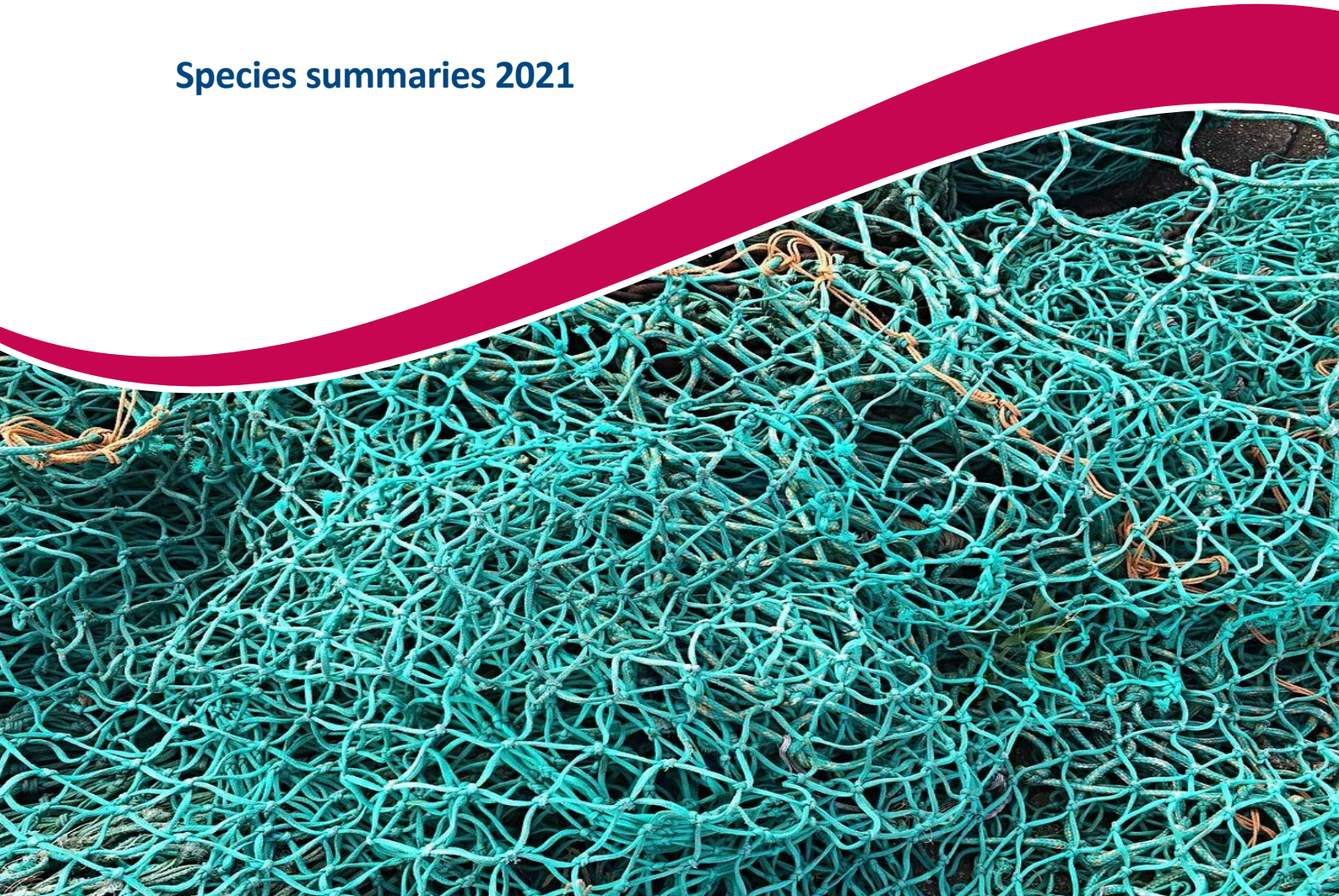
Australian Government

Australian Fisheries Management Authority

Southern and Eastern Scalefish and Shark Fishery (SESSF)

Species summaries 2021



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Summary of Total Allowable Catch (TAC)

Species	2020–21 agreed TAC (t)	2021–22 agreed TAC (t)	Change in TAC from 2020–21 (t)
Alfonsino	1,017	1,017	0
Bight redfish	893	893	0
Blue eye trevalla	448	241[1]	-207
Blue grenadier	12,183	12,183	0
Blue warehou	118	50[2]	-68
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	2,010	2,333	+323
Gemfish (eastern)	100	100[2]	0
Gemfish (western)	300	343	+43
Gummy shark	1,775	1,672	-103
Jackass morwong	468	463	-5
John dory	452	60	-392
Mirror dory	137	144	+7
Ocean perch	239	304	+65
Orange roughy (GAB Albany and Esperance zones)	50	50[2]	0
Orange roughy (Cascade)	500	500	0
Orange roughy (eastern)	1,276	1,277	+1
Orange roughy (southern) including Pedra Branca	125 (94 Pedra Branca, 31 incidental)	127 (96 Pedra Brancs, 31 incidental)	+2
Orange roughy (western)	60[3]	60[3]	0
Oreo, basket	185	139	-46
Pink ling	1,310	1,121[4]	-189
Redfish	50	50[2]	0

[1] A limit applies for the seamount stocks of 108 t over the three-year period with no more than 54 t to be caught in a single year.
[2] Incidental bycatch TAC.
[3] Incidental bycatch TAC and 200 t research catch allowance.
[4] Including 428 t eastern notional catch limit.

Species	2020–21 agreed TAC (t)	2021–22 agreed TAC (t)	Change in TAC from 2020–21 (t)
Ribaldo	422	396	-26
Royal red prawn	403	605	+202
Sawshark	432	509	+77
School shark	195	194[2]	-1
School whiting	788	917	+129
Silver trevally	289	197	-92
Silver warehou	450	450	0
Smooth oreo dory (Cascade)	150	150	0
Smooth oreo dory (other)	135	90	-45

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, Total Allowable Catch (TAC) recommendations from the relevant management advisory committee (MAC), including the Great Australian Bight MAC (GABMAC) and South East MAC (SEMAC), and final agreed TACs as determined by the AFMA Commission for the 2021-22 fishing year.

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.

The *SESSF Harvest Strategy Framework 2009* (the 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 Harvest Strategy is currently being developed for the SESSF. This follows the introduction of the *Commonwealth Fisheries Harvest Strategy Policy 2018* (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 period, the SESSF will continue to operate under the current Harvest Strategy with minor changes proposed to be incorporated in 2021 to introduce Tier 5 harvest control rules.

Ecological Risk Assessment results (bycatch & protected species)

Ecological Risk Assessments (ERAs) were undertaken in 2019 for the sectors of the SESSF identified below, and were supported by SEMAC in February 2020. The reports are in the process of being finalised.

- 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

A separate process is being undertaken to update the remaining SESSF ERAs (including the GHATS scalefish automatic longline and manual hook fleets) and are scheduled to be finalised in 2021. All ERAs will be publicly available when finalised. Results from the current ERAs have no implications for the current TAC setting process.

Other relevant considerations (e.g. climate effects, habitat issues)

Fisheries Research and Development Corporation (FRDC) Project 2016-146 'Understanding factors influencing under-caught TACs, declining catch rates and failure to recover for many species in the SESSF' recommended (amongst other things):

- incorporating the potential impacts of climate change on species abundance into assessments; and
- developing a robust and defensible method 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. In the intervening period, the Resource Assessment Groups (RAGs) have provided advice about productivity and how that has been addressed in assessments.

Operators in the SESSF have reported significant declines in catch rates of flathead and eastern school whiting in the area of the CGG seismic survey, which ran from January 2020 to July 2020. These reports have been supported by results of FRDC Project 2019-072, undertaken by Fishwell Consulting (the Fishwell survey), which found that during the period of the survey catch rates of flathead and eastern school whiting in the survey area reduced by 78.1 per cent and 99.7 per cent respectively, compared to catches outside the survey area (control sites).

Phase three of the Fishwell survey was undertaken from 3 August to 10 September 2020, approximately nine weeks after the CGG survey finished. The analysis shows no statistical difference between catch rates for eastern school whiting at sites inside the area of the survey compared to control sites. However, there is still a significant difference between catch rates for flathead, with a 35 per cent reduction in catch rates in the survey area compared to control sites. A summary of the Phase 1 - 3 surveys are available here.

Phase four of the survey has been undertaken and the results are expected in early 2021. The outcomes of this research will be considered by the relevant RAG when reviewing 2020 catch and effort data later in 2021.

Economic considerations

Key Economic Trends (Source: ABARES)

The CTS and the Shark Hook Sector (SHS) contributed approximately 49 per cent of total SESSF Gross Value of Production (GVP) ($86.85 million) in 2018–19. From 2008–09 to 2012–13, real GVP for the two sectors averaged $65.82 million (in 2018–19 dollars; Figure 1). By 2013–14, GVP had fallen, and has remained below $50 million since. Since 2008–09, declines in the value of blue grenadier and silver warehou catches were the key drivers of the reduction in scalefish GVP. In 2008–09, silver warehou catches were valued at $4.61 million, and blue grenadier catches were valued at $18.26 million. By 2018–19, the GVP of silver warehou catches had declined to $744,000, and blue grenadier catches had declined to $4.55 million. In terms of value during 2018–19, the mix of stocks caught was dominated by tiger flathead ($12.75 million; 26% of total GVP) and pink ling ($6.39 million; 13%).

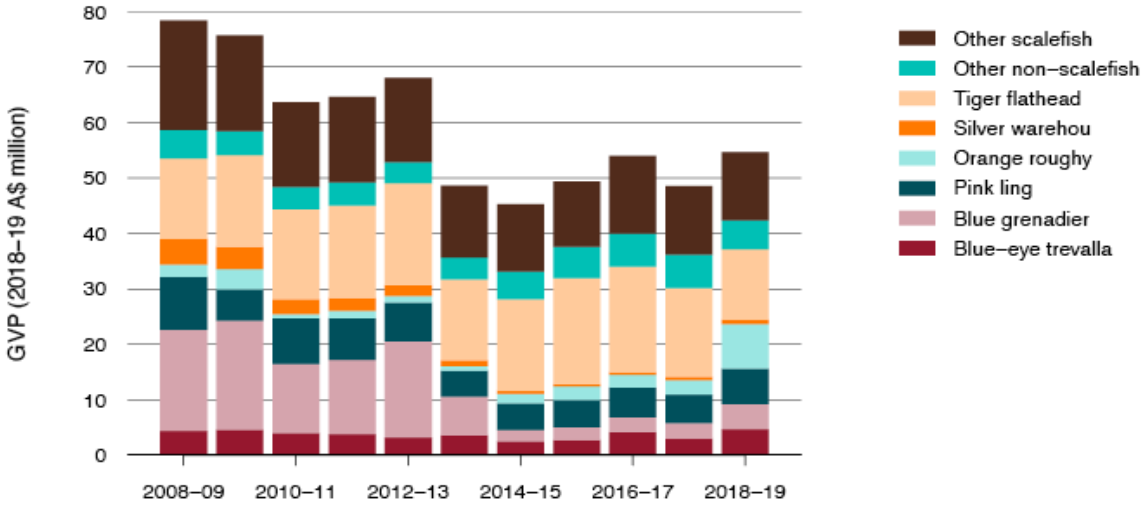


Figure 1: Real GVP, by key stocks, for the CTS and SHS of the SESSF 2008–09 t0 2018–19. Note: 'Real' indicates that value has been adjusted for inflation.

With respect to value, the CTS accounts for most of the scalefish catch (relative to the SHS). ABARES economic surveys of the CTS estimate that net economic returns (NER) in the CTS in 2013–14 were –$1.21 million (Bath et al., 2018). This was the first time they had been negative since 2004–05. The low NER were driven by low fishing income in the fishery as a result of an 11 per cent decline in catch from 2012–13, as well as lower unit prices. NER rose to reach $4.06 million by 2016–17 as a result of a fall in operating costs that exceeded a slight fall in fishing income (Mobsby forthcoming). The increase in NER in this period was supported by improvements in fishers' terms of trade. Preliminary estimates from the survey suggest that NER were –$0.17 million in 2017–18 and –$1.07 million in 2018–19 (Figure 2). NER are estimated to have decreased in 2017–18 and 2018–19 because lower levels of income are expected and operating costs are estimated to be higher as a result of higher levels of effort (trawl-hours and shots) in the fishery combined with higher unit fuel prices.

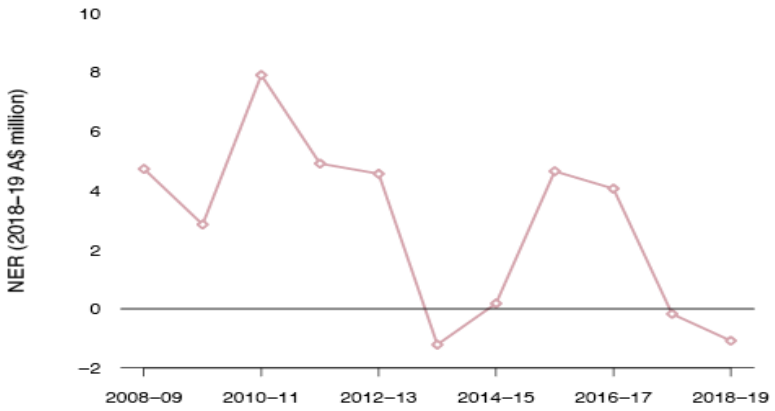


Figure 2: NER for CTS by financial year, 2007–08 to 2018–19.
Note: Results for 2017–18 and 2018–19 are preliminary, non–survey based estimates.

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

GVP in the GABTS declined by 7 per cent in 2018–19 to $8.5 million. This was the result of a fall in landed catch more than offsetting an increase in average prices. The value of deepwater flathead—a key commercial stock in the sector—declined by 9 per cent to $4.1 million (to be around 50% of total GVP), and the value of Bight redfish (the second most valuable stock caught in the sector) fell by 17 per cent to $1.1 million (to be around 13% of total GVP).

Between 2008–09 and 2018–19, GVP in the GABTS declined by 23 per cent in real terms (Figure 3). Reductions in GVP occurred across a number of species; however, deepwater flathead and Bight redfish accounted for most of the decline. Since 2008–09, there has been a trend of declining GVP, which has been the result of a similar declining trend in landed catch more than offsetting a rise in average prices.

Changes in hours trawled have generally been closely related to changes in GVP over the period 2008–09 to 2018–19 (Figure 3). Hours trawled in the sector decreased by 25 per cent from the 2008–09 fishing year to the 2018–19 fishing year, while GVP declined by 23 per cent in real terms between the 2008–09 and 2018–19 financial years.

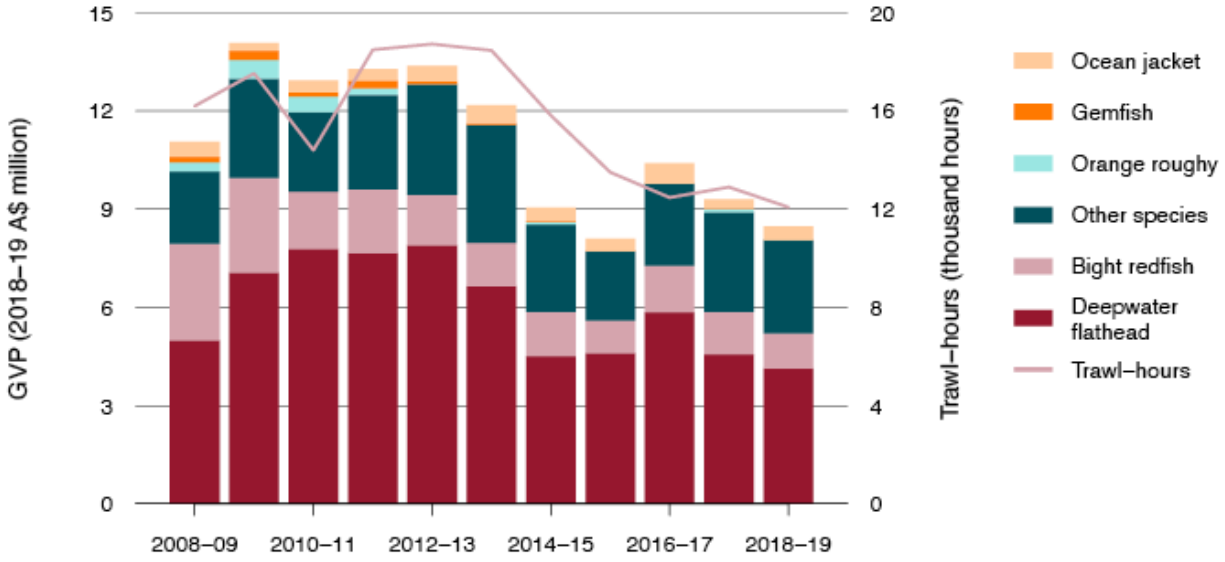


Figure 3: Real GVP for the GABTS of the SESSF, by key stock and trawl-hours, 2008–09 to 2018–19. Note: Trawl-hours do not include Danish seine effort. 'Real' indicates that value has been adjusted for inflation.

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

The real GVP in the SGSHS for the four shark species taken in the GHATS declined from a peak of $28.2 million in 2008–09 to $17.21 million in 2013–14 and then recovered to $23.66 million by 2018–19 (Figure 4). This recent recovery is primarily the result of higher volumes of gummy shark catch. Gummy shark accounts for the majority of GVP in the SGSHS (89% in 2018–19).

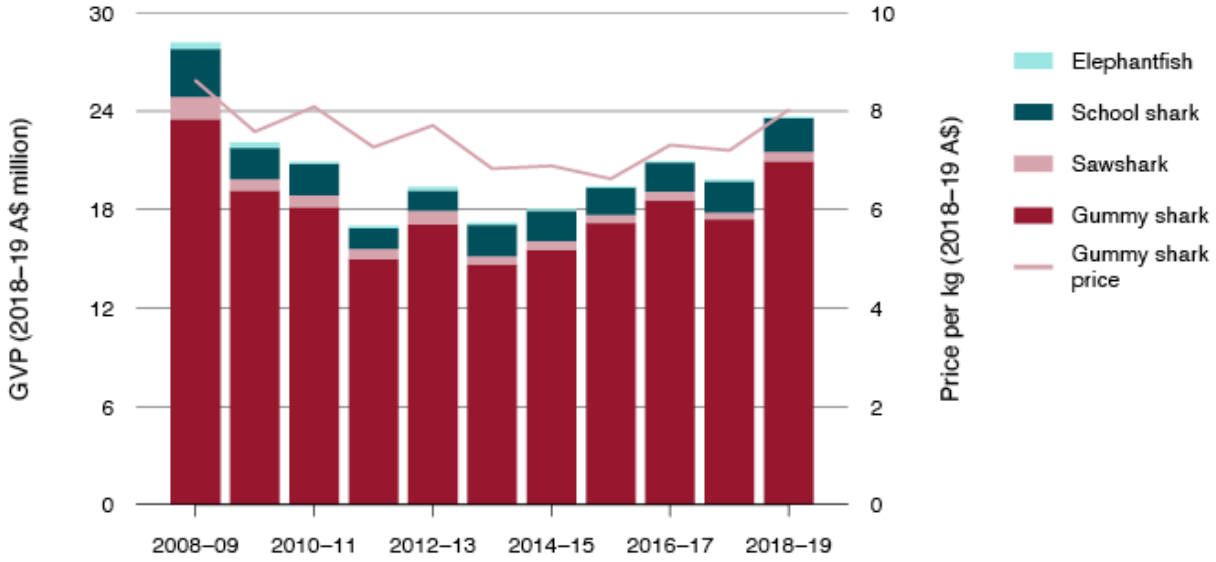


Figure 4: Real GVP for the SGSHS of the SESSF, by key species, and real price for gummy shark, 2008–09 to 2018–19. Note: 'Real' indicates that value has been adjusted for inflation.

The four shark species that make up the SGSHS catch—gummy shark, school shark, sawshark and elephant fish—accounted for around 74 per cent of the GHATS GVP in 2018–19, with scalefish species making up the remainder. Therefore, overall economic performance in the GHATS may contribute to an understanding of the economic status of the SGSHS.

Survey-based estimates of revenue, costs and NER in the GHATS are available for 2016–17, and preliminary estimates are available for 2017–18 and 2018–19 (Figure 5). In 2017–18, non–survey based estimates indicate that NER became negative, −$3.4 million, potentially a result of lower catch volume of gummy shark and higher unit fuel prices. In 2018–19, non–survey based estimates show a strong recovery, with NER estimated to reach $5.6 million, largely driven by a significant increase in fishing revenue from higher catch volumes and lower overall fishing costs.

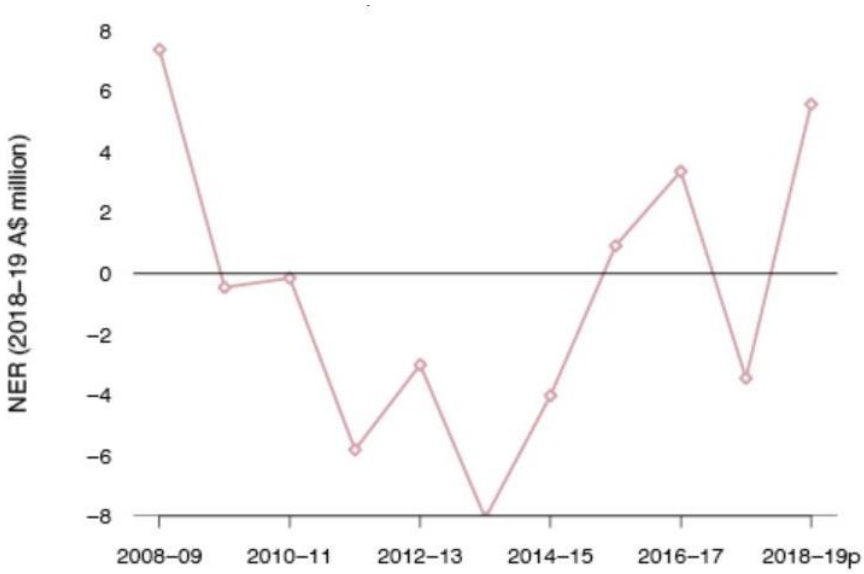


Figure 5: Real NER for the GHATS of the SESSF, 2008–09 to 2018-19. Note: NER estimates for 2018–19 are preliminary non-survey based estimates.

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 constrain the catches of shark to within SA's agreed allocation. AFMA is also working with NSW to develop complementary management arrangements and observed the NSW Total Allowable Fishing (TAF) Committee meeting, where TACs for NSW trawl species were being considered. AFMA also attend the NSW trawl whiting harvest strategy as an observer.

In addition, AFMA is also attending meetings held by the NSW Department of Primary Industries (DPI) in relation to developing specific Harvest Strategy documents for relevant fisheries, including the NSW Trawl Whiting Sector (first Harvest Strategy to be developed).

Recreational fishers' interests

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

The Harvest Strategy provides for recreational catches to be deducted from the RBC to produce a TAC (where recreational catches are included in the assessment).

Recreational catch information is listed in the relevant species summary below. However, 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.

Concerns have been raised by SEMAC and SESSFRAG regarding the paucity of recreational catch data, particularly for recreationally important species such as gummy shark, school shark, blue-eye trevalla and silver trevally. The MAC noted that CSIRO would be liaising with each of the state agencies in 2021 to obtain all available state data, and emphasised 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 February 2020, there was a call for applications for an FRDC-funded project for the development of an Indigenous Engagement Strategy, for future AFMA engagement with Indigenous fishing interests in Commonwealth fisheries management decisions.

As at the date of this paper, no Indigenous fishers' interests have been identified that would impact on SESSF TACs for the 2021–22 fishing year.

Intersection with State and International fisheries

Where State catches are included in the 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[5]. 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 are considered when making Commonwealth TAC recommendations in this paper for species where NSW State catches are deducted.

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

Fishery wide data and analysis considerations

Data uncertainty and impacts on TACs under the Harvest Strategy

The absence of complete or up to-date observer data can create uncertainty around stock assessments. Historically, SESSFRAG has highlighted concerns about significant underachievement of the Integrated Scientific Monitoring Program (ISMP) observer sampling targets over a number of years. ISMP coverage continues to improve in 2020, despite the impacts of COVID-19 on the ability to deploy observers. Species-specific issues are detailed in the summaries below.

Electronic monitoring (EM) was introduced across the GHATS in 2015. The use of data collected through EM is being investigated for assessments for key species in this sector. An industry-based crew member observer program commenced in October 2018 to supplement the GHATS EM program. The program, run by the Southern Shark Industry Alliance (SSIA), employs trained crew members and undertakes port sampling to collect biological information for target species.

