic diversity between all south east Australian stocks, however they may be demographically separate. The part of the Southern Zone catch that is caught on the Pedra Branca grounds is assumed to be part of the eastern stock.

Southern

Stock status against reference points (%B_0 in year +1)

Tier	Assessment Year	Biomass	
-	2000	<30 (95% probability)	Maintain spawning biomass above 30% of the spawning biomass at the onset of significant commercial fishing (1988). Where there is a greater than 50% probability that a stock is below 30%, the TAC will be set such that the biomass reaches 30%B_0 by 2004.
-	1996	<30 (56–68% probability)	
-	1995	<30 (9–55% probability)	

Pedra Branca

Stock status against reference points (%B_0 in year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment)	Target	Limit
1	2021	30	30	48	20
1	2017	33	26		
1	2014	26	22		

<table>
<tr><td>Stock trend and other indicators</td><td colspan="4">Southern Zone

Stock status: unresolved in the Southern Zone. The most recent accepted assessment (2000) concluded that the stock was less than the limit reference point.

The component of the Southern Zone stock that resides in the Pedra Branca seamounts is assessed as a part of the Eastern Zone stock assessment due to the stock structure assumptions. The Eastern Zone assessment in 2021 estimated the stock status in the Pedra Branca area to be 30% of unfished biomass in 2021 and projected to be at 30% B_0 at the beginning of 2022 (Burch et al, 2021).

Biomass trend: the 2021 stock assessment indicates that biomass is continuing to increase, however revisions to the model have resulted in an overall downward revision to the estimate of relative biomass – see ‘Biomass revised in most recent assessment’ above.

Recent acoustic surveys (1999, 2006, 2010, 2012, 2013, 2016 and 2019) undertaken at St. Helen’s Hill and St. Patricks’ Head have estimated an increase in abundance, which supports the estimated increase in abundance from the Tier 1 stock assessments.</td></tr>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="2">Year of MYTAC (2022-23)</td><td colspan="2">MYTAC advice</td></tr>
<tr><td colspan="2">N/A – Rebuilding species</td><td colspan="2">N/A</td></tr>
<tr><td rowspan="4">Catch and TAC (t)</td><td>SESSF fishing year</td><td>Agreed TAC</td><td>TAC after unders/overs</td><td>Cth Retained Catch</td></tr>
<tr><td>2022-23</td><td>113</td><td>113</td><td>-</td></tr>
<tr><td>2021-22</td><td>127</td><td>127</td><td>120</td></tr>
<tr><td>2020-21</td><td>125</td><td>125</td><td>117</td></tr>
<tr><td rowspan="4">Economics
(Primary)
Commonwealth Trawl and Scalefish Hook</td><td>Financial Year</td><td>Species GVP ($m)</td><td>Fishery GVP ($m)</td><td>% Fishery GVP</td></tr>
<tr><td>2020-21</td><td>Not Available</td><td>64</td><td>Not Available</td></tr>
<tr><td>2019-20</td><td>Not Available</td><td>51.34</td><td>Not available</td></tr>
<tr><td>2018-19</td><td>0.21</td><td>49.47</td><td>0.42</td></tr>
<tr><td>ABARES Status
(2022 report)</td><td colspan="2">Fishing Mortality: Uncertain</td><td colspan="2">Biomass: Overfished</td></tr>
<tr><td rowspan="2">Climate sensitivity</td><td colspan="2">Sensitivity</td><td>Preliminary projection</td><td>Confidence in projection</td><td>Comments</td></tr>
<tr><td colspan="2">High</td><td>Uncertain</td><td>High</td><td>↓40% through to ↑10-60% (dependent on trophic interactions and oceanography). Spatially uniform</td></tr>
<tr><td colspan="5">Assessment summary</td></tr>
</table>

Key model technical assumptions/ parameters	For Pedra Branca, see Orange Roughy East.
Significant changes to data inputs	For Pedra Branca, see Orange Roughy East.
Data and RAG comments	For Pedra Branca, see Orange Roughy East.
Stock assessment information and RAG comments	SERAG has previously agreed that, despite the absence of an agreed assessment model for the Southern Zone stock, the data show there is little targeting or bycatch of orange roughy. As such, the incidental bycatch TAC is applicable and does not impede recovery of the stock. For Pedra Branca, see Orange Roughy East.
Projected biomass	For Pedra Branca, see Orange Roughy East

Species specific research and priorities

Orange roughy acoustic survey 2023

This research has been identified as a priority and will provide an acoustic based biomass estimate for orange roughy (Eastern) for the 2023-24 fishing year. It also includes the collection of biological samples including length, weight, sex, spawning stage and otolith extraction.

RAG Recommendations

SERAG (2021) recommended a 3-year MYTAC for orange roughy (East) using the outputs of the MCMC analysis (see Orange Roughy East). If a TAC greater than the RBC were to be set in the east, the constant catch scenarios and associated risk profiles should be used as basis for determining the TAC. The orange roughy Pedra Branca area 3-year MYTAC will constitute 7 per cent of this RBC apportioned to the eastern zone.

SERAG (Nov 2022) recommended maintaining the 31 t incidental bycatch TAC for the remainder of the Southern zone.

	Year	RBC (t): Southern	RBC (t): Pedra Branca	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2025	0	58 (7% of 830)	Southern: No. Rebuilding species. Pedra Branca: Yes – (93% of the Eastern Zone Tier 1 stock assessment, with 7% apportioned to the Pedra Branca area of the Southern Zone.)
	2024	0	55 (7% of 789)	

	2023	0	52 (7% of 740)	
	2022	0	48 (7% of 681)	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 stock assessments (Pedra Branca) and there is no assessment for the Southern Zone.		
State catch (t)	N/A	There are no estimates of State catches.		
Discards (t)	N/A	There are no estimates of discards.		
Recreational catch (t)	N/A	There are no known recreational catches for orange roughy.		
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.		
Provisional TAC under the Harvest Strategy		Southern Zone: 31 t - Incidental bycatch TAC Pedra Branca: 52 t		

MAC Recommendations

Commercial fishers' interests	SETFIA wrote to the Commission about Orange Roughy (east), noting that the TAC for Pedra Branca area is based on a seven per cent allocation of the eastern zone RBC.
Species specific management (target, companion and bycatch)	This species is managed under the Orange Roughy Rebuilding Strategy 2022.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

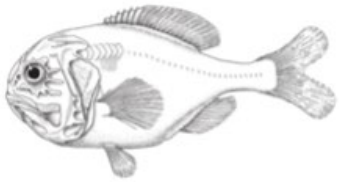
Noting AFMA's recommendation to set the eastern orange roughy TAC based on an RBC of 1,055 AFMA recommend the total catch permitted to be taken within the Pedra Branca area of the Southern zone is restricted to 74 t (7 per cent allocation of the 1,055 t RBC).

AFMA Management recommend maintaining the incidental bycatch TAC for the remainder of the Southern zone at 31 t for the 2023-24 fishing year.

AFMA Management recommends a TAC of 105 t for the 2023-24 fishing year, the second of a 3-year MYTAC, with undercatch and overcatch provisions set at zero per cent, and a determined amount of 2 t.				
2022–23 agreed TAC (t)	**2023–24 recommended TAC (t)**	**Overcatch & undercatch (%)**	**Determined amount (t)**	**Change in TAC (t)**
113	105 74 t (Pedra Branca) 31 t (Southern Zone bycatch TAC)	0	2	-8

Orange roughy Western Zone

Hoplostethus atlanticus



ABARES (2012): Line Drawing – Rosalind Poole

<table>
<tr><th colspan="6">Species summary</th></tr>
<tr><td>Common names</td><td colspan="5">Slimehead, deep sea perch, red roughy, orange ruff</td></tr>
<tr><td>Stock assessment</td><td colspan="5">Tier 1 Species – Last assessed by SlopeRAG in 2002</td></tr>
<tr><td>Stock structure</td><td colspan="5">Based on the existing data and fishery dynamics multiple regional stocks of orange roughy are assumed and the fishery is managed and assessed as a number of discrete regional stocks. Recent genetic studies indicate little genetic diversity between all South Eastern Australian stocks, however they may be demographically separate.</td></tr>
<tr><td rowspan="4">Stock status against reference points (%B₀)</td><td>Tier</td><td>Assessment Year</td><td>Biomass</td><td colspan="2"></td></tr>
<tr><td>-</td><td>2002</td><td><30
(>50% probability)</td><td colspan="2" rowspan="2">Maintain spawning biomass above 30% of the spawning biomass at the onset of significant commercial fishing (1988).
Where there is a greater than 50% probability that a stock is below 30%, the TAC will be set such that the biomass reaches 30%B₀ by 2004.</td></tr>
<tr><td>-</td><td>2000</td><td><20
(97% probability)</td></tr>
<tr><td colspan="3">No earlier assessment</td></tr>
<tr><td>Stock trend and other indicators</td><td colspan="5">Stock status is unresolved in the Western Zone however considering that there has been minimal fishing in the Western Zone and that the eastern stock has rebuilt to a harvestable level it is appropriate to consider that similar rebuilding may have occurred in the Western Zone.</td></tr>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="3">Year of MYTAC (2022-23)</td><td colspan="2">MYTAC advice</td></tr>
<tr><td colspan="3">N/A – Rebuilding species</td><td colspan="2">N/A</td></tr>
<tr><td rowspan="4">Catch and TAC (t)</td><td colspan="2">SESSF fishing year</td><td>Agreed TAC</td><td>TAC after unders/overs</td><td>Cth Retained Catch</td></tr>
<tr><td colspan="2">2022-23</td><td>60</td><td>60</td><td>-</td></tr>
<tr><td colspan="2">2021-22</td><td>60</td><td>60</td><td>10</td></tr>
<tr><td colspan="2">2020-21</td><td>60</td><td>60</td><td>9</td></tr>
<tr><td>Economics</td><td>Financial Year</td><td>Species GVP ($m)</td><td>Fishery GVP ($m)</td><td colspan="2">% Fishery GVP</td></tr>
</table>

(Primary) Commonwealth Trawl and Scalefish Hook	2020-21	Not Available	64	Not Available
	2019-20	Not Available	51.34	Not Available
	2018-19	0.21	49.47	0.42
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**		**Biomass: Overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	High	Uncertain	High	↓40% through to ↑10-60% (dependent on trophic interactions and oceanography). Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	N/A
Significant changes to data inputs	N/A
Data and RAG comments	N/A
Stock assessment information and RAG comments	SERAG has previously agreed that, despite the absence of an agreed assessment model, the data show there is little targeting or bycatch of western orange roughy. As such the incidental catch TAC is applicable and does not impede recovery of the stock. Bearing in mind the rebuild of the eastern stock from a low biomass it could be argued that the Southern and Western Zones should have recovered somewhat. This is tempered by not knowing if recruitment processes and stock movement in the Southern and Western Zones are similar or different to those in the Eastern Zone. SERAG (Dec 2022[15]) noted that the Western Zone continues to be managed under an incidental bycatch TAC and noted there was no additional information that would provide a basis for SERAG to change its' previous TAC advice. SERAG recommended that the Western Zone orange roughy incidental bycatch TAC remain unchanged – 60 t. SERAG noted that given the life history of orange roughy, multiple years of sufficient data will be required to provide informed advice on the recovery of western orange roughy. SERAG recommended maintaining the Western Orange Roughy Research Plan, including the research catch allowance of 200 t.
Projected biomass	N/A

[15] Meeting minutes are currently being finalised

Species specific research and priorities

Western Orange Roughy Research Plan

The Western Orange Roughy Research Plan (WORRP) was introduced in 2020 with the aim to assess the status of the western orange roughy stock and determine sustainable harvest levels for commercial fishing under the Harvest Strategy Framework for the SESSF. This will be achieved by collecting robust scientific information including biological data, in each western orange rough research area.

RAG Recommendations

SERAG (Nov 2022) recommended maintaining the bycatch TAC of 60 t for the 2023-24 fishing year.

SERAG also recommended maintaining the 200 t RCA for the 2023-24 fishing year to support the WORRP, and this continue to be reviewed on a yearly basis.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	0	No. Rebuilding species.
	2022	0	
	2021	0	
Discount factor (t)	N/A	Discount factors are not applied to bycatch TACs.	
State catch (t)	N/A	There are no estimates of State catches.	
Discards (t)	N/A	Discards are not deducted from the bycatch TAC.	
Recreational catch (t)	N/A	There are no known recreational catches for orange roughy.	
Research Catch Allowance (t)	200	Research catch allocated under the Western Orange Roughy Research Plan.	
Provisional TAC under the Harvest Strategy		60 t - Incidental bycatch TAC	

MAC Recommendations

Commercial fishers' interests	Five scientific permits were allocated during the 2022-23 fishing year to fish under the WORRP. The program achieved the sampling requirements and approximately 96 t of the RCA was utilised. There was no observer coverage in 2022 due to logistical constraints. This will be a focus of the 2023-24 fishing year.
Species specific management (target, companion and bycatch)	This species is managed under the Orange Roughy Rebuilding Strategy 2022.

MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

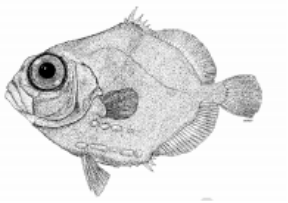
AFMA Advice

AFMA Management recommends an incidental bycatch TAC of 60 t for the 2023-24 fishing year, with no undercatch and overcatch provisions and a determined amount of 2 t.

AFMA Management also recommend a 200 t western orange roughy Research Catch Allowance for the 2023-24 fishing year and catch trigger of 100 t for each sampling zone.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
60	TBC	0	2	TBC

Oreo basket



Species summary

Species	Black oreodory (*Allocyttus niger*), spikey oreodory (*Neocyttus rhomboidalis*), warty oreodory (*Allocyttus verrucosus)* and other *Neocyttus* spp.				
Stock assessment	Tier 4 Species – last assessed by SERAG in 2020				
Stock structure	Little is known about the stock structure of the oreo species in this basket quota. They are bentho-pelagic species that are caught mainly below 600m. For assessment and management purposes they are treated as a single unit of stock through the SESSF.				
Stock status against reference points (C_{Targ}/C_{Lim})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	0.3986	0.4855	0.2023
	4	2017	0.4297	0.4743	0.1976
	4	2013	0.4076	0.464	0.1856
Stock trend and other indicators	Catches have been variable through time, as high as 3,352 t in 1992, and between 780 -2,091 t from 1993 to 2003. Since then, catches have declined and have remained below 200 t since 2011. After an initial period of great volatility between 1986 - 1994, standardized CPUE has been essentially flat and stable since 2000. For another analysis that uses a shorter time series, i.e., between 1995 – 2021, the standardized CPUE has been essentially flat, below the long-term average and stable between 2002-2019 with an increase to the long-term average in 2020, followed a decrease to below the long-term average in 2021 (Sporcic, 2022a).				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	2nd of 3-year			Need to consider high discard estimates in the east trawl zone and impact on 2023-24 TAC.	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		137	150	-
	2021-22		139	157	111
	2020-21		185	203	138
Economics	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**

(Byproduct) Commonwealth Trawl and Scalefish Hook	2020-21	0.40	64.00	0.67
	2019-20	0.66	51.34	1.29
	2018-19	0.35	49.47	0.71
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**		**Biomass: Uncertain**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	There is currently no available information regarding climate change sensitivity for mixed oreos.			

