



Australian Government  
Australian Fisheries Management Authority

## 2018 Species Summaries for the Southern and Eastern Scalefish and Shark Fishery

For stock assessments completed in  
2018 in preparation for the 2019-20  
fishing seasons.

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## Introduction

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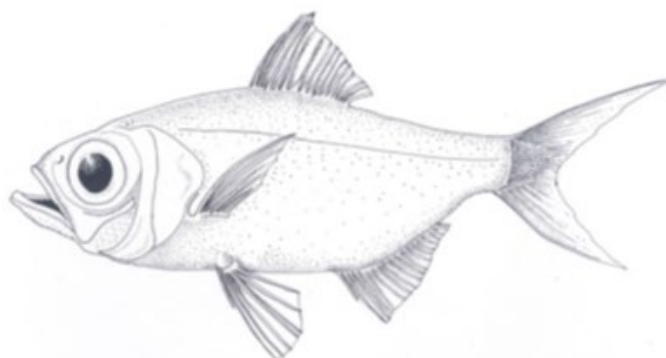
These species summaries provide information on quota species assessed by the various Resource Assessment Groups (RAGs) for the Southern and Eastern Scalefish and Shark Fishery (SESSF) including Great Australian Bight RAG (GABRAG); South East RAG (SERAG) and SharkRAG.

These assessment summaries apply to stock assessments conducted in 2018 and made available for the 2019-20 fishing season.

The summaries contain basic information on stock status, Total Allowable Catches (TACs) and catch trends, assessment details and RAG comments. The summaries are designed to be a quick reference, and should be read in conjunction with RAG minutes and the applicable species stock assessments. Annual updates are completed for species that have a new stock assessment, were considered by the RAGs or species that are under AFMA rebuilding strategies. The most recent full set of species summaries can be found on the AFMA website.

A glossary of commonly used terms is available at the end of the document.

# 1 Alfonsino (*Beryx splendens*)



ABARES (2012): Line drawing – William Murray

**Tier 3 - last assessed by SlopeRAG in 2013.**

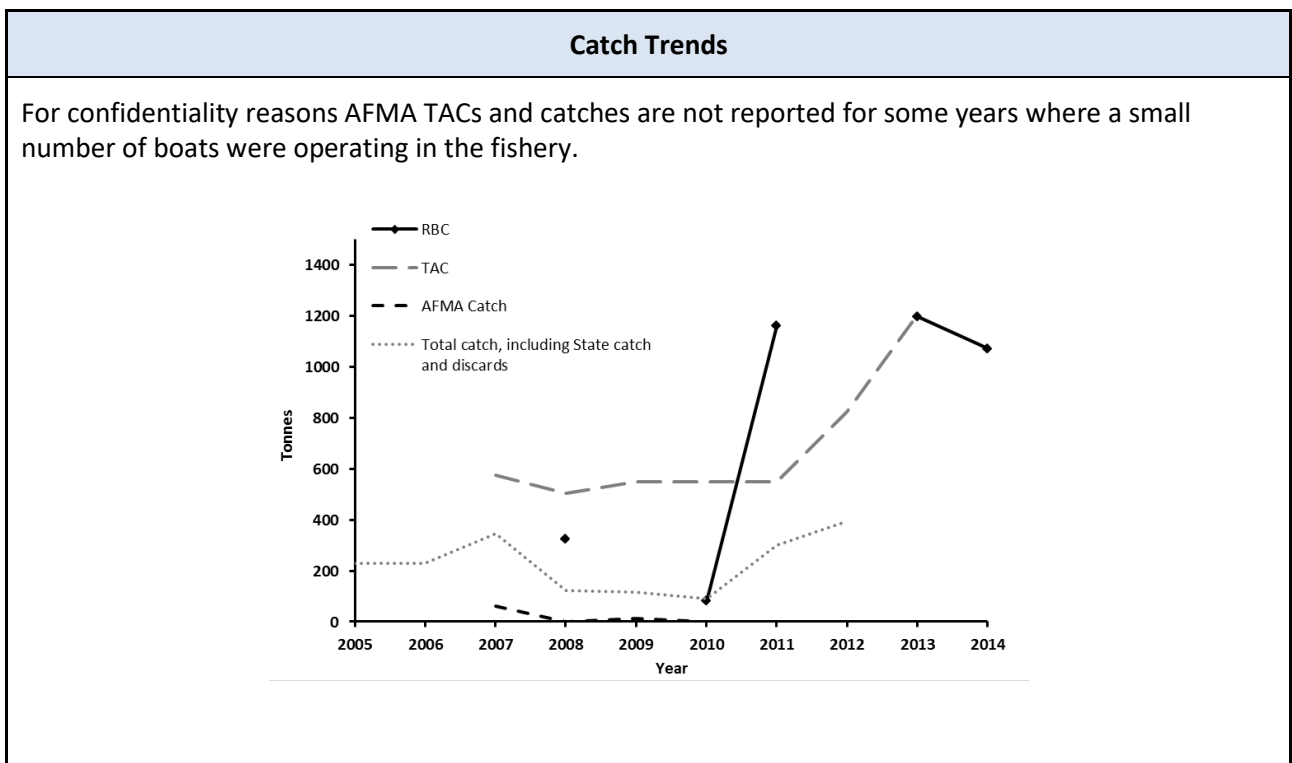
Summary									
<b>Stock Structure</b>	<p>Little is known about the stock structure of Alfonsino in the SESSF. However, it is acknowledged that this is a straddling stock between the Australian Fishing Zone (AFZ) and the high seas. Only the East Coast Deepwater Zone (ECDWZ) resource is under quota management and this assessment summary only pertains to the ECDWZ (within the AFZ).</p>								
<b>Stock status against reference points and trend</b>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Current</th> <th>Target</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>F = 0.022</td> <td>F<sub>48</sub>=0.149</td> <td>F<sub>20</sub>=0.479</td> </tr> </tbody> </table> <p>Catches remain well below the TACs because 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.</p> <p>Tier 3 species use estimates of fishing mortality (F) that will reduce spawning biomass to a given level as reference points.</p> <p>The Tier 3 target reference point for Alfonsino is the level of F that will produce a spawning biomass of 48% of unfished levels.</p> <p>The Tier 3 limit reference point for Alfonsino is the level of F that will produce a spawning biomass of 20% of unfished levels.</p>			Current	Target	Limit	F = 0.022	F <sub>48</sub> =0.149	F <sub>20</sub> =0.479
Current	Target	Limit							
F = 0.022	F <sub>48</sub> =0.149	F <sub>20</sub> =0.479							
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing							
<b>GVP Figures</b>	<b>GVP</b> confidential	<b>% Fishery GVP</b> N/A							
<b>Is a MYTAC in place this season?</b>	No	<b>Have breakout rules been triggered?</b>	N/A						



Assessment Summary	
<b>Tier Level</b>	Tier 3 (last assessed in 2013)
<b>Stock indicator trends</b>	The age structure indicates that the stock has not been greatly impacted by fishing. TACs were increasing but catches remain well below the TACs. Nearly all the catch in the AFZ comes from the East Coast Deep Water Trawl Sector (ECDW) and due to low effort catches have been low.
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/assumptions</b>	N/A
<b>Significant changes to data inputs</b>	Calculation of the RBC only uses AFZ data, and so pertains only to the AFZ.
<b>RAG Comments on data</b>	Little new data is available given the lack of fishing for operational reasons.
<b>RAG Comments on assessment</b>	In 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.
<b>Projected Biomass (including confidence intervals)</b>	N/A – Tier 3

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Tier 3	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
<b>Stock Status</b>	Fishing mortality lower than target	Fishing mortality lower than target	Fishing mortality lower than target	Fishing mortality lower than target	Fishing mortality lower than target	Fishing mortality lower than target
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC (retained)</b>	1070	1070	1070	1070	1070	1070
<b>Agreed TAC</b>	1017	1016	1017	1017		
<b>TAC after unders/overs</b>	1130	1118	1119	1119		
<b>% TAC caught</b>	0%	0%	0%	0%		

RAG Recommendations		
<b>Recommended Biological Catch (2014/15)</b>	1-year: 1070 tonnes 3-year: 1070 tonnes	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 5%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3 year MYTAC, calculated from the RBC of 1070 t.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation</b> N/A. <b>Alternative Catch Scenarios:</b> N/A	
<b>Research Catch Allowance</b>  <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A	



## 2 Bight Redfish (*Centroberyx gerrardi*)



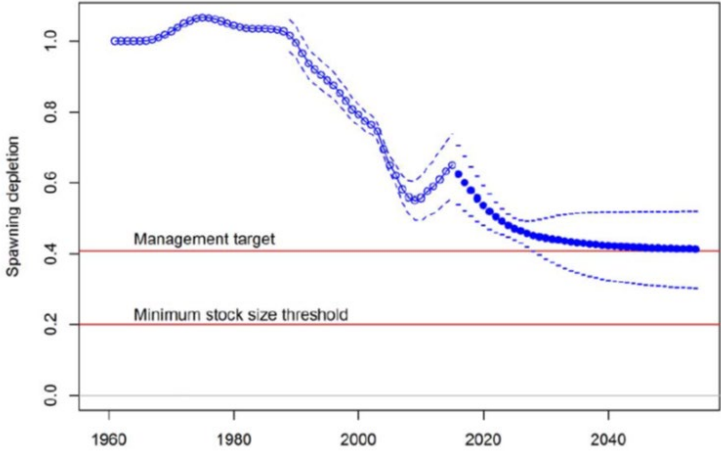
Common names: Nannygai, redfish, red snapper, king snapper, golden snapper.