Revisions to the catch series used to estimate discards resulted in some significant changes to the weighted average discards for some species, notably ocean perch and oreo (basket).

[5] 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.

Key fishery projects and developments relating to TACs

Minor changes to the Harvest Strategy proposed for 2021-22

While the SESSF Harvest Strategy is being reviewed as part of the Multi-Species Harvest Strategy project, minor changes are proposed for 2021 as recommended by SESSFRAG at their March 2020 meeting:

1. to enable multispecies considerations rather just single species considerations where appropriate;
2. the development of harvest control rules to enable the conversion of Tier 5 assessment outcomes into TACs, noting Tier 5 methods may be broader than those currently specified, and these methods may need different harvest control rules; and
3. provide guidance on how to recommend TACs if a species assessment has not been updated within the specified MYTAC period.

The recommendations from a working group will be considered by SESSFRAG at their March 2021 meeting and the Commission will be asked to consider the proposed changes to the Harvest Strategy later in 2021, before the 2022-23 TAC setting process commences.

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 recommended based on modelled-projections from the most recent stock assessment, as either single-year RBCs or average 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: Currently, RBCs are not recommended based on Tier 5 assessments or using a 'weight of evidence' approach. Rather, TACs are recommended either as single-year TACs or MYTACs.

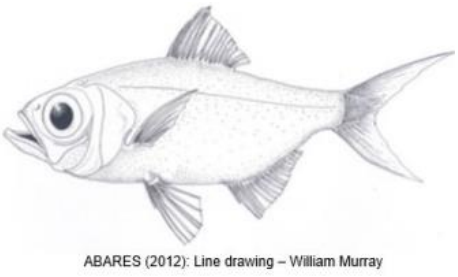
Where a MYTAC has been recommended, the RBC/TACs for that period are included in the tables below. Where a single-year TAC has been recommended, only the 2021 RBC/TAC is included in addition to the previous two years' RBC/TAC.

Discount factor

Consistent with the HSP, which establishes a more precautionary approach to harvest control rules for species subject to more uncertain assessments, the Harvest Strategy allows for application of a 15 per cent discount factor to RBCs derived from Tier 4 assessments, however this is not applied for all species. 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 East Coast Deepwater Trawl (ECDWT) Sector, as this is the only resource under quota management.

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

Tier	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

See CPUE Report

See Data Summary

Catches remain well below the TAC as no 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).

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.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
6th of 3-year	Yes SESSFRAG (August 2020) recommended continuing the MYTAC, with future assessment needs to be reviewed if catches increase.

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	1,017	1,119	-

	2019-20	1,017	1,119	6
	2018-19	1,017	1119	12
	2017-18	1,017	1119	0
Economics (Byproduct) East Coast Deepwater Trawl	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	Confidential	Confidential	Confidential
	2017-18	Confidential	Confidential	Confidential
	2016-17	Confidential	Confidential	Confidential
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	N/A
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. RBC calculations used to set TAC are taken from the AFZ only.

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 three- 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.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	1,070*	Yes
	2020	1,070*	

	2019	1,070*	3-year MYTAC recommended, using 3-year average RBC of 1,070 t.
	* 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	The default Tier 3 discount factor of 5 per cent 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	**2021-22 TAC recommendation** 1017 t Extend the MYTAC to 2021-22. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	1,017

Final agreed TAC

The AFMA Commission determined a TAC of 1,017 t for the 2021-22 fishing year, the seventh year of a 3-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020–21 agreed TAC (t)	2021–22 agreed TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,017	1,017	10	2	0

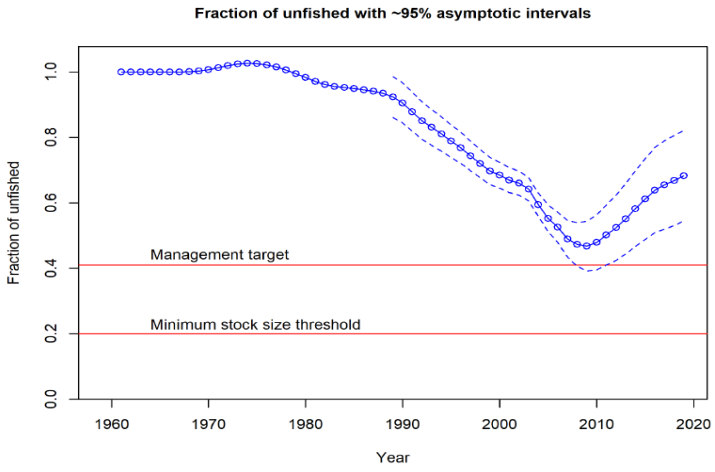
Bight redfish

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 2019.				
Stock structure	Assessed as a single stock				
Stock status against reference points (%B_0)	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2019	65	41	20
	1	2015	63		
	1	2011	90		
Stock trend and other indicators [See CPUE Report] [See Data Summary]	Modelling suggests a slow decline in abundance, consistent with the fish-down of a developing fishery to near the target in 2009, with a steady increase to an estimated biomass of 64%B_0 at the start of 2020. 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. The current biomass is higher than the target biomass.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	1st of 5-year			**No** GABRAG (October 2020) recommended maintaining the 5-year MYTAC. GABRAG recommended fishery indicators be reviewed annually.	
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC (t)**	**TAC (t) after unders/overs**	**Cth Retained Catch**	
	2020-21	893	953	-	
	2019-20	600	680	170	
	2018-19	800	880	220	
Economics (Primary) Great Australian Bight Trawl	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**	
	2018-19	1.07	8.48	12.62	
	2017-18	1.30	9.16	14.19	

	2016-17	1.43	10.04	14.24
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	
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, Great Australian Bight Fishery Independent Survey (GABFIS)). Selectivity allowed to vary between GABFIS trawl fleet. Discards: minimal (ignored). Natural morality rate *(M)*: estimated at 0.1017 (well estimated, range 0.093-0.11). Recruitment: estimated (1960-2003).			
Significant changes to data inputs	The catch series was revised to include catches up to 2018–19, including replacing the estimated catch data used in the last assessment with actual catch. The standardised Catch Per Unit Effort (CPUE) series was updated to April 2018. Length frequency data up to 2018–19, and age-at-length data up to 2017–18 (including GABFIS age-at-length data from 2008) was included using an updated age error matrix. The final year of recruitment estimation changed to 2003.			
Data and RAG comments	Standardised catch rates only include data up to April 2019. Errors detected during processing of the data prevented inclusion of additional data to June 2019 in the catch rate standardisation and including this updated catch rate series as a sensitivity. Recruitment was only estimated up to 2003 (previously to 2005). The variance was high on the last few recruitment events in the previous assessment, and selectivity suggest recruitment at age 15 is more appropriate than at age nine. The likelihood profile for natural mortality indicates that *M* is reasonably well estimated. The age data are most influential, with biomass index data (higher mortality) and length data (lower mortality) showing some conflict. The likelihood profile for steepness (*h*) is uninformative The likelihood profile for spawning stock biomass (SSB_0) is broad and hence is not precisely estimated. The biomass index and trawl age data are most influential. The likelihood profile for spawning stock biomass at the end of the time series (SSB_{2018}) is broad and not precisely estimated. The index and recruitment data are most influential, though there is a conflict between the two. The likelihood profile for relative stock status (depletion at 2018-19) is broad and hence relative stock status is not precisely estimated. The index and recruitment data are the most influential, though there was conflict between the two. GABRAG (December 2018) noted concerns with decreases in commercial catches and a continuing decline in the GABFIS index of abundance. GABRAG recommended that the RBC for Bight redfish for the 2019–20 fishing year be reduced to 600 t and that the stock assessment be moved forward from 2020 to 2019.			

	November 2019 GABRAG noted the following: - CPUE is unlikely to be an accurate index of abundance for Bight redfish, as catches are taken from aggregations over only a few months. - GABFIS age data was missing from the SESSF Data Summary for Bight redfish. - There are no clear cohorts apparent in the ISMP data, concerns regarding the decrease in number of large fish (in the length compositions) over the past few years.
Stock assessment information and RAG comments	November 2019 The model was not adequately able to fit the decline in the initial part of the CPUE series (i.e. 1987–1994) and the model fits to commercial CPUE are generally poor. The inter-annual variation in CPUE over time is unexpected for such a long-lived species; this may be driven by availability, rather than changes in biomass. The market value of Bight redfish could also influence CPUE if targeting is not occurring. Seven out of the last ten recruitments are above average. While the standardised CPUE series and GABFIS abundance indices may be influenced by availability, GABRAG urged caution, noting a similar instance for the eastern redfish stock; where the model and stock indicators suggested the stock was sustainable, and was later assessed to be overfished.
Projected biomass	The projected 2020–21 spawning stock biomass is estimated to be 64%B_0. The biomass is expected to reach the target reference point beyond 2040, assuming average recruitment and the RBC is fully caught.  **Figure 6: Time-trajectory of spawning biomass depletion (with approximate 95% asymptotic intervals) corresponding to the maximum posterior distribution (MPD) estimates for the base case analysis for Bight redfish (Sporcic, Day and Burch 2019).**

Species specific research and priorities

Great Australian Bight Fishery Independent Survey (GABFIS)

A FIS is scheduled for April 2021 which will provide further points in the times-series of FIS abundance indices. The resulting FIS data series will be included in stock assessments of target species and time series analysis of major by-product and by-catch species.

RAG Recommendations

GABRAG (February 2020) recommended up to a five year RBC, using either the single year RBCs or the average across the chosen period. Fisheries indicators are to be monitored annually to ensure key inputs to the Tier 1 assessment (CPUE, age/length frequencies) do not change.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2024	813	Yes. 5-year MYTAC recommended using 5-year average RBC of 912 t
	2023	856	
	2022	905	
	2021	961	
	2020	1,024	
	5-year average	912	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	19.2	Estimates of State catches from SA.	
Discards (t)	N/A	Estimates of discards are considered to be low and are not deducted from the RBC.	
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		893 t	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	GABRAG has noted concerns regarding the lower catches of Bight redfish in recent years; with the species being taken as bycatch when targeting deepwater flathead.

MAC advice and any dissenting views	**2021-22 TAC recommendation** 893 t Second year of a five-year MYTAC. **SEMAC advice and any dissenting views** There were no dissenting views and GABMAC (October 2020) were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	893

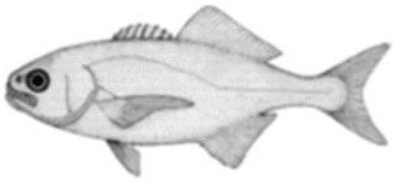
Final agreed TAC

The AFMA Commission determined a TAC of 893 t for the 2021-22 fishing year, the second of a five-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020–21 agreed TAC (t)	2021–22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
893	893	10	2	0

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 considered by SERAG in 2020. Catch-Maximum Sustainable Yield (MSY) and age-structured stock reduction analysis for the seamount stock considered by SERAG in 2018.
Stock structure	Blue-eye trevalla is managed as a single stock in the SESSF. 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 geographically 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 global TAC continues to be set for blue-eye trevalla.

SLOPE

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

Tier	Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2020	0.7656	1.2321	0.5134
4	2018	0.9994	1.2288	0.512
4	2016	0.9230	1.0660	0.4442

SEAMOUNT

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

Tier	Year	Biomass	Target	Limit
5	2018	33	48	20

No previous assessment.

Stock trend and other indicators

See CPUE Report

See Data Summary

Total blue-eye trevalla catches have declined from 687 t in 2004 to 300 t in 2019.

Slope

Standardised CPUE has decreased over the last five years from above the target reference point in 2014 to a point just above the limit reference point in 2019. At its February 2020 meeting, SEMAC noted industry concerns about decreases in catch rates in 2019. SESSFRAG (August 2020) recommended bringing the Tier 4 assessment forward one year, to 2020.

Seamount

While highly uncertain, the catch-MSY analysis generates an MSY of about 45-50 t with a depletion estimate of about 33%B_0. Constant catches of 40 t or less would maintain stock status at the proxy target of 48%B_0. The age-structured stock reduction analysis gives approximately the same answer as the catch-MSY assessment.

<table>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="2">Year of MYTAC (2020-21)</td><td colspan="2">Have breakout rules been triggered?</td></tr>
<tr><td colspan="2">2nd of 3-year</td><td colspan="2">Yes
SESSFRAG (August 2020) recommended bringing the slope Tier 4 assessment forward to 2020.</td></tr>
<tr><td rowspan="5">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>2020-21</td><td>448</td><td>493</td><td>-</td></tr>
<tr><td>2019-20</td><td>458</td><td>499</td><td>217</td></tr>
<tr><td>2018-19</td><td>462</td><td>502</td><td>377</td></tr>
<tr><td>2017-18</td><td>458</td><td>444</td><td>329</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>2018-19</td><td>4.65</td><td>49.47</td><td>9.40</td></tr>
<tr><td>2017-18</td><td>2.94</td><td>41.86</td><td>7.02</td></tr>
<tr><td>2016-17</td><td>4.05</td><td>46.42</td><td>8.72</td></tr>
<tr><td>ABARES Status
(2020 report)</td><td colspan="2">Biomass: Not overfished</td><td colspan="2">Fishing Mortality: Not subject to overfishing</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.

Both assessments assume that biomass was unfished prior to 1985 (when fishing started).

Slope

In September 2015, SlopeRAG agreed to use a revised catch per hook metric in the Tier 4 analysis in place of the previously used catch per record/day. SlopeRAG considered the updated analysis to be a better reflection of CPUE in the early part of the fishery.

Seamount

Catch-MSY

The catch-MSY assessment is a data-poor approach which makes assumptions about unfished biomass and requires a minimum amount and quality of data.

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</td></tr>
</table>

	analysis and assumes that there must have been at least twice the biomass relative to what was caught in any year.
Significant changes to data inputs	Slope Since 2018, the assessment has used catches from Zone 10 to 83, and CPUE from non-trawl catches in Zones 20 to 50. Seamount No previous Tier 5 assessment for seamounts.
Data and RAG comments	Slope Early records of high discards are likely from trawl. There are no significant discards and as such are not included in the Tier 4 assessment. Revised NSW annual catches were provided from 1986 onwards, noting the assessment only used catches from 1997 onwards. Seamount It is difficult to get representative catch data from logbooks. There are a number of methods that can estimate the catch and uncertainty around accuracy of reporting.
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. It is likely that CPUE is impacted by applying CPUE standardisations across the distribution. The most recent estimate of standardised CPUE (0.53) has decreased to be just above the limit reference point (0.51). This is consistent with industry comments at the February 2020 SEMAC meeting that catch rates had decreased, and was the reason for bringing the assessment forward one year. The four-year average CPUE has decreased since the 2018 assessment, resulting in an RBC of 227 t from the 2020 assessment, compared to 439 t from the 2018 assessment (Sporcic, 2020a). Seamount *Catch-MSY Analysis (2018)* Without extra information, such as an index of relative abundance, the default assumptions of the catch-MSY lead to highly uncertain outcomes. For all other assessments, SERAG would use the median of the estimate in generating RBC advice, however this assessment has not been MSE tested. Dr Haddon suggested treating the median as a summary rather than the 'best estimate' of stock status. In the absence of any other information, it is still the most appropriate estimate. While highly uncertain, the catch-MSY analysis generates an MSY of about 45-50 t with a depletion estimate of about 33%B_0. Constant catches of 40 t or less would maintain stock status at the proxy 48%B_0. *Age-structured stock reduction analysis (2018)* The age-structured stock reduction analysis gives approximately the same answer as the catch-MSY assessment. Constant catches leading to relative stability in depletion were estimated at about 25 t for lower productivity combinations of *M* and h (0.08, 0.6) and 48 t for higher productivity combinations (0.12, 0.8)

	Considering plausible productivity (biology and maximum age) SERAG suggested M = 0.08 and h = 0.75, which is consistent with what New Zealand use. SERAG agreed to a constant catch of 36 t based on the constant catches generated when values of h = 0.7 and h = 0.8. SERAG (November 2018) recommended allowing up to 50 per cent of the combined 3-year RBC (54 t) to be taken in any given year from the seamounts. This recognises the economics of the fishery and that catches up to this level do not represent a risk to the stock.
Projected biomass (Tier 5)	The Tier 5 assessment assumed that constant catches of 36 t would maintain stock stability or slow stock changes.

Species specific research and priorities

Blue-eye close-kin scoping study

Blue-eye trevalla is one of the few target species not assessed at a Tier 1 level. A close kin study could help to determine population characteristics. The proposed study will provide a sample design and costing for a sampling study. The subsequent study would aim to determine whether current catches are sustainable and if the stocks are at target levels, using close kin samples.

RAG Recommendations

SERAG (November 2020) recommended a single year TAC combining the RBC of 227 t from the 2020 Tier 4 assessment for the slope stock and the RBC of 36 t from the 2018 Tier 5 assessment of the seamount stock (November 2018).

	Year	RBC (t): Slope	RBC (t): Seamount	Is a MYTAC recommended?
Recommended Biological Catch (t)	2021	227	36	**No.** SERAG recommended setting a single-year MYTAC, which will allow for the Tier 4 and Tier 5 assessments and TAC period to align moving forward. Up to 50 per cent of the combined seamount 3-year RBC (54 t) could be taken in any year.
	2020	449	36	
	2019	439	36	
Discount factor (t)	N/A	SERAG recommended not applying the discount factor due to the conservative estimate of the Tier 4 RBC due in part to unaccounted orca predation and protection afforded by fishing closures.		
State catch (t)	22.1	Estimates of State catches mostly from NSW.		
Discards (t)	N/A	Estimates of discards are considered to be low, 7 t, 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.		

Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		241 t

MAC Recommendations

Commercial fishers' interests	Industry have noted that the seamount stock of blue eye trevalla is an episodic fishery with high operating costs given the travel time. Some operators may visit the seamounts as part of operations on the high seas. Other operators may fish the seamounts until catch rates are no longer economically viable and then not fish the area for a number of years.
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 TAC. Trigger to be implemented for the seamount stocks, with no more than 54 t to be taken in any fishing year.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 241 t Single-year TAC. **SEMAC advice and any dissenting views** An industry invited participant referred to a letter distributed to the MAC on the morning of 2 February 2021, noting the following: - The CPUE series used in the Tier 4 assessment excludes catch and effort data from important areas in the fishery, and may not truly reflect the status of the stock; - Industry recognise there need to reduce in the TAC, however, is concerned that the TAC is being reduced by 46 per cent. SEMAC noted there has been a decline in catch rates, with the 2019 CPUE point the lowest ever, and is sitting just above the limit reference point. There is a need to reduce catches to ensure the decline does not continue. CSIRO request recreational catch data from the relevant state agencies each year, however it is often either not available or cannot be provided. It is likely that recreational catch has increase in recent years with improvements in fishing technology, however, this is not accounted for in the assessment or TAC setting process. The MAC suggested resolving this issue for future assessments. Commonwealth catch as of 24 December 2021 was 92 t, compared to 99 t at the same time last year. Industry expect caches to increase over the next few months. The Harvest Control Rule under the SESSF Harvest Strategy is designed to return the stock to the target reference point, and the resulting RBC should be considered the most appropriate level of catch. SEMAC recommended that SERAG consider CPUE from all zones of the fishery to ensure the 2021 Tier 4 assessment uses representative catch and effort data.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	241

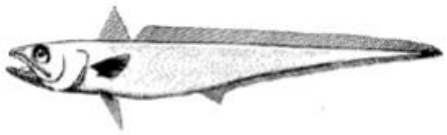
Final agreed TAC

The AFMA Commission determined a 2021-22 TAC of 241 t, a single-year TAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
448	241	10	2	-207

Blue grenadier

Macruronus novaezelandiae



ABARES (2012) Line drawing - Rosalind Poole

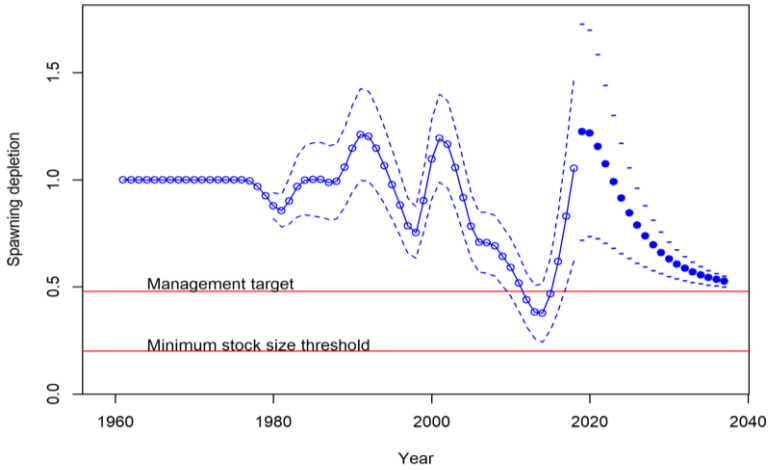
Species summary

Common names	Hoki, blue hake, whiptail				
Stock assessment	Tier 1 Species - last assessed by SERAG in December 2018.				
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 ($\%B_0$)	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2018	122	48	20
	1	2013	94		
	1	2011	77		
Stock trend and other indicators See CPUE Report See Data Summary	Updates to the model down-weighted the large recruitment estimated in 1993, which led to a decrease in the spawning biomass below the target (48%B_0) from around 2011 to 2015. Biomass has increased to be above virgin stock biomass (122%B_0) at the start of 2019, due to high recruitment from 2010 to 2015.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	2nd of 3-year			Yes SESSFRAG (August 2020) recommended continuing the current MYTAC and ensuring the Tier 1 assessment is updated in 2021.	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		12,183	13,316	-
	2019-20		12,183	11,964	7,044
	2018-19		8,810	9,636	1,809
	2017-18		8,765	9,627	1,624
Economics	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**

(Primary) Commonwealth Trawl and Scalefish Hook	2018-19	4.55	49.47	9.20
	2017-18	2.80	41.86	6.69
	2016-17	2.54	46.42	5.47
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	2 sex model, age-structured Steepness (h) is fixed at 0.75 Recruits estimated between 1974 and 2014 Maturity: 50% female maturity at 63.7 cm The base case estimates natural mortality (M) for females at 0.174 and uses 1.2Mf to provide M for male at 0.209. SERAG (September 2018) requested that M for males be estimated in the model. This resulted in female M estimated at 0.154 and male M at 0.230.
Significant changes to data inputs	CTS FIS non-spawning abundance index included.
Data and RAG comments	There are good fits to age and length data, as well as acoustic surveys. Model fits to the non-spawning fishery CPUE are poor. The model suggests a strong period of recent recruitment.
Stock assessment information and RAG comments	The addition of new data through 2017 imply a reduction in spawning biomass to below the target reference point in 2012. Concern was raised about the estimated 2010 recruitment in the last assessment. This now appears to be supported by subsequent age/length data. The model projected discards are based on current fleet structure (wet boats). Factory freezer vessels do not discard. If the RBC were caught, it would be largely by factory vessels, in which case the actual discards would be lower. The large increase in biomass, and hence RBC, is largely driven by five years of above average recruitment. The spawning stock biomass is estimated to be 122%B_0 and it is expected to take many years to reduce the stock to target reference point. There may be short-term economic benefits to fishing at a higher rate. There was a suggestion that the RBC is only applied over 2 years so that recruitment and biomass can be monitored. SERAG (September 2018) recommended looking at likelihood profiles for M as part of the next stock assessment. SERAG (November 2020) considered the potential impacts of catching a large proportion of the TAC from the spawning aggregation and noted the following: - The model projections assume that the full RBC is caught, and there are different selectivity functions for the spawning fleet and the wet boat fleet, which accounts for a large proportion of the TAC potentially being taken from the spawning aggregation.

	- SERAG was not concerned that catching a large proportion of the TAC from the spawning aggregation would have any long-term impacts on sustainability.
Projected biomass	The biomass is not expected to reach the target reference point until after 2037 when catches are projected under the harvest control rule.  **Figure 7: The time series of spawning biomass depletion with a projection to 2037 (Castillo-Jordán and Tuck 2018).**

Species specific research and priorities

Analysis of blue grenadier acoustic survey data (Industry 2019) for inclusion in the 2021 Tier 1 stock assessment

Acoustic data was collected from the factory freezer vessels that fished blue grenadier in 2019 and 2020. Some factory vessels are equipped with gear that collects acoustic data. These data were collected as part of commercial fishing operations in 2019 and 2020, however, has not been analysed. The AFMA Research Committee recently considered an Expression of Interest to analyse the existing data and undertake future surveys.

Whilst the current stock status is estimated to be well above target, continued collection and analysis of survey points is worthwhile. There have not been any new survey points for some years and, as they are influential in the model, additional evidence to support the current healthy stock status would be valuable.