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	The average of existing discard estimates were used to backfill earlier years' estimates. Revised NSW annual catch were provided from 1992 onwards.
Data and RAG comments	It has become apparent that spikey oreodory are being reported as 'oxeye' in logbooks. For the purpose of the Tier 4 assessment, logbook records of oxeye are assumed to be spikey oreodory. Most catches are from Zones 10 and 20. Estimated discards for 2021 are 196 t, resulting in a 4-year weighted average of 128.4 t. Once deducted from the RBC, the resulting TAC is approximately 42 t. AFMA is currently seeking advice from SERAG regarding whether discards for 2021 are overestimated.
Stock assessment information and RAG comments	Including discard estimates from 1986-2006 in the updated assessment has resulted in an increase in C_{Targ}. There was a decrease in the RBC to 170.2 t from the 2020 assessment compared to 256.5 t from the 2017 assessment. This was driven by an increase in C_{Targ} and a decrease in the four-year average CPUE (Sporcic, 2020a).
Projected biomass	N/A

Species specific research and priorities

There has been no species specific research priorities identified.

RAG Recommendations

SERAG (December 2020) recommended a 3-year MYTAC using the RBC of 170.2 t from the 2020 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	170.2	Yes. 3-year MYTAC using the RBC from the 2020 Tier 4 assessment.
	2022	170.2	
	2021	170.2	
Discount factor (t)	N/A	SERAG (December 2020) recommended not applying the discount factor due to 40 per cent of the oreo fishery being protected by deepwater closures.	
State catch (t)	N/A	There are no estimates of State catch.	
Discards (t)	128.4	See 'Data and RAG comments' above regarding discard estimates.	
Recreational catch (t)	N/A	There are no known recreational catches as oreo are a deepwater species and are not targeted by recreational fishers.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		TBC - See 'Data and RAG comments' above regarding discard estimates that will influence the TAC calculations.	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion or bycatch species.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management is currently seeking advice from SERAG regarding estimates of discards for 2021 which will influence the TAC calculations - See 'Data and RAG comments' above.				
2022–23 agreed TAC (t)	**2023–24 recommended TAC (t)**	**Overcatch & undercatch (%)**	**Determined amount (t)**	**Change in TAC (t)**
137	TBC	10	2	TBC

Pink ling

Genypterus blacodes

Species summary

Common names	Pink cusk-eel, kingclip, golden ling, ling, Australian rock-ling
Stock assessment	Tier 1 Species - last assessed by SERAG in 2021
Stock structure	Pink ling are assessed as separate stocks east and west of Longitude 147° East. Genetic variation between eastern and western pink ling has not been found, however, there are differences in size and age structure, growth and catch rates between the Eastern and Western Zones. These differences suggest there is little mixing of pink ling between the zones, and that fishing in one area will have limited impact on fish in the other area.

East

Stock status against reference points (%B_0 in year +1)

Tier	Assessment Year	Biomass	Target	Limit
1	2021	34	48	20
1	2018	30		
1	2015	30		

West

Stock status against reference points (%B_0 in year +1)

Tier	Year	Biomass	Target	Limit
1	2021	91	48	20
1	2018	84		
1	2015	73		

Stock trend and other indicators	Zones 10-30 – Annual standardized CPUE has been below average corresponding to a relatively flat trend over the 2001-19 period, with the 2021 estimate just below the long-term average, based on 95% confidence intervals. More recently, CPUE has increased since 2015, despite the decrease in 2021 relative to the previous year. The structural adjustment had a major effect upon the influence of the vessel factor from 2006 or 2007 onwards (Sporcic, 2022). Zones 40-50 – Annual standardized CPUE reached to a minimum in 2005 and increased since then to the long-term average from 2013 to 2016, increased to above average in 2017 to 2018, decreased to the long-term average in 2019 and then increased above the long-term average in 2020 and 2021 based on the 95% confidence intervals. Also, there has been an overall increase in CPUE since 2005 (i.e., the lowest CPUE index) (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
1st of 3-year	Maintain current MYTAC

Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23	1,568	1,655	-
	2021-22	1,121	1,229	818
	2020-21	1,310	1,436	910
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	6.76	64	10.56
	2019-20	6.37	51.34	12.41
	2018-19	6.38	49.47	12.90
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	↓ 40%	Medium	Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	Single area, two sex, age-structured (east and west) Von Bertalanffy growth, single natural mortality (M) Fixed maturity and steepness (h=0.75) SSB: female only, mid-year Two fisheries: trawl, non-trawl Time-blocked selectivities for trawl Boat effects in CPUE standardisation time-blocked for most boats (1986-1999, 2000-2006, 2007-2020) to account for effects of structural adjustment and halving in the number of boats from 2006 to 2007. Estimate parameters: B_0, growth, recruitments strengths, natural mortality, selectivities. Data weighting followed Francis (except age-length not fully down-weighted). A full Bayesian estimation was undertaken; Mode of the posterior distribution (MPD) runs for diagnostics followed by Markov Chain Monte Carlo (MCMC) runs for estimates.
Significant changes to data inputs	The 2021 assessment was an update of the 2018 assessment with no significant changes to data inputs other than addition of new data (catch, CPUE, length and age frequencies).
Data and RAG comments	Changes to the trip limits in the east since 2013 make it difficult to resolve the standardised CPUE and estimates of discards. ISMP data was used to estimate stock and fishing method specific landing multipliers (m) by year (west) and by trip limit periods and year for the east. Catch histories were revised for 2016 to 2018 (compared to the 2018 assessment) and catches for 2019 and 2020 were added, with catches in 2020 assumed to be the same in 2021.

<table>
<tr><td></td><td>East (as in 2018), multiply estimated landing for each trawl record by the appropriate landings multiplier to get an estimate catch for each trawl.
There is a strong depth effect on length frequency for trawl, so port sampled length frequencies were not used in the east.</td></tr>
<tr><td>Stock assessment information and RAG comments</td><td><u>West</u>
A comparison of trawl CPUE series across the last four stock assessments shows a similar trend, with western CPUE trending upwards.
Western MPD runs estimate relative biomass ranging from 78%B_0 to 93%B_0 based on the addition of data since the 2018 stock assessment. Estimates of relative spawning biomass are highly dependent on values of M, and range 71%B_0 to 95%B_0 under high (0.26) and low (0.2) values of M.
Model fits to trawl CPUE are good in the later part of the time series. Model fits to FIS and trawl length frequencies are also good, but less so for the FIS indices.
There is a ‘spike’ in fish around 90-95cm in 2018 which the model cannot fit.
The likelihood profile for B_0 showed little conflict between the data sets with the MPD estimate at 5910 t and little support for values below 4000 t.
The likelihood profile for M showed little conflict between the data sets with most information coming from age data. This provides a good basis for estimating M in the model (the MPD estimate was 0.22 and the MCMC estimate was 0.23).
<u>East</u>
A comparison of trawl CPUE series across the last four stock assessments shows a similar trend, with eastern CPUE trending upwards.
Adding a latitude effect to the CPUE series depresses the series, driven by lower catch rates in the northern latitudes – there has been a southerly shift in the eastern trawl catches over time.
MPD estimates are primarily presented for diagnostic purposes, whereas the results of the MCMC runs are used as a basis for management advice. Eastern MPD runs estimate relative biomass ranging from 29%B_0 to 33%B_0 based on the addition of data since the 2018 stock assessment with fixed value of M (0.23). Estimates of relative spawning biomass are highly dependent on values of M, and range 22%B0 to 36%B0 under high (0.26) and low (0.2) values of M.
Model fits to the eastern trawl CPUE, length frequencies and Fishery Independent Survey Indices (5 years) are very good.
The likelihood profile for B0 shows good agreement between the data sets and provides a well-defined MPD estimate of 5890 t. However, the likelihood profile for M shows a confusing picture where age data favour high estimates of M and are opposed by length frequency data. This profile does not support the estimation of M in the base model.
SERAG (September 2021) supported the proposed base case models and recommended that the eastern model use a value of M fixed at the estimate from the Western base case MCMC model.
The MCMC estimates the 2021 eastern stock biomass at 34%B_0 with a 2022 RBC of 410 t and the western stock is estimated to be 91%B_0 with a 2022 RBC of 1300 t (Figure 14). The table below provides the likelihood of being below 20%B_0, or 30%B_0 or being at or above 48%B_0 in 2024 and 2031 under constant catch scenarios.
<table>
<tr><th>Catch (t)</th><th>E(B_{24}) (%B_0)</th><th>E(B_{31}) (%B_0)</th><th>P(ss_{24} < 0.2)</th><th>P(ss_{31} < 0.2)</th><th>P(ss_{24} < 0.3)</th><th>P(ss_{31} < 0.3)</th><th>P(ss_{24} ≥ 0.48)</th><th>P(ss_{31} ≥ 0.48)</th></tr>
<tr><td>0</td><td>47</td><td>75</td><td>0.00</td><td>0.00</td><td>0.01</td><td>0.00</td><td>0.41</td><td>1.00</td></tr>
<tr><td>400</td><td>40</td><td>51</td><td>0.00</td><td>0.00</td><td>0.12</td><td>0.03</td><td>0.17</td><td>0.56</td></tr>
<tr><td>475</td><td>39</td><td>46</td><td>0.00</td><td>0.01</td><td>0.15</td><td>0.07</td><td>0.14</td><td>0.43</td></tr>
<tr><td>500</td><td>38</td><td>45</td><td>0.01</td><td>0.01</td><td>0.18</td><td>0.10</td><td>0.12</td><td>0.36</td></tr>
</table></td></tr>
</table>

550	37	42	0.01	0.02	0.20	0.15	0.11	0.28
600	36	38	0.01	0.05	0.25	0.24	0.09	0.20
650	36	36	0.02	0.08	0.28	0.34	0.09	0.14
700	34	32	0.03	0.16	0.33	0.46	0.07	0.10
750	34	29	0.04	0.23	0.37	0.55	0.07	0.06

Projected biomass

East:

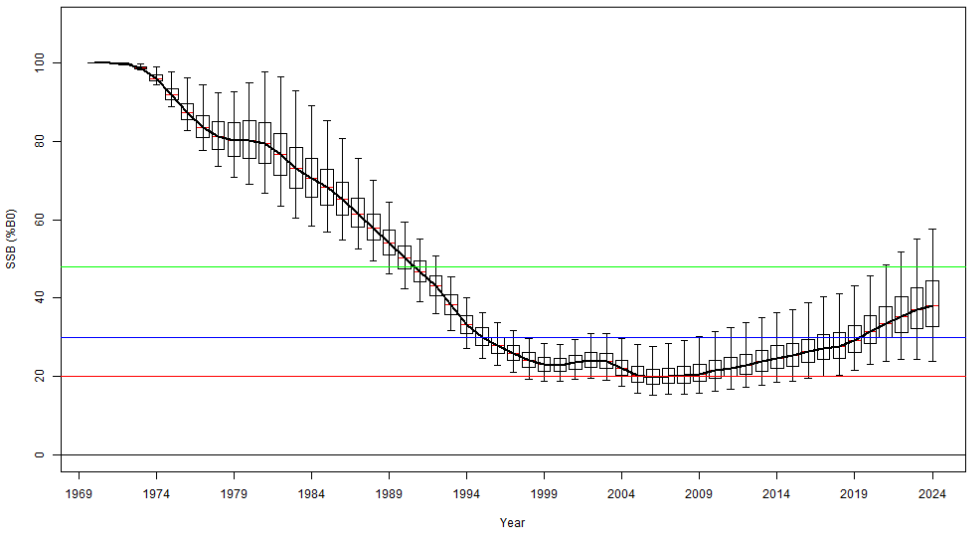


Figure 14: MCMC projected eastern biomass under the harvest control rule RBC

West:

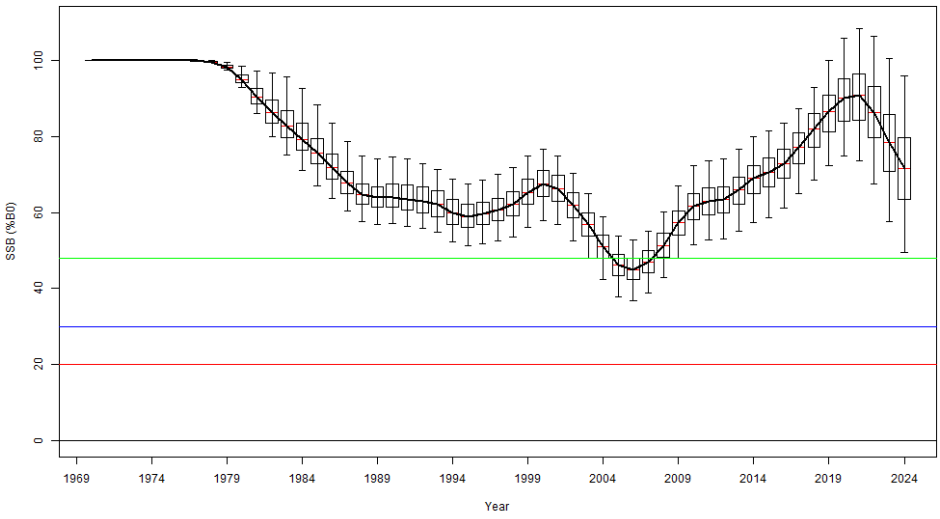


Figure 15: MCMC projected western biomass under the harvest control rule RBC

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (November 2021) recommended a 3-year MYTAC with RBCs for the east and west stocks based on the outputs of the MCMC analysis. If a TAC greater than the RBC were to be set in the east, the constant catch scenarios and associated risk profiles should be used as basis for determining the TAC.

	Year	RBC (t): East	RBC (t): West	Combined (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2024	490	1,090	1,580	Yes. 3-year MYTAC using average east (457 t) and west (1,193 t) RBCs from the 2021 assessment.
	2023	470	1,190	1,660	
	2022	410	1,300	1,710	
	Long term yield	570	730	1,300	

Discount factor (t)	N/A	A discount factor is not applied.
State catch (t)	East = 52.5 West = 0.5 Combined =53	The majority of State catches were recorded in NSW (east) and TAS (west), and are deducted from the RBC.
Discards (t)	East = 37 West = 5.1 Combined = 42.1	Discards are not modelled in the Tier 1 assessment – weighted average discards are deducted from the RBC.
Recreational catch (t)	N/A	There are reports of increasing recreational catch of this species, but catches are not estimated and unlikely to be significant.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		East: 381 t West: 1,185 t Combined: 1,565 t * Eastern notional catch limit will be considered using constant catch scenarios

MAC Recommendations

Commercial fishers' interests	Line and trawl operators have previously noted the difficulty in constraining catches in the east. Pink ling are largely caught as a byproduct species using trawl methods, however line operators target pink ling, and can limit catches by focusing fishing effort in other areas of the fishery.