Tier 1 - assessed by GABRAG in 2018

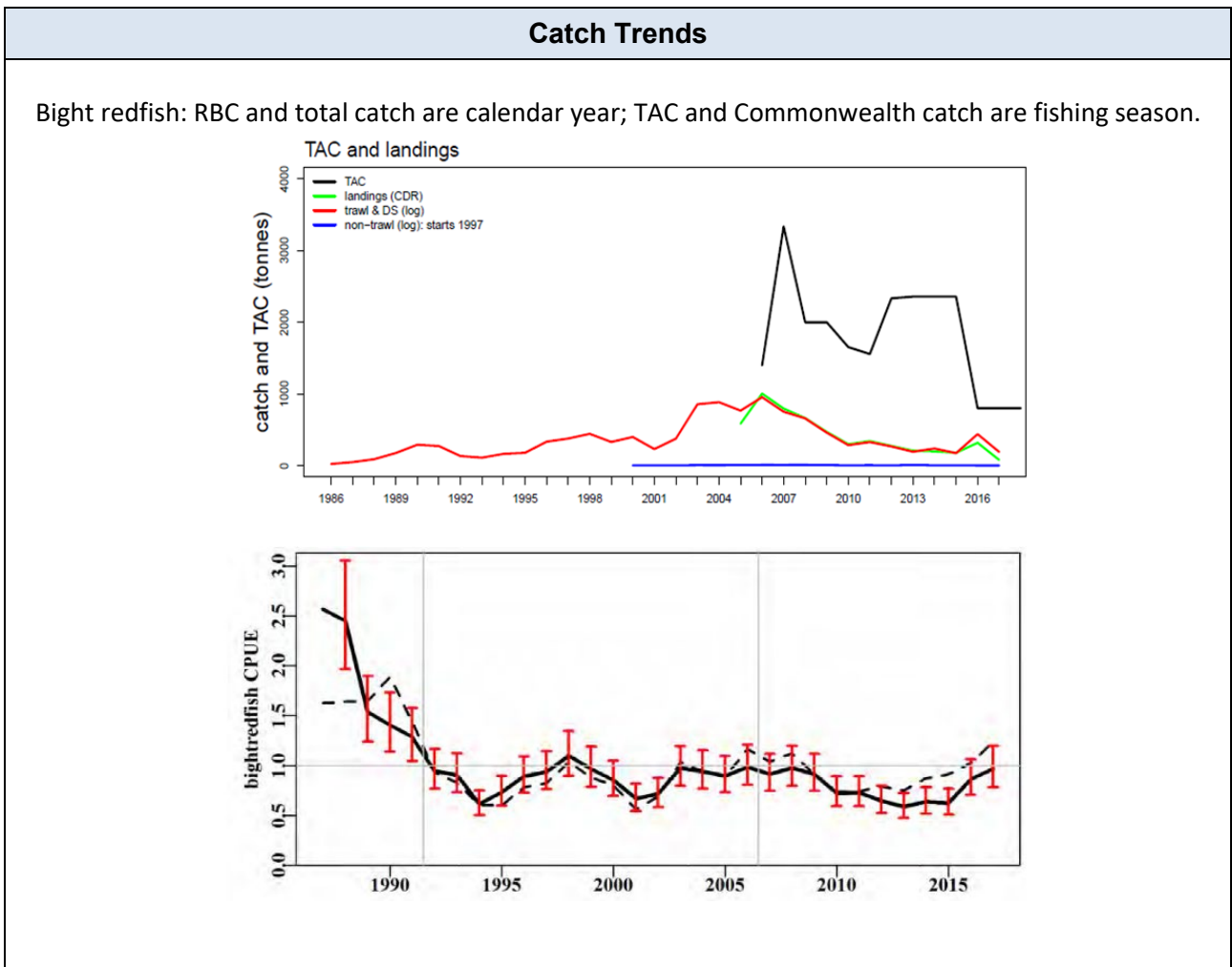
Summary			
<b>Stock Structure</b>	Assessed as a single stock.		
<b>Stock status against reference points and trend</b>	<p>Limit reference is 20 per cent of unfished biomass.</p> <p>Target reference is 41 per cent of unfished biomass.</p> <p>2015 assessment: 63 per cent of unfished biomass</p> <p>Modelling suggests a slow decline in abundance consistent with the fish-down of a developing fishery. 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. Current biomass is higher than the target biomass.</p>		
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$1.43 million	<b>% Fishery GVP</b> 14.2% (GABTS)	
<b>Is a MYTAC in place this season?</b>	Yes. 5-year RBC = 797 t	<b>Have breakout rules been triggered?</b>	N/A



<b>Assessment Summary</b>																																																															
<b>Tier Level</b>	Tier 1																																																														
<b>Stock indicator trends</b>	Model fits a decline in abundance, consistent with the fishdown of a developing fishery. Biomass is high relative to targets.																																																														
<b>Key model technical assumptions/ parameters</b>	<p><b>Table 2.</b> Summary of selected parameters from the base case model. Sources: (1) Analyses of biological samples collected during the 2004 GAB reproductive study (Brown and Sivakumaran, 2007), (2) length and age samples collected between 2000-2003 and (3) length samples collected during the 2001 FRDC project</p> <table border="1"> <thead> <tr> <th>Description</th> <th>Source</th> <th>Parameter</th> <th>Combined Male/Female</th> </tr> </thead> <tbody> <tr> <td>Years</td> <td></td> <td><math>y</math></td> <td>1960-2014</td> </tr> <tr> <td>Recruitment Deviates</td> <td></td> <td><math>r</math></td> <td>est 1960 - 2005</td> </tr> <tr> <td>Fleets</td> <td></td> <td></td> <td>1 trawl only</td> </tr> <tr> <td>Discards</td> <td></td> <td></td> <td>none significant, not Fitted</td> </tr> <tr> <td>Age classes</td> <td></td> <td><math>a</math></td> <td>0-65 years</td> </tr> <tr> <td>Sex ratio</td> <td></td> <td><math>p_s</math></td> <td>0.5 (1:1)</td> </tr> <tr> <td>Natural mortality</td> <td></td> <td><math>M</math></td> <td>estimated (0.1) per year</td> </tr> <tr> <td>Steepness</td> <td></td> <td><math>h</math></td> <td>0.75</td> </tr> <tr> <td>Recruitment variation</td> <td></td> <td><math>\sigma_r</math></td> <td>0.35</td> </tr> <tr> <td>Female maturity</td> <td>1</td> <td></td> <td>25 cm (SL)</td> </tr> <tr> <td rowspan="4">Growth</td> <td rowspan="4">2</td> <td><math>L_{max}</math></td> <td>37.939 cm (SL)</td> </tr> <tr> <td><math>K</math></td> <td>fitted</td> </tr> <tr> <td><math>L_{min}</math></td> <td>fitted</td> </tr> <tr> <td>CV</td> <td>fitted</td> </tr> <tr> <td rowspan="2">Length-weight (based on standard length)</td> <td rowspan="2">3</td> <td><math>f_1</math></td> <td>F 0.000128 cm (SL)/gm</td> <td>Male</td> </tr> <tr> <td><math>f_2</math></td> <td>F 2.559</td> <td>M 2.522</td> </tr> </tbody> </table>	Description	Source	Parameter	Combined Male/Female	Years		$y$	1960-2014	Recruitment Deviates		$r$	est 1960 - 2005	Fleets			1 trawl only	Discards			none significant, not Fitted	Age classes		$a$	0-65 years	Sex ratio		$p_s$	0.5 (1:1)	Natural mortality		$M$	estimated (0.1) per year	Steepness		$h$	0.75	Recruitment variation		$\sigma_r$	0.35	Female maturity	1		25 cm (SL)	Growth	2	$L_{max}$	37.939 cm (SL)	$K$	fitted	$L_{min}$	fitted	CV	fitted	Length-weight (based on standard length)	3	$f_1$	F 0.000128 cm (SL)/gm	Male	$f_2$	F 2.559	M 2.522
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<b>Changes to model structure/assumptions</b>	N/A																																																														
<b>Significant changes to data inputs</b>	<ol style="list-style-type: none"> <li>Repeat the assessment from 2011 using the new software version SS3.24u</li> <li>Use the older version of SS3 (SS3.24f) to test the effect of using new software.</li> <li>Add catch and commercial CPUE to 2014/15.</li> <li>Add survey abundance estimates to 2014/15.</li> <li>Add length composition data from 2011/12 to 2014/15; a new step this year was to keep the port and on-board ISMP data separate. In addition, length composition data from all surveys were included and, again new this year, the on-board length composition data obtained through crew sampling from 2010/2011 – 2014/2015 were also included.</li> <li>Estimate the selectivity curve for the Fishery Independent Survey</li> <li>Add age composition data from 2011/12 to 2014/15.</li> <li>Add the ageing error matrix</li> <li>Estimate <math>L_{min}</math> (a growth curve parameter)</li> <li>Again use the older version of SS3 (SS3.24f) to test the effect of using new software.</li> <li>New to this assessment, add the age composition data from the FIS for the years 2008/2009, 2010/2011, and 2014/2015, in which it is available.</li> <li>Use variance estimates around the recruitment deviates to set the last estimated recruitment to 2004/2005. Accept fitted recruitment deviation bias adjustment values.</li> <li>The variance of the different length and age composition data and the CPUE data were balanced to generate the initial base case. The balancing procedure this year attempts to apply more emphasis to the CPUE time series. The model balancing also involved increasing the recruitment variation from 0.2 to 0.34 as further bias adjustments were required after adjusting the variance estimates on different data streams.</li> </ol>																																																														

<p><b>RAG Comments on data</b></p>	<p>Data in the 2015 is more informative than for previous assessments. This is the result of the heavier fishing pressure applied to the fishery in the mid-2000s, and the 10-15 year delay before recruitment effects are seen in the fishery (given bight redfish late age-at-maturity).</p>
<p><b>RAG Comments on assessment</b></p>	<p>At their December 2018 meeting, the RAG noted that overall catches of bight redfish have decreased in the last two years.</p> <p>The decrease in 2015 was attributed to the seismic survey that was also conducted that year. However, catches have not bounced back over the three years following this survey. Either the seismic survey had a longer term influence than expected or another factor is impacting stocks (may not be related to fishing pressure).</p> <p>The length frequency measurements of bight redfish have decreased from modal length = 30-35cm in previous years to modal length =29cm in 2018.</p> <p>In both 2015 and 2018 relative biomass for bight redfish has decreased.</p> <p>Depth distribution of bight redfish appear to have shifted; with movement inshore apparent.</p> <p>There have been significant changes to the catch composition in the GAB. In 2005, bight redfish and deepwater flathead accounted for approximately half of the total composition. In 2018, both species contributed only 11% of the catch each.</p> <p>Due to the above information, the RAG recommended that the stock assessment for bight redfish be moved forward from 2020 to 2019.</p> <p>The RAG recommended that the RBC for bight redfish for the 2019-20 season be cut to 600 t.</p> <p>The MAC recommended that the TAC for bight redfish for the 2019-20 season be cut to 600 t.</p>
<p><b>Projected Biomass (including confidence intervals)</b></p>	<p>Projections from 2015 assessment:</p> 

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	MYTAC	MYTAC	Tier 1	MYTAC	MYTAC	MYTAC
Stock Status	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (retained)	Rollover	Rollover	797	797	797	600
Agreed TAC	2358	2358	800	800	800	600
TAC after unders/overs	2593	2593	1034	879	879	
% TAC caught	8%	7%	28%	35%		



RAG Recommendations		
<b>Recommended Biological Catch (2019-20)</b>	2019-20 = 600 t 5-year RBC = 797 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 5-Year MYTAC The one-year, 862 t RBC is based on the 2015 Tier 1 assessment, while the five-year RBC recommendation of 797 t used for MYTAC purposes is based on the average of RBC values projected over a five year period. For TAC calculations: no discards or state catch to be deducted (M. Haddon confirmed that these sources of mortality don't contribute to RBC outcome) from TAC calculation summary.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation = unlikely. Alternative Catch Scenarios: N/A	
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	N/A	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	GABRAG has noted concerns regarding the lower catches of bight redfish in recent years, with catches being taken as bycatch when targeting deepwater flathead.	