Blue grenadier is due for a Tier 1 assessment in 2021. Any analysis of these data would need be undertaken prior to the next assessment in order for it to be incorporated. The cost needs to be established, which includes consideration of whether the new data will fit in the existing index of abundance or if a new series will be needed.

RAG Recommendations

SERAG (November 2018) recommended a three year RBC, using either the single year RBCs or the three year average.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	11,052	Yes. 3-year MYTAC using 3-year average RBC 12,183 t (2018 stock assessment).
	2020	12,238	
	2019	13,260	
	3-year average	12,183	

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 since 2013, and none greater than 0.6 t since 2000.
Discards (t)	N/A	Discards are estimated in the model, however are not included in the RBC and do not need to be deducted.
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		12,183 t

MAC Recommendations

Commercial fishers' interests	The proportion of the TAC caught has increased over the last two fishing years due to factory freezer boats fishing the winter spawning aggregation. 47 per cent of the 2019-20 TAC was caught, and as of 1 February 2-21, approximately 93 per cent of the 2020-21 TAC had been caught.
Species specific management (target, companion and bycatch)	SERAG (November 2018) recommended looking at the proportion of silver warehou bycatch in the grenadier fishery (including factory vessel catches). A review of catch and discards indicated that increases to blue grenadier TAC did not appear to be significantly impacting silver warehou catches/discards.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 12,183 t The third year of a three-year MYTAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	12,183

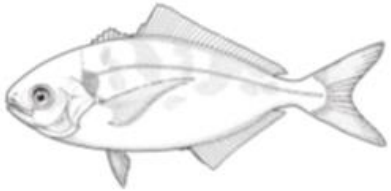
Final agreed TAC

The AFMA Commission determined a TAC of 12,183 t for the 2021-22 fishing year, the third year of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
12,183	12,183	10	2	0

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. Rebuilding strategy reviewed by SERAG in 2020.				
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**	**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**	**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 See CPUE Report See Data Summary	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 The standardised CPUE for both stocks continue to be low and declining in 2019, however, due to avoidance of blue warehou by operators, the use of CPUE as an index of abundance is no longer considered reliable. Catch against TAC Since the implementation of the 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 and 118 t in 2012-13. The TAC has remained at 118 t since 2012-13. Commonwealth catches have always been less than the incidental TAC, with the TAC being 9 per cent caught in 2019-20.				

Multi-Year TAC	Year of MYTAC (2020-21)	Have breakout rules been triggered?
	N/A – Rebuilding species	N/A

Catch and TAC (t)	SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
	2020-21	118	118	-
	2019-20	118	118	10
	2018-19	118	118	54
	2017-18	118	118	25

Economics (Secondary) Commonwealth Trawl and Scalefish Hook	Financial year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2018-19	0.17	49.47	0.34
	2017-18	0.11	41.86	0.26
	2016-17	0.04	46.42	0.09

ABARES Status (2020 report)	Biomass: Overfished	Fishing Mortality: Uncertain

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 a large amount of small fish were discarded. Recent estimates of discards are much lower – the 2018 estimate was 65 per cent and 28 t, and the 2019 estimate was 73 per cent and 36 t.
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 (December 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 Rebuilding Strategy is to establish a reliable index of abundance and consider available information with which to update expected rebuilding timeframes. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021. SERAG also suggested that AFMA need to reconsider how to account for factors that may be preventing the recovery of overfished species, such as climate-driven changes in population and recruitment dynamics, when implementing management arrangements and rebuilding strategies. SERAG 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 blue warehou for 2021 is 29.1 t, with a range between 21.2 and 39.9 t.

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

SERAG did not recommend a blue warehou incidental bycatch TAC for the 2021-22 fishing year. Instead, SERAG recommended SEMAC consider the following:

- RBCs continue to be set at zero, with bycatch TACs set at a level to cover incidental catches without promoting discarding and misreporting.
- Consider the results from the companion species analysis.
- While total fishing mortality should be minimised to promote recovery, consideration should be given to the potential economic impact of changes to bycatch TACs or management arrangements for other key companion species (i.e. flathead, pink ling and blue grenadier).

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	0	No. Rebuilding species.
	2020	0	
	2019	0	
Discount factor (t)	N/A	Discount factor not applied to incidental bycatch TAC.	
State catch (t)	N/A	Average recorded State catches are low – 4.2 t in the east and 1.5 t in the west.	
Discards (t)	N/A	Recent discard rate estimates in the east remain high, between 65-73 per cent, however total catch and discards remains low and below the incidental bycatch TAC. Discard estimate in 2020 for the east was 55.7 t.	

		There are no estimates of discards in the west.
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)	Managed under the Blue Warehou Stock Rebuilding Strategy. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 50 t Single-year bycatch TAC. **SEMAC advice and any dissenting views** Industry noted potential issues with the reliability of discard estimates from the Danish seine fleet, and how this might influence estimates of unavoidable catch. SEMAC asked to be provided with an overview of observer coverage in the trawl sector (planned vs actual days) and recommended that SESSFRAG review the current data plan to ensure there is sufficient observer coverage to support assessment and management decisions. Industry noted the importance of allowing for a buffer in the TAC to ensure individual quota holdings are sufficient to cover unavoidable catches and reduce the risk of discards. The SESSF Harvest Strategy recognises stock sustainability issues as a reason for not applying the large change limiting rule. SEMAC supported the use of the companion species (metier) analysis as a useful tool for understanding the level of unavoidable bycatch and assist setting the bycatch TAC.

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

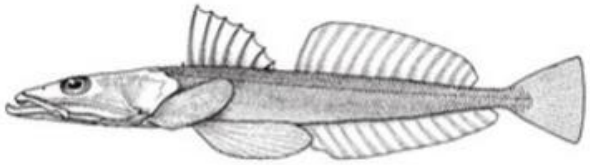
Final agreed TAC

The AFMA Commission determined an incidental bycatch TAC of 50 t for the 2021-22 fishing year, a single-year incidental bycatch TAC, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
118	50	0	2	-68

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)	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2019	45	43	20
	1	2016	45		
	1	2013	45		
Stock trend and other indicators See CPUE Report See Data Summary	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.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	1st of 3-year			Yes GABRAG (October 2020) recommended maintaining the 3-year MYTAC	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		1,238	1,349	-
	2019-20		1,128	1,229	694
	2018-19		1,128	1,241	529
	2017-18		1,128	1,240	548
Economics **(Primary)** Great Australian Bight Trawl	**Financial year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19		4.14	8.48	48.82
	2017-18		4.57	9.16	49.89

	2016-17	5.86	10.04	58.37
ABARES Status (2020 report)	**Not overfished**		**Not subject to overfishing**	
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 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	Updated software: from SS-V3.24U to SS-V3.30.14.05 Apply new features in Stock Synthesis (SS) to allow better tuning of length and age data, automatically tune abundance indices Retune translated model using current model tuning protocols (revised since 2015) 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	Crew collected length data is not available from the Danish seine vessel. This information is important and should be collected. The Great Australian Bight Industry Association (GABIA) will pursue this. 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 vessel. 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. 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. The fits to trawl CPUE are much better from 2003 compared to earlier in the time series, where the model couldn't fit to the large increase in commercial CPUE in the early 1990s. 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. Various sensitivities were explored, however, there was minimal variation from the base case.
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. 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. GABRAG 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.
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 vessels operating in the fishery.

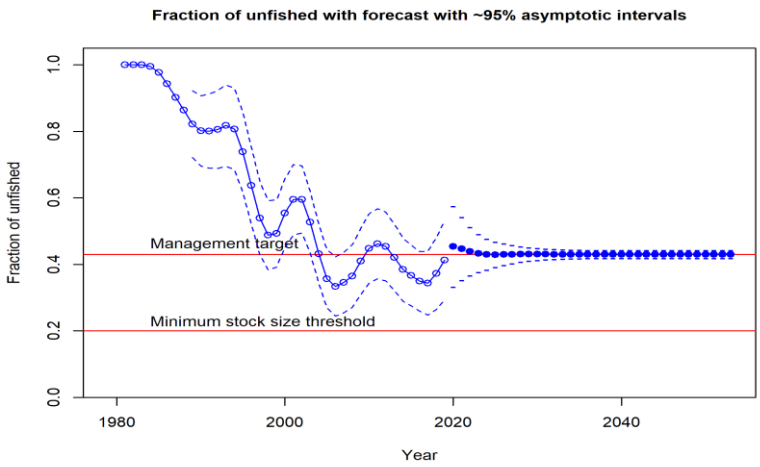


Figure 8: The projected relative spawning biomass trajectory for the deepwater flathead assessment (Tuck, Day and Burch 2019).

Species specific research and priorities

Great Australian Bight Fishery Independent Survey (GABFIS)

A fishery independent survey (FIS) is scheduled for April 2021 which will provide further points in the times-series of FIS abundance indices. The resulting FIS data series will be included in stock assessments of target species and time series analysis of major by-product and by-catch species.

RAG Recommendations

GABRAG (February 2020) recommended up to a four year RBC, using either the single year RBCs or the average across the chosen period. Fisheries indicators are to be monitored annually to ensure key inputs to the Tier 1 assessment (CPUE, age/length frequencies) do not change.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2022	1,224	Yes. 3-year MYTAC recommended using 3-year average of 1,238 t
	2021	1,238	
	2020	1,253	
	3-year average	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 to be low, 1.9 t, and are not included in 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	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	**2021-22 TAC recommendation** 1,238 t Second year of a three-year MYTAC. **SEMAC advice and any dissenting views** There were no dissenting views and GABMAC (October 2020) were comfortable with the advice provided in the paper.

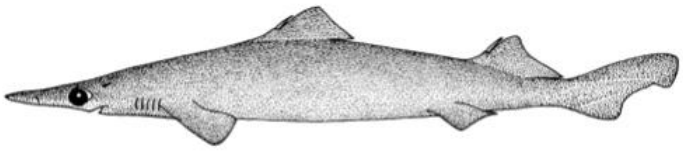
Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	1,238

Final agreed TAC

The AFMA Commission determined a TAC of 1,238 t for the 2021-22 fishing year, the second of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 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 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	Tier 4 Species – last assessed by SERAG in 2018. Scheduled to be assessed as Tier 5 in 2021.
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 42°S (approximately Strahan), including to the centre of Bass Strait to 146°22'E.

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

Tier	Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2018	0.5332	1.1592	0.4830
4	2017	0.5244	1.0699	0.4458
4	2013	0.7616	0.9993	0.3997

Stock trend and other indicators See CPUE Report See Data Summary	The CPUE trend in the eastern zone is slowly declining and is currently between the target and limit reference points.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
2nd of 3-year	Yes SESSFRAG (August 2020) recommended maintaining the MYTAC and assessing as a Tier 5 in 2021.

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	24	25	-
2019-20	24	26	21
2018-19	23	27	19

	2017-18	46	50	23
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	Not Available	49.47	Not Available
	2017-18	Not Available	41.86	Not Available
	2016-17	Not Available	46.42	Not Available
ABARES Status (2020 report)	**Biomass: Uncertain**		**Fishing Mortality: Uncertain**	

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. These are a basket of species, hence a key assumption is that the combined species CPUE at least broadly reflects the trends in CPUE for all the contributing species. Approximately 80% of the catch is *Deania calcea* (brier shark). The assessment based on open areas of the fishery only. The catch rates used in the analysis are based on log-transformed catches rather than log transformed catch/effort. This was a SERAG decision relating to how the sharks are fished.
Significant changes to data inputs	N/A
Data and RAG comments	Discards are not used in the CPUE series and are not included in C_{Targ} and so will not be deducted from the RBC. Catches have been stable between 20-30 t since 2012 and the CPUE has remained stable in the open areas.
Stock assessment information and RAG comments	A large proportion (>54%) of the catch of the entire fishery was previously taken in waters >700m and most of these areas are now closed (AFMA report 2008-836). The Tier 4 assessment excludes all catch taken in areas that are now closed (deepwater closures). SERAG has questioned whether the fishing in the reference period (which is prior to the implementation of the deepwater closures) is relevant to assessing the current status of the stock. There is limited data to inform the determination of an alternate reference period. Deepwater shark are not highly migratory. This was noted in relation to the influence of the closures on the component of the stock that remains open to the fishery. There has been a fishing down of the portion of the stock in the open areas. SERAG (November 2018) noted that catches and CPUE have been relatively stable over the past eight years, and there would be little risk in maintaining catches at current levels. SERAG (November 2018) accepted the results of the Tier 4 assessment and the 2019 RBC of 10 t. However, given the bycatch nature of the fishery, a reduction in TAC would likely lead to discarding which will have implications for the CPUE series.

	SESSFRAG (August 2020) noted there are species identification issues as there are large discrepancies between logbook catch and Catch Disposal Records (CDR). SERAG asked AFMA to look into the issue to determine how deepwater shark are being reported. While CPUE has decreased in 2019 (from 2018), the long-term CPUE has remained steady and the analysis of annual effort over time shows a similar decreasing trend. CPUE is not a reliable indicator of abundance and this species will be assessed as a Tier 5 species in 2021.

Species specific research and priorities

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

RAG Recommendations

Given stable catches and CPUE over the past eight years, SERAG (November 2018) advised there was little risk in maintaining the TAC at current catch levels, that is, 24 t.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	10	Yes. 3-year MYTAC set at recent catch levels (24 t).
	2020	10	
	2019	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)	N/A	There are no estimates of State catches.	
Discards (t)	N/A	Estimates of discards are considered to be low, 0.5 t. Discards are not used in the Tier 4 assessment and are 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		24 t	

MAC Recommendations

Commercial fishers' interests	This species has become a bycatch species in the east, and catches have been consistently around 24 t. An RBC of 10 t is likely to lead to discarding.
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	**2021-22 TAC recommendation** 24 t Third year of a three-year MYTAC. **SEMAC advice and any dissenting views** The current MYTAC is based on recent catch, which has the potential to increase unreported discards. There were some concerns raised around the uncertainty in the Tier 4 assessment and setting the TAC above the RBC of 10 t, however the MAC noted SERAG advice that catches and CPUE have been relatively stable over the past eight years, and there would be little risk in maintaining catches at current levels. SEMAC noted the potential increase in demand for shark livers as the oil has been identified as an adjuvant for the development of a Covid-19 vaccine. SEMAC recommended SERAG consider the uncertainty around stock structure and species composition when undertaking the 2021 Tier 5 assessment.

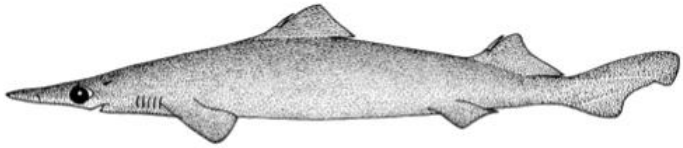
Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	24

Final agreed TAC

The AFMA Commission determined a TAC of 24 t for the 2021-22 fishing year, the third of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 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* 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 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	Tier 4 Species – Last assessed by SharkRAG in 2018. Scheduled to be assessed as Tier 5 in 2021.
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° S (approximately Strahan), around to WA.

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

Tier	Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2018	0.7292	0.6073	0.253
4	2017	0.6792	0.6027	0.2511
4	2013	0.9554	0.5169	0.2068

Stock trend and other indicators See CPUE Report See Data Summary	Standardised CPUE has increased for three of the last four years and was stable from 2016 to 2017. The four-year average in the Western Zone is currently above the target reference point.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
2nd of 3-year	**Yes** SESSFRAG (August 2020) recommended maintaining the MYTAC and assessing as a Tier 5 in 2021.

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	235	252	-
2019-20	235	255	85
2018-19	264	281	79

	2017-18	215	232	80
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	Not Available	49.47	Not Available
	2017-18	Not Available	41.86	Not Available
	2016-17	Not Available	46.42	Not Available
ABARES Status (2020 report)	**Biomass: Uncertain**		**Fishing Mortality: Uncertain**	

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. These are a basket of species, hence a key assumption is that the combined species CPUE at least broadly reflects the trends in CPUE for all the contributing species. Approximately 80% of the catch is *Deania calcea* (brier shark). The assessment based on open areas of the fishery only. The catch rates used in the analysis are based on log-transformed catches rather than log transformed catch/effort. This was a SERAG decision relating to how the sharks are fished.
Significant changes to data inputs	N/A
Data and RAG comments	If there is a change in discard estimates over time, SERAG should consider including them in the Tier 4.
Stock assessment information and RAG comments	A large proportion (>54%) of the catch of the entire fishery was previously taken in waters >700m and most of these areas are now closed (AFMA report 2008-836). Only the stock outside the closures is assessed and there is little understanding of the effect of the closures. SESSFRAG (August 2020) noted that the last two CPUE points since the last assessment have remained high, with the four year average increasing. The recent increase in CPUE is likely due to opening a section of the deepwater trawl closure in the west, however CPUE is not a reliable indicator of abundance and this species will be assessed as a Tier 5 species in 2021.

Species specific research and priorities

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

RAG Recommendations

SERAG (November 2018) recommended a three-year MYTAC using the RBC of 235 t from the 2018 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?

Recommended Biological Catch (t)	2021	235	Yes. Three-year MYTAC using the RBC of 235 t from the 2018 Tier 4 assessment.
	2020	235	
	2019	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)	N/A	An estimate of State catches have not been available since 2010 and are not deducted from the RBC.	
Discards (t)	N/A	Discards are estimated to be 28.7 t. However, discards are not used in assessment because they are poorly estimated and as such are 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	

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	A large proportion of the stock is protected by deepwater closures.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 235 t The third year of a three-year MYTAC. **SEMAC advice and any dissenting views** SEMAC noted the potential increase in demand for shark livers as the oil has been identified as an adjuvant for the development of a Covid-19 vaccine. The MAC noted the discrepancy in the CPUE series between the eastern and the western stocks and the uncertainty around stock structure and recent species catch composition. Approximately 80 per cent of the landed catch is brier shark, which was identified as a species of 'least concern' in the IUCN Red List (global assessment). Deepwater shark will be assessed as a Tier 5 species in 2021 and SEMAC recommended inviting a shark expert to the SERAG meetings in 2021. SEMAC also recommended SERAG consider the uncertainty around stock structure and species composition for the western stock when undertaking the 2021 Tier 5 assessment.

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

10	10	2	235

Final agreed TAC

The AFMA Commission determined a TAC of 235 t for the 2021-22 fishing year, the third of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
235	235	10	2	1

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	Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
Weight of evidence approach	2020	$F<F_{MSY}$	N/A	N/A
4	2018	0.8656	0.844	0.422
4	2015	1.0257	0.9750	0.3901

Stock trend and other indicators

See CPUE Report

See Data Summary

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.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
1st of 3-year	No

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	114	123	-
2019-20	114	124	47
2018-19	114	125	51
2017-18	114	122	46

Economics

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP

(Byproduct) Gillnet, Hook and Trap	2018-19	<0.10	23.66	<0.42
	2017-18	<0.10	19.51	<0.51
	2016-17	<0.10	20.23	<0.49
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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 three 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.

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 three 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)	2022	N/A	Yes. Three-year MYTAC using annual TAC of 114 t.
	2021	N/A	
	2020	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	State catches are estimated to be 2.4 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, 120.9 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	**2021-22 TAC recommendation** 114 t Second year of a three-year MYTAC. **SEMAC advice and any dissenting views** Discards are relatively high due to low market value – often less than the lease price. Elephant fish have been assessed as a species of least concern in the IUCN Red List (global assessment). There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

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

10	10	2	114

Final agreed TAC

The AFMA Commission determined a TAC of 114 t for the 2021-22 fishing year, the second of a three-year MYTAC, with under and overcatch provisions set at 10 per cent and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
114	114	10	2	0

Flathead

Neoplatycephalus richardsoni

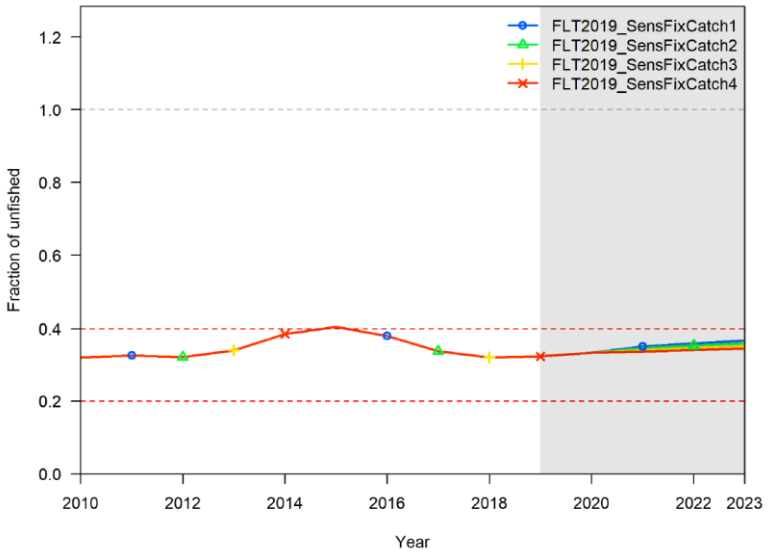
Species summary

Common names	King flathead, trawl flathead, deep-sea flathead				
Stock assessment	Tier 1 Species - last assessed by SERAG in December 2019.				
Stock structure	For management purposes a single continuous stock has been assumed throughout all zones of the SESSF.				
Stock status against reference points ($\%B_0$)	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2019	33	40	20
	1	2016	42	40	20
	1	2013	50	40	20
Stock trend and other indicators See CPUE Report See Data Summary	Otter board trawl CPUE in Zone 40 (east coast of Tasmania) remained above the long-term average from 2002 to 2017. There has been a decrease in CPUE since 2016, with the 2018 and 2019 CPUE points now just below the long-term average. Otter board trawl CPUE in Zones 10 and 20 has been variable around the long-term mean since the beginning of the time series, with the most recent 2019 estimate just below the long-term mean. There has been a decrease in the Danish seine CPUE from above the long-term average in 2007, to less than half the long-term average in 2019.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	1st of 3-year			Yes. SESSFRAG (August 2020) recommended maintaining the MYTAC.	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		2,010	2,236	-
	2019-20		2,468	2,695	1,967
	2018-19		2,507	2,761	2,039
	2017-18		2,712	2,850	2,439
Economics	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**

(Primary) Commonwealth Trawl and Scalefish Hook	2018-19	13.16	49.47	26.60
	2017-18	15.78	41.86	37.70
	2016-17	18.60	46.42	40.07
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	The current 2019 assessment assumes a single growth curve for the whole stock, an assumption also made in previous assessments.
Significant changes to data inputs	The following were included in the updated 2019 assessment: - Recruitment estimated from 1915 to 2015; - Length frequency data from the 2008, 2010, 2012, 2014 and 2016 CTSFIS; - Age-at-length data from the 2008 CTSFIS; and - CTS FIS abundance indices
Data and RAG comments	**2019** Catch rates have been lower over the past few years out of Lakes Entrance. There are 12-15 Danish seine vessels working similar grounds, and access to those grounds have been impacted by entrants to the Victorian octopus fishery. The poor recruitment estimated in 2014 is not reflected in the 2018 length frequency data. There is a need to investigate spatial differences in growth parameters between eastern Tasmania and other regions. There was a question around the post-capture mortality assumed in the assessment, noting the susceptibility score in the 2007 ERA considered post-capture mortality was not 100 per cent.
Stock assessment information and RAG comments	**2019** Updates to the software (SS-V3.24Z to SS-V3.30.14.05) affected historical estimates of biomass but made very little difference to the estimate of current spawning biomass. Recent recruitments are well estimated, and the last three years of recruitment estimates, including a reduction to the 2012 estimate, have resulted in a lower estimate of current biomass. Fits to CPUE are generally poor, especially for the last six years, partly because the model is trying to fit the indices to three different fleets. An alternative discard estimate series was used (reverting to previously used methodology) which increased biomass estimates slightly, including the 2016 estimate being above the target, but the final estimate is similar. <u>Likelihood profiles</u> SSB_0 estimated to be 22,000 t with plausible estimates ranging 15,000 – 29,000 t. SSB_{2018} estimated to be 7,000 t with plausible estimates ranging 5,500 – 8,750 t. Current depletion estimated to be 33%B_0, with plausible estimates ranging 20%B_0 to 45%B_0. Industry have noted poor catches and changes in environmental conditions, which may have implications for recruitment. SERAG recommended monitoring fishery indicators closely each year as part of the annual MYTAC analysis.