Species specific management (target, companion and bycatch)	While the pink ling TAC is set across the whole fishery (east and west), pink ling is assessed separately as two stocks: eastern and western. The eastern stock, although above the limit reference point (LRP), requires rebuilding to the target reference point (TRP). Similar to the approach adopted for the previous 3-year MYTAC, SEMAC (2022) considered setting a notional eastern catch limit based on constant catch projections (see stock assessment information and RAG comments), rather than the RBC. This allows a level of incidental catch of pink ling to be landed instead of discarded, whilst allowing the stock to rebuild to the TRP (although at a slower rate than under the RBC). For the 2022-23 fishing year, operators opted to either limit their catches under the SETFIA commitment arrangement (commitment vessels) or default to a 200 kg trip limit. As of January 2023, all SETFIA vessels remain within their agreed catch limits, and total catches are on track to remain below the notional catch limit for the 2022-23 fishing year of 475 t, as they have for the previous several years.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC (Feb 2022) advice and any dissenting views** SEMAC (Feb 2022) recognised the positive work undertaken by SETFIA to manage industry catch commitments for the eastern stock and that the approach has been successful in limiting catches for a number of years. SEMAC (Feb 2022) recommended a total notional eastern catch limit of 550 t and considered this to be consistent with the level of risk applied when setting the notional catch limit for the previous MYTAC period. This provided for a notional eastern TAC of 475 t once state catches and discards are deducted. The eastern notional catch limit available to the Commonwealth will vary depending on the estimates of discards and state catches each year. **SEMAC (Feb 2022) advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

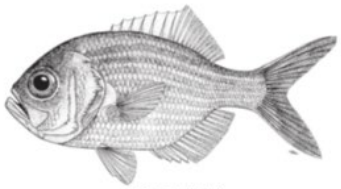
AFMA Management recommends a TAC of 1,565 t for the 2023-24 fishing year, the second year of a 3-year MYTAC, with overcatch and undercatch provisions set at 10 per cent and a determined amount of 2 t.

The eastern notional catch limit of 550 t minus state catches (52.5 t) and discards (37 t) is 461 t. AFMA will seek advice from SEMAC at its February meeting regarding application of the eastern notional catch limit.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,568	1,565	10	2	-3

Redfish

Centroberyx affinis


ABARES (2012)

Species summary

Common name	Nannygai, golden snapper, red snapper, king snapper
Stock assessment	Tier 1 Species - last assessed by SERAG in 2020
Stock structure	No formal stock discrimination studies have been done in Australia. Tagging studies suggested a single unit stock of redfish off NSW. Previous studies of mean length at age suggest differences in growth rates between the 'northern' and 'southern' sectors of the fishery off eastern Australia. The boundary being Latitude 36°S (just north of Montague Island).

Stock status against reference points (%B_0 in assessment year +1)

Tier	Assessment Year	Biomass (from assessment year)	Biomass (revised in most recent assessment	Target	Limit
1	2020	4	4	48	20
1	2017	8	3		
1	2014	12	2		

Stock trend and other indicators	The 2020 Tier 1 assessment estimates a slightly larger absolute spawning biomass compared to the 2017 assessment; however the relative spawning biomass has decreased from 7.8%B_0 to 3.8%B_0. Zones 10-20 – Annual standardized CPUE has declined since 1994 (relative to the previous year) and have been below average since 2000. There have been minimal increases in the last three years (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	30	30	-
2021-22	50	50	22
2020-21	50	50	26

Economics (Secondary)

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2020-21	0.16	64	0.25

Commonwealth Trawl and Scalefish Hook	2019-20	0.13	51.34	0.25
	2018-19	0.11	49.47	0.22
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	↑ 10-100%	Medium	N/A

Assessment summary

Key model technical assumptions/ parameters	Two sex, single stock in two regions; NSW and East Bass Strait. Steepness is fixed at 0.75. Natural Mortality (M) estimated at 0.075 (range 0.066 - 0.083) Recruitment deviations are estimated to 2015. The previous assessment (2017) estimated two selectivity patterns, one for onboard data and another for port, with one retention function. The current assessment structure only estimates one selectivity pattern for both NSW and eastern Bass Strait. The current assessment estimates two retention functions, one for each region to allow for differences in discard practices between each region.
Significant changes to data inputs	There were no significant changes to data inputs other than the standard inclusion of revised catch, CPUE, discards and biologicals.
Data and RAG comments	Length composition data is missing for the period 1993 - 1998 which has been filtered out in the data processing due to missing length type and location information.
Stock assessment information and RAG comments	<u>Fits to CPUE</u> Fitting to two separate catch rate indices results in similar fits to NSW catch rates as in the 2017 assessment, while also fitting to the eastern Bass Strait index. <u>Recruitment</u> The model estimates above average recruitment in 2013, returning to below average recruitment in 2014 and 2015 and addresses the retrospective pattern revising recruitment deviations down with the inclusion of additional years of data. <u>Biomass Estimate</u> The new model structure reduces uncertainty in the biomass estimate in the early part of the time series, and results in a lower estimate of absolute and relative biomass. <u>Likelihood profiles</u> Natural Mortality (*M*) – the likelihood profile suggests a range of values from 0.066 - 0.083, with the most likely value 0.075. Steepness (*h*) – there is little information in the model that can inform estimation of *h* and it is fixed at 0.75 in the model. SSB_{2019} - the likelihood profile suggests that the model estimates depletion in 2019 with high certainty, between 2% and 4.75% of unfished levels. Fixed catch projections from the 2020 Tier 1 assessment suggested there is three years difference in expected rebuilding timeframes for catches of 0 t, 50 t or 100 t under average recruitment, and five years between catch scenarios under a low recruitment scenarios (see Projected Biomass, Fig 18). However, catch projections should be treated with caution given the limited recovery of this species observed to date (Figure 16).

SERAG (November 2020) considered a companion species analysis which investigated the link between target species catch and the associated level of unavoidable bycatch of recovering species. The analysis incorporated a range of factors such as area, depth fished and gear type – also known as metiers.

Using logbook data from 2018 and 2019, and expected 2021-22 TACs for the main companion species, the estimated unavoidable bycatch of redfish for 2021 is 32.2 t, with a range between 26.7 and 38.7 t.

SERAG (November 2021) reviewed the catch and effort information in 2021.

The majority of catch continues to be taken off the east coast of NSW, and there has been no apparent shift distribution.

There are two boats which have consistently caught redfish in high amounts, relative to other boats in the fleet, and a third boat has appeared in 2020 and has caught more than any other boat in recent years – this may be evidence of targeting.

Catches have increased in 2020, and are close to the estimated level of fishing that would constitute overfishing estimated in the 2020 stock assessment.

SERAG could not resolve the estimates of discards, and could not provide advice on whether total mortality is sufficiently low to allow rebuilding. Observed estimates of discards over time have been higher than those modelled.

Projected biomass

Fixed catch projections

Due to consistent estimation of recruitment below average levels, projections were conducted under a low recruitment scenario using the average recruitment over the past ten years. This updated ten year average was higher than the ten-year average used in the 2017 assessment and results in estimation of shorter recovery timeframes.

Estimated year of recovery to B_{Lim} under different catch and recruitment scenarios

Catch (t)	Average recruitment	Low recruitment
0	2032	2037
50	2033	2039
100	2035	2042

Predicted discards are considered in the projections, but are in addition to the projected retained catches.

SERAG noted that factors other than fishing mortality seem to be preventing recovery of this species and management intervention has not prevented the decline in recent years.

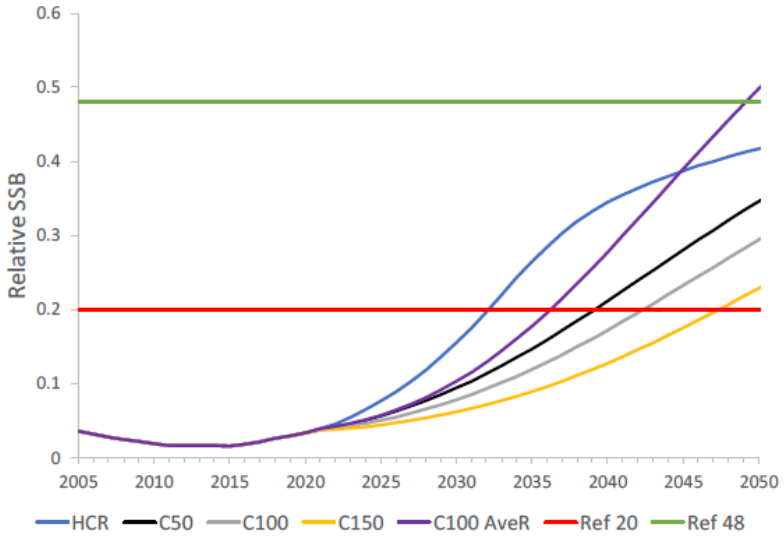


Figure 16: Relative spawning biomass time-series for alternative catch scenarios. Catches of 50 t (black), 100 t (grey) and 150 t (orange) are projected under a low recruitment scenario and the purple line (100 t) is projected under an average recruitment scenario (Bessell-Browne & Tuck 2020).

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (November 2022) noted there was no metier analyses being presented at this meeting as they rely on fishing activity as a predictor of catches for next year. With the substantial management changes coming into place in the 2023-24 season these predictions will not be valid. SERAG is not recommending any changes to the bycatch TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	0	No. Rebuilding species
	2022	0	
	2021	0	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	8.3	State catches are not deducted from the bycatch TAC but are considered as part of the annual review of the rebuilding strategy each year.	
Discards (t)	N/A	Discards are modelled in the Tier 1 assessment but are not deducted from the bycatch TAC. Estimates for 2023 are 17.4 t.	

Recreational catch (t)	N/A	There are no estimates of recreational catch.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		0 t – incidental bycatch TAC

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	The species is manage under the Redfish Rebuilding Strategy 2016-2021.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC at Feb 2023 SEMAC meeting	TBC at Feb 2023 SEMAC meeting	TBC at Feb 2023 SEMAC meeting	TBC at Feb 2023 SEMAC meeting

AFMA Advice

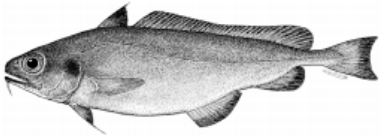
The AFMA Commission reduced the 2022-23 bycatch TAC to 30 t as a better reflection of recent catches.

AFMA Management recommends maintaining the bycatch TAC of 30 t for the 2023-24 fishing year, a single-year bycatch TAC, with overcatch and undercatch provisions set at zero per cent and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
30	30	0	2	0

Ribaldo

Mora mora



Species summary

Common name	Ribaldo cod, googly-eyed cod, ghost cod, deepsea cod, common mora, morid cod, giant cod				
Stock assessment	Tier 4 Species - last assessed by SERAG in 2020.				
Stock structure	Assumed to be a single stock in the SESSF.				
Stock status against reference points (C_{Lim}/C_{Targ})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	0.7894	0.3728	0.1864
	4	2017	0.7978	0.3597	0.1799
	4	2013	0.6671	0.3416	0.164
Stock trend and other indicators	CPUE has been above the target reference point since the reference period and has increase from just above the target reference point in 2007 to a four-year average of more than double the target reference point in 2019. Annual standardized CPUE trend is noisy and relatively flat since about 2005 and mostly below average (Sporcic, 2022). Zones 10-50 – Annual standardized CPUE trend is noisy and relatively flat since 1996 and mostly below average (Sporcic, 2022).				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	2nd of 3-year			Maintain current MYTAC	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		397	436	-
	2021-22		396	437	98
	2020-21		422	463	132
Economics (Byproduct) Commonwealth Trawl and Scalefish Hook	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21		0.29	64	0.45
	2019-20		0.29	51.34	0.56

	2018-19	0.25	49.47	0.51
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	Uncertain	Medium	↓>50% through to ↑10+%. Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	The average of discard estimates from 1998-2004 (reference period) have been used to backfill discard rates from 1986-2003. There have been revisions to the NSW annual catch from 2009 onwards. CDR records begin in 2005 – the agreed catch history from the previous Tier 4 assessment was used again in 2020 (Sporcic, 2020a).
Data and RAG comments	Most of the catch is taken in Zone 40. Catches have increased from 85 t to 126 t over the last four years.
Stock assessment information and RAG comments	While C_{Targ} increased because of revisions to NSW catches, a slight reduction in the four-year average CPUE has resulted in an RBC of 405.4 t, a reduction from 430.3 t from the 2017 assessment.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (December 2020) recommended a 3-year MYTAC using the RBC of 405.4 t from the 2020 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	405	Yes. 3-year MYTAC using RBC of 405 t from the 2020 Tier 4 assessment.
	2022	405	
	2021	405	

Discount factor (t)	N/A	SERAG recommended not applying a discount factor because deepwater closures provide protection to the stock.
State catch (t)	1	Mostly NSW State catches; consistently low.
Discards (t)	10.9	The 2019 estimated discard rate of 9.1 per cent was carried forward to 2020 and 2021.
Recreational catch (t)	N/A	There are no estimates of recreational catch – likely insignificant.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		393 t

MAC Recommendations

Commercial fishers' interests	Industry members have previously noted the undercatch is due to the fact that a large portion of the stock is unavailable due to ground closures.
Species specific management (target, companion and bycatch)	Deepwater closures are considered to provide significant protection.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 393 t for the 2023-24 fishing year, the third year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022–23 agreed TAC (t)	2023–24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
397	393	10	2	-4

Royal red prawn

Haliporoides sibogae

Species summary

Common names	Pink prawn, jack-knife prawn, redspot king prawn
Stock assessment	Tier 4 Species - last assessed by SERAG in 2020
Stock structure	Little is known of the stock structure in Australia, but they are assumed to comprise a common stock off eastern Australia which straddles the Barrenjoey Point SESSF management line.

Stock status against reference points (C_{Lim}/C_{Targ})

Tier	Assessment Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2020	1.6045	0.9463	0.3943
4	2017	1.1114	1.0692	0.4455
4	2013	1.0443	1.0615	0.4246

Stock trend and other indicators

Annual standardized CPUE trend is noisy and relatively flat across the years analysed, except between 2017 and 2020, where the trend is increasing and above the long-term average. From 2013 - 2016 the standardized trend deviates from the nominal geometric mean trend such that the trend stays on the long-term average CPUE while the geometric mean appears to rise well above it. The significant drop in the 2021 standardized CPUE relative to 2020 is attributed to the relatively low and sparse catches in 2021 (2.1 t) from only two vessels. This species was not actively fished in 2021, based on the high proportion (0.44) of small catches less than 30 kg. So, the standardization has become more uncertain and dependent on fishers specific fishing activities (Sporcic, 2022).