### 3 Blue-eye Trevalla (*Hyperoglyphe antarctica*)



ABARES (2012): Line drawing – FAO

**Tier 4 for slope stock and catch-MSY Tier 5 for seamount stock, last assessed by SERAG 2018.**

Summary																									
<b>Stock Structure</b>	<p>Blue-eye trevalla (<i>Hyperoglyphe antarctica</i>) is managed as a single stock in the SESSF. Recently, three lines of evidence based on phenotypic variation in age and growth, otolith chemistry and potential larval dispersal, suggest spatial patterns that may delineate natural subpopulations (Williams et al. 2017). This indicates that 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. The slope stock is assessed under a Tier 4 stock assessment.</p> <p>Fish on the seamounts are assumed to be geographically isolated from the slope stock. Potential stock structure among the seamounts is not clear. The seamount stocks are assessed under a Tier 5 stock assessment.</p> <p>Separate RBCs were determined for the slope and seamount stocks for the first time in 2018 but a global TAC is set for Blue-eye trevalla.</p>																								
<b>Stock status against reference points and trend</b>	<p><u>Tier 4 for slope stock</u></p> <p>Tier 4 species use CPUE targets as a proxy for biomass targets.</p> <p>The Tier 4 target reference point is the level of CPUE assumed to be a proxy for spawning biomass of 48 per cent of unfished levels. The limit reference point is the equivalent CPUE that acts as a proxy for 20 per cent of unfished levels.</p> <p>In 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. The RAG considered the updated analysis to be a better reflection of CPUE in the early part of the fishery.</p> <p><b>Stock status:</b> standardised CPUE has decreased over the last three years from above the target reference point in 2014 to a point between the limit and the target reference point in 2017.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1997-2006</td> <td>Scaling</td> <td>0.6799</td> </tr> <tr> <td>CE_Targ</td> <td>1.2288</td> <td>Last Yr TAC</td> <td>458</td> </tr> <tr> <td>CE_Limit</td> <td>0.512</td> <td>Ctarg</td> <td>645.263</td> </tr> <tr> <td>CE_Recent</td> <td>0.9994</td> <td>RBC</td> <td>438.697</td> </tr> <tr> <td>Wt_Discard</td> <td>0</td> <td></td> <td></td> </tr> </tbody> </table>	Parameter	Value	Parameter	Value	Reference Years	1997-2006	Scaling	0.6799	CE_Targ	1.2288	Last Yr TAC	458	CE_Limit	0.512	Ctarg	645.263	CE_Recent	0.9994	RBC	438.697	Wt_Discard	0		
Parameter	Value	Parameter	Value																						
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Wt_Discard	0																								

	<p><u>Tier 5 for seamount stock:</u></p> <p><b>Catch-MSY</b></p> <p>Analysis estimates the depletion to be approximately 33%B<sub>0</sub> although that estimate is highly uncertain.</p> <p><b>Age-structured stock reduction analysis</b></p> <p>Deterministic estimates vary greatly depending on assumed exploitation rates and which values for natural mortality and steepness of the stock-recruitment relationship are used.</p>																						
	<table border="1"> <thead> <tr> <th colspan="4">Projected Catches by Steepness and Natural Mortality</th> </tr> <tr> <th></th> <th>h=0.6</th> <th>h=0.7</th> <th>h=0.8</th> </tr> </thead> <tbody> <tr> <td><b>M=0.08</b></td> <td>25</td> <td>32</td> <td>40</td> </tr> <tr> <td><b>M=0.1</b></td> <td>35</td> <td>40</td> <td>45</td> </tr> <tr> <td><b>M=0.12</b></td> <td>37</td> <td>43</td> <td>48</td> </tr> </tbody> </table> <p><i>Figure 9 from report</i></p>			Projected Catches by Steepness and Natural Mortality					h=0.6	h=0.7	h=0.8	<b>M=0.08</b>	25	32	40	<b>M=0.1</b>	35	40	45	<b>M=0.12</b>	37	43	48
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<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished		<b>Fishing Mortality</b> Not subject to overfishing																				
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$4.05 million		<b>% Fishery GVP</b> 8.7%																				
<b>Is a MYTAC in place this season?</b>	No	<b>Have breakout rules been triggered?</b>	N/A																				

Assessment Summary	
<b>Tier Level</b>	Tier 4 for slope stock and Tier 5 for seamounts stock.
<b>Stock indicator trends</b>	<p><u>Tier 4 slope stock:</u></p> <p>Total blue-eye trevalla catches have declined from 650 t in 2006 to 328.5 t for the 2017-18 season. The 430 t TAC was slightly over caught (within over catch provisions) in 2016-17.</p> <p>Standardised CPUE has decreased over the last three years from above the target reference point in 2014 to a point between the limit and the target reference point in 2017.</p> <p><u>Tier 5 seamount stock:</u></p> <p><b>Catch-MSY</b></p> <p>Analysis estimates the depletion to be approximately 33%B<sub>0</sub> although that is highly uncertain. The model assumed maximum harvest rate in any one year is limited to 0.5, implying no more than 50% of exploitable Blue-eye could be taken in any single year.</p>



	<p><b>Age-structured MSY</b></p> <p>Estimates vary greatly depending on exploitation rates and which values for natural mortality and steepness of the stock-recruitment relationship are used.</p>
<p><b>Key model technical assumptions/ parameters</b></p>	<p>Both assessments assume that biomass was unfished prior to 1985 (when fishing started).</p> <p><u>Tier 4 slope stock:</u></p> <p>Standardised CPUE from zones 20 to 83 is assumed to be proportional to abundance.</p> <p>The best assessment is obtained by using catch per hook as the effort metric for CPUE. Standardised blue-eye trevalla catch rates (Sporcic &amp; Haddon 2018) combined dropline and longline catch-per-hook. The target reference period provides an acceptable CPUE proxy for the target reference point. Total catch history is accurate.</p> <p><u>Tier 5 seamount stock:</u></p> <p><b>Catch-MSY</b></p> <p>The catch-MSY data-poor stock assessment method requires some strong assumptions and a minimum amount and quality of data. The blue-eye fishery that has occurred on the eastern seamounts is a difficult fishery to assess.</p> <p><b>Age-structured stock reduction analysis</b></p> <p>Noting that not all of the seamounts would be fished in a given year, the model has assumed that harvest rates do not rise above 0.5 in a single year. This adds constraints to the analysis and assumes that there must have been at least twice the biomass relative to what was caught in any year.</p>
<p><b>Significant changes to data inputs</b></p>	<p><u>Tier 4:</u></p> <p>Catches from zone 10-83 are included in <math>C_{\text{targ}}</math></p> <p>Only non-trawl catches from zones 20-83 are included in the CPUE analysis</p> <p><u>Tier 5:</u></p> <p>No previous tier 5 assessment for seamounts.</p>
<p><b>RAG Comments on data</b></p>	<p><u>Tier 4:</u></p> <p>Early records of high discards are likely from trawl. There are no significant discards and so they are not included in the Tier 4 assessment.</p> <p><u>Tier 5:</u></p> <p>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. Most coming from automatic longline and drop-line.</p>
<p><b>RAG Comments on assessment</b></p>	<p><u>Tier 4:</u></p> <p>In 2015 the RAG agreed to use the catch per hook metric from drop-line and automatic longline, noting that this is a better reflection of CPUE across the fishery.</p>

The updated analysis resulted in a lower CPUE in the early part of the data series, confirming that the 2014 Tier 4 assessment was conservative in nature and that blue eye trevalla are less depleted than the assessment indicated.

The RAG noted a shift in fishing effort and catch to the western region in the GAB.

The March 2018 blue-eye trevalla workshop recommended assessing the slope stock as a whole (Z20-83) and to monitor catches/CPUE in the GAB.

SERAG supported including catches from zone 10 and the GABT in  $C_{\text{targ}}$  however catches from Z10 are small and are not included in the CPUE analysis.

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 are missed by applying CPUE standardisations across the distribution.

Noting the interest in collecting representative age and length data and developing alternative stock assessment such as close-kin, the RAG was comfortable using the Tier 4 assessment to provide RBC advice.

#### Tier 5:

#### **Catch MSY Analysis**

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, the RAG 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.

If the catch based MSY were to be used in the future, management may consider using some level greater than the median as the 'driver'.

There is currently no accepted harvest control rule for Tier 5 analyses. While highly uncertain, the catch-MSY analysis generates an MSY of about 45-50 t with a depletion estimate of about 33%B<sub>0</sub>. Constant catches of 40 t or less would maintain stock status at the proxy 48%B<sub>0</sub>.

#### **Age-structured stock reduction analysis**

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) the RAG suggested M=0.08 and h=0.75, which is consistent with what New Zealand use. The RAG agreed to a constant catch of 36 t based on the constant catches generated when values of h = 0.7 and 0.8.