Projected biomass	Under **average recruitment**, the biomass is expected to increase to 36.7%B_0 by 2023 under the harvest control rule with RBCs of 2,334 t (2020), 2,648 t (2021) and 2,706 t (2022). If a three year average is applied (2,563 t) the biomass is expected to increase to 36.6%B_0. Under **low recruitment**, and assuming the RBC's from the average recruitment scenario are fully caught, the biomass is expected to decrease to 29.2%B_0 by 2023. Under **high recruitment**, and assuming the RBCs from the average recruitment scenario are caught, the biomass is expected to increase to 49.8%B_0 by 2023. While there were two years of poor recruitment in 2013 and 2014, the most recent recruitment estimate (2015) is considered to be average. While the 2015 recruitment estimate may also be revised as additional data is collected on this recruitment event, SERAG recommend setting RBCs based on average recruitment.  **Figure 9: Relative spawning biomass (2010-2023) for four fixed catch projections under average recruitment – Catch1 used the RBC from the 2019 assessment, Catch4 uses higher RBCs from the 2016 assessment, with Catch2 and Catch3 values between them.**

Species specific research and priorities

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

RAG Recommendations

SERAG (December 2019) recommended a three-year RBC using either the single year RBCs or the three year average, noting the expected biomass in 2023 under each scenario is 36.7%B_0 and 36.6%B_0, respectively.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2022	2,706	Yes. 3-year MYTAC using the single year RBCs each year.
	2021	2,648	
	2020	2,334	
	3-year average	2,563	

Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.
State catch (t)	134.1 t	Mostly NSW catches – NSW maintained the 2019-20 TAC of 166.9 t for the 2020-21 fishing year, which was set at the maximum annual catch during the eight year individual allocation period.
Discards (t)	181 t	Model estimated discards from the most recent Tier 1 assessment are deducted from the 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		2,333 t

MAC Recommendations

Commercial fishers' interests	Operators in the SESSF have reported significant declines in catch rates of flathead in the area of the CGG seismic survey, which finished on 11 July 2020. FRDC project 2019-072 undertaken by Fishwell Consulting shows that, during the period of the survey, catch rates of flathead in the survey area reduced by 78.1 per cent compared to catches outside the survey area.
Species specific management (target, companion and bycatch)	Tiger flathead are the main companion species for eastern redfish. A companion species analysis considered by SERAG at their December 2020 meeting, provided estimates of unavoidable catch of redfish if the 2021-22 fishing year flathead TAC were to be set at 2,333 t (provisional TAC below).
MAC advice and any dissenting views	**2021-22 TAC recommendation** 2,333 t Second year of a three-year MYTAC. **SEMAC advice and any dissenting views** Members questioned the increasing TAC for a species assessed as being below the target reference point with a decreasing CPUE. AFMA noted the complexities of the Tier 1 assessment and that the 20:35:48 harvest control rule is designed to allow for recovery towards the target, with a gradual increase in the annual RBCs. The MYTAC framework is designed to flag any concerns with fishery indicator data during the MYTAC period, to ensure the assumptions made in the Tier 1 assessment remain valid. SEMAC recommended including biomass projections from the most recent stock assessment for all Tier 1 species in the species summary.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	2,333

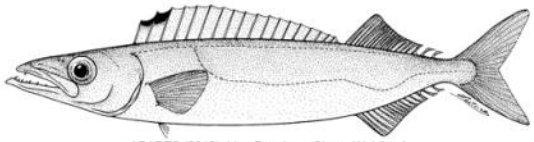
Final agreed TAC

The AFMA Commission determined a TAC of 2,333 t for the 2021-22 fishing year, the second of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
2,010	2,333	10	2	+323

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. Rebuilding strategy reviewed by SERAG in 2020.
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 ($\%B_0$)

Tier	Year	Biomass	Target	Limit
1	2010	15.6	48	20
1	2008	16.5		
1	2007	10		

Stock trend and other indicators See CPUE Report See Data Summary	The last updated assessment in 2010 (updated from 2008), estimated eastern gemfish to be at 16 per cent of its unfished biomass, below the limit reference point. The assessment model was updated in 2016 with more recent data. The updated assessment was not accepted by SERAG (November 2016), however, SERAG noted there was no evidence of stock recovery.

Multi-Year TAC

MYTAC (2020-2021)	Have breakout rules been triggered?
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	100	100	-
2019-20	100	100	71
2018-19	100	100	40
2017-18	100	100	32

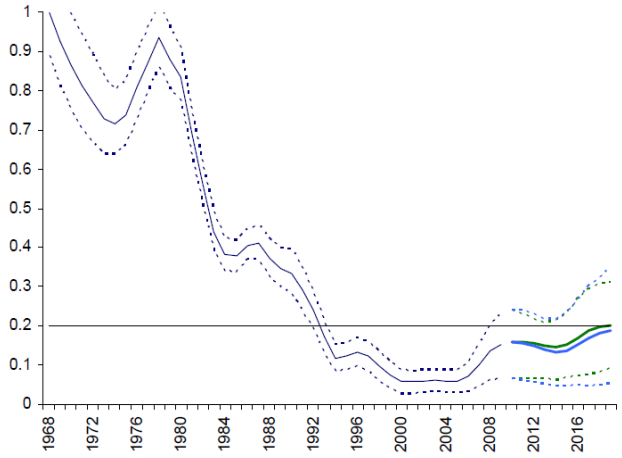
Economics

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP

(Secondary) Commonwealth Trawl and Scalefish Hook	2018-19	0.09	49.47	0.18
	2017-18	0.07	41.86	0.17
	2016-18	0.06	46.42	0.13
ABARES Status (2020 report)	**Biomass: Overfished**		**Fishing Mortality: Uncertain**	

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 three 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 three 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 is scheduled for a Tier 1 stock assessment in 2021. 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 (December 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 eastern gemfish for 2021 is 81 t, with a range between 68.3 and 95.8 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 10: 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 (Little & Rowling 2010).**

Species specific research and priorities

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

RAG Recommendations

SERAG did not recommend an eastern gemfish incidental bycatch TAC for the 2021-22 fishing year. Instead, SERAG recommended SEMAC consider the following:

- RBCs continue to be set at zero, with bycatch TACs set at a level to cover incidental catches without promoting discarding and misreporting.
- Consider the results from the companion species analysis as well as projections from the 2010 Tier 1 stock assessment (see 'projected biomass' above).
- While total fishing mortality should be minimised to promote recovery, consideration should be given to the potential economic impact of changes to bycatch TACs or management arrangements for other key companion species (i.e. flathead, pink ling and blue grenadier).

	Year	RBC (t)	Is a MYTAC Recommended?

Recommended Biological Catch (t)	2021	0	No. Rebuilding species
	2020	0	
	2019	0	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	State catches, 2.7 t, 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, 49.1 t, are modelled in the Tier 1 assessment but are not deducted from the bycatch TAC.	
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 the South East Trawl Fishery Industry Association (SETFIA). The code includes move-on and reporting obligations to assist operators in avoiding incidental catches.
Species specific management (target, companion and bycatch)	The species is managed under the Eastern Gemfish Stock Rebuilding Strategy 2015. AFMA are currently undertaking a five-year review with a view to having a revised strategy implemented in 2022.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 100 t Single-year bycatch TAC. **SEMAC advice and any dissenting views** SEMAC suggested that SERAG consider the non-trawl CPUE index when updating the Tier 1 assessment in 2021. Industry noted that hook-caught blue-eye trevalla is likely to become a companion species based on catches in 2020.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
0	0	2	100

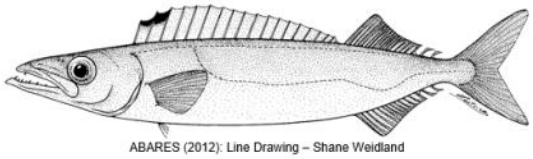
Final agreed TAC

The AFMA Commission determined a TAC of 100 t for the 2021-22 fishing year, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 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 2019
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	Year	$CPUE_{Recent}$	$CPUE_{Target}$	$CPUE_{Limit}$
4	2019	1.0418	0.9942	0.4143
4	2016	0.9378	1.1816	0.4923
1	2013	74% B_0	48% B_0	20% B_0

Stock trend and other indicators

See CPUE Report

See Data Summary

The Tier 4 assessment is based on catch rates from Zone 50 of the CTS only.

The Tier 4 target reference point is the proxy level of CPUE assumed to produce a target biomass consistent with the HSP, and avoid the limit reference point.

Stock status

Standardised CPUE has been variable (but increasing) since 2008. While the last two years' estimates are decreasing, with the 2018 estimate being below the target reference point, the recent average remains above the long term average.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
1st of 3-year	No. SESSFRAG (August 2020) recommended maintaining the MYTAC for the 2021-22 fishing year.

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	300	317	-
2019-20	200	218	96

	2018-19	200	218	79
	2017-18	199	223	77
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0.21	49.47	0.42
	2017-18	0.17	41.86	0.41
	2016-17	0.19	46.42	0.41
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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	CPUE from Zone 50 only are used in the Tier 4 assessment.
Data and RAG comments	The estimated discard rate seems to be tracking the CPUE trajectory, with a decrease in the estimated from 27% in 2017 to 11% in 2018.
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 2019 Tier 4 assessment produced an RBC of 423 t, compared to the RBC of 436 t from the 2016 assessment.

Species specific research and priorities

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

RAG Recommendations

SERAG (December 2019) recommended a three- year MYTAC using the RBC of 423 t from the 2019 Tier 4 assessment.

	Year	RBC (t)	Is a MYTAC Recommended?

Recommended Biological Catch (t)	2022	423	Yes. 3-year MYTAC using the RBC of 423 t from the 2019 Tier 4 assessment.
	2021	423	
	2020	423	
Discount factor (t)	63	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 to be low.	
Discards (t)	17.3	Estimates of discards have decrease from 96 t in 2014 to 11 t in 2019.	
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		343 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	**2021-22 TAC recommendation** 343 t Second year of a three-year MYTAC. **SEMAC advice and any dissenting views** The MAC noted the reason for the increase in TAC since the 2019-20 season: - The 2019-20 TAC (200 t) was based on a weight of evidence approach. - The 2020-21 TAC (300 t) was based on the output of the 2019 Tier 4 assessment but was limited by the large change limiting rule. - The 2021-22 proposed TAC (343 t) is based on the 2019 Tier 4 assessment, however the large change limiting rule does not apply.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	343

Final agreed TAC

The AFMA Commission determined a TAC of 343 t for the 2021-22 fishing year, the second of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
300	343	10	2	+43

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 three separate sub-stocks within broad regions on the continental shelf of Bass Strait, Tasmania and SA.				
Bass Strait **Stock status against reference points (%SB)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	48	48	20
	1	2016	59		
	1	2013	>48		
Tas **Stock status against reference points (%SB)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	69	48	20
	1	2016	83		
	1	2013	>48		
SA **Stock status against reference points (%SB)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	66	48	20
	1	2016	69		
	1	2013	>48		
Stock trend and other indicators See CPUE Report See Data Summary	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.				
	Year of MYTAC (2020-21)		**Have breakout rules been triggered?**		

<table>
<tr><td>Multi-Year TAC</td><td colspan="2">4th of 3-year MYTAC</td><td colspan="2">Yes
SESSFRAG (August 2020) recommended continuing the current MYTAC and to update the assessment in 2020.</td></tr>
<tr><td rowspan="5">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>2020-21</td><td>1,775</td><td>1,854</td><td>-</td></tr>
<tr><td>2019-20</td><td>1,785</td><td>1,897</td><td>1,779</td></tr>
<tr><td>2018-19</td><td>1,763</td><td>1,871</td><td>1,682</td></tr>
<tr><td>2017-18</td><td>1,774</td><td>1,916</td><td>1,745</td></tr>
<tr><td rowspan="4">Economics
(Primary)
Gillnet, Hook and Trap</td><td>Financial Year</td><td>Species GVP ($m)</td><td>Fishery GVP ($m)</td><td>% Fishery GVP</td></tr>
<tr><td>2018-19</td><td>20.94</td><td>23.66</td><td>88.50</td></tr>
<tr><td>2017-18</td><td>17.13</td><td>19.51</td><td>87.80</td></tr>
<tr><td>2016-17</td><td>17.93</td><td>20.23</td><td>88.63</td></tr>
<tr><td>ABARES Status (2020 report)</td><td colspan="2">Biomass: Not overfished</td><td colspan="2">Fishing Mortality: Not subject to overfishing</td></tr>
<tr><td colspan="5">Assessment summary</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td colspan="4">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;</td></tr>
</table>

	- 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 three 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 (November 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 will discuss a future work plan for the next assessment in 2023, at their next meeting (tentatively scheduled for early 2023).
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 three 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 11. 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.

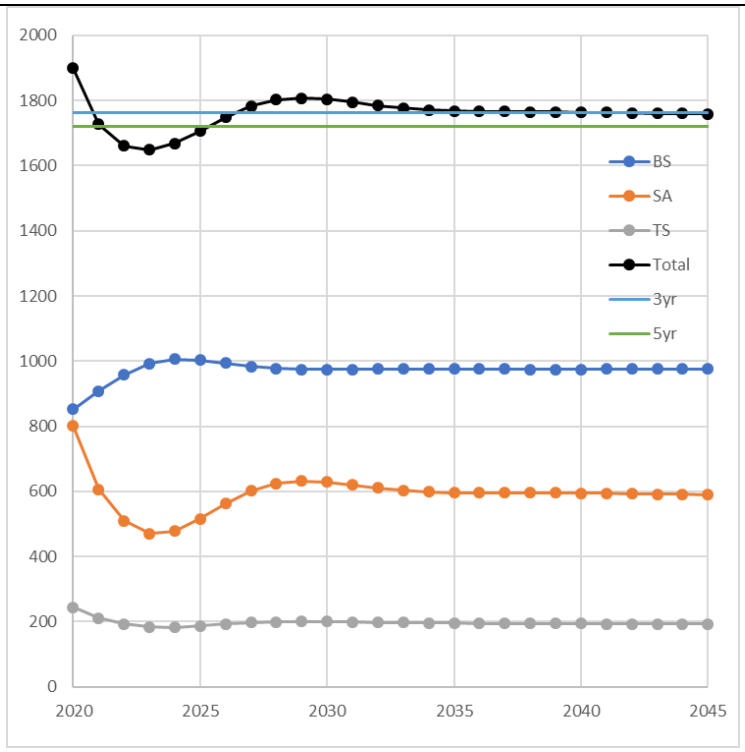


Figure 11: This figure shows the RBC calculations based on the base case model (CAL2019c). The annual RBC is calculated separately for each of the three sub-stocks and is then summed across the three (black line). The three year average and five year average RBCs are also shown. Source: Presentation by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Gummy shark assessment update for 2020: Choosing the base case*.

Projected biomass	SharkRAG (December 2020) discussed the pup production projections shown in Figure 12 (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.

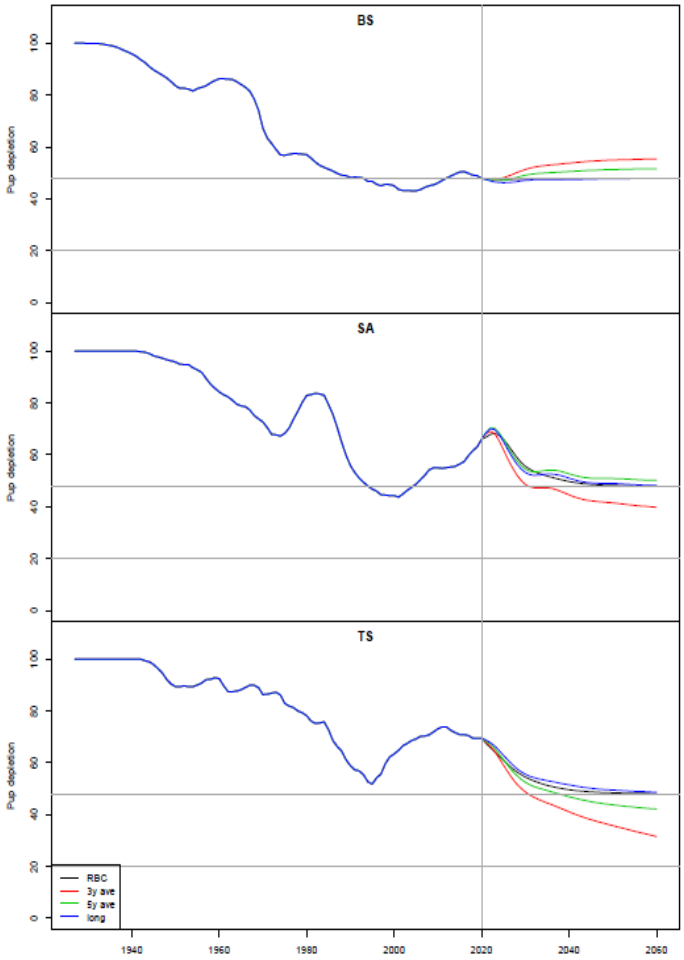


Figure 12: Pup depletion for the three sub-stocks showing future projections using annual RBC (RBC), the average over the most recent three RBCs (3y ave) and the most recent five (5y ave) as well as the long-term RBC (long). A vertical grey line marks the year 2020, and horizontal grey lines mark the 20% and 48% reference points (Thomson 2020).

Species specific research and priorities

GHAT CPUE calculation methodology

CPUE for gillnet-caught species was previously calculated on a kilogram per shot basis. Given the change to net length restrictions, the RAG 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.

School shark and gummy shark post release survival (proposed, not funded)

Investigation of the post-release survival rates of gummy shark (focus on tertiary stress response) and school shark (focus on immediate and post-release mortality), and the application of survivability to discard estimates for these species.

RAG Recommendations

SharkRAG (December 2020) recommended that any of the four RBC options presented 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.

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
Three-year average	907 t	639 t	217 t	1,763 t
Five-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.
	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 5-year – 1,721 t Long term – 1,757 t	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	132.2 t	The 2016-2019 weighted average of State catches is to be deducted from the RBC. 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.	
Discards (t)	95 t	Weighted average of discards are to be deducted from the RBC, as there is no model estimate produced. This is calculated by applying a weighted average to the last 4 years of annual discard estimates (annual discard estimate = 4.786% of annual	

		total landed catches (including State catches)). The weights are 8,4,2,1 with the most recent year receiving the highest weighting.
Recreational catch (t)	N/A	Estimates of recreational catches are available but are considered uncertain and as such are 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		Annual – 1,672 t 3-year – 1,536 t 5-year – 1,494 t Long term – 1,530 t

MAC Recommendations

Commercial fishers' interests	Industry supports the adoption of a step-down TAC.
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 performant 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	**2021-22 TAC recommendation** 1,672 t First year of a three-year MYTAC. **SEMAC advice and any dissenting views** A scientific member noted there was a spike in the estimated recruitment in South Australia in 2015, and this could justify using an averaged RBC value. Industry noted concerns regarding the decrease in the TAC and the impact this would have on industry. Catch rates during 2020 are reported as high, however this data will not be available until later in 2021, and was not included in the 2020 assessment. There was some concern expressed that the TAC could 'bounce' around as the stock biomass fluctuates between assessments. Industry advised of their preference to either setting a single-year TAC with a view to updating the stock assessment in 2021, or a two-year MYTAC to allow for two more years of biological data to be collected and included in a 2022 assessment. Industry expressed their concern at an absence of biological data for a three-year period when observers were removed from boats during the implementation of electronic monitoring in the GHAT sector. The SIDaC program was implemented in late 2018 to collect biological data, which was included in the 2020 stock assessment. Gummy shark

	are a long-lived species, and gaps in the data time-series are unlikely to be significantly influential on the model outputs given the available time-series of information. Gummy shark has been assessed as a species of 'least concern' in the IUCN Red List (global assessment). The RBC projections are based on the harvest control rule which is designed to fish a stock towards the target reference point. The South Australia and Tasmania sub-stocks are currently above the target reference point, so it is possible an updated stock assessment would produce similar RBCs if the TAC is fully caught Updating the stock assessment in 2022 would require scheduling changes to allow for an additional Tier 1 stock assessment to be undertaken or to delay / bring forward scheduled Tier 1 assessment to a different year. SEMAC considered the impact on industry of using a three-year average or a step-down approach. While catch rates are high, there may be a benefit in taking a step-down approach to take advantage of current operating and market conditions. Noting there are no sustainability concerns under any of the four options provided, SEMAC supported a step-down TAC over three years (annual RBC), with a view to SharkRAG reviewing fishery data each year and considering an update to the stock assessment in 2022. If the stock assessment is not updated in 2022, the projected 2023 annual RBC (1,662 t) would be used to calculate the TAC for the 2023-24 fishing year.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	1,672

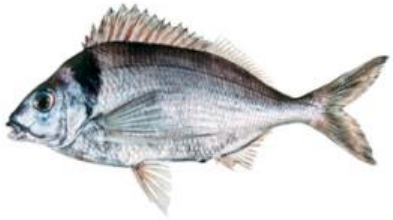
Final agreed TAC

The AFMA Commission determined a TAC of 1,672 t for the 2021-22 fishing year, the first of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,775	1,672	10	2	-103

Jackass morwong

Nemadactylus macropterus



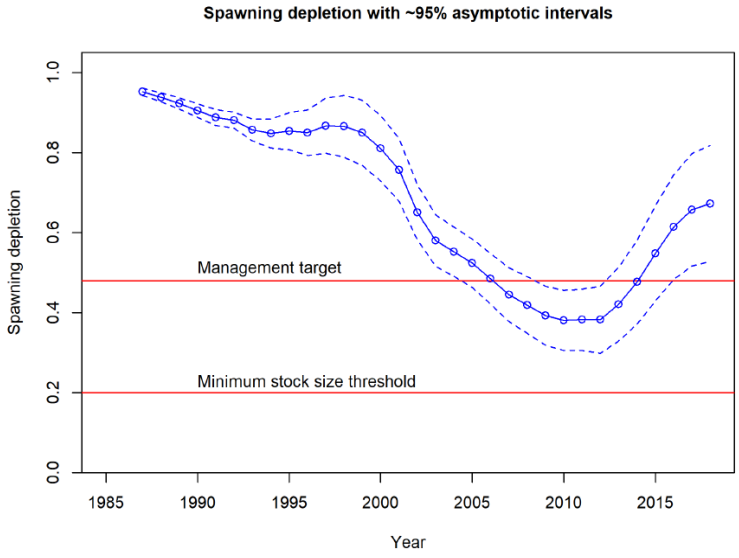
Species summary

Common names	Sea bream, jackass fish, perch, silver perch, squeeker perch, deepsea perch, mowie				
Stock assessment	Tier 1 Species - last assessed by SERAG in 2018.				
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 ($\%B_0$)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2018	68	48	20
	1	2015	69		
	1	2011	67		
East **Stock status against reference points ($\%B_{1988}$)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2018	35	48	20
	1	2015	36.5		
	1	2011	35		
Stock trend and other indicators See CPUE Report See Data Summary	**West** The 2018 assessment estimated that the biomass was below the target reference point between 2006 and 2014 and has increased to an estimated 2019 biomass of 68%B_0. This is slightly lower than the 2015 estimated biomass of 69%B_0. CPUE is increasing but the fit is poor and there are some questions about the quality of the CPUE data. **East** The estimated 2019 biomass is 35% of the 1988 biomass reference point which is slightly lower than the 2015 estimated biomass of 37%. CPUE has been decreasing since 2008 although there has been a slight increase in the last two years for eastern trawl, but not for Tasmanian trawl.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	2nd of 3-year			Yes SESSFRAG (August 2020) recommended maintaining the MYTAC and updating the assessment in 2021.	
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**		**TAC after unders/overs**	**Cth Retained Catch**

	2020-21	468	514	-
	2019-20	469	515	109
	2018-19	505	556	186
	2017-18	513	554	185
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0.64	49.47	1.29
	2017-18	0.45	41.86	1.08
	2016-17	0.47	46.42	2.15
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	**West** 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 2011 **East** 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 2012.
Significant changes to data inputs	Discard rates included and retention estimated (change only for west).
Data and RAG comments	Poor data quality and quantity continues to be an issue, particularly in the west.
Stock assessment information and RAG comments	**West** The last assessment in 2015 (Tuck et al, 2015) estimated a 2016 spawning stock biomass of 69%B_0. The 2018 base case estimates a 2019 spawning stock biomass of 68%B_0. The 2015 assessment did not estimate the biomass series to have fallen below the target reference point. The 2018 assessment suggests the biomass was below the target between

	2006 and 2014. This was largely driven by updates to software and tuning procedures, but was also influenced by revisions to historical data on discard rates and additional new data. The last five recruitments are estimated to be above average. SERAG recommended including the CTSFIS length frequencies in the base case for the next assessment. Fits to the CTSFIS abundance are poor. It was noted that western jackass morwong are caught from February to April. The results should be treated with considerable caution due to the poor quality of the data. **East** The last assessment in 2015 (Tuck et al, 2015) estimated a 2016 spawning stock biomass of 37% of the 1988 biomass reference point. The 2018 base case estimates a 2019 spawning stock biomass of 35% of the 1988 biomass. Exploration of model sensitivity showed variation in spawning biomass across all sensitivities ranging from 18% to 52% of SSB_0 with greatest sensitivity to natural mortality. Excluding the sensitivity to natural mortality, the other sensitivities showed a much narrower range of affect, from 29% to 40% of SSB_0. Fits to Eastern trawl CPUE and Tasmanian trawl CPUE are remarkably good. CTSFIS abundance index declines more than the model is able fit. Recruitment deviations indicate that the regime shift may not have been a step change (as currently modelled) and it would be worth investigating whether this is the most appropriate way to model changes in productivity. There may be some value in investigating different methods for implementing a regime shift. This would constitute a change to the model structure, which is not a standard sensitivity. Seven of the last nine recruitment events are estimated to be below average, however the last four estimated recruitments are close to average. Industry noted they are seeing more small fish but not in large numbers.
Projected biomass	**West** Projected to reach 48%B_0 by 2045 assuming average recruitment.  **Figure 13: Time-trajectory of spawning biomass depletion (with approximate 95% asymptotic intervals) corresponding to the Mode of the posterior distribution (MPD) estimates for the 2018 base-case analysis for jackass morwong (Day & Castillo-Jordán 2018a).** **East**

Projected to reach 48%B_0 by 2045 assuming average recruitment.