Multi-Year TAC

Year of MYTAC (2022-23)	MYTAC advice
2nd year of 3-year	Maintain current MYTAC

Catch and TAC (t)

SESSF Fishing Year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2022-23	651	712	-
2021-22	605	645	2
2020-21	403	444	33

Economics (Secondary)

Commonwealth Trawl and Scalefish Hook

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2020-21	0.10	64	0.16
2019-20	0.56	51.34	1.09

	2018-19	0.56	49.47	1.13
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	Uncertain	Low	N/A

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	The average discard proportion for years after 1998, excluding years where estimates are not available, is used to 'backfill' the discard estimates pre-1998. A revised NSW catch series was provided by Dr Liggins for the period 1986 to 1997, however these were not used because the records were vastly different to previous catch series held by CSIRO. Dr Sporcic suggested this should be resolved before the catch series is updated for the next assessment in 2021.
Data and RAG comments	The CPUE analysis was updated using bathymetry data to modify depth-reporting issues from the main boats in 2018 and 2019. SERAG (December 2020) noted the revised catch at depth is still too shallow, but noted there was very little change in CPUE trajectory. State catches are high in the early part of the time-series (150 - 330 t), however have been typically less than 10 t since 2007. State catches in 2016 we 51 t, most likely from NSW catches north of Barrenjoey point. Commonwealth catch has been between 115 and 220 t since 2010, with 143.4 t landed in 2019. Commonwealth discards are typically low, between 1.3 and 5.5 per cent since 2011. The TAC has never been a limiting factor for this species – catches are influenced by market demand.
Stock assessment information and RAG comments	There was little difference in the CPUE series after modifications to depth records. CPUE over the past six years has increased significantly, resulting in an RBC of 869.6 t from the 2020 assessment compared to 430.8 t from the 2017 assessment. This was also influenced by an increase in C_{Targ} and the scaling factor (Sporcic, 2020a). The increase in CPUE is assumed to reflect an increase in biomass, however royal red prawns are only targeted by two boats, and it is difficult to account for targeting and improved efficiency when standardising CPUE.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (December 2020) recommended a 3-year MYTAC using the RBC of 869.6 t from the 2020 Tier 4 assessment. SERAG noted the large change limiting rule would preclude the TAC from increasing by more than 50 per cent.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	869.6	Yes. 3-Year MYTAC using the RBC of 869.6 t from the 2020 Tier 4 assessment.
	2022	869.6	
	2021	869.6	

Discount factor (t)	130.4	A discount factor was not applied in 2020-21 because of the protection afforded by deepwater closures. Due to the increased uncertainty in the 2020 Tier 4 assessment, SERAG agreed to apply the default 15 per cent discount factor.
State catch (t)	108.1	All NSW catch. There was a significant increase in the reported catch in NSW from less than 1 t in 2019, to 153 t in 2020 and 126 t in 2021.
Discards (t)	3.5	Estimated discard rates have been consistently low over time.
Recreational catch (t)	N/A	Royal red prawn are a deep water species and are not targeted by recreational fishers.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		628 t

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	Royal red prawn fishing grounds off Sydney historically occurred in areas of core habitat for Harrisson's and southern dogfish and subsequently some of the fishing grounds have been closed under the Upper Slope Dogfish Management Strategy.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 628 t for the 2023-24 fishing year, the third year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
651	628	10	2	-23

Sawshark

Pristiophorus spp.

CSIRO national Fish Collection (2009)

Species summary

Common names	Common sawshark (*Pristiophorus cirratus*), southern sawshark (*P. nudipinnis*), eastern sawshark (*P.* spp)
Stock assessment	Tier 4 Species - last assessed by SharkRAG in 2020.
Stock structure	Sawshark (comprising of *P. cirratus*, *P. nudipinnis*, *P.* spp and *Pristiophoridae*) are currently assessed as a single stock. Three endemic species of sawsharks occur off southern Australia, but their distributions have not been described precisely. Common sawshark (*P. cirratus*) is reported to range from Jurien Bay in WA to Eden in NSW, including Tasmania, to depths of 310 m. Southern sawshark (*P. nudipinnis*) is reported to range from the western region of the GAB to eastern Gippsland in Victoria, including Tasmania, to depths of 70 m. The eastern sawshark (*P. sp. A*) is reported to range from approximately Lakes Entrance in Victoria to Coffs Harbour in NSW at depths of 100–630 m (Last and Stevens 1994). Little is known of stock structure or movement rates. For assessment purposes, all sawshark south of the Victoria–NSW border are assumed to be common sawshark and southern sawshark, whereas those north of this border are assumed to be eastern sawshark.

Stock status against reference points (C_{Lim}/C_{Targ})

Tier	Assessment Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2020	0.9476	0.7293	0.3646
4	2017	0.9443	0.7236	0.3618
4	2013	1.0050	0.8740	0.3497

Stock trend and other indicators	Trawl CPUE is increasing towards the long-term average and has been used for the Tier 4 assessment. The assessment also includes discard estimates and State catches. The distribution of effort at depth has remained stable throughout the time series. The length frequency distribution has remained stable throughout the time series. Trawl annual standardized CPUE has increased, reached the long-term average over the 2017-2019 period, decreased in 2020, and increased to above the long-term average in 2021, based on 95% confidence intervals (Sporcic, 2022b). Gillnet annual standardized CPUE has been below the long-term average since 2009, with minor increases over the 2015-2016 and 2018-21 periods (Sporcic, 2022b). Danish seine annual standardized CPUE has remained consistently below or at the long-term average since 2001 and above the long-term average in 2021 (Sporcic, 2022b).

Multi-Year TAC	**Year of MYTAC (2022-23)**	**MYTAC advice**
Catch and TAC (t)	2nd year of a 3-year MYTAC	Maintain current MYTAC

	SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
	2022-23	519	564	-
	2021-22	509	547	147
	2020-21	432	471	172

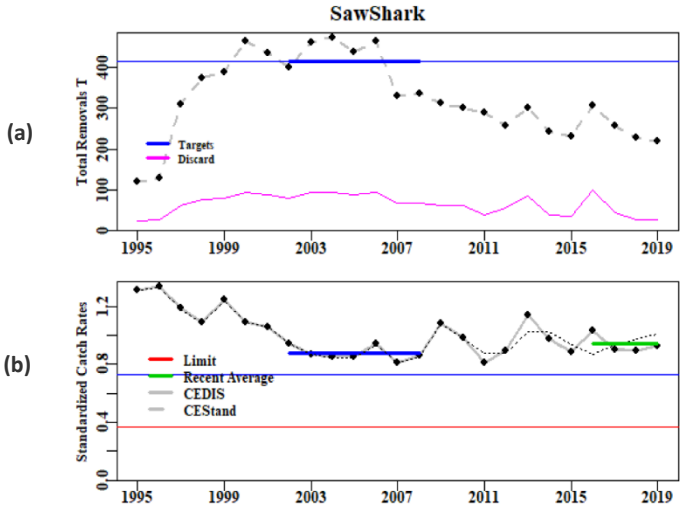
Economics (Secondary) Gillnet, Hook and Trap	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2020-21	0.56	24.84	2.25
	2019-20	0.48	19.67	2.44
	2018-19	0.60	23.66	2.54

ABARES Status (2022 report)	Fishing Mortality: Not subject to overfishing	Biomass: Not overfished

Climate sensitivity	Sensitivity	Preliminary projection	Confidence in projection	Comments
	High	There is no further information regarding sawshark sensitivity to climate change.		

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment uses the standardised trawl CPUE series as a key input (Sporcic, 2020). Landings data between 1995 and 2001 was sourced solely from GABTS logbook data. Since 2002, data has been sourced from CDRs. It was noted the reference period (2002 – 2008) for the 2020 assessment used CDR data. The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	In addition to the inclusion of new data for 2016-2020, SharkRAG (November 2020) recommended, consistent with the approach adopted by SERAG for other Tier 4 assessments, the following changes to data inputs to the assessment: - an updated catch series incorporated part of a revised NSW annual catch. There are issues of (i) double reporting of Commonwealth catch and NSW catch and (ii) misreporting of Commonwealth catch as NSW catch before about 1998 which needs to be resolved. However, revised NSW annual catch post 1998 are not subject to the above (double and misreporting) issues and was therefore used in this assessment (i.e. in the reference period 2002-08); - $P_{Discard}$ values were estimated for years where no data exists, inclusive of the reference period (2002-2008). These $P_{Discard}$ values were estimated by calculating the average value for years where data exists. The average $P_{Discard}$ value did not include values which were forward filled from previous years (i.e. 2010, 2015 and 2019).

Data and RAG comments	SESSFRAG (August 2020) noted there is a lack of availability of port or length data, however there is some data from trawlers and Danish seine, and gillnet boats in 2017 and 2018.
Stock assessment information and RAG comments	SharkRAG (December 2020) noted, that as shown in Figure 17, the standardised trawl CPUE which is used in a Tier 4 assessment has been increasing towards the long-term average and is above the target reference point (CPUE Report, Sporcic, 2020).  **Figure 17: (a) total removals with the fine line illustrating the target catch, (b) standardised catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate. The thin black dotted line is the unmodified standardised CPUE before the inclusion of discards. Source: Report presented by Dr Sporcic to SharkRAG on 3-4 December 2020 titled, *Draft Tier 4 Sawshark assessment in Australia's Gillnet Hook and Trap Sector of the SESSF (data to 2019)*.** The RBC for sawshark was calculated to be 653.4 t, an increase of 135 t from the previous RBC (2017). This increase was mostly attributable to the inclusion of annual discard estimates within the reference period (2002-08), which was not included in the previous Tier 4 assessment. Noting that the assessment covers two species, SharkRAG requested that AFMA monitor species composition over the coming seasons to be able to respond to any potential changes which would have implications for the assessment. AFMA is considering how to approach this task, including using the use of logbooks and EM to differentiate between common sawshark and southern sawshark.
Projected biomass	N/A

Species specific research and priorities

GHAT CPUE calculation methodology

Currently CPUE for gillnet-caught species is calculated on a kilogram per shot basis. Given the change to net length restrictions, SharkRAG has identified a strong need to change gillnet CPUE calculations: from catch by shot to catch by metres of net set to better account for zero shots.

RAG Recommendations

SharkRAG (December 2020) recommended a 3-year MYTAC using the RBC of 653.4 t from the 2020 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	653.4	Yes 3-Year MYTAC using the RBC of 653.4 t from the 2020 Tier 4 assessment.
	2022	653.4	
	2021	653.4	
Discount factor (t)	98 t	SharkRAG (December 2020) recommended applying the default Tier 4 discount factor of 15 per cent.	
State catch (t)	9.4 t	2018-2021 weighted average.	
Discards (t)	21.3 t	2018-2021 weighted average.	
Recreational catch (t)	N/A	Recreational catch estimates are uncertain. Recreational catch is not included in the assessment and not deducted from the RBC.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		525 t	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion or bycatch species.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 525 t for the 2023-24 fishing year, the third year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
519	525	10	2	+6

School shark

Galeorhinus galeus

Fisheries Research & Development Corporation (2012)

Species summary

Common names	School shark				
Stock assessment	Tier 1 Species - last assessed by SharkRAG in 2018 (CKMR assessment model).				
Stock structure	Tagging and genetic data suggests a relatively well mixed stock with some evidence for localisation of stocks, or reproductively isolated sub-stocks.				
Stock status against reference points (%B_0)	**Tier**	**Assessment Year**	**Biomass**	**Target**	**Limit**
	1	2018	50 000 mature individuals in 2000 and increasing at ~ 3 % p.a. Status unknown relative to B_0.	48	20
	1	2016	<20		
	1	2012	<20		
Stock trend and other indicators	The CKMR assessment model provides an estimate of current absolute abundance with trend back to 2000. It does not provide an estimate of depletion relative to B_0. The CKMR model indicates that the stock had recovered slightly during the period from 2000 to 2017 although the CV on trend is so large that is also allows for a declining scenario. Gillnet CPUE is not considered a reliable index of abundance as school shark are actively avoided by gillnet fishers. Although representing only a small proportion of total catch, the trawl CPUE shows an increasing trend since 2003. In 2016, SharkRAG noted that this is a positive sign suggesting that the school shark is rebuilding. This is consistent with advice from industry that school shark, particularly juveniles, are in relatively high abundance. Interpretation of the trawl CPUE is complicated by (lack of) availability of quota for trawl operators. Trawl annual standardized CPUE has been above the long-term average since 2013, based on the 95% confidence intervals. There was a slight decrease in standardized CPUE in 2020 relative to 2019 and an increase in 2021 relative to the previous year (Sporcic, 2022b).				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	N/A – Rebuilding species			N/A	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		250	250	-

	2021-22	194	194	192
	2020-21	195	195	184
Economics (Secondary) Gillnet, Hook and Trap	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	1.96	24.84	7.89
	2019-20	1.53	19.67	7.78
	2018-19	2.04	23.66	8.62
ABARES Status (2022 report)	**Fishing Mortality: Uncertain**		**Biomass: Overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	High	↓ up to 20%	High	Spatially uniform

Assessment summary

Key model technical assumptions/ parameters	The CKMR assessment model assumes that there is one well mixed stock.
Significant changes to data inputs	The Shark Industry Data Collection (SIDaC) program continues to collect close kin samples as a key input to the CKMR assessment.
Data and RAG comments	The CKMR assessment model considers only one region, one population, starts in 2000 and does not allow (or need to take account of) movement between regions because there is only one region. For the 2023-24 fishing season, SharkRAG (December 2022[16]) recommended using the logbook method annually as it was cost effective and required much less analysis time compared to the metier analysis. The logbook method also produced a result with a more conservative approach. In addition, the metier analysis could be included every 3 or 5 years on a regular basis possibly as part of the usual stock assessment project to have a more robust scientific assessment as it also considers factors such as, area of fishing occurred and discard rates that the logbook analysis did not consider.
Stock assessment information and RAG comments	Assessments (since 1991) have consistently estimated the school shark population to be below the limit reference point of 20 per cent of unfished levels. The objective of the current rebuilding strategy is to rebuild the stock to B20 in 66 years since it was first implemented in 2009. In October 2018, SharkRAG accepted the new CKMR assessment. The CKMR assessment model provides an estimate of current absolute abundance with trend back to 2000. It does not provide an estimate of depletion from B_0. SharkRAG noted high confidence in the

[16] Minutes from this meeting are currently being finalised

absolute estimate of abundance produced by the model, but lower confidence in the estimate of trend but that confidence in the trend will improve with additional data.

The CKMR assessment underwent four reviews between 2019 and 2021. The final review was an expert panel commissioned by AFMA. The outcome of this review found the methodology appropriate to inform management and identified key uncertainties to be addressed to improve confidence in the results. SharkRAG (and AFMA) adopted the outcomes of the review. The next update to the CKMR assessment is not due until 2024.

For 2019-20, 2020-21 and 2021-22, SharkRAG recommended setting an incidental catch TAC based on projections using the average fishery mortality rates over the last five years ("2013-17 mean F", red line in figures below). This rate, taking into account increasing stock size due to rebuilding, gave total fishing mortality estimates of 256 t, 263 t and 270 t in the relevant fishing years, respectively. This level of fishing mortality provides for consistent recovery.