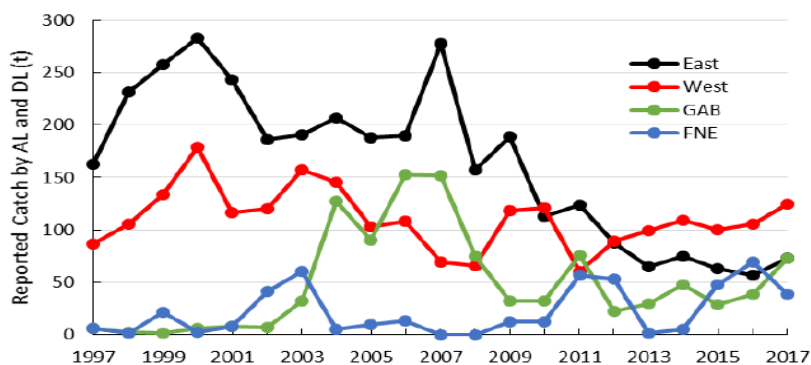
	<p><b>Discussion</b></p> <p>Industry have noted it is an episodic fishery because of how far they travel. Some operators may visit the seamounts as part of operations on the high seas. For economic reasons, other operators will fish the seamounts until catch rates are no longer viable due to long distance travel.</p> <p>The slope and seamounts are managed under a single blue-eye trevalla TAC. The RAG noted that a 36 t RBC applied annually on the seamounts might not be as economically viable as a larger combined RBC over a 3-year period to allow for the episodic and targeted style of fishing.</p> <p>The RAG recommended allowing up to 50 per cent of the combined 3-year RBC (54t) could 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.</p> <p>Age and length composition data from across the seamounts should be collected over time to monitor the stock. Electronic monitoring could be used to collect length information, however it might be difficult to collect enough age samples to get a representative sample. This will be addressed at SESSFRAG as part of the SESSF Data Plan development.</p>
<p><b>Projected Biomass (Tier 5)</b></p>	<p>See figure 9. It is assumed that constant catches of 36 t would maintain stock stability or slow stock changes.</p>

RAG Recommendations		
<p><b>Recommended Biological Catch (2019/20)</b></p>	<p>Slope: 3-year RBC: 439 t per year</p> <p>Seamounts: 3-year RBC: 36 t per year</p> <p>(Total: 475 t)</p>	<p><b>Undercatch:</b> 10%</p> <p><b>Overcatch:</b> 10%</p> <p><b>Discount Factor:</b> 0%</p> <p>The RAG recommended that the discount factor not be applied due to the conservative estimate of the RBC (due in part to unaccounted orca predation) and protection afforded the stock by fishing closures.</p>
<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p><u>Slope:</u></p> <p>Yes. 3-Year MYTAC</p> <p><u>Seamounts:</u></p> <p>Yes. 3-Year MYTAC</p> <p>The RAG recommended allowing up to 50 per cent of the combined 3-year RBC (54 t) could be taken in any given year from the seamounts.</p>	

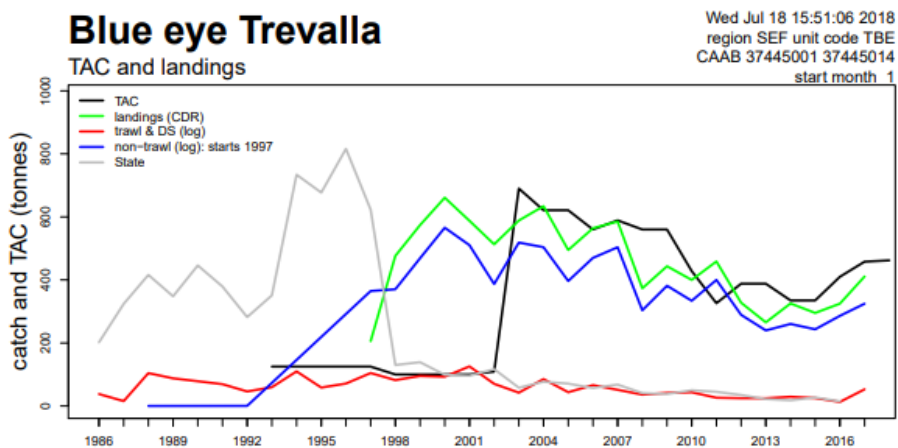
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i></p>	<p>Tier 4 assessments do not assess the probability of being below the limit reference point. If the standardised CPUE series is a reasonable index of relative abundance catches up to the RBC are considered to have a very low probability of causing the stock to decline to below the limit reference point. However, the RAG considers the current assessment to be conservative.</p> <p>The RBC is taken from the MSE-tested harvest control rules. If the standardised CPUE series is a reasonable index of relative abundance the RBC will have a very low probability of causing a decline below the limit reference point.</p> <p><b>Tier 5 RBC Recommendation:</b> The constant catch projections indicate that the risk of the stock declining to below the limit reference point is low.</p> <p>Alternative Catch Scenarios: N/A</p>
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>0 t</p>
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>Auto longline operators catch pink ling and blue-eye trevalla together. There may be implications to pink ling catch due to changes in TAC.</p>

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	MYTAC	Tier 4	Tier 4	Tier 4	Tier 4
Stock Status	CPUE between target and limit	MYTAC	CPUE between target and limit	CPUE between target and limit	CPUE between target and limit	CPUE between target and limit
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (t)	269	269*	444	526	482	Slope: 439 Seamount: 36 (Total: 475)
Agreed TAC	335	335	410	458	462	
TAC after Unders/Overs	355	363	430	444	502	
% TAC caught	76%	82%	100%	74%		

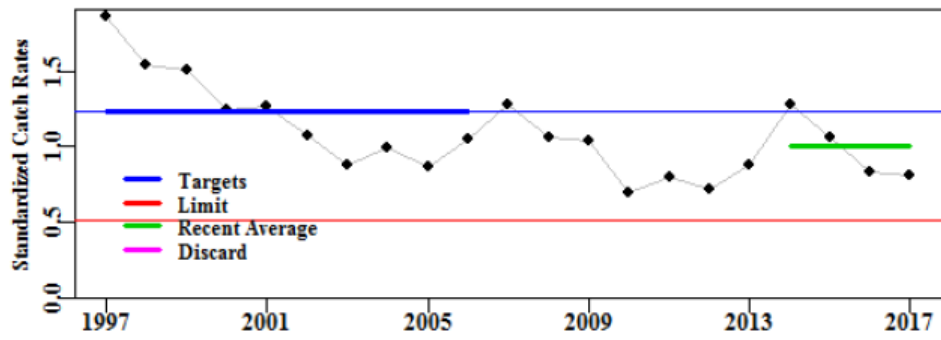
### Catch Trends



**Figure 1.** The total reported catches from 1997-2016 taken by autoline and drop-line combined across the east, west, the GAB and far north east (black and red used for CPUE standardisation)

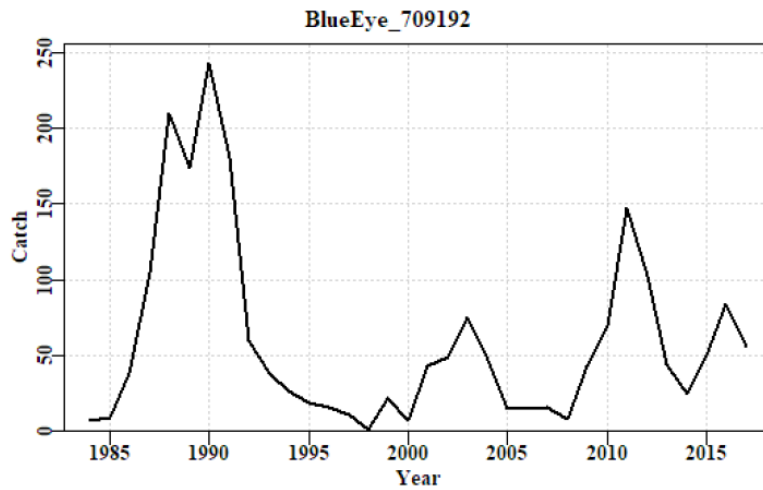


**Figure 2** TAC and landings for blue-eye trevalla up to the 2017 calendar year



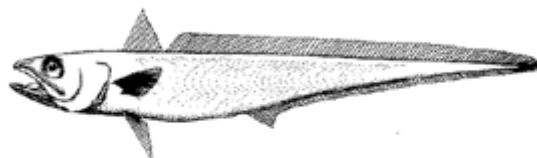
**Figure 3** Standardised catch rates with the upper fine line represents the target catch rate and the lower line the limit catch rate. Thickened line (Blue line) represents the reference period for catches, catch rates, and the recent average catch rate (green line).

**Tier 5 Seamounts:**





## 4 Blue Grenadier (*Macrurus novaezelandiae*)



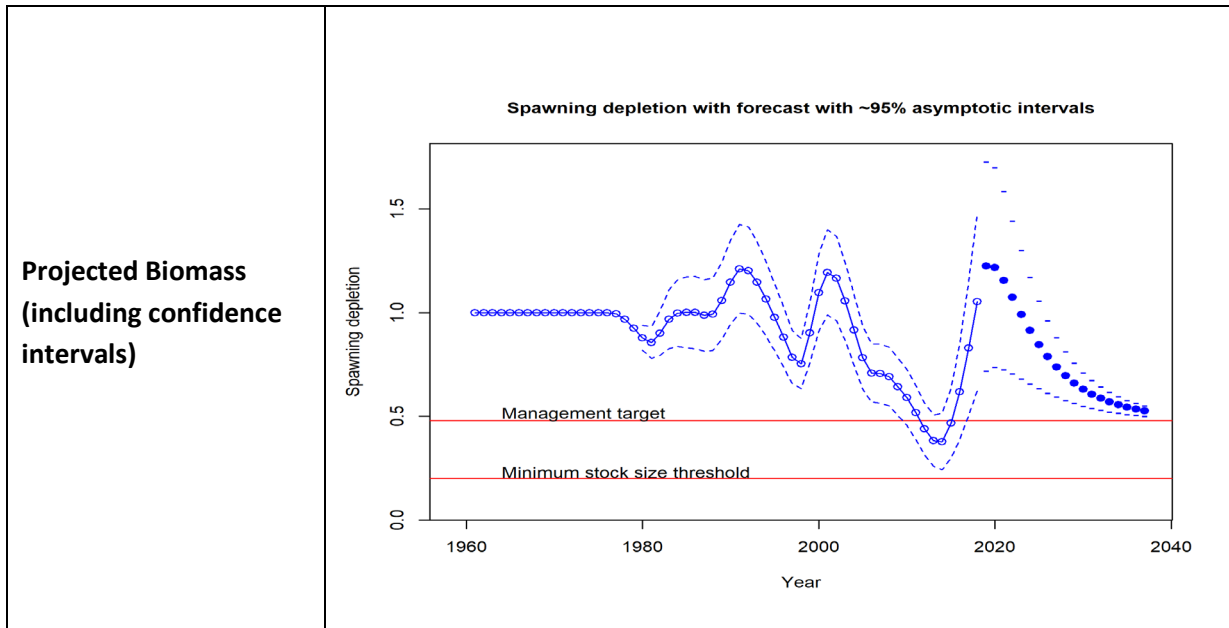
ABARES (2012) Line drawing - Rosalind Poole

Tier 1: last assessed by SERAG in 2018.