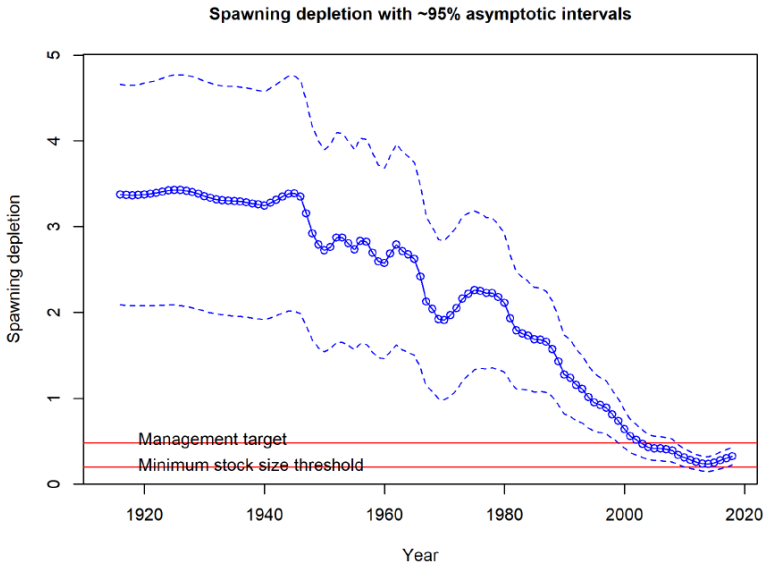


Figure 14: Time-trajectory of spawning biomass depletion (with approximate 95% asymptotic intervals) corresponding to the MPD estimates for the base case analysis for eastern jackass morwong (Day & Castillo-Jordán 2018b).

Species specific research and priorities

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

RAG Recommendations

Noting the uncertainty in the assessment, SERAG (November 2018) recommended a three-year RBC, using either single year RBCs or the three-year average, for both east and west stocks (or both combined).

	Year	RBC (t): East	RBC (t): West	RBC (t): Total	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	280	211	491	Yes. 3-year MYTAC using the three-year average RBC of 494 t.
	2020	271	223	494	
	2019	261	235	496	
	3-year average	271	223	494	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments			
State catch (t)	East = 8.3 West = 0.3	Four-year weighted average - mostly NSW catches.			
Discards (t)	East = 14.6 West = 8.3	In 2020, the weighted average discards from the CSIRO Catch and Discards Report were deducted from the RBC. This was an error and the correct calculation will be used for the 2021 TAC calculation.			

		The three-year average of the model estimated discards from the most recent Tier 1 assessment should be deducted.
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	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		463 t

MAC Recommendations

Commercial fishers' interests	Industry have previously noted that catches were patchy, noting jackass morwong were a very temperature-dependent species.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion or bycatch species.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 463 t Third year of a three-year MYTAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	463

Final agreed TAC

The AFMA Commission determined a TAC of 463 t for the 2021-22 fishing year, the third of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
468	463	10	2	-5

John dory

Zeus faber

Species summary

Common names	St Peter's fish				
Stock assessment	Last considered by SERAG in 2020 using a weight of evidence approach.				
Stock structure	For management purposes, a single stock is assumed for the SESSF.				
Stock status against reference points (F_{Cur}/F_{Tar})	**Tier**	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	N/A – Weight of evidence		
	3	2017	$F_{CUR} = 0.036$	$F_{MSY} = 0.126$	$F_{LIM} = 0.198$
	3	2014	$F_{CUR} = 0.120$	$F_{MSY} = 0.159$	$F_{LIM} = 0.287$
Stock trend and other indicators See CPUE Report See Data Summary	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.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	3rd of 3-year			Yes. SESSFRAG (August 2020) recommended undertaking A Tier 4 assessment (with and without discards) in 2020.	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		452	491	-
	2019-20		395	421	68
	2018-19		263	279	62
	2017-18		175	191	83
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19		0.50	49.47	1.01
	2017-18		0.82	41.86	1.96

	2016-17	0.72	46.42	1.55
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	
Assessment Summary				
Key model technical assumptions/ parameters	TAC advice is based on a weight of evidence approach using standardised CPUE, the outputs from Catch-MSY and Surplus Production models, as well as the 2019 Sustainability Assessment of Fishing Effects (SAFE). Each of these make assumptions about the productivity of the stock, including recruitment, and rates of instantaneous fishing mortality.			
Significant changes to data inputs	N/A – Advice based on weight of evidence approach.			
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. State catches – 2002 Fishery Assessment Reports (FAR) was used to establish State catch history for 1986-1993. An Excel spreadsheet was used (Matt Koopman and Neil Klaer) to establish a Commonwealth catch history for 1986-1993 and 1998, Commonwealth logbook data was used for 1994-1997, and CDRs since 1999.			
Stock assessment information and RAG comments	John dory was previously assessed as a Tier 3 species and was recommended by SESSFRAG to be assessed as a Tier 4 species in 2020. The CPUE series shows a decrease in the CPUE since the mid-1980's and has been relatively flat since around 2015. If the default reference period (1986-1995) from the SESSF Harvest Strategy is used, which assumes the stock was at 48%B_0 at the time, then the stock is likely to be below the limit reference point. However, given uncertainties in historical catch and the status of the stock during the default reference period, SERAG recommended not applying a Tier 4 analyses to John dory in support of recommending an RBC for 2021-22. A weight of evidence approach, including the outputs of the Catch-MSY and Surplus production models (Tier 5 assessments), was used to recommend a TAC for the 2021-22 fishing year. <u>Catch-MSY</u> Catch has declined since the 1980s. Catch-MSY uses catch as a proxy for abundance and therefore perceives this decline in catch as a decline in biomass which may be driven by other factors such as declining effort or management intervention. Catch-MSY estimated that the biomass declined below the limit reference point in the 2000's before recovering to a current estimated biomass of 32%B_0, based on reduced catches in recent years and the deterministic model design of Catch-MSY (assumptions about productivity, recruitment etc.). <u>Surplus production model</u> The model struggled to fit well to the CPUE, and is therefore uncertain in its estimate of current abundance. This analysis estimated that biomass has declined and is currently below the limit reference point of 20%B_0.			

	Summary The stock has declined over time, however it is not clear what the current estimate of biomass is. The CPUE series is potentially influenced by targeting behaviour (not a targeted species) and an apparent southerly shift in the distribution of catch. Both the Catch-MSY and Surplus Production models estimate that the biomass exceeded the target reference point (48%B_0) between 1985 and 1990. This will be important when determining a reference period for future John dory CPUE Tier 4 analyses. However, the analyses produce markedly different estimates of MSY – 180 t from Catch-MSY and 60 t from the Surplus Production model. SERAG (November 2020) recommended exploring differences in standardised CPUE between ISMP Zones 10, 20 and 30 as a potential indicator of range shift. This will be considered by SESSFRAG at its 2021 data meeting, with a view to undertaking a Tier 4 analysis in 2021.

Species specific research and priorities

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

RAG Recommendations

Given the uncertainty in CPUE and the outputs from the Catch-MSY and Surplus Production models, SERAG (November 2020) recommended that John dory catches should be limited to a TAC of 60 t for the 2021-22 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	N/A – weight of evidence.	No. Single-year TAC of 60 t based on weight of evidence approach.
	2020	485	
	2019	485	

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)	6.5	Four-year weighted average – mostly NSW catch. The recommended TAC is effectively an incidental bycatch TAC, in which case State catches are not deducted from the TAC.
Discards (t)	5.3	The estimated discard rate increased from 3.3 per cent in 2018 and 1.6 per cent in 2019, to 10.2 per cent in 2019. The recommended TAC is effectively an incidental bycatch TAC, in which case discards are not deducted from the TAC.
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	60 t –The large change limiting rule is not applicable in this instance.

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. Recent catches have been between 60 and 80 t and industry are concerned that reducing the TAC to 60 t will impact individual quota holdings and may lead to increased discarding.
Species specific management (target, companion and bycatch)	There are no identified implications for target, companion or bycatch species.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 60 t Single year TAC. **SEMAC advice and any dissenting views** Industry noted recent catches have been between 60 t and 70 t, suggesting a TAC of 60 t will become a limiting factor due to quota availability. John dory are a bycatch species, and changes to the TAC are unlikely to have a material impact on total mortality. Undercatch provisions will mean approximately 35 t of quota will be carried over for the 2021-22 fishing year, resulting in an available TAC of approximately 95 t. There will be no undercatch or overcatch provisions for the 2021-22 fishing year, and there is a risk that the TAC for the 2022-23 fishing year becomes a limiting factor if it remains at 60 t. Industry members suggested a TAC of 60 t is likely to result in unreported discarding and negatively influence the CPUE series. SEMAC noted that SERAG had provided firm advice regarding the total catch recommended for the 2021-22 fishing year, however recommended that SERAG consider an appropriate buffer to account for potential discarding when considering the recommended TAC for the 2022-23 fishing year. There is a lot of uncertainty in the outputs of the Catch-MSY and Surplus Production models, particularly the influence of environmental factors on stock dynamics. SEMAC noted the challenges associated with responding to concerns with a bycatch species such as John dory, and the reliance on CPUE to inform future management for the stock. SEMAC suggested further consideration be given to how to better manage predominantly bycatch species subject to a TAC and how to incorporate environmental considerations, noting the RAG have made similar recommendations. SEMAC recommended the TAC for 2021-22 be treated as a bycatch TAC, and as such is not subject to deductions of state catch, discards or recreational catch, or application of undercatch and overcatch provisions.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
0	0	2	60

Final agreed TAC

The AFMA Commission determined a TAC of 60 t, a single-year TAC, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
452	60	0	2	-392

Mirror dory

Zenopsis nebulosus

Species summary					
Common names	Deepsea dory, mirror perch, trawl dory, silver dory				
Stock assessment	Tier 4 Species – last assessed by SERAG in 2020.				
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**	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	0.729	1.1808	0.492
	4	2019	0.6482	1.1542	0.4809
	4	2018	0.723	1.1408	0.4753
West **Stock status against reference points (C_{Lim}/C_{Targ})**	**Tier**	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	0.6798	1.0054	0.4189
	4	2019	0.7488	0.9941	0.4142
	4	2018	0.8184	0.9841	0.41
Stock trend and other indicators See CPUE Report See Data Summary	**East – including discards** CPUE has been cyclical over time, decreasing from above the target reference point in the late 1980's to just above the limit reference point in the late 1990's and early 2000's. CPUE increased to above the target reference point between 2007 and 2011, then decreased again to be between the target and limit reference points in 2019. **West** CPUE has been cyclical in the west, though much more variable than in the east, ranging from above the target and limit reference points since the mid-1980's. The CPUE has been relatively flat since 2012, between the limit and target reference points.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	Single year TAC			N/A	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		137	155	-
	2019-20		188	212	117

	2018-19	253	275	117
	2017-18	253	262	220
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0.37	49.47	0.75
	2017-18	0.82	41.86	1.96
	2016-17	0.99	46.42	2.13
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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	**East** 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. State catches since 2008 have updated to account for corrections to the NSW catch history in 2020 – this has resulted in an approximately doubling of State catches. For years where data has not been provided for confidentiality reasons, catches are 'forward filled' using previous years data. NSW may be able to provide this 'in confidence' for future assessments. **West** The catch series have been updated to include logbook records for the period 1992-97, and CDR records for the period 1998-2019.
Data and RAG comments	**East** Most of the catch is from Zone 10. Increases to historical discard estimates have resulted in an increase to C_{Targ}. **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 increase in CPUE in 2019, combined with an increase in scaling and C_{Targ} resulted in an RBC of 145.7 t, an increase from 92.7 t from the 2019 Tier 4 assessment. **West**

	The 2019 CPUE point is lower than the 2015 estimate included in the last assessment. This has resulted in a decrease to the four-year average CPUE, and an RBC of 61.7 t in 2020, a decrease from 76.7 t in 2019.

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 single year TAC using a combined east and west RBC of 207.4 t for the 2021-22 SESSF fishing year.

	Year	RBC (t)		Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	East: 145.7 West: 61.7	Total: 207.4	No. Single year TAC.
	2020	East: 92.7 West: 76.7	Total: 169.4	
	2019	East: 140 West: 95	Total: 325	
Discount factor (t)	31.1	The default Tier 4 discount factor of 15 per cent is applied.		
State catch (t)	East: 0.4 West: N/A	There are no estimates of State catch for mirror dory (west).		
Discards (t)	East: 31.8 West: N/A	Discards are considered low for the west and are not included in the Tier 4 assessment.		
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		144 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 driven the decrease in mirror dory catch in the east.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 144 t

	Single year TAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	144

Final agreed TAC

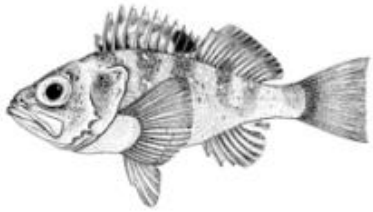
The AFMA Commission determined a TAC of 144 t for the 2021-22 fishing year, a single-year TAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
137	144	10	2	+7

Ocean perch (basket)

Offshore ocean perch (*Helicolenus barathri)*

Inshore ocean perch (*Helicolenus percoides)*



Species summary

Common names	**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**	**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**	**Biomass**	**Target**	**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 See CPUE Report See Data Summary	While Commonwealth catches of offshore ocean perch have decreased from 440 t in 1997 to be between 160-200 t since 2014, standardised CPUE has steadily increased from between the target and limit reference points to above the target reference point during the same time period.				
Multi-Year TAC	**Year of MYTAC (2020-21)**		**Have breakout rules been triggered?**		
	3rd of 3-year		Yes SESSFRAG (August 2020) recommended a Tier 4 assessment in 2020 for offshore ocean perch only (inshore ocean perch discards create too much uncertainty for an assessment).		

Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21	239	262	-
	2019-20	241	259	169
	2018-19	241	255	195
	2017-18	190	204	169
Economics (Secondary) Commonwealth Trawl and Scalefish Hook sectors	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0.43	49.47	0.87
	2017-18	0.04	41.86	0.10
	2016-17	0.52	46.42	1.12
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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).

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 three-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)	13.9	Offshore ocean perch only – mostly NSW catches.	
Discards (t)	40.2	Estimates of discards have been variable and ranged between 25 t in 2018 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		304 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	**2021-22 TAC recommendation** 304 t First year of a three-year MYTAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	304

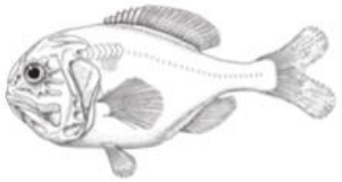
Final agreed TAC

The AFMA Commission determined a TAC of 304 t for the 2021-22 fishing year, the first of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
239	304	10	2	+65

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. Rebuilding strategy reviewed by GABRAG in 2019.
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	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 See Data Summary	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). No large aggregations have been reported since 1990, with the species believed to have declined in the GAB, as it had in other parts of the SESSF.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	50	50	-
2019-20	50	50	0
2018-19	50	50	0
2017-18	50	50	0

Economics (Primary)

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2018-19	-	8.48	-

Great Australian Bight Trawl	2017-18	0.10	9.16	1.1[6]
	2016-17	0	10.04	0
ABARES Status (2020 report)	**Biomass: Overfished**		**Fishing Mortality: Not subject to overfishing**	

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.

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 2020) recommended maintaining the Albany & Esperance orange roughy incidental bycatch TAC at 50 t for the 2021-22 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	0	No. Rebuilding species.
	2020	0	
	2019	0	

[6] Research catch

	-	-	
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	Discards, 1.5 t, are not deducted from the incidental bycatch TAC	
Recreational catch (t)	N/A	There are no known recreational catches for orange roughy.	
Research Catch Allowance (t)	200	GABT Orange Roughy Research Plan	
Provisional TAC under the Harvest Strategy		50 t - Incidental bycatch TAC	

MAC Recommendations

Commercial fishers' interests	Three scientific permits were allocated during the 2020-21 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 2014. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 50 t Single-year bycatch TAC. **SEMAC advice and any dissenting views** There were no dissenting views and GABMAC (October 2020) were comfortable with the advice provided in the paper.

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

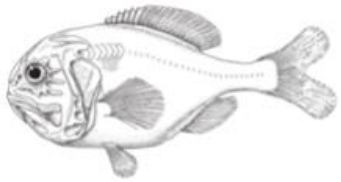
Final agreed TAC

The AFMA Commission determined a bycatch TAC of 50 t for the 2021-22 fishing year, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
50	50	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	Year	Biomass	Target	Limit
1	2009	64	60	20
2	2006	73		
2	2005	30-60		

Stock trend and other indicators See Data Summary	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 (2020-21)	Have breakout rules been triggered?
Single year TAC	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	500	550	-
2019-20	500	550	24
2018-19	500	550	0
2017-18	500	550	0

Economics (Primary)

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2018-19	0	49.47	0

Commonwealth Trawl and Scalefish Hook	2017-18	0	41.86	0
	2016-17	0	46.42	0
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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. In 2008 a DeepRAG member expressed concerns that the 2005 biomass estimate was biologically unfeasible. In 2009 the 2005 acoustic data were reanalysed and as a result biomass estimates were downgraded. Using these data the assessment suggested that maintaining the TAC at 500 t in 2010 would result in a depletion of 34% at the start of 2011. 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 has noted that recent low levels of fishing catch and effort reduces the information available for updating the assessment and may make it difficult for it to provide useful guidance in the future. Until new data are obtained, and in particular a new survey is conducted, SERAG would not be in a position to update the assessment. Negligible levels of fishing over recent years constitute a low risk to stocks even if the TAC were to be taken over the next few years.
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. Given the significant orange roughy aggregations observed by the acoustic surveys between 1999 and 2005, the reason for this sharp downturn is not clear. As a precautionary measure the TAC was set on the basis that the fishery would not fall below 60% of B_o and has remained at 500 t despite catches falling well below this amount. The need for an updated stock assessment is apparent to inform appropriate TAC levels into the future. This proposed project would provide acoustic based

biomass estimates for the 2021 season for input into a future stock assessment. Additionally biological samples would be collected for otolith ageing as a separate exercise to this project.

RAG Recommendations

Noting the absence of new information and negligible fishing effort over recent years, SERAG (November 2020) recommended maintaining the TAC at the current level (500 t) for the 2021-22 SESSF fishing year, with the TAC to be reconsidered in 2021, based on outputs of the orange roughy working group being led by CSIRO.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2020	500	No. DeepRAG (2009) recommended that the RBC should be set at 500 t.
	2019	500	
	2018	500	
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	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		500 t	

MAC Recommendations

Commercial fishers' interests	SERAG (November 2020) noted that two boats fished the area during the 2020-21 fishing year to date, with approximately 212 t caught. One of the boats reported large aggregations of orange roughy.
Species specific management (target, companion and bycatch)	This species is managed under the Orange Roughy Rebuilding Strategy 2014. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 500 t Single year TAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	500

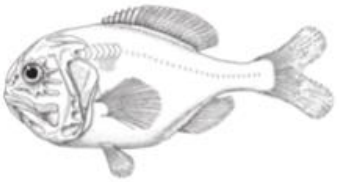
Final agreed TAC

The AFMA Commission determined a TAC of 500 t for the 2021-22 fishing year, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
500	500	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 2017.
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 ($\%B_0$)

Tier	Year	Biomass	Target	Limit
1	2017	33	48	20
1	2014	26		
1	2011	17		

Stock trend and other indicators See Data Summary	Stock status: The most recent assessment (2017) indicates that the stock is above the limit reference point, and is estimated to be at 33% of unfished biomass for the beginning of 2018. Biomass trend: the 2017 stock assessment indicates that biomass is continuing to increase. 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 (2020-21)	Have breakout rules been triggered?
3rd of 3-year	Yes SESSFRAG (August 2020) recommended extending the MYTAC for one year and undertaking the assessment in 2021.

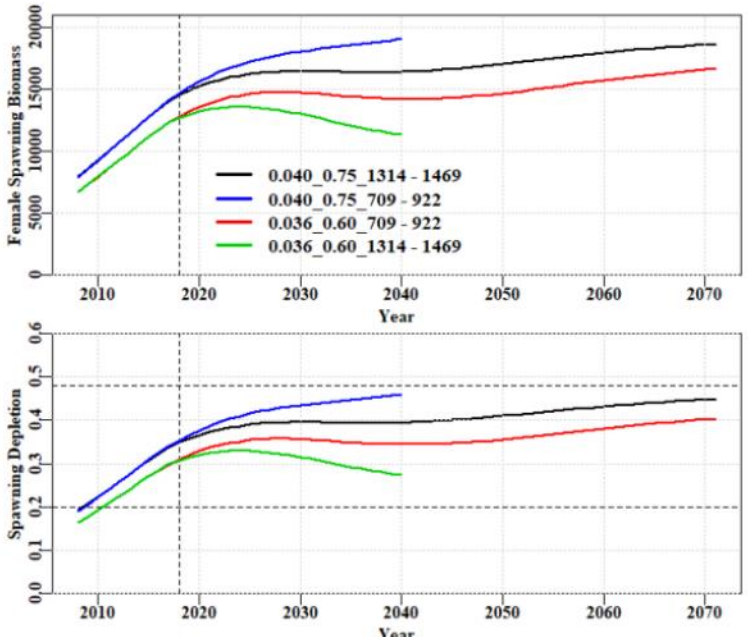
Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	1,276	1,628	-
2019-20	900	976	619
2018-19	689	966	856

	2017-18	465	584	297
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	7.15	49.47	14.45
	2017-18	2.30	41.86	5.49
	2016-17	1.64	46.42	3.53
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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. Recruitment is assumed to be distributed about a Beverton-Holt stock recruitment relationship. Plus group age was set at 80 years. Recruitment steepness and rate of M – refer to base case and alternate case below. Recruitment variability – 0.70 Length at maturity – 35.8 cm Von Bertalanffy (VB) growth co-efficient (*K*) – 0.06
Significant changes to data inputs	Assumed single stock structure encompassing Eastern Zone (Orange Roughy Zone 10) and the eastern side of the Southern Zone (Orange Roughy Zone 21, Pedra Branca).
Data and RAG comments	The Tier 1 model inputs include: new ageing error matrix, new age data for 2012 and 2016, new acoustic survey index from 2016, revised acoustic survey estimate for 2013, catches from Eastern Zone and Pedra Branca, male and female age composition and abundance indices from acoustic sampling, and an increase in the variability that the recruitment deviates could express. The 2017 assessment assumes a single stock that includes Eastern Zone plus Pedra Branca. Constants of M and Steepness: noted the wide range of M estimates that have been used in orange roughy assessments in other jurisdictions. Previous eastern orange roughy assessment used 0.04. Preliminary likelihood analysis presented to SERAG indicated most likely values of M and h may be lower than used in the base case. Additional work is required to ensure the robustness of the likelihood profile analysis.
Stock assessment information and RAG comments	Future assessments should consider the implications of temporal changes in distribution of fishing effort. This will have implications for data collection and data plan. Future assessment to consider mechanism for considering changes in fecundity. Even though the model fits to the available data were reasonable the model remains uncertain with relatively wide confidence intervals around the median stock estimates. Despite uncertainties in input parameters the model was stable. There are 2 scenarios: the base case and another scenario with alternate M and h. SERAG noted that based on a forecasts and cross-catch risk assessment (Figure 14), the spawning stock is not expected to decline before the next assessment under either scenario. SERAG recognise that there are potential alternative values to M and h and that further analysis of likelihood profiles is needed. Alternative approaches to likelihood profiles e.g. gridding of different parameters should be investigated prior to the next assessment.