For the 2022-23 fishing year in the absence of an update to the CKMR assessment, SharkRAG (November 2021) recommended setting the incidental catch TAC to minimise the total mortality of school shark by accounting for the minimum unavoidable catch, including the discards associated with that minimum catch, as well as reflecting the estimated 3 per cent p.a. rate of increase in the population (Thomson et al 2020), and the 13 per cent reduction in the gummy shark TAC for 2022:

Past landings (L), plus discards (D), multiplied by a 3% annual increase, and by a 13% reduction in the gummy quota: TAC = (L + D) * (1-0.13) * (1 + 0.03)

SharkRAG (Dec 2022) considered a metier analysis for school shark based on assumed TACs for companion species in 2023-24 which estimated a median value of 218.8 t (95%CI ranging from 183.6 – 260.1 t) if the gummy shark TAC is maintained, or 202.5 t (95%CI tanging 202.5 t – 170.3 t) if the step-down MYTAC is adopted. The RAG also considered the logbook approach applied in 2021 which resulted in similar values, and resolved that this approach should be retained for recommending bycatch TACs, with periodic metier analyses to confirm that the approach remains valid.

The estimated level of unavoidable bycatch (using the 'logbook' method) for 2023-24 is 251.t if the 2022-23 gummy shark TAC is maintained, or 223.3 t if the step-down MYTAC is adopted.

Projected biomass

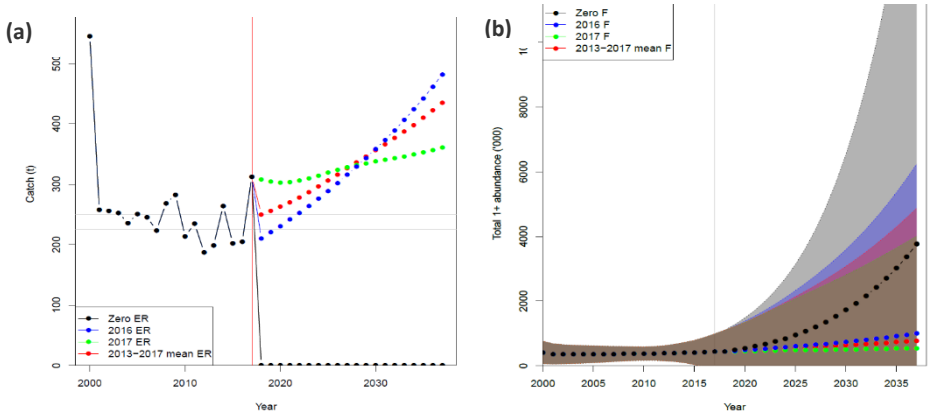


Figure 18: (a) Projected catch (t) using different constant exploitation rate scenarios. (b) Projected abundance estimates based on different constant fishing mortality rate scenarios.

Species specific research and priorities

Continued Close Kin Mark Recapture sampling and analysis for school shark (funded)

Continue close kin sampling and analysis for school shark as the primary indicator of abundance for this species.

Improved Ageing Techniques (pilot funded)

Ageing of vertebrae was known to be biased for mature animals however the CKMR study for school shark showed that even for younger animals, the method performs poorly. The expert panel review of the CKMR assessment recommended improving the ageing of school shark as a key priority to improving confidence in the new assessment approach. A pilot study using epigenetic and bomb radio-carbon ageing is being undertaken as part of the CKMR project. The outcomes of this pilot study will inform an additional ageing project.

Developing a Harvest Strategy for school shark as a case study for species where depletion can no longer be estimated against B_0 (funded)

Investigate development of a harvest strategy for species where depletion can no longer be estimated against B_0 (only an absolute estimate is available), using school shark as a case study. To be informed by the multi-species harvest strategy project (MSHSP), and dynamic reference points project.

Improving CPUE standardisations for sharks (supported by SharkRAG 2022, yet to be funded by ARC)

Improve standardisations: a) Clarify relationship between CPUE and net length, b) Effects of Sea Lion and other closures on CPUE, and c) Account for changing dynamics of fleet with new entrants.

RAG Recommendations

SharkRAG (Dec 2022) recommended a bycatch TAC of 251.7 t if the 2022-23 gummy shark TAC is maintained, or 223.3 t if the step-down MYTAC is adopted for the 2023-24 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	0 (223 - 251 t incidental bycatch TAC, subject to gummy shark TAC)	No. Rebuilding Species
	2022	0 (225 incidental bycatch TAC)	
	2021	0 (270 incidental bycatch prior to deductions)	
Discount factor (%)	N/A	Discount factors are not applied to bycatch TACs.	
State catch (t)	N/A	2018-2021 weighted average of 27 t Due to the way that the 2023-24 recommended TAC is calculated, state catch is not deducted. SharkRAG did however consider its TAC recommendation in the context of the 287 t that the CKMR model estimated would still allow for rebuilding of the school shark stock in 2023 and that the range of bycatch TACs allows room for state catches and discards in addition to the TAC.	
Discards (t)	N/A	2018-2021 weighted average of 60.7 t.	

		Discards are explicitly accounted for via inclusion in the best estimate of total mortality used as the basis for the 2023-24 TAC calculation – they are not deducted in this instance. Trawl discards are collected via the ISMP program and a discard rate was calculated for calendar years 2018 to 2021, and applied to the retained trawl catch to estimate a discard tonnage. Discards from gillnet and hook methods were obtained from logbooks* for the calendar years 2018-2021. Trawl and GHATF discards were then added to the retained catch for each calendar year 2018-2021, to provide an estimate of total fishing mortality. A four-year weighted average, with the more recent years given the higher weights, was calculated to provide the best estimate of total fishing mortality. This number provided the basis for the TAC calculation. Note * GHAT boats now carry EM and it has recently been shown that logbook records of piece counts for discards for school shark are sufficiently accurate for use by management (Tim Emery, ABARES, pers comm).
Recreational catch (t)	N/A	Recreational catch estimates are uncertain. Recreational catch is not included in the assessment and is not deducted from the RBC.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		0 t – incidental bycatch TAC to be resolved

MAC Recommendations

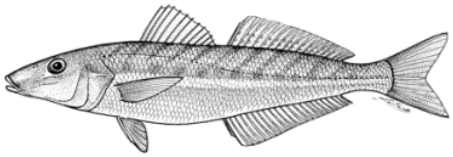
Commercial fishers' interests	Industry have previously expressed that it is difficult to avoid school shark in Tasmania and SA waters.
Species specific management (target, companion and bycatch)	The gillnet sector interacts with Australian sea lions in waters off SA. ASL interactions are managed through the ASL Management Strategy, which sets trigger limits that close spatial zones for 18 months if interaction numbers exceed the triggers. To prevent targeting of school shark, GHAT operators (excluding scalefish hook which are subject to 100 kg trip limits) must: • limit their total school shark catch to 20% of their gummy shark catches, based on overall quota holdings. • release any school shark assessed as alive and vigorous.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice				
AFMA management will seek advice from SEMAC in February 2023 regarding the school shark bycatch TAC, which will be subject to the TAC set for gummy shark.				
2022-23 agreed TAC (t)	**2023-24 recommended TAC (t)**	**Overcatch & undercatch (%)**	**Determined amount (t)**	**Change in TAC (t)**
250	TBC	0	2	TBC

School whiting

Sillago flindersi



Species summary						
Common names	Red spot whiting, spotted whiting, silver whiting, trawl whiting.					
Stock assessment	Tier 1 Species - Last assessed by SERAG in 2020					
Stock structure	Eastern school whiting is currently managed as a single stock from western Victoria, around Tasmania and along the east coast of Australia to southern Queensland. Dixon et al. (1986, 1987) report a discontinuity in the relatedness between samples observed between Forster and Coffs Harbour, which may indicate some degree of separation between the fish from northern and southern NSW. A FRDC project is currently underway to improve our understanding of stock structure using improved genetic techniques. The results of this project were not available for the 2020 assessment.					
Stock status against reference points (%B_0 in assessment year +1)	**Tier**	**Assessment Year**	**Biomass (from assessment year)**	**Biomass (revised in most recent assessment)**	**Target**	**Limit**
	1	2020	41	41	48	20
	1	2017[17]	47	36		
	1	2009	50	39		
Stock trend and other indicators	The stock declines slowly from the beginning of the fishery in 1942, before a sharp decline in the 1980s corresponding to an increase in catch. The stock status then varied between around 30% SSB_0 to 50%B_0 from 1992. In 1999 the stock declines to a low of 28% SSB_0, then increases to over 40% SSB_0 between 2006 and 2009, followed by another decline to 29% SSB_0 in 2014, and then varying between around 30% and 40% SSB_0 since then. The increase in stock status from 1999 to 2007 occurred during a period of general decline in total catches starting in the mid-1990s and lasting around 25 years. This rebound in spawning stock biomass from 1999 to 2008 also appears to have been boosted by good recruitment in 1999, 2003 and 2005 (Day et al., 2020). Commonwealth catch is mostly by Danish seine. The Danish seine (Zone 60) (excluding seismic survey records) standardized CPUE exhibits a flat trend over 2012-17 and has declined and dropped below the long-term average over the 2017-20 period, based on 95% confidence intervals. Also, there has been an increase in standardized CPUE in 2021 relative to the previous year (Sporcic, 2022). The Zone 60 (excluding seismic survey records and non-survey records from same space-time period) standardized CPUE exhibits a flat trend over 2012-17 and has declined and dropped below the long-term average over the 2017-20 period, based on 95% confidence					

[17] A partial update to the 2017 assessment in 2019 estimated a biomass of 36%B_0.

<table>
<tr><td></td><td colspan="4">intervals. Also, there has been an increase in standardized CPUE in 2021 relative to the previous year (Sporcic, 2022).</td></tr>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="2">Year of MYTAC (2022-23)</td><td colspan="2">MYTAC advice</td></tr>
<tr><td colspan="2">2nd of 3-year</td><td colspan="2">SESSFRAG data meeting 2022 reaffirmed their decision to postpone the assessment to 2024</td></tr>
<tr><td rowspan="4">Catch and TAC (t)</td><td>SESSF fishing year</td><td>Agreed TAC</td><td>TAC after unders/overs</td><td>Cth Retained Catch</td></tr>
<tr><td>2022-23</td><td>917</td><td>1004</td><td>-</td></tr>
<tr><td>2021-22</td><td>917</td><td>986</td><td>502</td></tr>
<tr><td>2020-21</td><td>788</td><td>862</td><td>520</td></tr>
<tr><td rowspan="4">Economics
(Primary)
Commonwealth Trawl and Scalefish Hook</td><td>Financial Year</td><td>Species GVP ($m)</td><td>Fishery GVP ($m)</td><td>% Fishery GVP</td></tr>
<tr><td>2020-21</td><td>2.22</td><td>64</td><td>3.47</td></tr>
<tr><td>2019-20</td><td>1.18</td><td>51.34</td><td>2.30</td></tr>
<tr><td>2018-19</td><td>1.37</td><td>49.47</td><td>2.77</td></tr>
<tr><td>ABARES Status (2022 report)</td><td colspan="2">Fishing Mortality: Not subject to overfishing</td><td colspan="2">Biomass: Not overfished</td></tr>
<tr><td rowspan="2">Climate sensitivity</td><td>Sensitivity</td><td>Preliminary projection</td><td>Confidence in projection</td><td>Comments</td></tr>
<tr><td>Medium</td><td>↑ 10-50%</td><td>Medium</td><td>N/A</td></tr>
<tr><td colspan="5">Assessment summary</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td colspan="4">Natural mortality (M) – fixed at 0.6
Steepness (h) – fixed at 0.75
Recruitment deviations – estimated from 1981-2016
CV growth – estimated at 0.0937
Growth (K) – estimated at 0.329
Growth l_{Min} – estimated at 7.26
Growth l_{Max} – estimated at 23.1</td></tr>
<tr><td>Significant changes to data inputs</td><td colspan="4">Additional Data
Catch adjusted with revision to 1942-2016 catch history – replace estimated 2017 catch with actual catch.
Added three years of Commonwealth data – catch, CPUE, discards, length composition and conditional age-at-length data to 2019 (include revisions to NSW historical catch data, see below)</td></tr>
</table>

	Revised five-fleet model (Danish seine, trawl, NSW Danish seine, NSW trawl and NSW prawn trawl) NSW Data New NSW Danish seine, NSW trawl and prawn trawl catch, CPUE, discard, length and age data included in the assessment. Monthly CPUE (NSW trawl and prawn trawl) available from 1998-2008 and daily CPUE for 2010-2019. This data is collected at a much coarser spatial and temporal resolution compared to Commonwealth CPUE. Discard rates are available for NSW trawl (1993-95 and 2014-16) and NSW prawn trawl (1990-92 and 2017-19).
Data and RAG comments	Biologicals Commonwealth length frequency data is showing larger fish are being recorded on board compared to port based sampling since 2015. It is not clear why this is occurring – AFMA are investigating. Recruitment Of the last ten years of recruitment estimated: • two years are good: 2014, 2015 • five years are poor: 2007, 2009, 2011, 2012, 2016 • three years is average: 2008, 2010, 2013 • ten year average recruitment deviation: -0.142 • five year average recruitment deviation: -0.017 The average recruitment deviation over the last ten years is lower than the average deviation over the previous ten years; however SERAG did not consider this compelling enough to consider a low recruitment scenario when recommending an RBC. The average recruitment deviation over the last five years has been close to zero, reflecting recruitment that can be considered close to. Discards There is a paucity of reliable discard estimates from Commonwealth Danish seine boats from about 2000 to 2010. The length and age sampling achieved over the same period suggests there was representative coverage. Resolving this would require further investigation of data collected by observers, which was not undertaken as part of this assessment. Both the observed and estimated NSW trawl and prawn trawl discard proportions are considerably larger than Commonwealth discards.
Stock assessment information and RAG comments	**New base case (adding NSW age, length and CPUE data – recommended as new base case)** M and h are fixed (M fixed at 0.6 and h fixed at 0.75) Five different selectivity curves (five-fleet model) Model fits to CPUE Fits to Commonwealth Danish seine and NSW trawl CPUE are reasonable; less so for NSW prawn trawl CPUE. Likelihood profiles Natural Mortality (M) - broad range of values from 0.64 - >1.0, with the optimal value at 0.9 which seems biologically implausible. Agreed to fix M at 0.6. 2019 biomass estimate (SSB_{2019}) – broad range of plausible values from 27%B_0 to 39%B_0, with the optimal value at 33%B_0. Likelihood profiles cannot be constructed for 2021 stock status for technical reasons. Recruitment The most recent estimate of recruitment (2016) is still below the long-term average (see summary above). 2021 Spawning stock biomass estimate

	There is much less uncertainty in the estimate of historical and current biomass compared to the 2017 assessment, due in part to fixing the value of M. The estimate of spawning stock biomass for 2021 is 41% SSB_0. SERAG (December 2020) considered options for future work: - Explore stock structure (this is being progressed as part of the FRDC project led by Dr Karina Hall) - Spike of large fish in the 2018 trawl on board length data should be investigated. (Actioned) - Automatic processing of NSW length and age data (may need additional resourcing). - Encourage ongoing collection and provision of NSW data (supported). - Retrospective analysis on final base case, rather than initial base case (supported on case-by-case basis). - Consider seismic effects on catches and catch rates in Bass Strait (considered a priority and will be considered at 2021-2023 data meetings - must be considered in next assessment). - Consider the need for time-blocking selectivity and retention functions for NSW fleets to account for changes in gear and management regimes over time (supported).
Projected biomass	The 2021 spawning stock biomass is estimated to be 41% SSB_0 (Figure 20) and under average recruitment is expected to exceed 47% SSB_0 by 2026. A low recruitment scenario was also considered, projecting low recruitment forward from 2017 to 2023, returning to average recruitment from 2024 onwards. Under this scenario, the stock is predicted to exceed 47%B_0 by 2040. SERAG noted that long-term projections are not particularly informative for a short-lived species with recent variable recruitment. Under the low recruitment scenario, the biomass is expected to remain between the limit and target reference points if catches from the Harvest Control Rule are maintained. Biomass projections up to 2025 under each of the recruitment scenarios are shown in Figure 19 (from Day *et al* 2020) below.