Summary			
<b>Stock Structure</b>	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.		
<b>Stock status against reference points and trend</b>	<b>Current</b>	<b>Target</b>	<b>Limit</b>
	2019: 122% B <sub>0</sub>	48% B <sub>0</sub>	20% B <sub>0</sub>
	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 <sub>0</sub> ) from around 2011 to 2015. Biomass has increased to be above virgin stock biomass (122%B <sub>0</sub> ) at the start of 2019 due to high recruitment from 2010 to 2015.  The catch in the Blue Grenadier spawning fishery is increasing but is still below 2000 levels. Catches in the non-spawning fishery have decreased.		
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$2.54m	<b>% Fishery GVP</b> 3.1%	
<b>Is a MYTAC in place this season?</b>	Yes.	<b>Have breakout rules been triggered?</b>	No.

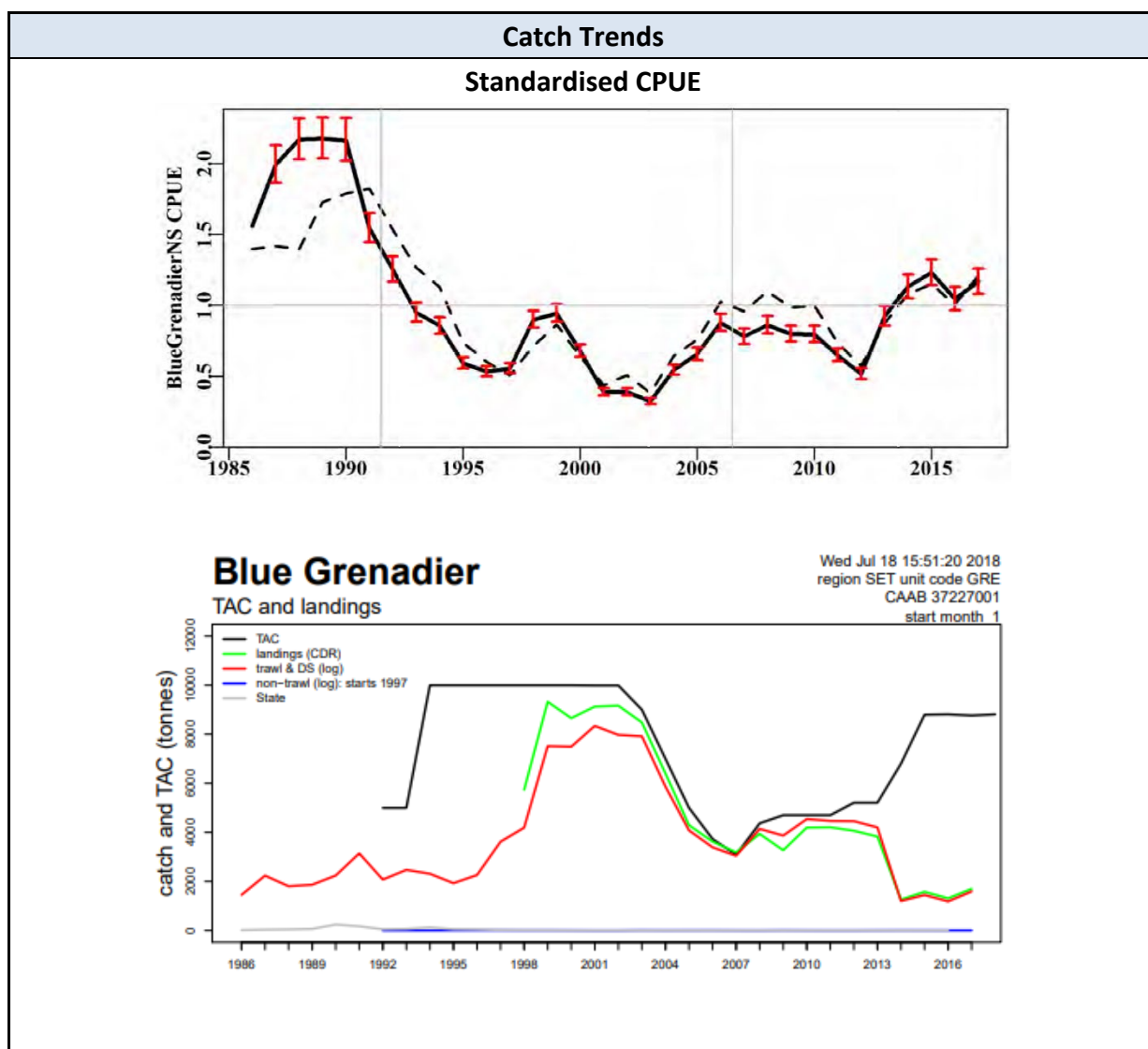
Assessment Summary	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	Biomass has increased to be above virgin stock biomass (122%B <sub>0</sub> ) at the start of 2019 due to high recruitment from 2010 to 2015. The model suggests the biomass decreased to below target in 2012.

<p><b>Key model technical assumptions/ parameters</b></p>	<p>2 sex model, age-structured  Female <math>M</math> estimated. Male 20% larger (<math>1.2 * M_f</math>) (sensitivity estimated <math>M_{males}</math>)  Steepness is 0.75  Recruits estimated between 1974 and 2014  All growth parameters estimated by sex  Cohort specific growth (estimated for cohorts from 1977 - 2014)  Maturity: 50% female maturity at 63.7 cm  Proportion of females that spawn 0.84 (Russell and Smith, 2006)  Spawning fleet (logistic selectivity)  Non-spawning fleet (dome-shaped selectivity)  FIS non-spawning area (mirror selectivity non-spawning fleet)  The base case estimates natural mortality (<math>M</math>) for females at 0.174 and uses <math>1.2M_f</math> to provide <math>M</math> for male at 0.209</p>
<p><b>Changes to model structure/assumptions</b></p>	<p>N/A</p>
<p><b>Significant changes to data inputs</b></p>	<p>FIS non-spawning abundance index included.</p>
<p><b>RAG Comments on data</b></p>	<p>Good fits to age and length data as well as acoustic surveys.  Poor fits to CPUE for the non-spawning fishery.  The model suggests a strong recent period of recruitment.</p>
<p><b>RAG Comments on assessment</b></p>	<p>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.  Given that the stock is estimated to be above <math>B_0</math> and with predicted catches at <math>F</math>, at that level it would 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.  At SERAGs request (Sept 2018) <math>M</math> for males was also estimated and resulted in female <math>M = 0.154</math> and male <math>M = 0.230</math>. This results in a small decrease in estimated spawning biomass.  SERAG (2018) recommended looking at likelihood profiles for <math>M</math> as part of the next stock assessment. This was done for the September 2018 RAG meeting.</p>



RAG Recommendations	
<b>Recommended Biological Catch (2019/20)</b>	2019 – 13260 t 2020 – 12238 t 2021 – 11052 t 3-year average = 12183 t
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-Year MYTAC. SEMAC to consider either the yearly RBC or the 3-year average.
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. <math>P &lt; 10\%</math>).</i>	<b>RBC recommendation</b> = very unlikely to cause a decline below $B_{LIM}$ <b>Alternative Catch Scenarios:</b> N/A
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t
<b>Implications for companion species / TEPs / multi-species fisheries</b>	There may be implications for the silver warehou bycatch with an increase in effort for blue grenadier. SERAG (2018) recommended looking at the proportion of silver warehou bycatch in the grenadier fishery (inc factory vessel catches). The ratio of silver warehou to blue grenadier is probably lower now than in the past.

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	MYTAC	MYTAC	MYTAC	MYTAC	MYTAC	Tier 1
Stock Status	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	122%B <sub>0</sub>
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (retained)	8138	8796	8810	8810	8810	
Agreed TAC	6800	8796	8810	8765	8810	
TAC after unders/overs	7205	9411	9618	9627	9636	
% TAC caught	19%	19%	14%	17%		



## 5 Blue Warehou (*Seriolella brama*)



ABARES (2012): Line Drawing – Rosalind Poole

**Common names:** Black trevally, sea bream, snotty trevalia.

Under a [Stock Rebuilding Strategy](#).

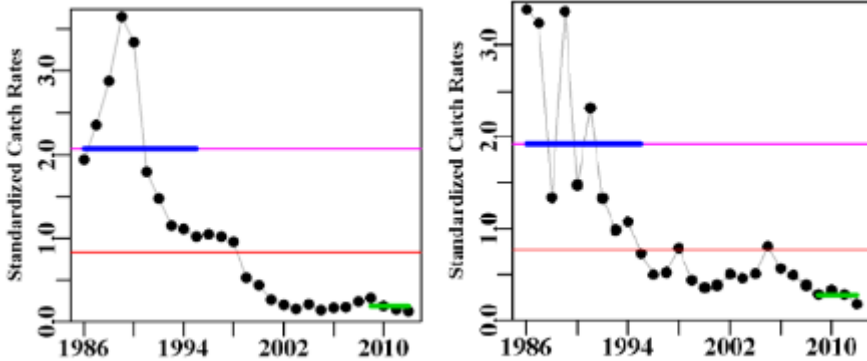
**Tier 4 last assessed in 2013 by ShelfRAG. Rebuilding species reviewed by SERAG in 2018.**

Summary													
<b>Stock Structure</b>	There is good evidence that there are two stocks of blue warehou, east and west of the Bass Strait, but the species is managed under a single TAC.												
<b>Stock Status</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets. SERAG noted a significant increase in discards in 2017, driven largely by small fish caught by Danish seiners in eastern Bass Strait.</p> <p>The Tier 4 target reference point is the level of CPUE assumed to be a proxy for spawning biomass of 48 per cent of unfished levels. The limit reference point is the equivalent CPUE that acts as a proxy for 20 per cent of unfished levels.</p> <table border="1"> <thead> <tr> <th>CPUE</th> <th>East</th> <th>West</th> </tr> </thead> <tbody> <tr> <td>Target</td> <td>2.0717</td> <td>1.9249</td> </tr> <tr> <td>Limit</td> <td>0.8287</td> <td>0.7699</td> </tr> <tr> <td>Recent</td> <td>0.1861</td> <td>0.2681</td> </tr> </tbody> </table> <p><u>2013 Stock status:</u></p> <p>In 2013 blue warehou was expected to be below the limit reference point and is subject to a rebuilding strategy. The last agreed Tier 1 assessment in 2005-06 found the eastern stock to be depleted below the limit reference point.</p> <p>In contrast, the western stock was thought to be above the limit reference point and close to the biomass maximum sustainable yield (<math>B_{40}</math>) level. However, the 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.</p> <p><b>Biomass trend:</b> The standardised CPUE for both stocks continue to be low and declining in 2015, however, due to avoidance of blue warehou by operators the use of CPUE as an index of abundance is no longer considered reliable.</p> <p>Catches have been low over the last few years and below the incidental TAC, particularly in 2015 with only 4.5 t landed. As a consequence of low catches there is little data.</p>	CPUE	East	West	Target	2.0717	1.9249	Limit	0.8287	0.7699	Recent	0.1861	0.2681
CPUE	East	West											
Target	2.0717	1.9249											
Limit	0.8287	0.7699											
Recent	0.1861	0.2681											

<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Overfished	<b>Fishing Mortality</b> Uncertain	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> < \$0.1 million	<b>% Fishery GVP</b> 0.05%	
<b>Is a MYTAC in place this season?</b>	No.	<b>Have breakout rules been triggered?</b>	N/A.