	SERAG noted that the acoustic surveys provide key data for the assessment and it is important that they are continued every 2-3 years. SERAG noted the recent temporal changes in fishing effort and the effect this has on the age and length data. SERAG (December 2017) recommended determining the RBC based on the initial base case, noting that the large change limiting rule will apply.
Projected biomass	Forecasts and cross-catch risk assessment The black line represents the higher productivity scenario and the catches as they are projected forward. Even after a 50 year project, it does not achieve the target, with a dip in the biomass from about 2030 to 2040, which is a reflection of the drop in recruitment following the start of the fishery. The red line is the same projection, using the lower productivity scenario and resulting RBCs applied. It follows the same pattern, but at a lower biomass. The green line represents the lower productivity scenario, with catches from the higher productivity scenario applied. The stock continues to increased up to ~2022, after which time, the stock is expected to decline. The blue line represents the higher productivity scenario, with catches from the lower productivity scenario applied. The stock is not expected to decline before the next assessment under any of the scenarios.  **Figure 15: The predicted spawning biomass of orange roughy east, projected for 55 years for the initial base-case (black line) and the final base-case (red line) using the standard 20:35:48 HCR. In addition, there is a projection to 2040 (24 years) of the initial base-case, using the predicted catches from the final base-case (blue line) and of the final base-case using the predicted catches from the initial base-case (green line) (Haddon 2017).**

Species specific research and priorities

Orange roughy acoustic survey

A major index for the Eastern Zone spawning stock has been the acoustic surveys, that due to multi-frequency species identification and optically verified target strengths, provide an estimate of stock biomass

at two frequencies (Kloser *et al.*, 2013). As part of the management requirements for the fishery an acoustic survey of the two known spawning sites of St. Patricks Head and St. Helens Hill was undertaken in 2019.

RAG Recommendations

In the absence of new information, and noting the increasing uncertainty with the time since the last assessment, SERAG (October 2020) recommended applying the RBC from the 2017 assessment (1,375 t) for eastern orange roughy for the 2021-22 fishing year (one year only). As has been the case in previous years, 93 per cent will be apportioned to the eastern stock, and seven per cent to the Pedra Branca area of the Southern Zone.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	1,279 (93 % of 1,375)	Yes. Three-year MYTAC using an RBC of 1,279 (93% of the Eastern Zone Tier 1 stock assessment, with 7% apportioned to the Pedra Branca area of the Southern Zone.)
	2020	1,279 (93% of 1,375)	
	2019	1,253 (93% of 1,347)	
	2018	1,222 (93% of 1,314)	
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)	1.6	Estimated discards (four year weighted average 2016-2019).	
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		1,277 t	

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 Orange Roughy Rebuilding Strategy 2014. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021. Species specific management 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	**2021-22 TAC recommendation** 1,277 t Fourth year of a three-year MYTAC. **SEMAC advice and any dissenting views** SEMAC noted the SERAG advice that there was little risk to carrying over the RBC from 2020 given the outputs of the cross-catch-risk assessment. SEMAC also noted the importance of resolving the issue regarding estimates of natural mortality in time for the 2021 stock assessment.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
100	10	2	1,277

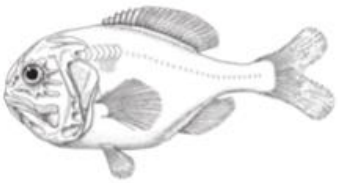
Final agreed TAC

The AFMA Commission determined a TAC of 1,277 t for the 2021-22 fishing year, the fourth of a three-year MYTAC, with overcatch provisions set at 10 per cent, undercatch provisions set at 100 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
1,276	1,277	10 overcatch 100 undercatch	2	+1

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 2017. Rebuilding strategy reviewed by SERAG in 2020
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 and was assessed as part of the 2014 base case assessment.

Southern

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

Tier*	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)	
*SESSF Harvest Strategy Framework developed Tier-based Harvest Control Rules in 2005.			

Pedra Branca

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

Tier	Year	Biomass	Target	Limit
1	2017	33	48	20
1	2014	26		
1	2011	17		

Stock trend and other indicators See Data Summary	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

<table>
<tr><td></td><td colspan="4">assumptions. The Eastern Zone assessment in 2017 estimated the stock status in the Pedra Branca area to be 33% of unfished biomass.

Biomass trend: the 2017 stock assessment indicates that biomass is continuing to increase. 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.

Recent catches are below the bycatch TAC and therefore overfishing is unlikely to be occurring.

The current TAC poses no impediment to stock recovery.

Due to an incidental catch TAC with no targeted fishing, CPUE is not a reliable index of abundance.</td></tr>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="2">Year of MYTAC (2020-21)</td><td colspan="2">Have breakout rules been triggered?</td></tr>
<tr><td colspan="2">Southern: N/A – Rebuilding species

Pedra Branca: 3rd Year of 3-year MYTAC.</td><td colspan="2">Yes (Pedra Branca)

SESSFRAG (August 2020) recommended extending the MYTAC into a fourth year, with the Tier 1 assessment scheduled for 2021.</td></tr>
<tr><td rowspan="5">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>2020-21</td><td>125</td><td>125</td><td>-</td></tr>
<tr><td>2019-20</td><td>94</td><td>94</td><td>91</td></tr>
<tr><td>2018-19</td><td>84</td><td>84</td><td>79</td></tr>
<tr><td>2017-18</td><td>66</td><td>66</td><td>53</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>2018-19</td><td>0.21</td><td>49.47</td><td>0.42</td></tr>
<tr><td>2017-18</td><td>0.18</td><td>41.86</td><td>0.43</td></tr>
<tr><td>2016-17</td><td>0.43</td><td>46.42</td><td>0.93</td></tr>
<tr><td>ABARES Status
(2020 report)</td><td colspan="2">Biomass: Overfished</td><td colspan="2">Fishing Mortality: Uncertain</td></tr>
<tr><td colspan="5">Assessment summary</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td colspan="4">For Pedra Branca, see Orange Roughy East.</td></tr>
<tr><td>Significant changes to data inputs</td><td colspan="4">For Pedra Branca, see Orange Roughy East.</td></tr>
</table>

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. Overcatch of 2019-20 Pedra Branca nominal TAC The 2019 RBC for the Pedra Branca area was 94 t (based on 7 per cent of the eastern 2019 RBC of 1,347 t), however industry proposed limiting the eastern TAC to 900 t because of uncertainties around estimates of natural mortality in the stock assessment. Therefore, the Pedra Branca nominal TAC was set at 63 t (seven per cent of 900 t), with an overall Southern Zone TAC of 94 t (including 31 t incidental bycatch TAC for the rest of the Southern Zone). Of the 93 t caught in the Southern Zone in the 2019-20 fishing year, 74 t was caught in the Pedra Branca area, 11 t more than the nominal TAC for the area. This was not detected during the fishing year, and AFMA will implement monitoring arrangements to ensure Pedra Branca catches are more closely monitored in future years. SERAG (November 2020) did not consider there to be any sustainability concerns with the 2019-20 Pedra Branca orange roughy TAC being overcaught by 11 t in the 2019-20 SESSF fishing year as the catch (74 t) was below the RBC of 94 t.

Species specific research and priorities

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

RAG Recommendations

SERAG recommended maintaining the 2020-21 TAC for Pedra Branca and 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)	2021	0	96 (7% of 1,375)	Southern: No. Rebuilding species. Pedra Branca: Yes – Three-year MYTAC using RBC of 96 t (7% of the 1,375 t RBC from the 2017 Tier 1 assessment of the Eastern Zone stock).
	2020	0	96 (7% of 1,375)	
	2019	0	94 (7% of 1,347)	
	2018	0	92 (7% of 1,314)	
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: 96 t

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 Orange Roughy Rebuilding Strategy 2014. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021. Increased catches of orange roughy in the south, due to the increased Pedra Branca TAC, are expected to result in increased catches of smooth oreo (other). SEMAC (February 2020) recommended increasing the smooth oreo (other) TAC from 90 t to 135 t for the 2020-21 fishing year. SERAG (November 2020) did not consider there was enough data to support maintaining the increased smooth oreo (other) TAC for the 2021-22 fishing year, and recommended reverting to the 90 t TAC until further information becomes available to support an increased TAC.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 127 t, comprising: - 31 t single-year bycatch TAC for the southern zone; and - 96 t for the Pedra Branca area, the fouth year of a three-year MYTAC. **SEMAC advice and any dissenting views** SEMAC noted the 2019-20 notional TAC for the Pedra Branca area was over caught, however this was below the RBC. The MAC noted that this was an administrative issue that AFMA needs to address, and that SERAG have advised there is no sustainability risk. SEMAC are supportive of industry's request to maintain the minimum quota holding requirements for entering and remaining in the eastern and southern ORMAs. SEMAC support moving into the fourth year of the three-year MYTAC, noting the assessment (eastern) is scheduled to be updated in 2021.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
0	0	2	127

Final agreed TAC

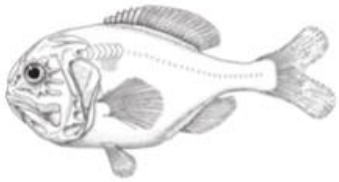
The AFMA Commission determined a bycatch TAC of 127 t for the 2021-22 fishing year, the fourth year of a three year MYTAC, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t. This consists of:

- 96 t for the Pedra Branca area (being assessed as part of the Eastern Zone stock)
- 31 t incidental bycatch TAC for the remainder of the Southern Zone.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
125	127	0	2	+2

Orange roughy Western 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 SlopeRAG in 2002 Rebuilding strategy reviewed by SERAG in 2020
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 Eastern Australian stocks, however they may be demographically separate.

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

Tier*	Year	Biomass	
-	2002	<30 (>50% 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.
-	2000	<20 (97% probability)	
No earlier assessment * SESSF Harvest Strategy Framework developed Tier-based Harvest Control Rules in 2005.			

Stock trend and other indicators See Data Summary	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.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	60	60	-
2019-20	60	60	24
2018-19	60	60	19
2017-18	60	60	23

Economics (Primary) Commonwealth Trawl and Scalefish Hook	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2018-19	0.21	49.47	0.42
	2017-18	0.84	41.86	2.00
	2016-17	0.11	46.42	0.24
ABARES Status (2020 report)	**Biomass: Overfished**		**Fishing Mortality: Uncertain**	

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 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. It was pointed out that the eastern stock part of the southern stock had rebuilt to a certain degree and that the recovery will have to be watched for at least a decade to monitor if previous high catches have any effect on recruitment. SERAG noted that the Western Zone continues to be on 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 MYTAC remain unchanged. SERAG supported undertaking an externally reviewed desktop study of how evidence of rebuilding should be collected, to identify if there is currently any evidence/likelihood of rebuilding and identification of information gaps that preclude a stock assessment of the southern and western orange roughy stocks. SERAG (October 2020) 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 an annual review of data collected under the Western Orange Roughy Research Plan, to accurately inform their advice. It was also recommended that a more formalised process or set of indicators/benchmarks be identified to inform the RAG of when sufficient data had been collected to support a quantitative stock assessment.

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 SESSF Harvest Strategy. This will be achieved by collecting robust scientific information including biological data, in each western orange rough research area.

RAG Recommendations

SERAG (October 2020) recommended maintaining the 60 t incidental bycatch TAC for the 2021-22 fishing year.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	0	No. Rebuilding species.
	2020	0	
	2019	0	
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 not deducted from the incidental 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 2020-21 fishing year to fish under the Western Orange Roughy Research Plan.
Species specific management (target, companion and bycatch)	This species is managed under the Orange Roughy Rebuilding Strategy 2014. AFMA sought public comment on the revised Rebuilding Strategy from 15 January to 12 February, 2021. AFMA will consider the feedback with a view to seeking Commission approval of the revised Rebuilding Strategy in May 2021.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 60 t - Single year bycatch TAC. 200 t – Research Catch Allowance. **SEMAC advice and any dissenting views**

	SEMAC noted the 1.6 t of benthos reported during the observed trips under the WORRP program. AFMA were not able to clarify which species this was but will provide advice out of session. SEMAC noted the success of the WORRP program and recommended a 200 t research catch allowance to support the program for the 2021-22 fishing year.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
0	0	2	60 - bycatch TAC 200 t – Research Catch Allowance

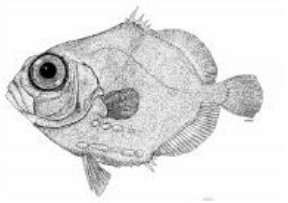
Final agreed TAC

The AFMA Commission determined a bycatch TAC of 60 t for the 2021-22 fishing year, with undercatch and overcatch provisions set at 0 per cent, and a determined amount of 2 t.

The Commission also supported 200 t western orange roughy Research Catch Allowance for the 2021-22 SESSF fishing year, including catch triggers of 100 t in each of the sampling areas, to support data collection under the WORRP.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
60	60	0	2	0

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	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

See CPUE Report

See Data Summary

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.

Standardised CPUE has been essentially flat and stable since 2000.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
3rd of 3-year	Yes SESSFRAG (August 2020) recommended continuing with the assessment in 2020.

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	185	203	-
2019-20	185	203	94
2018-19	185	197	82
2017-18	128	140	89

Economics (Byproduct)

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2018-19	0.35	49.47	0.71

Commonwealth Trawl and Scalefish Hook	2017-18	0.10	41.86	0.24
	2016-17	0.37	46.42	0.80
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Uncertain**	

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.
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).

Species specific research and priorities

There has been no species specific research priorities identified.

RAG Recommendations

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

	Year	TAC (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)	31.5	The estimated discards decreased from 54 t in 2018 to 4 t in 2019, however the four-year weighted average remains higher.
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		139 t

MAC Recommendations

Commercial fishers' interests	No specific commercial fisher interests have been identified.
Species specific management (target, companion and bycatch)	Industry noted there was approximately 50 t of mixed oredory caught as part of the Western Orange Roughy Research Plan (WORRP) in 2020. However, the proportion of the TAC caught in 2020 has not increased because the boats fishing under the WORRP are the boats that would have been expected to catch mixed oreo, had they not been fishing under the WORRP.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 139 t First of a three-year MYTAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	139

Final agreed TAC

The AFMA Commission determined a TAC of 139 t for the 2021-22 fishing year, the first of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
185	139	10	2	-46

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 2018
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 ($\%B_0$)

Tier	Year	Biomass	Target	Limit
1	2018	30	48	20
1	2015	30		
1	2013	25		

West

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

Tier	Year	Biomass	Target	Limit
1	2018	84	48	20
1	2015	73		
1	2013	58		

Stock trend and other indicators

See CPUE Report

See Data Summary

East

Biomass trend continuing recent increases and is between the limit and target reference point. There is some uncertainty around the rate given various estimates of M and which CPUE series is used (whether or not avoidance is accounted for).

West

Biomass increasing above management target.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
2nd of 3-year	Yes SESSFRAG (August 2020) recommended continuing with the MYTAC and assessing in 2021

Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21	1,310	1,436	-
	2019-20	1,288	1,378	833
	2018-19	1,117	1,203	952
	2017-18	1,154	1,262	1,036
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	6.38	49.47	12.90
	2017-18	5.05	41.86	12.06
	2016-17	5.22	46.42	11.25
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	Assessed using C++ Algorithmic Stock Assessment Laboratory (CASAL) based stock assessment model. See Cordue (2018) for detailed technical assumptions and parameters. Two 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 Vessel effects in CPUE standardisation time-blocked for most vessels (1986-1999, 2000-2006, 2007-2017) to account for effects of structural adjustment and halving in the number of vessels from 2006 to 2007. Estimate parameters: B_0, growth, recruitments strengths, M (E: 0.25, W: 0.23), 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	CTSFIS indices and length frequencies were included in the assessment. Trip limits formed part of the management arrangements to constrain catches in the Eastern Zone and although trip limits will reduce landings is not so obvious whether they will reduce total fishing mortality (removals). Period effects were estimated to account for discard avoidance behaviour due to trip limits (see Cordue 2018 for details). The 'Period CPUE' series appeared to have an implausible increase from 2015 to 2017. Excluding it (linkall CPUE) generates a 'pessimistic' index. CPUE is likely somewhere in between. Variations to the base case were presented; Three fixed-M, a uniform M, period CPUE with M fixed at 0.23, and a 'linkall CPUE'.
Data and RAG comments	SERAG (September 2018) agreed to include the CTSFIS CPUE indices (east and west) and length frequencies. There is generally a good fit to CTSFIS length frequency in the east and west.

	There is variation in the length of trawl shots, and so length frequencies are scaled by catch-rate, rather than catch. Non-trawl port length frequencies are not stratified by depth, based on 2013 analysis suggesting they're not required. Time-blocking on trawl selectivity suggests smaller fish were not caught during 'trawl 2' which is from 2000-2006. Industry suggested this is due to structural adjustment and vessel catching small fish leaving. MDP estimated and MCMC estimates were very similar (not always the case).
Stock assessment information and RAG comments	**East** Current stock status is not well estimated. It varies across model runs and is heavily dependent on M. Three variations to the base case are presented here: Reference: CPUE series with no period/avoidance effect, est. M of 0.25 M-0.23: CPUE series with no period/avoidance effect and M fixed at 0.23 Period: CPUE series with period/avoidance effect and M fixed at 0.23 The 'signals' in the data from the east make it difficult to estimate M and SERAG agreed that a fixed value of 0.23 should be used in the east. SERAG agreed that the steep increase in CPUE for the 'period CPUE' is not plausible and agreed to use the reference CPUE series. This series does not account for avoidance and is likely conservative. This should be considered when setting RBCs based on estimated depletion and rebuild timeframes. The base case model using the accepted CPUE series with a fixed M=0.23 estimates the current spawning biomass is 30%B_0 (22-42, 95% CI) and under the 20:35:48 harvest control rule generates an RBC of 260 t in 2019 (36-560, 95% CI) and a long-term yield of 570 t (540-620, 95% CI). SERAG noted these estimates are highly uncertain. SERAG accepted the final eastern pink ling base case stock assessment noting the estimated current Eastern Zone spawning stock biomass of 30%B_0 (22-42, 95% CI) and the 2019 median RBC of 260 t (36-560, 95% CI). SERAG recommended that if a TAC greater than the 2019 RBC was considered by the AFMA Commission then the table below (see 'Species specific management') should be used as basis for determining the TAC. It shows probabilities of being below the limit reference point or approaching the target reference point under constant catch scenarios from 0 – 650 t. A similar approach was taken in 2015 to provide advice regarding risks associated with setting multi-year TACs at constant catches. SERAG noted there has been an increase in biomass since then and it is reasonable that a similar approach is taken this time. Should the constant catch scenarios be used to consider management options or future TAC recommendations for the Eastern Zone, constant catches in excess of 550 t lead to a greater than 10 per cent probability of eastern pink ling declining to below the limit reference point by 2028 and substantially increase the time taken to rebuild the stock to the management target. **West** The likelihood profile for M suggests 0.23 is appropriate, although there is some conflict between trawl and non-trawl length frequencies. SERAG accepted the final western pink ling base case stock assessment noting the estimated current Eastern Zone spawning stock biomass of 84%B_0 (69-100, 95% CI), and the 2019 median RBC estimate of 1150 t (770-1,660, 95% CI).
Projected biomass	Pink ling base model MCMC: Spawning stock biomass trajectory (Cordue 2018). The horizontal lines are plotted at 20 per cent, 30 per cent and 48 per cent of B_0

East:

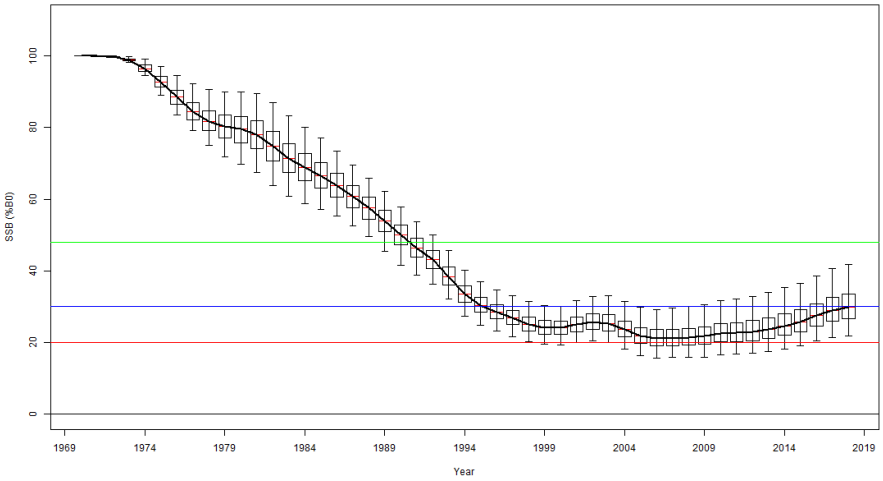


Figure 16: Eastern pink ling: MCMC estimates of stock status trajectory (SSB/B_0). Each box covers the middle 50% of the distribution and the whiskers extend to 95% confidence intervals (CIs). The medians are marked by red horizontal lines, within each box, which are joined by the solid black line. Horizontal lines are marked 20%, 30% and 48%B_0 (Cordue 2018).

West:

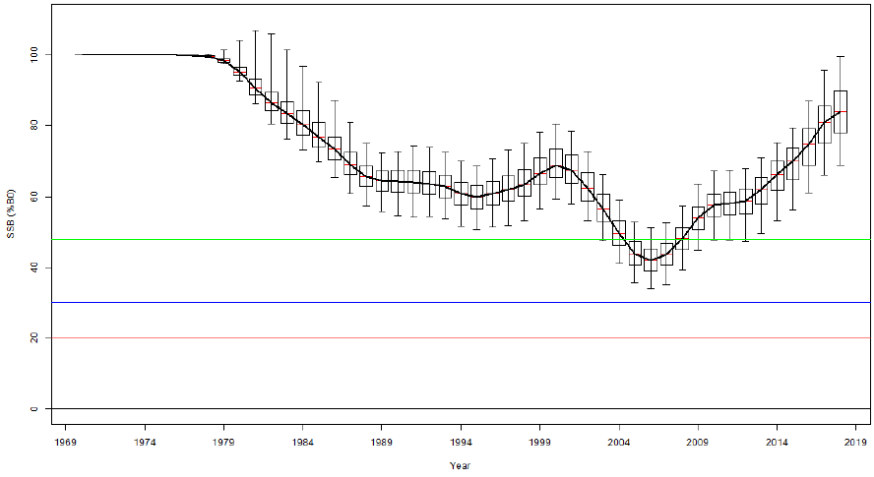


Figure 17: Western pink ling: MCMC estimates of stock status trajectory (SSB/B_0). Each box covers the middle 50% of the distribution and the whiskers extend to 95% confidence intervals (CIs). The medians are marked by red horizontal lines, within each box, which are joined by the solid black line. Horizontal lines are marked 20%, 30% and 48%B_0 (Cordue 2018).

Species specific research and priorities

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

RAG Recommendations

SERAG (November 2018) recommended that, if a TAC greater than the 2019 RBC was considered by the AFMA Commission, then the constant catch scenarios (see species specific management) should be used as basis for determining the TAC.

	Year	RBC (t): East	RBC (t): West	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	260	970	Yes. 3-year MYTAC using RBCs from the 2018 assessment (west), and a notional eastern catch limit, calculated using constant catch scenarios (see species specific management).
	2020	260	1,060	
	2019	260	1,150	
	Long term yield	570	690	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments		
State catch (t)	East = 56.2 West = 0.1 Combined = 56.3	The majority of State catches were recorded in NSW (east) and TAS (west), and are deducted from the RBC.		
Discards (t)	East = 42 West = 10.5 Combined =52.5	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: 162 t* West: 959 t Combined: 1,121 t * Eastern notional catch limit calculated using constant catch scenario (see species specific management).		

MAC Recommendations

Commercial fishers' interests

Both the line and the trawl industry have previously noted the difficulty in constraining catches in the east.

Species specific management (target, companion and bycatch)

Pink ling is caught in close association with blue-eye trevalla in the line sector and blue grenadier in the trawl fishery.

While the pink ling TAC is set globally (east and west), pink ling is assessed separately as an eastern and western stock.