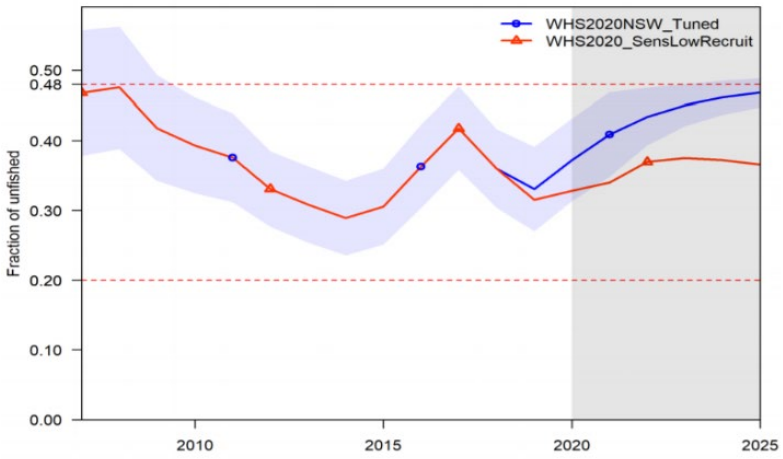


Figure 19: Projected relative spawning biomass (2007-2025) for the five-fleet base case (blue, average recruitment) and the low recruitment scenario (red, low recruitment) (Day et al., 2020).

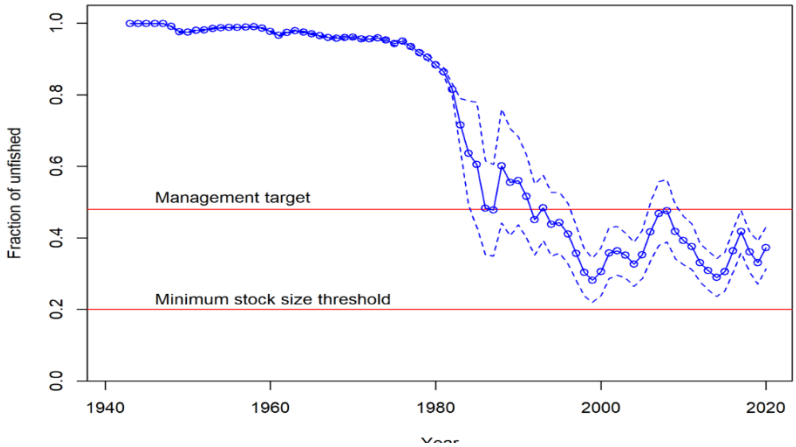


Figure 20: Time-trajectory of spawning biomass depletion (with approximate 95% asymptotic intervals) corresponding to the MPD estimates for the base case analysis for school whiting (Day et al., 2020).

Summary of projected total catch (landed catch plus model estimated discards) under the average recruitment and low recruitment scenarios.

Year	Average recruitment	Low recruitment
2020	2,140	2,136
2021	2,140	1,697
2022	2,250	2,019
2023	2,321	2,175
2024	2,368	2,287
2025	2,398	2,382

Species specific research and priorities

An updated understanding of Eastern School Whiting stock structure and improved stock assessment for cross-jurisdictional management

The project aims to clarify the stock structure of eastern school whiting in south-eastern Australian waters using a range of modern methods, investigate the spatial and temporal variation in the main biological parameters (length and age structures, growth and reproductive biology) of eastern school whiting across the species' distribution, investigate the species composition of mixed trawl whiting catches in northern NSW to improve the quality of state catch data used in stock assessments, and explore the effects of the findings from the first 3 objectives on the outputs of an updated Tier 1 stock assessment for eastern school whiting.

Genetic results of the study have identified that fish throughout NSW and Victoria have strong genetic flow and are a single stock while Tasmanian fish form a separate stock. Fish in western Victoria and South Australia have some genetic differentiation, although there is insufficient evidence to define them as a separate stock. Morphometric and otolith data will continue to assist in defining the stock dynamics. These results will contribute to the next Tier 1 stock assessment.

RAG Recommendations

SERAG (December 2020) recommended a 3-year RBC of 2,237 t, based on the 3-year average, minus the 3-year average of discards (378 t) for the SESSF. Fishery indicators will be monitored annually for any significant changes in fishery/stock trends.

<table>
<tr><th></th><th>Year</th><th>RBC (t)</th><th>Is a MYTAC Recommended?</th></tr>
<tr><td rowspan="4">Recommended Biological Catch (t)</td><td>2023</td><td>2,321</td><td rowspan="4">Yes
3-Year MYTAC using average RBC of 2,237 t.
SERAG recommended reviewing the fishery indicator data each year as part of the annual MYTAC analysis.</td></tr>
<tr><td>2022</td><td>2,250</td></tr>
<tr><td>2021</td><td>2,140</td></tr>
<tr><td>Long-term</td><td>2,448</td></tr>
<tr><td>Discount factor (t)</td><td>N/A</td><td colspan="2">Discount factors are not applied to Tier 1 assessments</td></tr>
<tr><td>State catch (t)</td><td>765.4 (includes 31 t of non-NSW catch)</td><td colspan="2">Mostly NSW catches. There was a large decrease in reported NSW catches in 2021 (492.2 t) and 2020 (802 t) compared to 2019 (1218 t).</td></tr>
<tr><td>Discards (t)</td><td>3-year average: 378</td><td colspan="2">Model estimated discards from the most recent Tier 1 assessment are deducted from the TAC.</td></tr>
<tr><td>Recreational catch (t)</td><td>N/A</td><td colspan="2">Recreational catch estimates are uncertain and species (including King George whiting) are not clearly delineated.
Recreational catch is not included in the assessment.</td></tr>
<tr><td>Research Catch Allowance (t)</td><td>N/A</td><td colspan="2">There has been no specific research catch allocated.</td></tr>
<tr><td colspan="2">Provisional TAC under the Harvest Strategy</td><td colspan="2">1,094 t (using 3-year averages)</td></tr>
</table>

MAC Recommendations

Commercial fishers' interests	NSW introduced quota shares in 2019, including a combined school whiting and stout whiting TAC of 1189 t, close to the highest historical catch over the last nine years. The TAC was reduced to 898.1 t for the 2020-21 fishing year, increasing to 1044 t in 2022-23. Catches in the NSW Southern Fish Trawl Fishery (SFTF) remain unrestricted, however there has a large decrease in reported NSW catches in 2020 (802 t) and 2021 (492.2 t) compared to 2019 (1218 t).
Species specific management (target, companion and bycatch)	Eastern school whiting through NSW and western Victoria have been identified as a single panmictic population and Tasmanian fish are a separate stock. There is uncertainty around the species composition of whiting landed in NSW, particularly north of Barrenjoey Head.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

Historically, catches in each of the jurisdictions represent an approximate 50:50 split of the landed catch. In the Commonwealth, all catches are controlled by setting the annual TAC, whereas in NSW the TAC does not apply to the SFTF, and catches are only restricted in the Ocean Trawl Fishery, north of Barrenjoey Head.

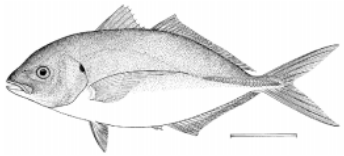
When modelled discards and non-NSW state catches are deducted from the 3-year average RBC, the sustainable catch to be shared between NSW and the Commonwealth is 1828 t.

AFMA Management recommends a TAC of 914 t for the 2023-24 fishing year, the third year of a 3-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t. This TAC constitutes 50 per cent of the sustainable catch after discards and non-NSW catches are deducted from the RBC and is consistent with the approach taken in 2022.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
917	914	10	2	-3

Silver trevally

Pseudocaranx georgianus



Species summary

Common names	Silver bream, skippy, white trevally, skipjack trevally				
Stock assessment	Tier 4 Species - last assessed by SERAG in 2022. NSW preliminary assessment also considered. Joint assessment results to be presented in 2023.				
Stock structure	Preliminary research suggests that the silver trevally off south-eastern Australia represents a single stock.				
Stock status against reference points (C_{Lim}/C_{Targ})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2022	0.4787	0.9504	0.396
	4	2021	0.5172	0.9418	0.3924
	4	2020	0.5642	0.9221	0.3842
Stock trend and other indicators	Zones 10-20 including MPA- Annual standardized CPUE trend is noisy and relatively flat since about 1992 and has remained below average since 2012 despite the recent increases in both 2020 and 2021 relative to 2019. A major change from the nominal geometric mean occurs from 2013 onwards and this is mainly due to changes in the vessels operating, the depths in which they fish, and the reduced amount of fish caught. The number of vessels actively contributing to this fishery has now reduced to low numbers and this may also be related to the recent major deviation from the nominal CPUE. Seven vessels operated in 2019 contributing to a total of only 1.9 t, the lowest in the series (Sporcic, 2022). Zones 10-20 excluding MPA- Annual standardized CPUE trend is noisy and relatively flat since about 2012 and below average. A deviation similar to that in the 'include MPA' scenario is apparent where the standardized trend deviates markedly from the nominal geometric mean trend from 2013 - 2017 and for the same reasons of changes in vessels fishing, low numbers of significantly contributing vessels, changes in the depth distribution of fishing and lower catches and numbers of records (Sporcic, 2022).				
Multi-Year TAC	**MYTAC (2022-23)**			**MYTAC advice**	
	Single year TAC			Proceed with 2022 assessment.	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		51	70	-
	2021-22		197	226	23
	2020-21		289	318	25

Economics (Secondary) Commonwealth Trawl and Scalefish Hook	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2020-21	0.08	64	0.12
	2019-20	0.21	51.34	0.41
	2018-19	0.01	49.47	0.02

ABARES Status (2022 report)	Fishing Mortality: Not subject to overfishing	Biomass: Not overfished

Climate sensitivity	Sensitivity	Preliminary projection	Confidence in projection	Comments
	Medium	There is no additional information regarding silver trevally sensitivity to climate change.		

Assessment summary

Key model technical assumptions/ parameters	The assessment excludes all data from inside the Batemans Bay Marine Protected Area (MPA). The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	Discard estimates were taken from Althaus et al 2022, and the mean discard estimates from 1998–2001 were used to backfill estimates from 1986–1997. Where discard data entries were missing 2016–21, data was forward filled for missing years. Discards are used in the Tier 4 but are quite low.
Data and RAG comments	The NSW results are consistent with recent assessment presented by NSW at previous RAGs. SERAG noted the ongoing conflict with the Commonwealth Tier 4 assessment and the reference period used within. The RAG believes the current Commonwealth assumption around the state of exploitation of the stock during the reference period may be incorrect. The RAG believes a decision regarding the change in reference period should be made after the joint assessment results are presented in 2023.
Stock assessment information and RAG comments	NSW DPI and CSIRO are working on a joint stock assessment that considers all available data from NSW and the Commonwealth. This will not be completed until the 2023 SERAG meetings. In lieu of the completed joint assessment, SERAG will consider additional information that NSW DPI holds, so that TAC advice is based on all available evidence. NSW Stock Assessment 2021-22 uses NSW Ocean Trawl data and a weight of evidence approach (catch rates, catch only methods, length based SPR) The CPUE series starts from 1997, where catch and effort can be linked to specific gear types. Data to 2009 is only available by month, and since then, daily catch and effort is available. NSW total catch peaked during the 1980s and has reduced to historical lows in 2019 and 2020 - most catch is from trawlers. Effort has decreased since 2007.

	Standardised CPUE series (3 series: 1998-2009, 2010-2020, 1998-2020) standardised for month, ocean zone, fisher and depth. All series show a recent declining trend, including when estimates of discards are included. Catch only modelling approaches produce estimates of B/BMSY from the trawl catch ranging from 0.18-0.20 (zBRT) and 0.25-0.30 (Optimise Catch-Only) and F/FMSY of 0.60 - 1.12 (Optimised Catch-Only). When total NSW catch was analysed, B/BMSY was estimated at 0.09 (zBRT) and 0.22 (OCOM). Length proportions from NSW observer records show fish >30cm FL from 1993-1995 range between 0.46 and 0.72, then declines from 0.4 in 1997 and to 0.06 in 2019. The Kapala survey during the 1993-95 period are consistent with the NSW observer data. Length-based Spawning Potential Ratio (LB-SPR) model estimates F/M is highly variable, ranging from 2.0 - 8.4 between 2004 and 2019. SPR shows consistent low value between 0.1 and 0.18 for the same period. Future work would ideally include Commonwealth catch data in catch-only modelling. While SERAG noted some potential issues with the various approaches, the review of various indicators shows a consistent story, that the stock has declined over time. Commonwealth Tier 4 The catch time series used in this assessment was derived from Sporcic and Day (2021), which incorporated the July 2021 revised NSW estimates and endorsed by SERAG (28-29 September 2021). There has been an overall decrease in the total annual catch (up to two orders of magnitude) since the start of this series, despite relatively small increases between some years. The 2021 annual catch decreased by 28.7 t relative to the previous year (84.6 t vs 113.3 t excluding discards;) (Sprocic, 2022c). The 2022 estimated RBC was 117.4 t, a 61.45 t decrease compared to the 2021 estimated RBC (178.85 t; Sporcic 2021a). This decrease in RBC can be mostly attributed to a decrease in the most recent four-year average CPUE which was used to calculate the RBC, despite an increase in the most recent (2021) standardized CPUE (including discards). The 2022 RBC is greater than the reported annual catch (including discards) of approximately 97.36 t in 2021 (Sprocic, 2022c).
Projected biomass	N/A

Species specific research and priorities

A joint stock assessment between the Commonwealth and NSW will be considered in 2023.