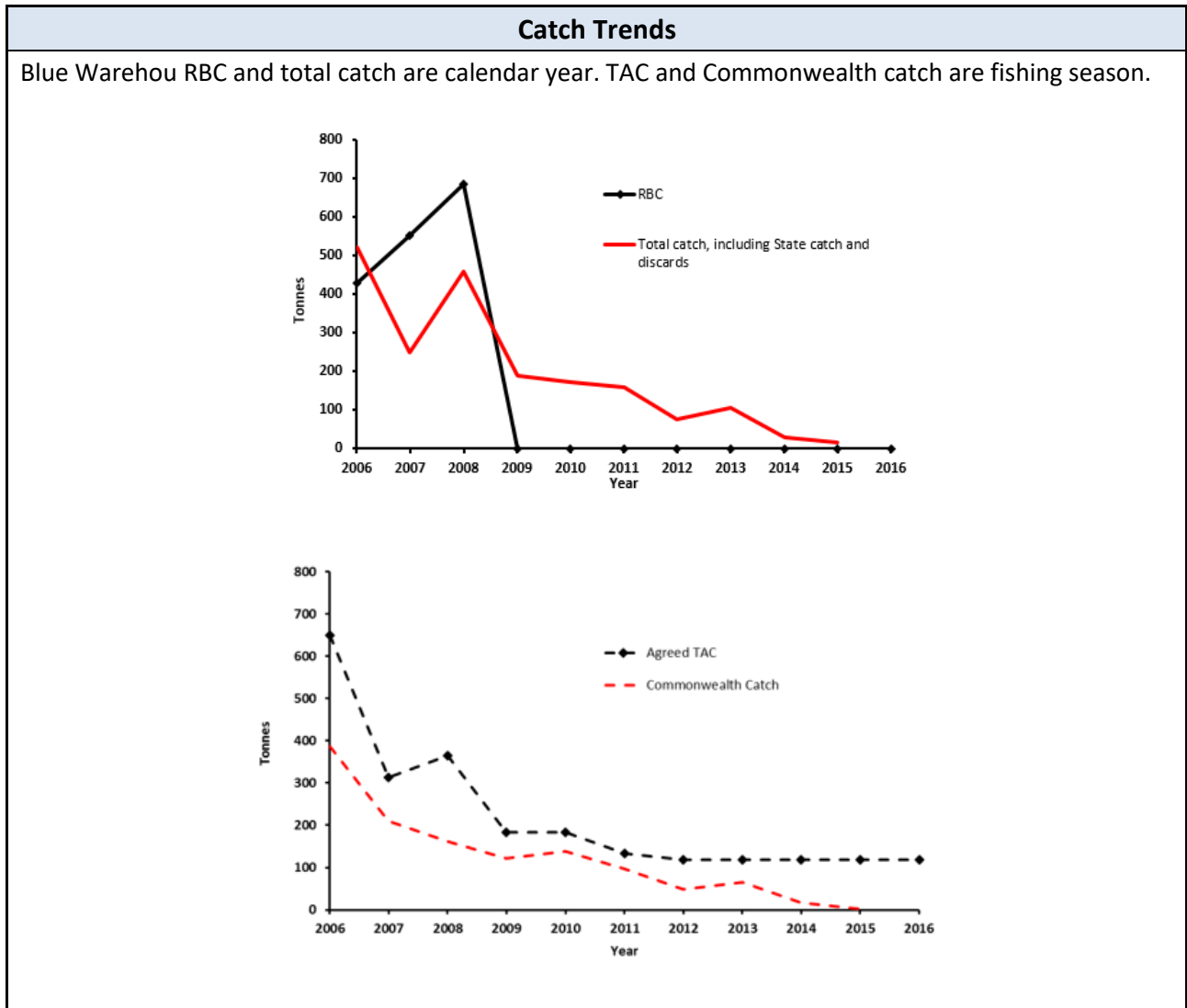
<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	<p>The RAG noted again its' concern that CPUE is not a good index of abundance while there is an incidental catch TAC in place and industry is actively avoiding the species. An alternative primary index of abundance needs to be developed as a high priority for use in future stock assessments.</p> <p>The RAG noted low catches of blue warehou in 2015 and that the geographic range of catches has contracted.</p> <p>There was no information available to the RAG to suggest that the stock was recovering; the RAG noted the importance of the planned project looking at declining and non-recovering stocks.</p>
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	<p>CPUE is not a good index of abundance while there is an incidental catch TAC in place because industry is actively avoiding the species. The RAG recommended that an alternative primary index of abundance be developed as a high priority for use in future stock assessments.</p> <p>There was no information available to the RAG to suggest that the stock was recovering; the RAG noted the importance of continuing work looking at declining and non-recovering stocks.</p>



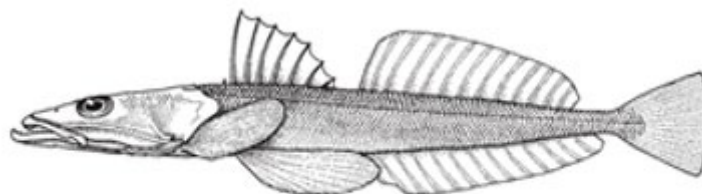
<p><b>RAG Comments on assessment</b></p>	<p>Standardized Catch Rates - N.B. Tier 4 not updated in 2016:</p>  <p>Blue warehou (east left, west right) standardized catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate.</p>
<p><b>Projected Biomass (including confidence intervals)</b></p>	

<p><b>RAG Recommendations</b></p>		
<p><b>Recommended Biological Catch (2017-18)</b></p>	<p>0 t RBCs for both eastern/western stocks remain at zero as standardised catch rates are below the limit reference points. Blue warehou is managed under the Blue Warehou Stock Rebuilding Strategy – this was updated in 2014 and is available <a href="#">here</a>. An incidental catch TAC of 118 t is recommended by SERAG.</p>	<p><b>Undercatch:</b> 0% <b>Overcatch:</b> 0% <b>Discount Factor:</b> 0%</p>
<p><b>Is a MYTAC recommended for future seasons?</b></p>	<p>No.</p>	
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. P&lt;10%).</i></p>	<p>N/A – Already considered to be below the limit reference point. <b>Alternative Catch Scenarios:</b> N/A</p>	
<p><b>Research Catch Allowance</b> <i>Included/Addition to TAC</i></p>	<p>0 t</p>	
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>N/A.</p>	

Catch and TAC						
Assessment Year	2011	2012	2013	2014	2015	2016
Tier / MYTAC	Tier 4	Tier 4	Tier 4	Not assessed	Not assessed	Not assessed
Stock Status	E: CPUE less than limit W: CPUE less than limit	E: CPUE less than limit W: CPUE less than limit	E: CPUE less than limit W: CPUE less than limit	E: CPUE less than limit W: CPUE less than limit	E: CPUE less than limit W: CPUE less than limit	E: CPUE less than limit W: CPUE less than limit
SESSF Season	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
RBC (retained)	0	0	0	0	0	0
Agreed TAC	118	118	118	118	118	118
TAC after unders/overs	118	118	118	118	118	118
% TAC caught	41%	55%	14%	2%	14%	21%



## 6 Deepwater Flathead (*Neoplatycephalus conatus*)



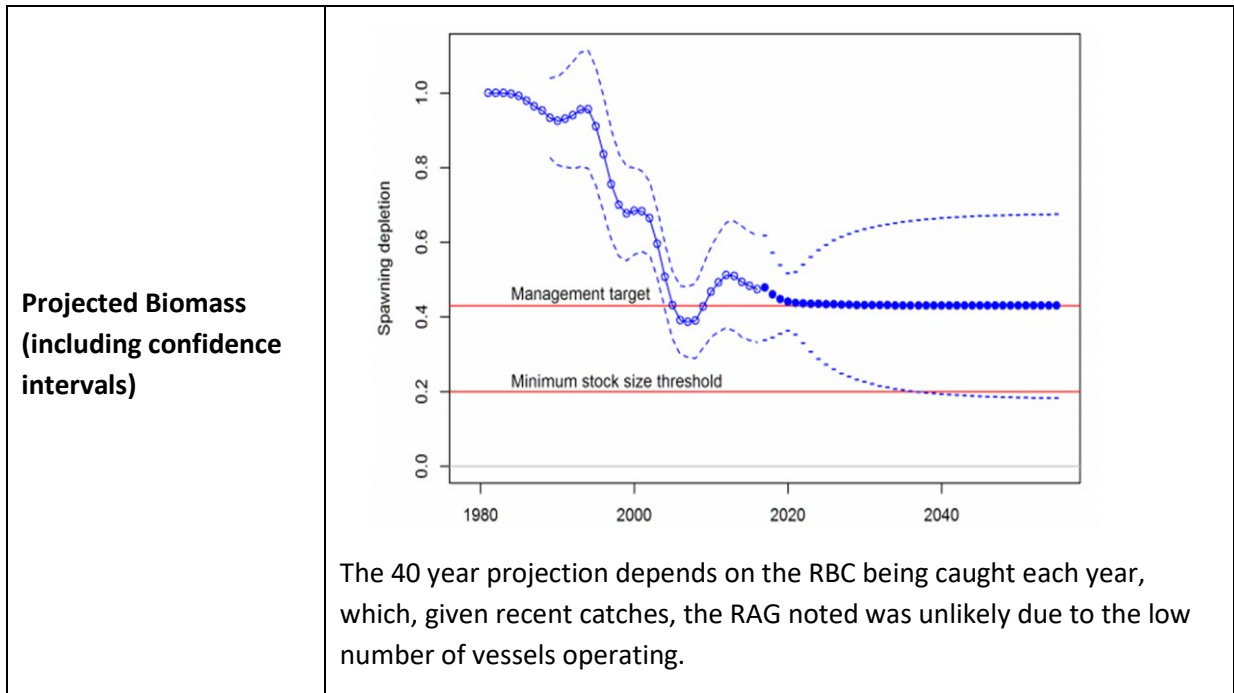
Obsolete common names: deep sea flathead, trawl flathead.