The eastern stock, although above the limit reference point, requires rebuilding to meet the target reference point. Similar to the approach adopted for the previous three year MYTAC, SEMAC (2019) recommended setting a notional eastern catch limit based on constant catches (see table below), rather than the RBC. This allows:

- a level of incidental catch of pink ling to be landed instead of discarded;
- a less than 10% probability of declining below the limit reference point; and
- the stock to rebuild (although at a slower rate than under the RBC).

Constant catches of 600 t or more lead to a greater than 10% probability of eastern pink ling declining to below the limit reference point by 2028 and substantially increases the time taken to rebuild the stock to the target reference point.

MCMC projection results for base model (M=0.23) showing the expected SSB in 2021 and 2028, relative to unfished biomass (as %), under different constant catch scenarios with the associated probabilities of being below 20% and 20%B_0 and at or above the target 48%B_0

Annual catch (t)	Cth-notional Eastern TAC	E(B_{21}/B_0)	E(B_{28}/B_0)	P(SS_{21}<0.2)	P(SS_{28}<0.2)	Rebuild year to B_{48}
0	N/A	42	72	0.00	0.00	2023
300	221	37	53	0.01	0.00	2026
400	321	35	47	0.02	0.01	2030
450	371	34	44	0.02	0.01	2033
500	421	33	41	0.04	0.02	2040
550	471	32	38	0.05	0.05	>2050
600	521	32	35	0.06	0.11	>2050
650	571	31	31	0.08	0.18	>2050

	Since 2013, AFMA has used a combination of trip limits, closures and industry agreements to limit catch in the east where the biomass is not considered overfished but requires rebuilding to reach the target reference point. The pink ling closures were repealed in December 2019, following SEMAC advice that they were not offering the level of protection they were originally implemented for, and that output based catch controls, including the industry-led initiatives, have proven to be successful at limiting catches in the east. For the 2020-21 fishing year, operators opted to either limit their catches under the SETFIA arrangement (SETFIA vessels), or are subject to a 200 kg trip limit. As of January 2021, all SETFIA vessels remain within their agreed catch limits, and total catches are on track to remain below the notional catch limit of 446 t. The 2020-21 notional catch limit of 446 t was based on constant catch of 525 t (between 500 and 550 t scenarios, see above) and deducting recent average discards (56 t) and State catches (23 t). The 2020 estimates of State catches remained stable and discards have increased, with a four year weighted average of 56 t and 42 t, respectively. Deducting the revised estimates from a fixed catch of 525 t results in a notional catch limit of 427 t.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 1,121 t including a notional eastern TAC of 427 t. Third year of a three-year MYTAC. **SEMAC advice and any dissenting views** Industry noted catch rates in the east continue to improve and suggested the biomass is likely higher than estimated by the model, whereas the estimate of biomass in the west is likely to be lower than estimated. Industry also noted the positive work undertaken by SETFIA to manage industry catch commitments for the eastern stock. While the approach has been successful in limiting catches for a number of years, it is becoming increasingly difficult. SEMAC questioned the progress of the quota regionalisation project. AFMA noted the outcomes of a recent stock structure project need to be considered further before a decision is made on whether to progress this work. The SETFIA arrangement will likely be necessary in the short-term.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	1,121 (including a 427 eastern notional catch limit)

Final agreed TAC

The AFMA Commission determined a TAC of 1,121 t (the provisional harvest strategy TAC) for the 2021-22 fishing year, the third of a three-year MYTAC, with undercatch and overcatch provisions set at 10 per cent, and a determined amount of 2 t.

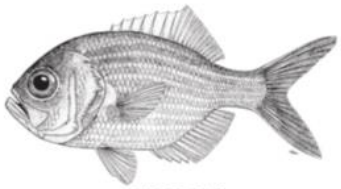
The AFMA Commission also supported a notional eastern catch limit of 428 t based on constant catch scenarios.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)

1,310 (including a 446 eastern notional catch limit)	1,121 (including a 428 t eastern notional catch limit)	10	2	-189

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)

Tier	Year	Biomass	Target	Limit
1	2020	4	48	20
1	2017	8		
1	2014	12		

Stock trend and other indicators See CPUE Report See Data Summary	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.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
N/A – Rebuilding species	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	50	50	-
2019-20	50	50	29
2018-19	100	100	31
2017-18	100	100	27

Economics (Secondary)

Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
2018-19	0.11	49.47	0.22

Commonwealth Trawl and Scalefish Hook	2017-18	0.11	41.86	0.26
	2016-17	0.08	46.42	0.17
ABARES Status **(2020 report)**	**Biomass: Overfished**		**Fishing Mortality: Uncertain**	

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	Fits to CPUE 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. Recruitment 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. Biomass Estimate 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. Likelihood profiles 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. 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.

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 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.

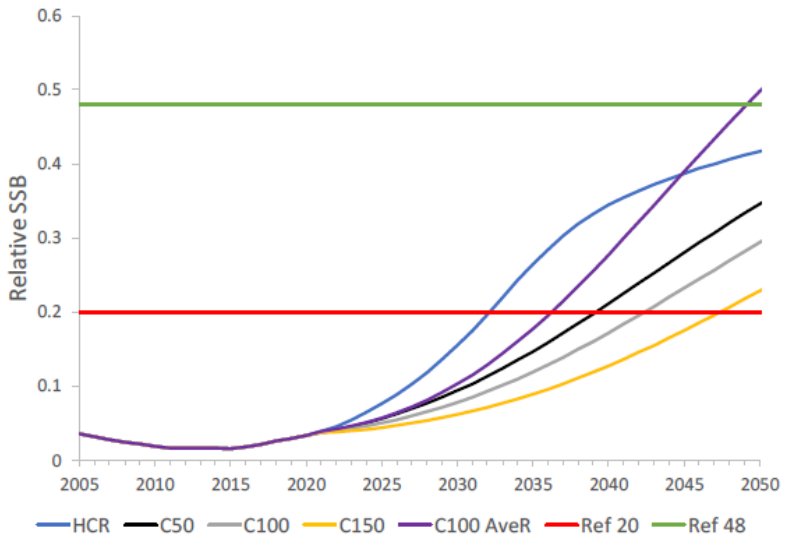


Figure 18: Relative spawning biomass time-series for alternative catch scenarios. Catches of 50 t (black), 100 t (grey) and 150 t (orange) are projected under a low recruitment scenario and the purple line (100 t) is projected under an average recruitment scenario (Bessell-Browne & Tuck 2020).

Species specific research and priorities

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

RAG Recommendations

SERAG did not recommend a redfish incidental bycatch TAC for the 2021-22 fishing year. Instead, SERAG recommended SEMAC consider the following:

- RBCs continue to be set at zero, with bycatch TACs set at a level to cover incidental catches without promoting discarding and misreporting.
- Consider the results from the companion species analysis as well as projections from the 2020 Tier 1 stock assessment (see 'projected biomass' above).
- While total fishing mortality should be minimised to promote recovery, consideration should be given to the potential economic impact of changes to bycatch TACs or management arrangements for other key companion species (i.e. flathead, pink ling and blue grenadier).

	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)	6.9	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.	
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 managed under the Redfish Stock Rebuilding Strategy 2016-2021.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 50 t Single year bycatch TAC. **SEMAC advice and any dissenting views**

	SEMAC noted the discrepancy between the tabled stock status in the species summary compared to the outputs of the most recent stock assessment – the assessment estimates an increase in the biomass since 2012, whereas the table shows a decrease from 12%B_0 since 2012. AFMA clarified that the biomass estimates provided in the species summary are from the time of the stock assessment which are then revised in subsequent stock assessments. AFMA will consider ways to provide both estimates in future species summary documents. There were no dissenting view and SEMAC were comfortable with the information provided in the table.

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

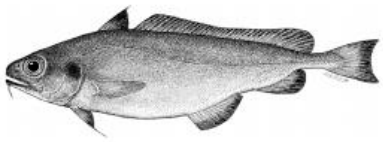
Final agreed TAC

The AFMA Commission determined a bycatch TAC of 50 t for the 2021-22 fishing year, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t. This continues the bycatch TAC from the 2020-21 fishing year and is at a level that allows for incidental catch without promoting discarding and misreporting.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
50	50	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**	**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 See CPUE Report See Data Summary	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.				
Multi-Year TAC	**Year of MYTAC (2020-21)**		**Have breakout rules been triggered?**		
	3rd of 3-year		Yes SESSFRAG (August 2020) recommended continuing with the 2020 Tier 4 assessment using trawl CPUE		
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**	
	2020-21	422	463	-	
	2019-20	422	461	129	
	2018-19	430	465	107	
	2017-18	355	390	95	
Economics (Byproduct) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**	
	2018-19	0.25	49.47	0.51	
	2017-18	0.22	41.86	0.53	

	2016-17	0.31	46.42	0.67
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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.

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 three-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. Three-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)	1.5	Mostly NSW State catches; consistently low.	
Discards (t)	7	The 2018 estimated discard rate of five per cent was carried forward to 2019.	

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		396 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 closures.
Species specific management (target, companion and bycatch)	Deepwater closures currently providing significant protection.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 396 t First of a three-year MYTAC. **SEMAC advice and any dissenting views** Industry noted ribaldo is a low value species and is not targeted. There were no dissenting views and SEMAC were comfortable with the information provided in the table.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	396

Final agreed TAC

The AFMA Commission determined a TAC of 396 t, the first of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
422	396	10	2	-26

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**	**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	Catches of royal red prawn have decreased from a peak in the 1990s (up to 640 t) to typically less than 200 t since 2006 – due largely to a decrease in the number of boats targeting. CPUE increased steadily from between the target and limit reference point in 2007 to above the target reference point 2017. There has been a large increase in CPUE in 2018 and again in 2019.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	3rd of 3-year			Yes. SESSFRAG (August 2020) recommended continuing with the 2020 Tier 4 assessment.	
Catch and TAC (t)	**SESSF Fishing Year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		403	444	-
	2019-20		409	447	164
	2018-19		381	418	147
	2017-18		384	421	222
Economics (Secondary)	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19		0.56	49.47	1.13

Commonwealth Trawl and Scalefish Hook	2017-18	0.88	41.86	2.10
	2016-17	0.89	46.42	1.92
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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 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.

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 three-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)	6	All NSW catch.	
Discards (t)	3.9	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		605 t - application of the 50 per cent large change limiting rule precludes setting a TAC of 729 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 occur in areas of core habitat for Harrisson's and southern dogfish and much of the fishing grounds have been closed under the Upper Slope Dogfish Management Strategy.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 605 t – large change limiting rule applies. First of a three-year MYTAC. **SEMAC advice and any dissenting views** SEMAC noted the large increase in recent CPUE and recommended reviewing the CPUE each year to monitor trends in catch and effort. There were no dissenting views and SEMAC were comfortable with the information provided in the table.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	605

Final agreed TAC

The AFMA Commission determined a TAC of 605 t for the 2021-22 fishing year, the first of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
403	605	10	2	+202

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	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 See CPUE Report See Data Summary	Total catches in 2019-20 are similar to the previous fishing year. 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.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
3rd of 3-year	Yes SESSFRAG (August 2020) recommended updating the Tier 4 assessment in 2020.

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	432	471	-

	2019-20	430	470	189
	2018-19	430	472	179
	2017-18	442	482	205
Economics (Secondary) Gillnet, Hook and Trap	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0.60	23.66	2.54
	2017-18	0.41	19.51	2.10
	2016-17	0.52	20.23	2.57
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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**Error! Bookmark not defined.**) 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 19, 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**Error! Bookmark not defined.**, Sporcic, 2020).

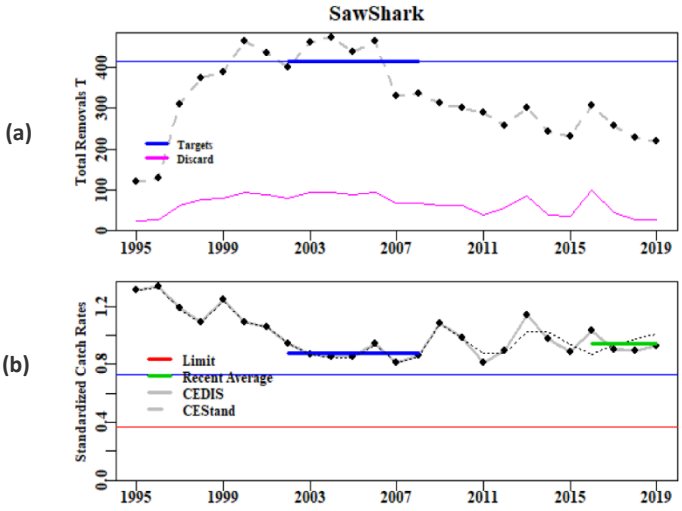


Figure 19: (a) total removals with the fine line illustrating the target catch, (b) standardised catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average 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, the RAG 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 will be considering how to approach this task at data workshop in early 2021, including using the use of logbooks and EM to differentiate between common sawshark and southern sawshark.

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, the RAG 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 three-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)	11.7 t	2016-2019 weighted average.
Discards (t)	34.4 t	2016-2019 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		509 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	**2021-22 TAC recommendation** 509 t First year of a three-year MYTAC. **SEMAC advice and any dissenting views** Industry noted that the targeting of this species is influenced by market demand, and there may be an increase in targeting if the gummy shark TAC is decreased. Both main species in the quota basket have been assessed as species of least concern in the IUCN Red List (global assessments).

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	509

Final agreed TAC

The AFMA Commission determined a TAC of 509 t for the 2021-22 fishing year, the first of a three year MYTAC, with under and overcatch provisions set at 10 per cent and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
432	509	10	2	+77

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 (close kin mark recapture (CKMR) assessment model). Review of Rebuilding Strategy underway by SharkRAG and SEMAC in 2020-21.
Stock structure	Tagging and genetic data shows some evidence for one well mixed stock. However, earlier data suggests there could be an east/west divide in stocks. This is supported by research documenting a collapse in the eastern part of the fishery around Tasmania and Bass Strait. After this collapse a fishery subsequently established in the west suggesting a reproductively isolated stock.

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

Tier	Year	Biomass	Target	Limit
1	2018	Unknown	48	20
1	2016	<20		
1	2012	<20		

Stock trend and other indicators See CPUE Report See Data Summary	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. The CKMR model indicates that the stock had recovered slightly during the period from 2000 to 2017. 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.

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
N/A – Rebuilding species	No

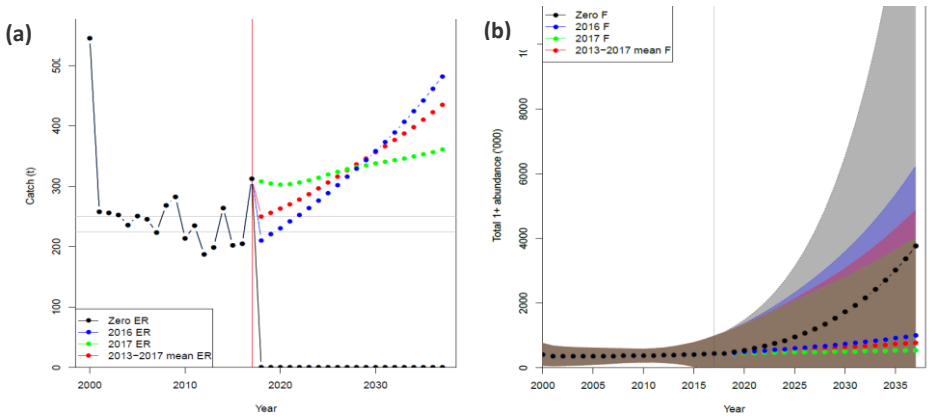
Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	195	195	-
2019-20	189	189	184
2018-19	215	215	196
2017-18	215	215	206

Economics (Secondary) Gillnet, Hook and Trap	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2018-19	2.04	23.66	8.62
	2017-18	1.87	19.51	9.58
	2016-17	1.70	20.23	8.40
ABARES Status (2020 report)	**Biomass: Overfished**		**Fishing Mortality: Uncertain**	

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.
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. In October 2018, SharkRAG accepted the CKMR assessment model noting high confidence in the absolute estimate of abundance produced by the model, but accepting lower confidence in the estimates of trend. 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, gives total fishing mortality estimates of 256 t in 2019-20, 263 t in 2020-21 and 270 t in 2021-22. This level of fishing mortality provides for consistent recovery, whereas projections using the 2017 fishing mortality rate (green line in figures below) would lead to an initial reduction (first two years) in stock size before recovery due to the effect of age class inputs in the model. The base case model shows a population that is relatively small compared with that estimated by the previous stock assessment model. However the model is inconsistent with the catches taken during the 1990s which brings into question whether or not the stock from which the CKMR sample was taken is different from the stock that sustained catches prior to 2000. That is, the stock being assessed may have been a different and smaller stock than the stock that was historically fished. Any future consideration of B_0 and associated reference points will need to take this into account. SSIA commissioned a review of the CKMR assessment in 2019. In 2020, FRDC also conducted a peer review process for the CKMR assessment report as part of its normal project review process. The outcomes of the FRDC peer review process have yet to be released. In January 2020, SharkRAG members supported the engagement of a third party to review the results of the CKMR assessment for school shark. A draft terms of reference for the review was considered by SharkRAG in May 2020 and were finalised out of session. Four experts were selected to form an Expert Panel to undertake the review: one chair and three panel members. A draft report from the Expert Panel has been provided to AFMA

	and will be presented to SharkRAG and SESSFRAG in early 2021, prior to public release. A meeting of SharkRAG will be convened for this purpose.
Projected biomass	The CKMR model provides an estimate of current absolute abundance with trend back to 2000. It does not provide an estimate of depletion from B_0. The CKMR model indicates that the stock had recovered slightly during the period from 2000 to 2017.  **Figure 20: (a) Projected catch (t) using different constant exploitation rate scenarios. (b) Projected abundance estimates based on different constant fishing mortality rate scenarios. Source: December 2018 SharkRAG**

Species specific research and priorities

Continued Close Kin Mark Recapture sampling and analysis for school shark

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

School shark and gummy shark post release survival (proposed, not funded)

Investigation of the post-release survival rates of gummy shark (focus on tertiary stress response) and school shark (focus on immediate and post-release mortality), and the application of survivability to discard estimates for these species.

Close kin sampling of school shark pupping grounds to understand stock structure (proposed, not funded)

Including locations, connectivity to get better understanding of stock structure. (SharkRAG needs to consider this). Noting that the stock assessment review should be completed first, as it may be found that broader sampling may be needed (or inversely there are enough samples).

RAG Recommendations

SharkRAG (December 2018) recommended an incidental bycatch TAC based on projections using the average fishery mortality rates over the last five years. The rate takes into account increasing stock size due to rebuilding, giving a total fishing morality estimate of 256t in 2019-20, 263 t in 2020-21 and 270 t in 2021-22.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	270	No. Rebuilding Species
	2020	263	
	2019	256	
Discount factor (%)	N/A	Discount factors are not applied to Tier 1 assessments.	

State catch (t)	32.3	2016-2019 weighted average. SharkRAG (October 2018) noted the importance of ensuring that State catches do not exceed the agreed levels allocated through the Memorandum of Understanding with Victoria, SA and Tasmania.
Discards (t)	43.5	Uses 2014 ISMP discard estimate of 15.1% (estimate not available from ISMP for later years due the introduction of e-monitoring in the GHAT sector).
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		194 t – incidental bycatch TAC

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. Dolphin interactions are managed through the GHAT Dolphin Strategy, which sets performant criteria for individual operators. School shark is caught in association with gummy shark by gillnet and longline fishers and may be a choke species, limiting gummy shark catches. To prevent targeting, gillnet operators are subject to a rule that constrains their catches of school shark to 20 per cent of their gummy shark catches.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 194 t Third year of a three-year MYTAC. **SEMAC advice and any dissenting views** Industry supported the proposed TAC, caveated by the need to progress issues related to post-release survival of school shark, live-release requirements under the rebuilding strategy, and the independent panel review of the CKMR assessment and ongoing collection of samples to support future assessments. SEMAC also noted the importance of continuing to progress the review of the CKMR assessment, noting school shark has been identified 'critically endangered' at a global level in the IUCN Red List. AFMA noted the progress to date of the review of the CKMR assessment. There has also recently been a research proposal submitted to FRDC regarding post-release survival of school shark. In addition, current management arrangements under the rebuilding strategy, including the live-release rule, will be considered by SharkRAG in 2021.

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

0	0	2	194

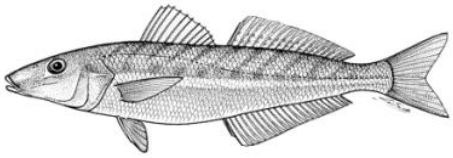
Final agreed TAC

The AFMA Commission determined a bycatch TAC of 194 t for the 2021-22 fishing year, with overcatch and undercatch provisions set at 0 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
195	194	0	2	-1

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 (%SSB_0)	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	41	48	20
	1	2017[7]	47		
	1	2009	50		
Stock trend and other indicators See CPUE Report See Data Summary	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) standardised CPUE moves around the long-term average between 2001 and 2017. However, there has been a decline in CPUE in 2018 and 2019 to the lowest CPUE values since 2000.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	3rd of 3-year			Yes SESSFRAG (August 2020) recommended that a stock assessment is undertaken in 2020.	
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**		**TAC after unders/overs**	**Cth Retained Catch**

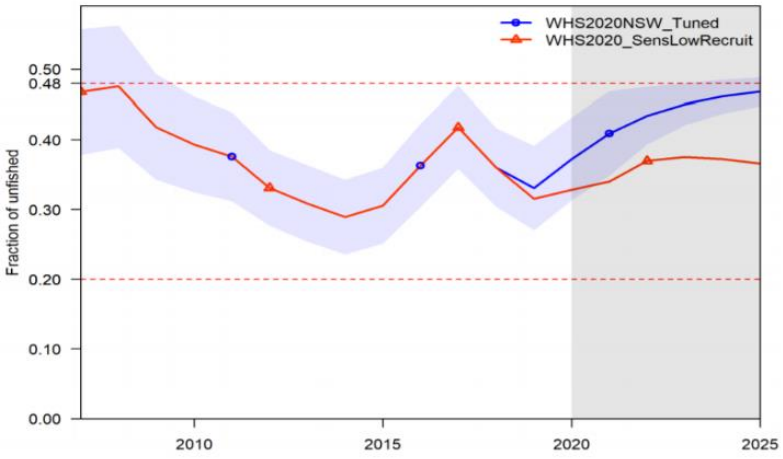
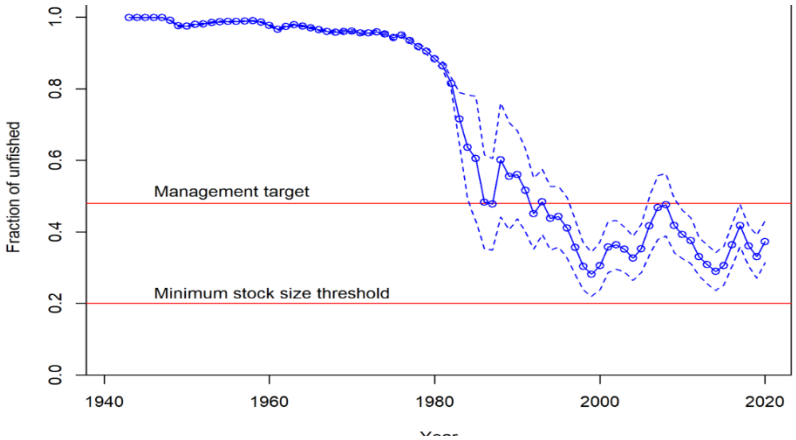
[7] A partial update to the 2017 assessment in 2019 estimated a biomass of 36%B_0.

	2020-21	788	862	-
	2019-20	788	867	526
	2018-19	820	915	537
	2017-18	986	1071	736
Economics (Primary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	1.37	49.47	2.77
	2017-18	2.27	41.86	5.42
	2016-17	1.49	46.42	3.21
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	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
Significant changes to data inputs	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) 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 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 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 determine the stock structure of eastern school whiting stock and better understand the species composition mix between eastern school whiting and stout whiting. Future stock assessments will consider the outcomes from this project.

RAG Recommendations

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

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	2,321	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.
	2022	2,250	
	2021	2,140	
	Long-term	2,448	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments	
State catch (t)	1,215.9 24.9 (excluding NSW)	Mostly NSW catches, which remained high in 2019. Weighted average NSW catches since 2016 are 1,191 t.	
Discards (t)	2021: 370 3-year average: 378	Model estimated discards from the most recent Tier 1 assessment are deducted from the TAC.	