RAG Recommendations

The RAG noted concerns regarding the outputs of the 2022 Tier 4, including application of the default reference period and stock status, and the information provided by NSW and recommended setting a 2023-24 TAC akin to an unavoidable bycatch TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	117	No.
	2022	179	
	2021	370	

Discount factor (t)	17.5	The 15 per cent discount factor is applied.
State catch (t)	73.5	Mostly NSW and SA catches.
Discards (t)	14.5	Four-year weighted average.
Recreational catch (t)	N/A	Recreational catch is not included in the Tier 4 assessment because of a lack of reliable catch estimates over time. Recreational catch in NSW was estimated in 2012 at between 54-120 t.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		11.5 t

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	The Batemans Bay MPA closure overlaps fishing ground that was preferred by NSW licenced operators (many of whom are dual endorsed)
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

While silver trevally has not formally been assessed as overfished in the Commonwealth, the outputs of the 2022 Tier 4 assessment and information provided by NSW stock assessment scientists suggest that the stock is declining and a TAC akin to an unavoidable bycatch TAC should be considered.

AFMA will seek advice from SEMAC at its February 2023 meeting regarding the TAC for the 2023-24 fishing year.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
51	TBC	10	2	TBC

Silver warehou

Seriolella punctata

ABARES (2012): Line drawing – FAO

Species summary

Common names	Spotted warehou, spotted trevally, spotted trevalla, snotty nose trevally, trevally, mackerel trevalla					
Stock assessment	Tier 1 Species - last assessed by SERAG in 2021					
Stock structure	Considered to be a single stock in the SESSF.					
Stock status against reference points (%B_0 in year +1)	**Tier**	**Assessment Year**	**Biomass (from assessment year)**	**Biomass (revised in most recent assessment)**	**Target**	**Limit**
	1	2021	29	29	48	20
	1	2018	31	25		
	1	2015	40	22		
Stock trend and other indicators	The 2021 assessment estimates that the projected 2022 spawning stock biomass will be 29%B_0 (projected assuming 2020 catches in 2021, compared to 31%B_0 at the start of 2019 from the 2018 assessment (Burch et al., 2018). Moving to the model with low recruitment projections as the base case (see below) for this assessment has been the main driver of this downward revision of stock status (Bessell-Browne & Day, 2021). The 2021 assessment suggests that spawning stock biomass was as low as 21% in 2016. The increase in estimated stock status since the 2018 assessment is likely due to slight increases in standardised catch rates and increasing recruitment combined with low catches (Bessell-Browne & Day, 2021). Annual standardized CPUE has declined since 2005, and since 2008 have been below the long-term average. The influence of the vessel factor was high from 1999 to about 2006 after which it was less influential. The 2021 catch (121 t) of Silver Warehou in the west was the lowest in the series (i.e., since 1986) which also corresponds to the lowest number of vessels. In the east, the annual standardized CPUE has declined since 1994 and have been below average since 2000 (Sporcic, 2022).					
Multi-Year TAC	**Year of MYTAC (2022-23)**			**Has the MYTAC advice been revised?**		
	2nd of 3-year			Maintain current MYTAC		
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**	
	2022-23		350	387	-	
	2021-22		450	487	235	

	2020-21	450	490	289
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21	0.73	64	1.14
	2019-20	0.40	51.34	0.78
	2018-19	0.37	49.47	0.75
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Low	Uncertain	Medium	↓30% through to ↑5-20%. Declines (if they occur) begin in the GAB first

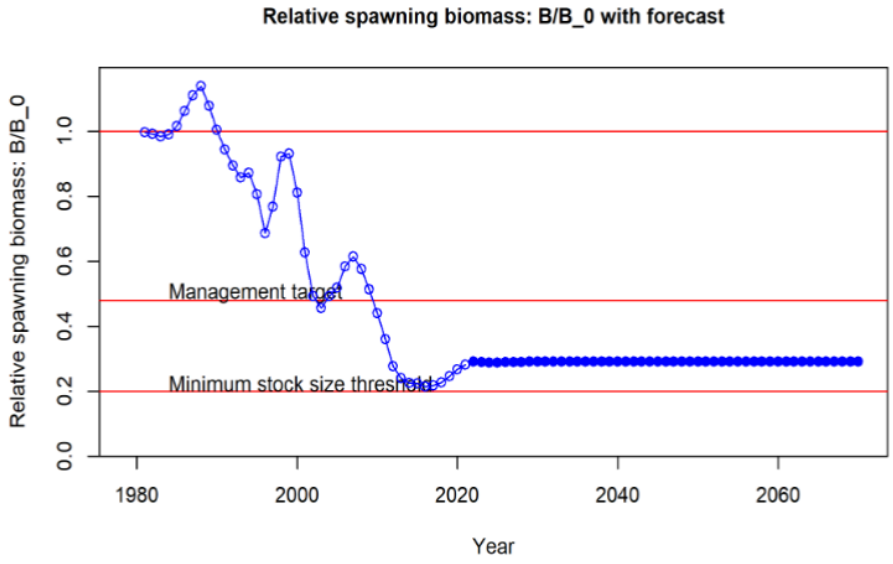
Assessment summary

Key model technical assumptions/ parameters	Single stock model with two fleets, one in the east and one in the west Von Bertalanffy growth curve estimated for one sex including both males and females Natural mortality fixed at 0.3 Stock recruitment steepness fixed at 0.75 The initial value of the parameter determining the magnitude of process error in annual recruitment is set to 0.7 Selectivity estimated for both fleets Retention estimated for both fleets, with a time block included in 2002, with all sizes discarded earlier and sized based discarding after this time. In the east trawl fleet an additional retention time block is included in 2018 to allow the model to fit increased discard estimates between 2018 and 2020 The age observation plus group is modelled to be 23 years The length-weight relationship is fixed based on previously determined estimates ($a = 0.0000065$ g^{-1} cm, $b = 3.27$) Female length at 50% maturity is assumed to be 37 cm
Significant changes to data inputs	There have been no significant changes to data inputs
Data and RAG comments	There has been a large increase in discard estimates in the east trawl fleet between 2018 and 2020. There were only five onboard retained length frequencies collected in the east in 2020, compared to 541 in 2019.
Stock assessment information and RAG comments	Recruitment has been below the long-term average since 2004. Only one additional recruitment deviation was estimated from the previous assessment rather than the usual 3 (removing a known retrospective pattern in estimation). This had no impact in the estimation of stock status.

	An extra time-block on retention from 2018 onwards for the east trawl fleet was also included to allow the model to fit the dramatic increase in discard estimates. This improved the model fits to discard estimates and CPUE in the east trawl fleet. The jump up of stock status at the end of the series, which uses assumed catches in 2021 based on those in 2020 was discussed by SEAG. This projected estimate is not constrained by data inputs, most notably CPUE, and may be an overoptimistic representation of recovery. On the basis that recruitment has been below average since 2004, SERAG recommended adopting a 'low recruitment' base case to use the average of recruitment deviations from 2011-2015 from 2016 onwards. SERAG requested fixed catch projections under the low recruitment scenario and fixed catch projections using the RBC produced from the HCR, and a range of lower catches. The 2021 base case stock assessment estimates that the 2022 spawning stock biomass will be 29% of virgin stock biomass (projected assuming 2020 catches in 2021 under low recruitment scenario) and a 2022 RBC of 587 t (Figure 21). Retrospective analyses under the low recruitment scenario have alleviated concerning patterns observed in previous assessments and in the model with average recruitment projections. Application of the harvest control rule catches estimate that there is no increase in stock status towards the target reference point (48%B_0) and stock status remains at 29%B_0. Projected stock status under constant catch scenarios and the low recruitment scenario are provided below. SERAG noted silver warehou are not a targeted species, and that a reduction to the TAC alone is not likely to constrain total mortality. The TAC is currently set at 450 t, of which 289 t and 307 t was caught in the 2020-21 and 2019-20 fishing year, respectively.

Constant catch scenarios developed using low recruitment projections (average recruitment over the last five years).

Retained catch scenario (t)	Mean discards (t)	2022 (%B_0)	2023 (%B_0)	2024 (%B_0)	2025 (%B_0)	2026 (%B_0)
0	0	29	31	34	36	37
250	59	29	30	31	32	33
350	85	29	30	30	31	31
450	110	29	29	29	29	29
2022 RBC	118	29	29	29	29	29

Projected biomass	 **Figure 21: The estimated time-series of relative spawning biomass 2021 base case assessment with projections applying the HCR to 2070 (Bessell-Browne & Day, 2021)**

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG recommended setting the TAC for the 2022-23 fishing year on the basis of the fixed catch scenarios outlined above, while understanding the risk associated with stock status and time taken to rebuild towards the target.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2024	575	Yes. 3-year MYTAC using the 'low recruitment' constant catch scenario, noting the RBCs from the HCR (left) will not result in any rebuilding to the TRP and estimate stock status will remain at 29%B_0.
	2023	580	
	2022	587	
	3-Year Average	581	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	State catches are very low and are not deducted from the RBC because a TAC based on constant catch is recommended.	
Discards (t)	85	Modelled discards from the 2021 stock assessment.	
Recreational catch (t)	N/A	There are no estimates of recreational catch.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	

Provisional TAC under the Harvest Strategy	506 t - calculated using the 3-year average HCR RBC and modelled discards from the 2021 assessment. However, SERAG recommended setting the TAC based on fixed catch projection, and not the RBC produced by the HCR.

MAC Recommendations

Commercial fishers' interests	Industry have reported that catch rates have recently improved off the east coast from St Helens to Ulladulla. There has been an increase in catches of smaller fish, indicating a level of recruitment.
Species specific management (target, companion and bycatch)	There were no specific management arrangements identified.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

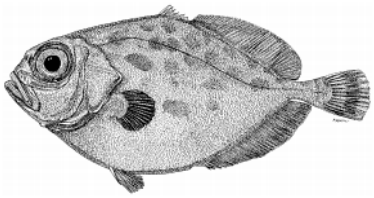
AFMA Management recommends maintaining the TAC of 350 t for the 2023-24 fishing year, the second year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

Fishery indicator data will be monitored closely as part of the annual MYTAC analysis (formally breakout analysis) to ensure there are no sustainability concerns identified.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
350	350	10	2	0

Smooth oreo (Cascade)

Pseudocyttus maculatus



Species summary

Common names	Smooth dory, smooth oreo, spotted dory, St. Pierre				
Stock assessment	Tier 4 Species – last assessed by SlopeRAG in 2010.				
Stock structure	Stock structure of smooth oreodory is unknown. For assessment and management purposes the Cascade Plateau is regarded as a separate stock.				
Stock status against reference points (C_{Lim}/C_{Targ})	**Tier**	**Assessment Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2010	1.3575	0.4989	0.1996
	4	2008	1.962	0.4905	0.1962
	4	2008	96 t (C_{CUR})*	-	-
	*Tier 4 assessment used geometric mean catch rates rather than standardised CPUE				
Stock trend and other indicators	Stock status: the most recent assessment (a Tier 4 assessment in 2010 using data up to 2009) concluded that the CPUE-based biomass proxy was above the target reference point. SlopeRAG (November 2011) questioned the validity of the unrealistically high RBC from the updated assessment, concluding that CPUE may not be an accurate index of abundance. Low catch and effort levels since 2009 have precluded any updates to the Tier 4 assessment. Biomass trend: When last assessed, CPUE had been extremely variable and the fluctuations were considered to be not indicative of changes in stock status.				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	Single year TAC			Continue with 2022 review of catch	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		150	169	-
	2021-22		150	168	0
	2020-21		150	169	6
Economics	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**

(Byproduct) Commonwealth Trawl and Scalefish Hook	2020-21	0	64	0
	2019-20	0	51.32	0
	2018-19	0	49.47	0
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Medium	↓5%	Low	Declines stronger in the north (information relevant to Western Deepwater Trawl)

Assessment summary

Key model technical assumptions/ parameters	The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year. Catch rates are estimated as catch per shot rather than catch per hour.
Significant changes to data inputs	SlopeRAG (October 2010) considered whether data from Zone 70 should be included in the analysis, given that the area was now closed to fishing. Noting the uncertainty of movement of the species between closures and permitted areas, SlopeRAG recommended excluding Zone 70 catches and CPUE from future stock assessments.
Data and RAG comments	Using the standardised catch rates and the updated catches for 2009, the Tier 4 analysis shows the recent catch rates are well above the target, resulting in the calculation of a large RBC (711t). It is uncertain whether the catch rate value for 2009 is valid, as only 60kg of data meet reporting requirements.
Stock assessment information and RAG comments	The rapid changes in apparent catch rates indicates that the observed catch rates are unlikely to be representative of the stock size, therefore the validity of applying a Tier 4 should be considered. SlopeRAG (October 2010) noted that were was a low number of boats, with a low level of catch, and that standardised catch rate contained a large number of errors.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SlopeRAG (October 2010), due to the lack of confidence in CPUE as an indicator of stock status, recommended using the RBC from the previous assessment (247 t) and maintaining the TAC from the 2010-2011 fishing year (150 t). SlopeRAG recommended maintaining the TAC at this level until catches reach at least 10 t.

SERAG (November 2022) noted the there is no basis to change management advice.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2010	711	No. Single year TAC 150 t recommended until catch levels reach at least 10 t.
	2009	770	
	2008	247	
Discount factor (t)	N/A	SlopeRAG (November 2011) determined that a discount factor was not required, due to the TAC being set at a level well below the RBC.	
State catch (t)	N/A	There are no estimates of State catch.	
Discards (t)	N/A	There are no estimates of discards.	
Recreational catch (t)	N/A	There are no estimates of recreational catch.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		150 t	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified
Species specific management (target, companion and bycatch)	Catches are reliant on trawl fishing (primarily for orange roughy) occurring on the Cascade Plateau.
MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

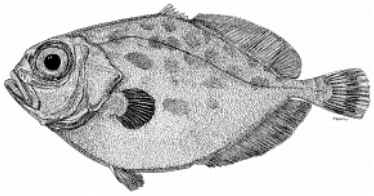
AFMA Advice

AFMA Management recommends a TAC of 150 t for the 2023-24 fishing year, a single year TAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
150	150	10	2	0

Smooth oreo (other)

Pseudocyttus maculatus



Species summary					
Common names	Smooth dory, Smooth oreo, spotted dory, St. Pierre				
Stock assessment	Last considered by SERAG in 2020 using a weight of evidence approach.				
Stock structure	Little is known about the stock structure of smooth oreodory. For assessment and management purposes they are treated as a single unit of stock through the SESSF excluding the Cascade Plateau and South Tasman Rise.				
Stock status against reference points (F_{Cur}/F_{MSY})	**Tier**	**Assessment Year**	**$F_{Current}$**	**F_{MSY}**	**F_{Limit}**
	Weight of evidence approach	2020	$F<F_{MSY}$	F_{MSY} = 0.16	F_{LIM} = 0.23
	Weight of evidence approach	2019	$F<F_{MSY}$		
	Tier 5	2015	N/A 90 t TAC maintains stock >35%B_0		
Stock trend and other indicators	Catches have reduced in the last two seasons and remain below the 90 t TAC.				
Multi-Year TAC	**Year of MYTAC (2022-23)**			**MYTAC advice**	
	Single year TAC			Continue with 2022 data review	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2022-23		90	97	-
	2021-22		90	103	44
	2020-21		135	144	47
Economics (Byproduct)	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2020-21		0.15	64	0.23

Commonwealth Trawl and Scalefish Hook	2019-20	0.13	51.34	0.25
	2018-19	0.33	49.47	0.67
ABARES Status (2022 report)	**Fishing Mortality: Not subject to overfishing**		**Biomass: Not overfished**	
Climate sensitivity	**Sensitivity**	**Preliminary projection**	**Confidence in projection**	**Comments**
	Medium	↓5%	Low	Declines stronger in the north (information relevant to Western Deepwater Trawl)

Assessment summary

Key model technical assumptions/ parameters	The Sustainability Assessment of Fishing Effects (SAFE) provides an absolute measure of risk of overfishing by estimating fishing mortality rates, relative to fishing morality rate reference points (based on life history parameters). To measure fishing mortality, SAFE estimates: - Spatial overlap between species distribution and fishing effort distribution - Catchability resulting from the probability of encountering the gear and size-dependent selectivity - Post capture mortality Fishing mortality is the fraction of overlap between fished area and the species distribution, adjusted by catchability and post-capture mortality. Uncertainty around the estimated fishing mortality is estimated by including variances in encounterability, selectivity, survival rate and fishing effort between years. Assumes that: - Fisheries are impacting local stocks (within the jurisdictional area of the fishery) - There are no local effects from repeat trawls at the same location (i.e. populations rapidly mix between fished and unfished areas) - Mean fish density does not vary between fished and non-fished area within their distributional range.
Significant changes to data inputs	N/A – advice based on weight of evidence approach.
Data and RAG comments	SERAG (October 2019) noted the need to develop a data collection plan, with the intent to undertaking a future quantitative stock assessment.
Stock assessment information and RAG comments	SESSFRAG (August 2019) recommended assessing smooth oreo (other) as a weight of evidence approach recognising issues with the previous Tier 5 assessment, specifically that a key underlying assumption of the methodology – that catch is an indicator of abundance – is undermined because catch has been affected by the closure and then reopening of orange roughy fishing grounds.