Tier 1 assessed by GABRAG in 2016, species summary updated in 2016.

Summary			
<b>Stock Structure</b>	Assessed as a single stock.		
	Reference point is 20% of unfished biomass. Target is 43% of unfished biomass. 2016: 45% of unfished biomass. The stock remains above the target.		
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$5.86 million	<b>% Fishery GVP</b> 58.4% (GABTS)	
<b>Is a MYTAC in place this season?</b>	Yes. 2019/20 is the final year of the MYTAC.	<b>Have breakout rules been triggered?</b>	N/A. Observed standardized CPUE or FIS (when run) falls outside the 95 per cent confidence intervals projected from the assessment.

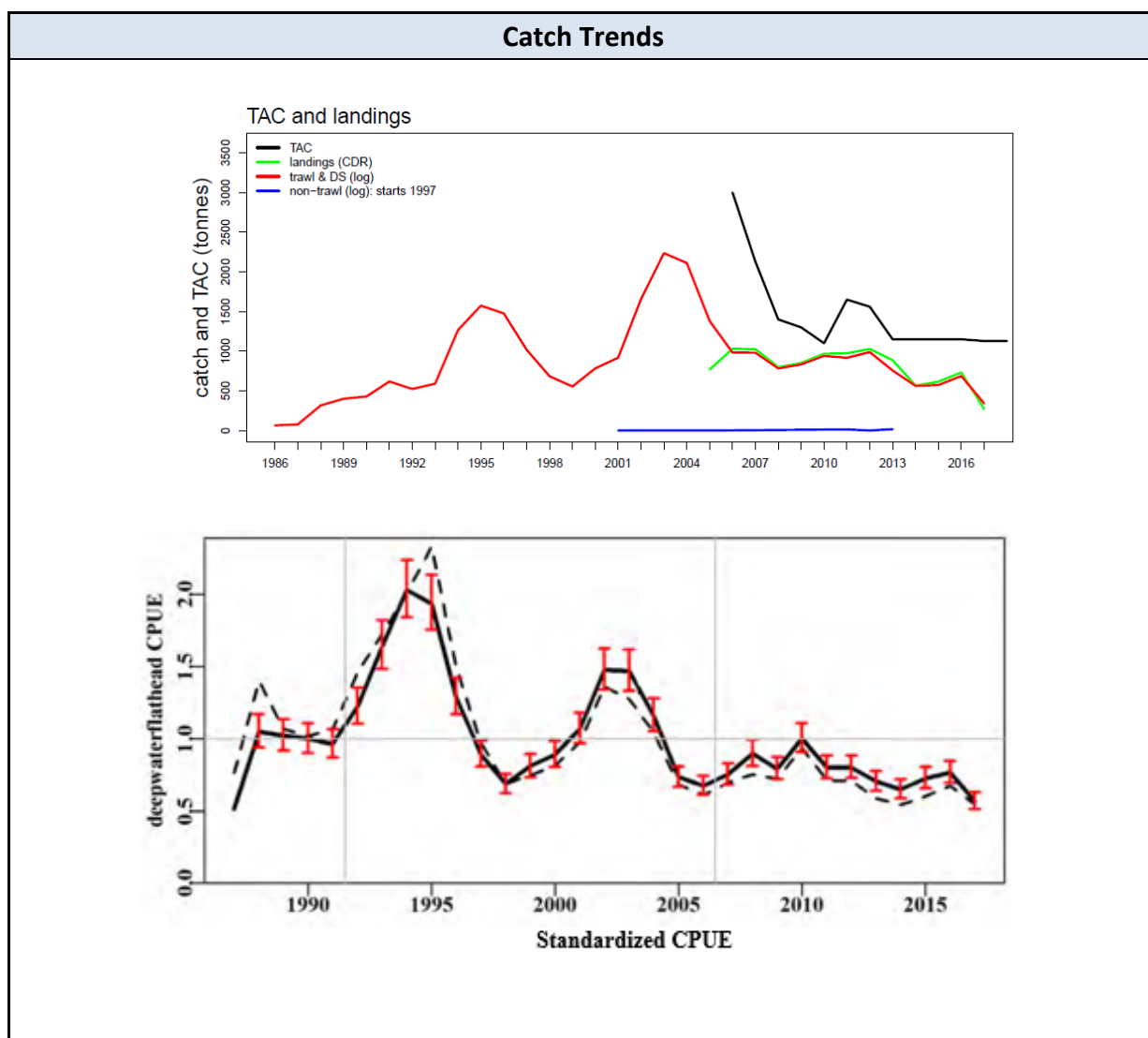
Assessment Summary	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	While remaining above target, estimated spawning biomass suggests a gradual decline toward the target since 2012-13.  The spread of ages in recent age data indicates the stock is responding to a reduction in fishing effort.

<b>Key model technical assumptions/ parameters</b>	The model projections assume average recruitment. However, recruitment estimates for recent years have been below average.
<b>Changes to model structure/assumptions</b>	The latest version of stock synthesis 3 software (SS3.24z) was applied.
<b>Significant changes to data inputs</b>	<p>ISMP data were divided into the onboard and port based samples. Length and age composition data from the FIS and industry collected length composition were included for the first time.</p> <p>There were large numbers of new samples, for example the industry collected length frequency samples alone contribute more than 35 000 extra records.</p>
<b>RAG Comments on data</b>	<p>The RAG noted the 2015 FIS survey index is within bounds of variability of the commercial catch rate index. While the FIS survey index and commercial catch rates were unusually low over the same two months, which may be related to the substantial seismic survey being conducted over the same period, the RAG did not consider there was sufficiently strong basis for excluding the 2015 FIS catch rate data from the assessment.</p> <p>Danish seine catch are included in the assessment but no additional data (age/length) from this fleet are available. The RAG recommended that AFMA observers undertake a Danish seine trip, focusing on length data. At its December meeting the RAG was pleased to note that one trip had recently been observed.</p> <p>The RAG noted that it would be useful to undertake a meta-analysis to better understand the value for natural mortality in the assessment.</p>
<b>RAG Comments on assessment</b>	<p>Catches of deepwater flathead have decreased overall over the last two years. The decrease in 2015 was attributed to the seismic survey that was also conducted that year. However, catches have not bounced back over the three years following this survey. Either the seismic survey had a longer term influence than expected or another factor is impacting stocks (may not be related to fishing pressure).</p> <p>In both 2015 and 2018 there has been a decrease in relative biomass for both bight redfish and deepwater flathead.</p> <p>Deepwater flathead appear to be shifting to shallower depths. There appears to have been a temporal shift in the spawning season for deepwater flathead.</p> <p>There have been significant changes to the catch composition in the GAB. In 2005, bight redfish and deepwater flathead accounted for approximately half of the total catch composition. In 2018, both species contributed only 11% of the catch each.</p> <p>The RAG recommended that the RBC for deepwater flathead remain at 1128 t for the 2019-20 season.</p> <p>The MAC recommended that the TAC for deepwater flathead remain at 1128 t for the 2019-20 season.</p>

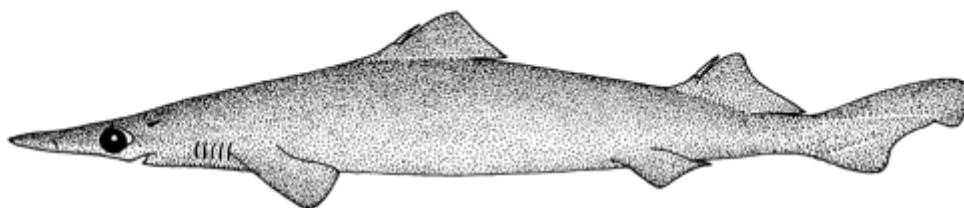


RAG Recommendations		
<b>Recommended Biological Catch (2019/20)</b>	2019-20 RBC = 1128 t 1-year: 1155 t 3-year: 1128 t 5-year: 1115 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-year: 1128 t 5-year: 1115 t  For TAC calculations: no discards or state catch to be deducted (M. Haddon confirmed that these sources of mortality don't contribute to RBC outcome) <i>from TAC calculation summary.</i>	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation</b> = <10% - very unlikely to cause a decline below $B_{LIM}$  <b>Alternative Catch Scenarios:</b> N/A	
<b>Research Catch Allowance</b>  <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	The RAG noted that deepwater flathead effort contributes to catches of other commercial species in the GAB.	

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	MYTAC	MYTAC	MYTAC	Tier 1	MYTAC	MYTAC
Stock Status	45%	Not assessed	Not assessed	45%	Not assessed	Not assessed
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (retained)	1146	1112	1112	1128	1128	1128
Agreed TAC	1150	1150	1150	1128	1128	1128
TAC after unders/overs	1264	1265	1256	1241	1241	
% TAC caught	52%	50%	54%	44%		



## 7 Deepwater Shark Basket - East



The Deepwater Shark Basket quota includes multiple species of deepwater sharks: Brier shark (*Deania calcea*), Platypus shark (*Deania quadrispinosa*), Plunket's shark (*Centroscyrnus plunketi*), Roughskin Shark (*Centroscyrnus* and *Deania* spp), Pearl shark (*D.calcea* and *D.quadrispinosa*), Black shark (*Centroscyrnus* spp), Lantern shark (*Etmopterus* spp), Dogfish Family *squalidae* and other sharks.