Recreational catch (t)	N/A	Recreational catch estimates are uncertain and species (including King George whiting) are not clearly delineated. Recreational catch is not included in the assessment.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		644 t (using 3-year average) or 555 t (using 2021 RBC & discards)

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, however catches in the NSW Southern Fish Trawl Fishery (SFTF) remain unrestricted, and NSW catches remained high in 2019 at 1,204 t compared to 1,212 t and 1,294 t in 2018 and 2017, respectively.
Species specific management (target, companion and bycatch)	There is uncertainty around the stock structure as well as the species composition of NSW catches, particularly north of Barrenjoey Head. A FRDC project is currently underway, led by Dr Karina Hall (NSW DPI) and scheduled for completion by May 2022, to better understand stock structure.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 917 t First year of a three-year MYTAC. **SEMAC advice and any dissenting views** The NSW representative advised that the NSW TAC Committee are meeting on the 9th of February 2021 to discuss the TAC for the 2021-22 fishing season. SEMAC noted that the NSW Southern Fish Trawl Fishery (SFTF) is not currently managed under quota, and there are no catch restrictions in place for eastern school whiting. The sector is expected to transition to the Commonwealth under proposed Offshore Constitutional Settlement (OCS) arrangements, however the implementation dates have not been finalised. There has been an increase in the estimates of discards, with an average three-year modelled estimate of 378 t. This was partly driven by the recent inclusion of NSW discard information in the stock assessment, as well as an increase in the estimated discards in the Commonwealth. The MAC noted that catch sharing discussions are currently underway between the Commonwealth and NSW, however an agreement has not been reached. In the interim, SEMAC supported AFMA's approach to setting the TAC based on a 50 per cent allocation of the sustainable catch between the jurisdictions. SEMAC noted the development of a NSW harvest strategy for whiting, and emphasised the importance of consistency between that and the SESSF Harvest Strategy.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	917

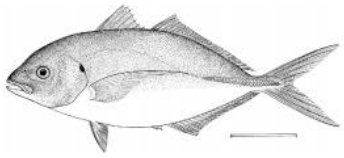
Final agreed TAC

The AFMA Commission determined a TAC of 917 t for the 2021-22 fishing year, the first year of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
788	917	10	2	+129

Silver trevally

Pseudocaranx dentex



Species summary					
Common names	Silver bream, skippy, white trevally, skipjack trevally				
Stock assessment	Tier 4 Species - last assessed by SERAG in 2020.				
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**	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	0.5642	0.9221	0.3842
	4	2017	0.6722	0.9026	0.3761
	4	2013	0.8956	0.8527	0.3411
Stock trend and other indicators [See CPUE Report] [See Data Summary]	Standardised CPUE has been declining for the last three years and the most recent estimate is below the limit reference point. The four-year average remains above the limit reference point.				
Multi-Year TAC	**MYTAC (2020-21)**		**Have breakout rules been triggered?**		
	3rd of 3-year		Yes. SESSFRAG (August 2020) recommended undertaking the 2020 Tier 4 assessment.		
Catch and TAC (t)	**SESSF fishing year**	**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**	
	2020-21	289	318	-	
	2019-20	292	323	21	
	2018-19	307	368	8	
	2017-18	613	672	55	
Economics (Secondary) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**	
	2018-19	0.01	49.47	0.02	
	2017-18	0.23	41.86	0.55	

	2016-17	0.24	46.42	0.52
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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 rate estimates from 1998-2001 were used to backfill estimates from 1986-2000. NSW and Victoria annual catches were revised for the 2020 assessment.
Data and RAG comments	Most of the Commonwealth catch is from Zone 10. 81 t of the 84 t landed in 2019 was taken by State fisheries – mostly NSW and SA. Only seven Commonwealth boats caught silver trevally in 2019, a reduction from 14 boats in 2018 and 21 boats in 2015. Only Commonwealth catch and effort are used to inform the CPUE analysis, and State catches are included to inform C_{Targ} in the Tier 4 assessment.
Stock assessment information and RAG comments	The RBC has decreased from 445 t under the 2017 Tier 4 assessment, to 369.7 t under the 2020 Tier 4 assessment. While the most recent estimate of standardised CPUE is below the limit reference point, the RBC is calculated using the four-year average CPUE, which remains above the limit reference point. The CPUE trend is consistent with catch rates from NSW fisheries. The status of the NSW Silver Trevally stock is classified as depleted (see NSW Stock Assessment) The Commonwealth Tier 4 harvest control rules have been tested using Management Strategy Evaluation (MSE), and under the SESSF Harvest Strategy, a single CPUE point below the limit reference point does not require that the RBC is set at zero. Industry have noted that recent low catches of silver trevally are due to the stock residing more inside State waters, and catch rates would be expected to increase when there is an influx of fresh water in the estuaries, forcing the stock into Commonwealth waters.

Species specific research and priorities

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

RAG Recommendations

Given the most recent standardised CPUE point is below the limit reference point, SERAG recommended a single-year TAC using the RBC of 369.7 t for the 2021-22 SESSF fishing year.

SERAG recommended updating the Tier 4 assessment in 2021 to allow for close monitoring of the four-year average CPUE.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	370	No. SERAG recommended a single-year TAC in order to more closely monitor the average CPUE.
	2020	445	
	2019	445	
Discount factor (t)	N/A	The Tier 4 discount factor is not applied because of the protection afforded by the Batemans Bay Marine Park closure.	
State catch (t)	99	Mostly NSW and SA catches.	
Discards (t)	18.1	The 2015 discard rate estimate of 13.1 per cent has been carried forward to 2019.	
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		253 t	

MAC Recommendations

Commercial fishers' interests	NSW set a 26.8 t TAC for the first time in 2019 – this was carried over for the 2020-21 fishing year.
Species specific management (target, companion and bycatch)	The Batemans Bay MPA closure overlaps fishing ground that was preferred by Commonwealth operators.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 253 t Single-year TAC. **SEMAC advice and any dissenting views** Industry noted silver trevally is not targeted in the trawl sector, and catches are well below the proposed TAC. Recreational catch is estimated to be between 54 t and 120 t in NSW but is not included in the assessment. The MAC noted the importance of obtaining recreational catch data and recommended that SERAG consider the available recreational catch data in the 2021 Tier 4 assessment. This has previously been considered by SERAG, and CSIRO will engage the state agencies throughout 2021 to obtain the available data for future assessments. Recreational catch is high, which may be contributing to the decline in CPUE. There will be significant implications for the Commonwealth if the

	stock status continues to decline, and it is important that the Commonwealth emphasise the importance of the state agencies collecting reliable data. NSW recreational catch surveys were undertaken in 2017-18 and 2019-20, and are scheduled to be completed every two years. FRDC have recently funded a project to inform the collecting of recreational catch data from the states through a comparison of traditional (telephone/diary) survey methods and emerging technologies (e.g. smartphone application).

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	253

Final agreed TAC

The AFMA Commission determined a TAC of 197 t for 2021-22 fishing year, a single year TAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
289	197	10	2	-92

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 2018
Stock structure	Considered to be a single stock in the SESSF.

Stock status against reference points (%B_0)

Tier	Year	Biomass	Target	Limit
1	2018	31	48	20
1	2015	40		
1	2012	47		

Stock trend and other indicators

See CPUE Report

See Data Summary

Biomass Trend: The biomass has declined since the mid-2000s with the 2018 assessment estimating a recent increase from close to the limit reference point to the estimated biomass of 31%B_0.

Previous assessments (Day et al 2012, 2015) have shown that the optimistic recent recruitments which may be driving the recent increase in biomass have been revised downwards in subsequent assessments.

Standardised CPUE has continued to decline and is at historically low levels, but there are no major changes in other indicators (size composition, age composition, area of the fishery, or depth distribution of the catch).

Multi-Year TAC

Year of MYTAC (2020-21)	Have breakout rules been triggered?
2nd of 3-year	Yes SESSFRAG (August 2020) recommended continuing with the current MYTAC and updating assessment in 2021

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	450	490	-
2019-20	450	505	307
2018-19	600	652	352
2017-18	605	716	432

Economics (Primary) Commonwealth Trawl and Scalefish Hook	Financial Year	Species GVP ($m)	Fishery GVP ($m)	% Fishery GVP
	2018-19	0.37	49.47	0.75
	2017-18	0.57	41.86	1.36
	2016-17	0.45	46.42	0.97
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment summary

Key model technical assumptions/ parameters	The ageing error matrix has been updated. A new tuning procedure has been used to balance the weighting of each of the data sources that contribute to the overall likelihood function.
Significant changes to data inputs	Catches from the GHATS and the Small Pelagic Fishery (SPF) are now included. Estimated annual discard rates that are fitted to by the model have been split into eastern and western components. Factory trawlers are now included in the estimation of annual discard rates when there is observer coverage. CTSFIS abundance indices for east and west fleets are removed from the base case and are considered as a sensitivity.
Data and RAG comments	There were questions regarding the discarding of silver warehou on factory trawlers. For this assessment discard estimates from factory trawlers were incorporated into the overall estimate where observers were present. CPUE assumes targeting practices have not changed over time. Industry members suggested larger vessels leaving the fleet have changed the dynamics of the fishery. CPUE standardisation may not adequately account for this.
Stock assessment information and RAG comments	Base case results Under the assumption that there was an increase in the stock size in 2016 & 2017 and that the stock will return to average recruitment, the spawning biomass in 2019 under the base case is estimated to 31% of B_0. Previous assessments (Day et al 2012, 2015) have shown the pattern of optimistic recent recruitments and increases in stock status have not been realised in subsequent assessments. The recent estimates of recruitment and stock size have been revised downwards in subsequent assessments. An application of the Tier 1 harvest control rule with a target depletion of 48 per cent leads to the RBCs below. Assuming average recruitment, the biomass is projected to reach target by 2030. Predicted RBCs under average recruitment are well above current catch levels (~350 t). Average recruitment has not been observed since 2003. Variations to future recruitment At SERAG's request (September 2018), projections were carried out using two scenarios of below average recruitment assuming catches continue at current levels (~350 t): Mean of last five years: stock status improves more slowly (~31%B0 in 2021). This was used as the scenario in the 2015 assessment. Mean of the lowest three of the last five years: spawning biomass stabilises at around 27%B_0.

A retrospective analysis was undertaken to determine whether the pattern of optimistic recruitment revised down in previous assessments was still present in the 2018 assessment structure.

The 2018, 2016 and 2014 scenarios all saw increases in estimated stock depletion levels in the final two or three years of the assessment. That pattern was not present in the 2012 assessment.

Estimated recruitment deviations from the 2014 and 2016 scenarios are revised downwards in subsequent assessments.

Dr Burch suggested the increase in biomass in the last two years could be due to an overestimation of CPUE in the last two years.

Uncertainty around assessment

The depletion from an MCMC in 2019 of 30.4% is slightly lower than the MLE estimate of 31.3%B_0.

MCMC analysis suggests the probability that depletion was <20%B_0 between 2013 and 2016 was between 68% and 75%.

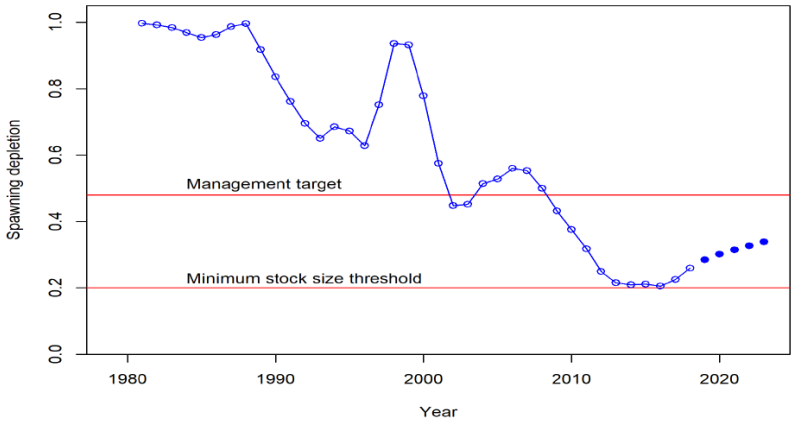
RBC advice

In forming RBC advice, SERAG recommended using projections that use the low recruitment scenario (average of the last five years). This was also used in the 2015 assessment.

Consistent with the approach in 2015, SERAG requested running a series of fixed catch projections under the 'low' recruitment scenario to assist in forming RBC advice; harvest control rule catches, current TAC, current catches, 450 t and 750 t.

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

Catch scenario	Mean RBC (t)	Mean discards (t)	2019 (%)	2020 (%)	2021 (%)	2022 (%)	2023 (%)
348	375.0	26.9	28.4	30.1	31.4	32.6	33.9
400	431.1	31.1	28.4	29.9	31.0	32.0	32.3
450	485.3	35.3	28.4	29.6	30.5	31.4	32.3
500	539.5	39.5	28.4	29.4	30.1	30.7	31.5
550	593.8	43.8	28.4	29.2	29.6	30.1	30.7
600	648.2	48.2	28.4	29.0	29.2	29.5	29.9
750	811.8	61.8	28.4	28.3	27.9	27.6	27.5
2019 RBC (under average recruitment)	854.0	70.0	28.4	27.8	25.3	22.7	20.4

Projected biomass	 **Figure 21: Time-trajectory of spawning biomass depletion (with 95 per cent confident intervals) under poor recruitment and catches maintained at current levels (Burch, Day and Castillo-Jordán 2018).**

Species specific research and priorities

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

RAG Recommendations

SERAG (November 2018) recommended using the 'low recruitment' constant catch scenario for setting the TAC, noting that that the RBC from the assessment (942 t) would likely result in stock decline.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	1,420	Yes. 3-year MYTAC recommended using the 'low recruitment' constant catch scenario.
	2020	1,353	
	2019	942	
	3-Year Average	1,238	
Discount factor (t)	N/A	Discount factors are not applied to Tier 1 assessments.	
State catch (t)	N/A	The majority of State catches were recorded from VIC and NSW, 0.2 t. State catches are not deducted from the RBC because a TAC based on constant catch is recommended.	
Discards (t)	N/A	Discards, 100.7 t, are not deducted from the RBC because a TAC based on constant catch is recommended.	
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		1,319 t*	

	*calculated using the 2021 RBC from the 2018 assessment. This TAC has not been recommended, TAC calculated using 'low recruitment' constant catch scenario.

MAC Recommendations

Commercial fishers' interests	Industry have reported that catch rates have recently improved off the east coast from St Helens to Ulladulla. Industry have previously advised that silver warehou had not been targeted by many boats, however there had been positive conditions and increasing catches of smaller fish, indicating a level of recruitment.
Species specific management (target, companion and bycatch)	Silver warehou are caught as bycatch when fishing for blue grenadier. There is a risk that an increase in blue-grenadier catches in the winter spawning fishery could see an increase in catches/discards of silver warehou.
MAC advice and any dissenting views	**2021-22 TAC recommendation** 450 t Third of a three-year MYTAC. **SEMAC advice and any dissenting views** Industry noted silver warehou is not typically targeted, however are often retained when caught. There were no dissenting views and SEMAC were comfortable with the information provided in the table.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	450

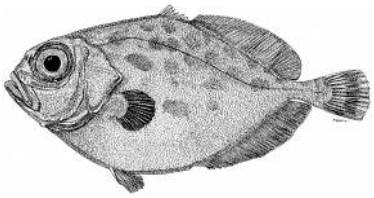
Final agreed TAC

The AFMA Commission determined a TAC of 450 t for the 2021-22 fishing year, the third year of a three-year MYTAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
450	450	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	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

See Data Summary

Tier 4 species use CPUE targets as a proxy of biomass targets.

The Tier 4 target reference point is the level of CPUE assumed to produce a spawning biomass of 48 per cent of unfished levels.

The limit reference point is the level of CPUE assumed to produce a spawning biomass of 20 per cent of unfished levels.

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 (2020-21)	Have breakout rules been triggered?
Single year TAC	N/A

Catch and TAC (t)

SESSF fishing year	Agreed TAC	TAC after unders/overs	Cth Retained Catch
2020-21	150	169	-
2019-20	150	169	0
2018-19	150	169	0

	2017-18	150	169	0
Economics (Byproduct) Commonwealth Trawl and Scalefish Hook	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0	49.47	0
	2017-18	0	41.86	0
	2016-17	0	46.42	0
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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. Depth categories of 20m (acknowledged that 50 m may be more appropriate). Standardised catch rates: 1994-2010 Zone 40 (depth 650 – 1,250 m)
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 vessels, with a low level of catch, and that standardised catch rate contained a large amount of errors.

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.

	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	**2021-22 TAC recommendation** 150 t – subject to 10 t trigger. Single-year TAC. **SEMAC advice and any dissenting views** There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

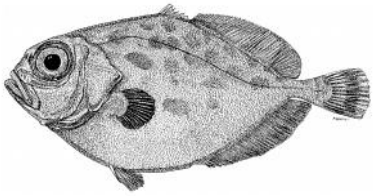
Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	150

Final agreed TAC

The AFMA Commission determined a TAC of 150 t, a single year TAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.				
2020-21 agreed TAC (t)	**2021-22 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**	**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 See Data Summary	Catches have increased in recent years, as the TAC and targeting of eastern and Pedra Branca orange roughy stocks have increased. 85-90 per cent of the TAC has been caught over the last two fishing years.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	Single year TAC			N/A	
Catch and TAC (t)	**SESSF fishing year**		**Agreed TAC**	**TAC after unders/overs**	**Cth Retained Catch**
	2020-21		135	144	-
	2019-20		90	97	76
	2018-19		90	99	81
	2017-18		90	99	55
Economics	**Financial Year**		**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**

(Byproduct) Commonwealth Trawl and Scalefish Hook	2018-19	0.33	49.47	0.67
	2017-18	0.14	41.86	0.33
	2016-17	0.19	46.42	0.41
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

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. Noting the potential for smooth oreo (other) to become a choke species given the increase to the Pedra Branca orange roughy TAC, SEMAC (February 2020) recommended setting the

	smooth oreo (other) TAC at 135 t for the 2020-21 fishing year, subject to a trigger at 70 t, at which point SERAG advice would be sought regarding catches up to the 135 t TAC. If SERAG did not support exceeding the existing 90 t TAC, AFMA would explore options for closing the Pedra Branca area once 90 t was caught. SERAG (2020) noted there was no increase in catch of smooth orea (other) during the 2020-21 fishing year. In the absence of any new data to support an increase to the TAC, SERAG recommended setting the 2021-22 TAC at the previous level of 90 t. SERAG agreed to consider future increases to the TAC if additional information became available to support it.

Species specific research and priorities

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

RAG Recommendations

SERAG (October 2020) noted that no new information was available to change its advice provided at SERAG (October 2019), and recommended a TAC of 90 t for the 2021-22 fishing year, a single year TAC.

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2021	90	No. Single year TAC.
	2020	90	
	2019	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)	Smooth oreo are caught with orange roughy and may be considered a choke species in some zones.

MAC advice and any dissenting views	**2021-22 TAC recommendation** 90 t Single year TAC. **SEMAC advice and any dissenting views** SEMAC recalled their advice from 2020 to set the TAC at 135 t to account for the expected increase in catch, due to increased fishing effort for orange roughy. This did not occur, and in the absence of any new information, SERAG recommended setting the TAC at the previous level of 90 t. SEMAC were supportive of SERAG's advice to set the TAC at 90 t for the 2021-22 fishing year.

Undercatch (%)	Overcatch (%)	Determined amount (t)	TAC (t)
10	10	2	90

Final agreed TAC

The AFMA Commission determined a TAC of 90 t, a single year TAC, with overcatch and undercatch provisions set at 10 per cent, and a determined amount of 2 t.

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & undercatch (%)	Determined amount (t)	Change in TAC (t)
135	90	10	2	-45

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 2020 SERAG meeting**Error! Bookmark not defined.**.

As at 4 January 2020, no catch has been recorded in the ECDWT Sector for the 2020-21 fishing year. SERAG (October 2020) recommended a continuation of previous TACs and catch triggers for boarfish and orange roughy in the ECDWT Sector for the 2021-22 fishing year (Table 1); noting that boarfish catches in the ECDWT Sector have been below 100 kg for the past two fishing years, and no orange roughy catch has been reported since 2003-04.

2021-22 SEMAC recommendation

Boarfish – 200 t trigger

Orange roughy - 50 t trigger

SEMAC advice and any dissenting views

There were no dissenting views and SEMAC were comfortable with the advice provided in the paper.

Final agreed catch trigger

The AFMA Commission determined catch triggers of 200 t for boarfish and 50 t for orange roughy in the ECDWT Sector for the 2021-22 fishing year (Table 1).

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

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

Non-Quota species	2020-21 Catch Trigger (t)	2021-22 Recommended Catch Trigger (t)	Change from 2020-21 (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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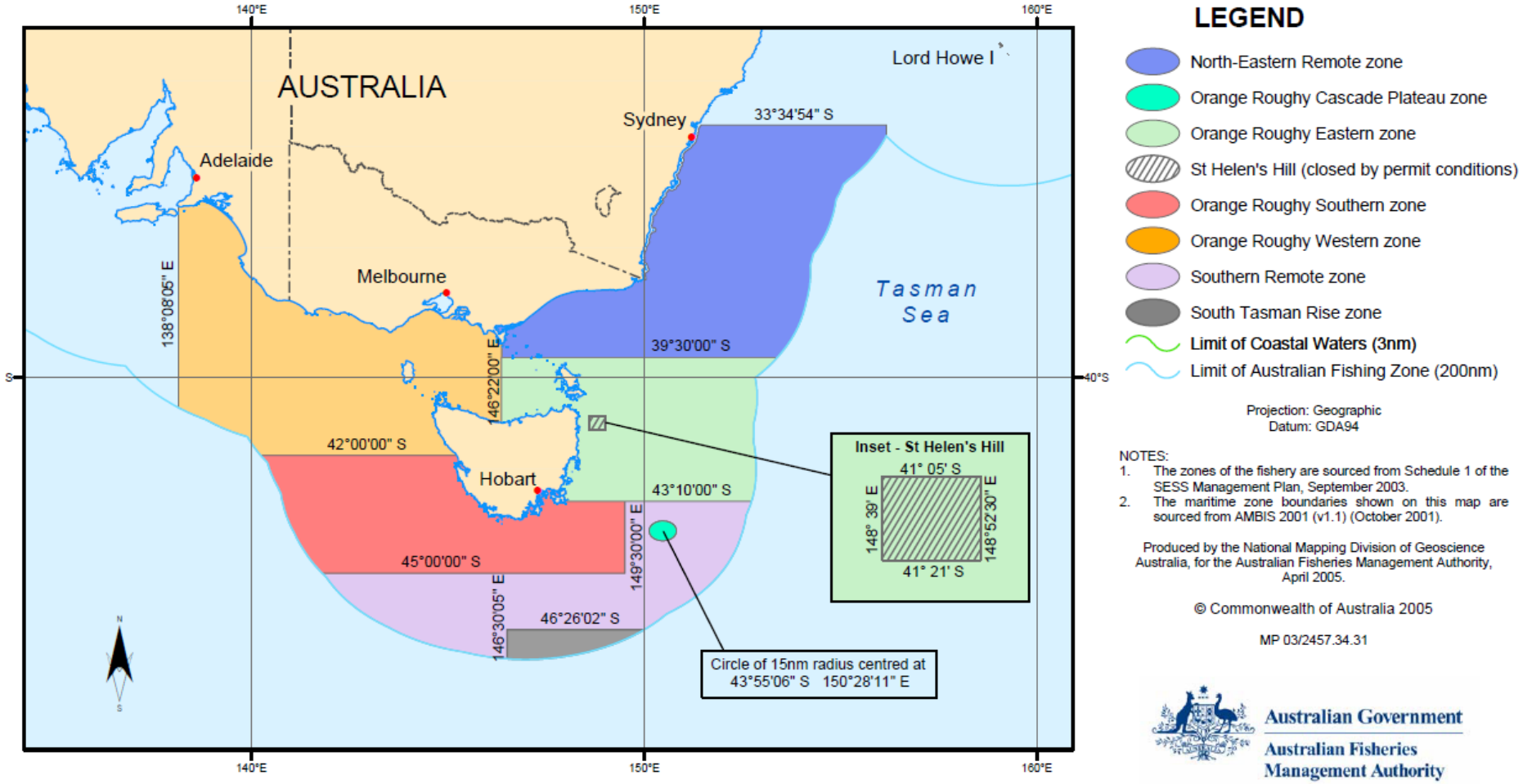
Wayte, S (2004) Stock assessment of the Cascade Plateau orange roughy. Technical report presented to DeepRAG 2004.

Appendix A - SESSF ISMP Scalefish Zones

Appendix B - Orange Roughy Zones