	The 2019 Commonwealth Trawl Ecological Risk Assessment assessed smooth oreo (other) as 'low risk' which means the instantaneous fishing mortality rate (F) for the period of the assessment (2012-2016) was less than the F that corresponds to the maximum sustainable fishing mortality (MSM) at B_{MSM}, similar to the target species MSY. Considering the outcomes of the ERA and recent catches, SERAG (October 2019) recommended rolling over the 90 t TAC for a single year, and reviewing catches 2020. SERAG (2022) recommended maintaining the 90 t TAC for the 2023-24 fishing year.
Projected biomass	N/A

Species specific research and priorities

There is no species-specific research currently underway or identified as future priorities.

RAG Recommendations

SERAG (Nov 2022) noted that no new information was available to change its advice recommended a TAC of 90 t for the 2023-24 fishing year, a single year TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	90	No
	2022	90	
	2021	90	
Discount factor (%)	N/A	A discount factor is not applied as the TAC is set based on a weight of evidence approach.	
State catch (t)	N/A	There are no estimates of State catch.	
Discards (t)	N/A	There are no estimates of discards.	
Recreational catch (t)	N/A	There are no estimates of recreational catch.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		90 t	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	No implications for other target, companion or bycatch species have been identified.

MAC advice and any dissenting views	**2023-24 TAC recommendation** TBC at Feb 2023 SEMAC meeting **SEMAC advice and any dissenting views** TBC at Feb 2023 SEMAC meeting

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
TBC	TBC	TBC	TBC

AFMA Advice

AFMA Management recommends a TAC of 90 t for the 2023-24 fishing year, a single year TAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2022-23 agreed TAC (t)	2023-24 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
90	90	10	2	0

Non-Quota species recommendations

Boarfish and orange roughy are non-quota species in the East Coast Deepwater Trawl (ECDWT) Sector and are managed under catch triggers. These triggers were reviewed at the October 2022 SERAG meeting.

As at 21 September 2022, no catch has been recorded in the ECDWT Sector for the 2022-23 fishing year. SERAG recommended a continuation of previous TACs and catch triggers for boarfish and orange roughy in the ECDWT Sector for the 2023-24 fishing year (Table 1); noting that boarfish catches in the ECDWT Sector have been below 100 kg in the 2018-29 and 2019-20 fishing season with no catch reported since and no orange roughy catch has been reported since 2003-04.

SERAG (October 2022) recommended maintaining the 200 t boarfish and 50 t orange roughy catch triggers in the ECDWT Sector for the 2022-23 fishing year (Table 1), with a 50 t data collection trigger to be introduced for boarfish.

There are no undercatch or overcatch provisions for these species in the ECDWT Sector.

SEMAC advice

TBC at Feb 2023 Meeting

AFMA Advice

AFMA recommend maintaining the catch triggers for non-quota species in the ECDWT Sector for the 2023-24 fishing year.

Table 1 Summary of catch triggers for Non-Quota species determination

Non-Quota species	2022-23 Catch Trigger (t)	2023-24 Recommended Catch Trigger (t)	Change from 2022-23 (t)
Boarfish	200	200	0
Orange roughy	50	50	0

Glossary

Biological reference points – quantitative values, often stated in terms of fishing mortality or stock size, that summarise either a desired state for the stock (a target) or a state of the stock that should be avoided (a threshold).

Biomass – the total weight of all the fish in a stock or a component of a stock.

B_{LIM} (biomass limit reference point) – The point beyond which the risk to the stock is regarded as unacceptably high.

B_{MEY} (biomass at maximum economic yield) – Average biomass corresponding to maximum economic yield.

B_{MSY} (biomass at maximum sustainable yield) – Average biomass corresponding to maximum sustainable yield.

B_{TARG} (target biomass) – The desired biomass of the stock.

B_0 (mean equilibrium unfished biomass) – Average biomass level if fishing had not occurred.

CASAL (C ++ Algorithmic Stock Assessment Laboratory) - an advanced software package developed by the National Institute of Water and Atmospheric Research (NIWA, New Zealand) for fish stock assessment. The software implements a generalised age or length structured fish stock assessment model that allows a great deal of choice in specifying the population dynamics, parameter estimation and model outputs.

Catch Per Unit Effort (CPUE) – the number or biomass of fish caught as by a unit of fishing effort. Often used as a measure of fish abundance.

C_{TARG} (Catch target) – The target catch level.

CE_{LIM} (CPUE limit reference point) – the point below which CPUE is too low and can indicate stock depletion.

CE_{TARG} (CPUE target) – The target CPUE rate.

Close Kin Mark Recapture (CKMR) – uses advances in genetics to affordably and reliably identify parent-offspring pairs (and conceivably other types of kin), and then analyses the number and pattern of pairs in a mark-recapture framework.

Commonwealth Trawl Sector Fishery Independent Survey (CTS FIS) - a survey undertaken in the CTS to provide a time-series of abundance indices that are independent from commercial fishing.

Confidence interval – also called the confidence bound, a range of values within which the true value most likely lies.

Determined amount - for a quota species and a fishing year, means the amount (in kilograms) of that species specified in a determination made by AFMA for section 22A of the *Southern and Eastern Scalefish and Shark Fishery Management Plan 2003* for that species and year.

F (fishing mortality) – The instantaneous rate of fish deaths due to fishing a designated component of the fish stock. F reference points may be applied to entire stocks or segments of the stocks and should match the scale of management unit. Instantaneous fishing mortality rates of 0.1, 0.2 and 0.5 are equivalent to 10 per cent, 18 per cent and 39 per cent of deaths of a stock due to fishing.

F_{LIM} (fishing mortality limit reference point) – The point above which the removal rate from the stock is too high.

F_{MEY} (fishing mortality at maximum economic yield) – The fishing mortality rate that corresponds to maximum economic yield.

F_{MSY} (fishing mortality maximum sustainable yield) – The fishing mortality rate that achieves maximum sustainable yield.

F_{TARG} (fishing mortality target) – The target fishing mortality rate.

Great Australian Bight Fishery Independent Survey (GABFIS) - a survey undertaken in the GAB to provide a time-series of abundance indices that are independent from commercial fishing.

Index of abundance – numerical value used to demonstrate the trend in relative abundance over time.

Markov Chain Monte Carlo (MCMC) – an approach to estimate uncertainty in a statistical model by beginning with a final model and shifting its associated parameter values slightly to recalculate the model's goodness of fit thousands or millions of times.

Maximum economic yield (MEY) – The sustainable catch level for a commercial fishery that allows net economic returns to be maximised. For most practical discount rates and fishing costs, MEY implies that the equilibrium stock of fish is larger than that associated with maximum sustainable yield (MSY). In this sense, MEY is more environmentally conservative than MSY and should, in principle, help protect the fishery from unfavourable environmental impacts that could diminish the fish population.

Maximum sustainable yield (MSY) – The maximum average annual catch that can be removed from a stock over an indefinite period under prevailing environmental conditions. MSY defined in this way makes no allowance for environmental variability, and studies have demonstrated that fishing at the level of MSY is often not sustainable.

Mortality – Deaths from all causes (usually expressed as a rate or as the proportion of the stock dying each year).

Multi-Year Total Allowable Catch (MYTAC) – MYTACs are applied for Tier 1, Tier 3 and Tier 4 species where suitable. The Harvest Strategy outlines criteria that should be considered when determining whether a stock is suitable for a MYTAC.

Overfished – A fish stock with a biomass below the biomass limit reference point. 'Not overfished' implies that the stock is not below the threshold.

Overfishing, subject to – A stock that is experiencing too much fishing, and the removal rate from the stock is unsustainable. Also:

- Fishing mortality (F) exceeds the limit reference point (F_{LIM}). When stock levels are at or above B_{MSY}, F_{MSY} will be the default level for F_{LIM}.
- Fishing mortality in excess of F_{LIM} will not be defined as overfishing if a formal 'fish down' or similar strategy is in place for a stock and the stock remains above the target level (B_{TARG}).
- When the stock is less than B_{MSY} but greater than B_{LIM}, F_{LIM} will decrease in proportion to the level of biomass relative to B_{MSY}.
- At these stock levels, fishing mortality in excess of the target reference point (F_{TARG}) but less than F_{LIM} may also be defined as overfishing, depending on the harvest strategy in place and/or recent trends in biomass levels.
- Any fishing mortality will be defined as overfishing if the stock level is below B_{LIM}, unless fishing mortality is below the level that will allow the stock to recover within a period of 10 years plus one mean generation times the mean generation time, whichever is less.

Spawning stock biomass (SB) – the total weight of all adult (reproductively mature) individuals in a population. Also called spawning biomass.

SB_{MSY} – Spawning or 'adult' equilibrium biomass at maximum sustainable yield.

Stock assessment – an evaluation of the past, present and future status of the stock that includes a range of life history characteristics for a species, such as the geographical boundaries of the population and the

stock; information on age, growth, natural mortality, sexual maturity and reproduction, feeding habits and habitat preferences; and the fisheries pressures affecting the species.

Stock Synthesis (SS) – is a statistical age-structured population modeling framework that has been applied in a wide variety of stock assessments globally (Methot & Wetzel, 2013).

Von Bertalanffy (VB) growth model – used in stock assessments to model the mean length or weight of fishes.

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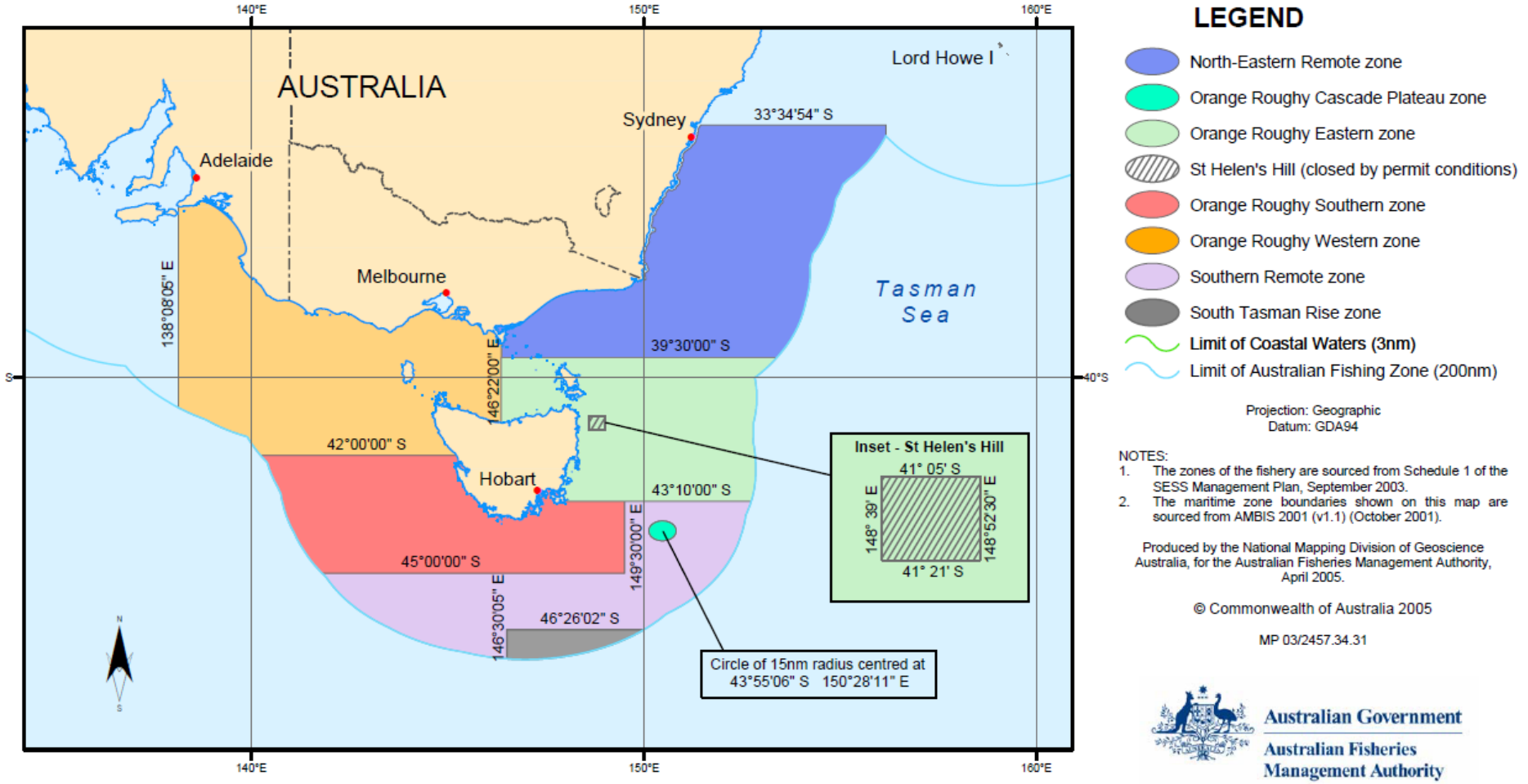
Appendix A – SESSF ISMP Scalefish Zones

Appendix B - Orange Roughy Zones