### Tier 4: last assessed by SERAG in 2018

Summary																											
<b>Stock Structure</b>	<p>Little is known about the stock structure of deepwater sharks. They are benthic-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.</p> <p>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.</p>																										
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 Target reference point is the level of CPUE assumed to produce a spawning biomass of 48% of unfished levels.</p> <p>The limit reference point is 20% of the target reference point.</p> <table border="1" data-bbox="587 1317 1257 1541"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1997-2004</td> <td>Scaling</td> <td>0.0743</td> </tr> <tr> <td>CE_Targ</td> <td>1.1592</td> <td>Last Yr TAC</td> <td>23 t</td> </tr> <tr> <td>CE_Limit</td> <td>0.483</td> <td>C<sub>targ</sub></td> <td>134.443</td> </tr> <tr> <td>CE_Recent</td> <td>0.5332</td> <td>RBC</td> <td>9.993</td> </tr> <tr> <td>Wt_Discard</td> <td>-</td> <td></td> <td></td> </tr> </tbody> </table> <p>CPUE trend: Standardised CPUE has been slowly declining since 2009, and has been flat since 2010.</p>			Parameter	Value	Parameter	Value	Reference Years	1997-2004	Scaling	0.0743	CE_Targ	1.1592	Last Yr TAC	23 t	CE_Limit	0.483	C <sub>targ</sub>	134.443	CE_Recent	0.5332	RBC	9.993	Wt_Discard	-		
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Wt_Discard	-																										
<b>ABARES most recent assessment (2017)</b>	<p><b>Biomass</b></p> <p>Uncertain</p>	<p><b>Fishing Mortality</b></p> <p>Not subject to overfishing</p>																									
<b>GVP Figures (2016-17 season)</b>	<p><b>GVP</b></p> <p>N/A</p>	<p><b>% Fishery GVP</b></p> <p>N/A</p>																									
<b>Is a MYTAC in place this season?</b>	No.	<b>Have breakout rules been triggered?</b>	N/A																								

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	The CPUE trend in the eastern zone is slowly declining and is currently between the target and limit reference points.
<b>Key model technical assumptions/ parameters</b>	<p>Major assumption that the CPUE represents the status of the whole stock, uncertain given the large closures.</p> <p>Assessed as a separate east and west stock.</p> <p>Basket of species (see stock structure), hence a key assumption is that the combined species CPUE at least broadly reflects the trends in CPUE for all the contributing species. Noted that approximately 80 % of the catch was one species; <i>Deania calcea</i> (brier shark).</p>
<b>Changes to model structure/assumptions</b>	<p>Assessment based on open areas only.</p> <p>Reference period maintained at 1997-2004.</p> <p>The catch rates used in the analysis are based on log-transformed catches rather than log transformed catch/effort. This was a RAG decision relating to how the sharks are fished.</p>
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	<p>Discards are not used in the CPUE series and are not included in <math>C_{targ}</math> and so will not be deducted from the RBC.</p> <p>Catches have been stable between 20-30 t since 2012 and the CPUE has remained stable in the open areas.</p>
<b>RAG Comments on assessment</b>	<p>A large proportion (&gt;54%) of the catch of the entire fishery was previously taken in waters &gt;700m and most of these areas are now closed. (AFMA report 2008-836).</p> <p>The Tier 4 now excludes all catch taken in areas that are now closed (deepwater closures). The RAG 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.</p> <p>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.</p> <p>The RAG accepted the results of the Tier 4 assessment and the 2019 RBC of 9 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.</p> <p>With regards to setting TACs, the RAG 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.</p>

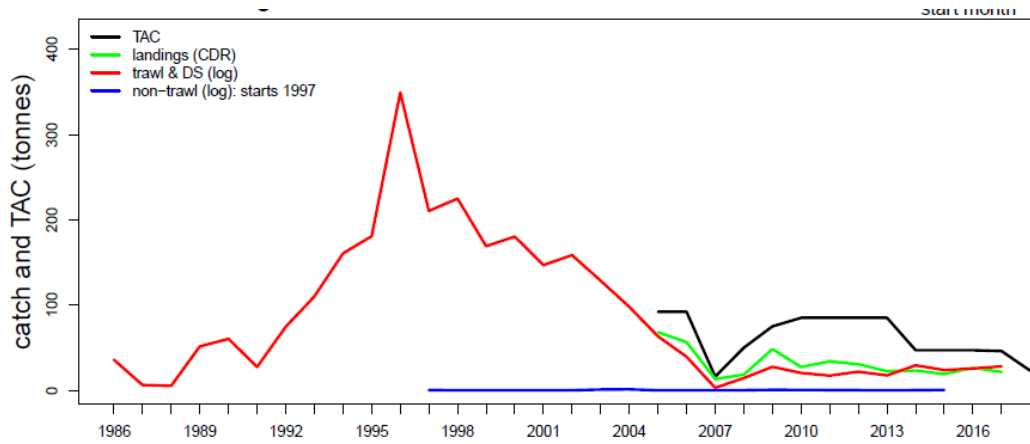


RAG Recommendations														
<b>Recommended Biological Catch (2019-20)</b>	9 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0 %												
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	<p>Yes. 3-Year MYTAC</p> <p>A large portion of the stock is protected by closures. Given stable catches and CPUE over the past eight years, there is little risk to maintaining the TAC at current catch levels.</p> <p>Recent catches:</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Catch (t)</th> </tr> </thead> <tbody> <tr> <td>2013</td> <td>23</td> </tr> <tr> <td>2014</td> <td>23</td> </tr> <tr> <td>2015</td> <td>19</td> </tr> <tr> <td>2016</td> <td>26</td> </tr> <tr> <td>2017</td> <td>22</td> </tr> </tbody> </table>		Year	Catch (t)	2013	23	2014	23	2015	19	2016	26	2017	22
Year	Catch (t)													
2013	23													
2014	23													
2015	19													
2016	26													
2017	22													
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<p>Tier 4 assessments do not assess the probability of being below the limit reference point. If the standardised CPUE series is a reasonable index of relative abundance catches up to the RBC are considered to have a very low probability of causing the stock to decline to below the limit reference point.</p> <p><b>Alternative Catch Scenarios:</b> Not available.</p>													
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t													
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A													

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	Tier 4
<b>Stock Status</b>	CPUE between target and limit	Not assessed	Not assessed	Not assessed	CPUE between target and limit	CPUE between target and limit
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	78	47	47	47	9	9
<b>Agreed TAC</b>	47	47	47	46	23	
<b>TAC after unders/overs</b>	55	51	51	50	27	
<b>% TAC caught</b>	46%	44%	49%	46%		

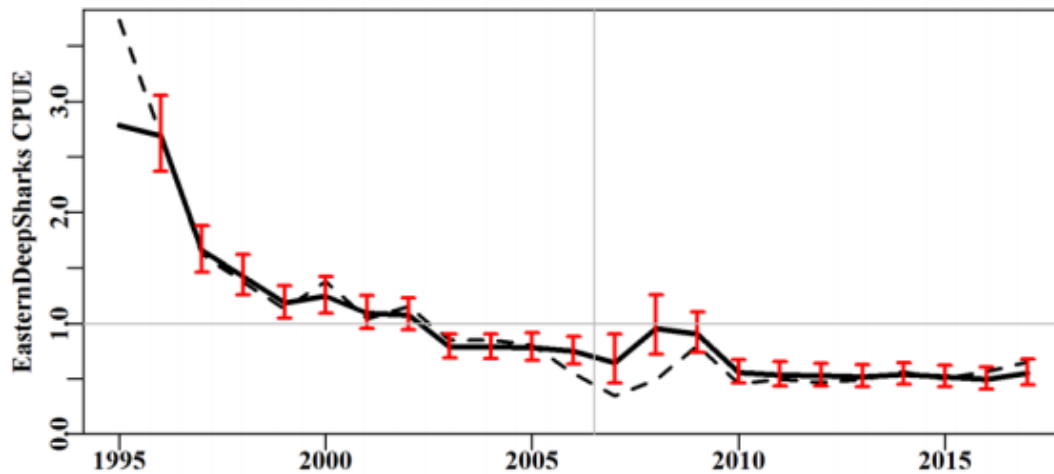
## Catch Trends

Deepwater shark (east) catches against TAC for various gear types:

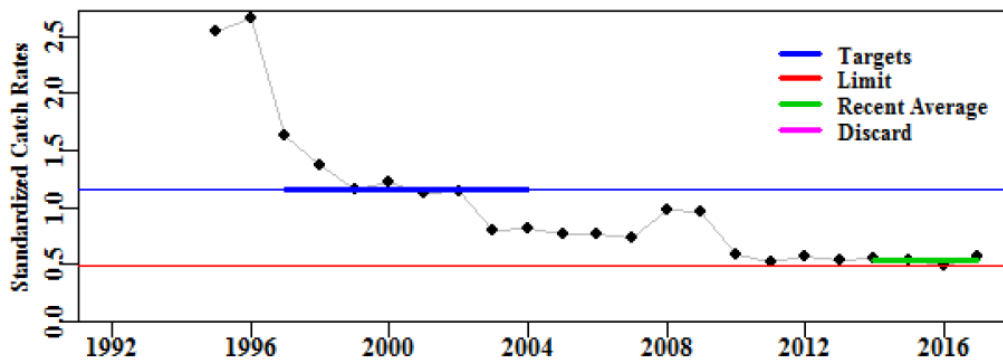


## Standardised Catch Rates

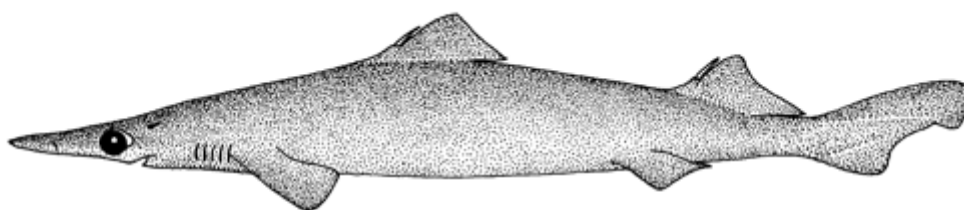
Standardised catch rates for eastern deepwater sharks in open areas only. The dashed black line represents the geometric mean catch rate, solid black line the standardized catch rates. The red bars are the 95% confidence intervals about the mean estimates. The graph scales both time-series of standardized catch rates relative to the mean of each time-series.



Deepwater Shark (east) standardised catch rates relative to the target and limit rates. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate.



## 8 Deepwater Shark Basket - West



The Deepwater Shark Basket quota includes multiple species of deepwater sharks: Brier shark (*Deania calcea*), Platypus shark (*Deania quadrispinosa*), Plunket's shark (*Centroscyrnus plunketi*), Roughskin Shark (*Centroscyrnus* and *Deania* spp), Pearl shark (*D.calcea* and *D.quadrispinosa*), Black shark (*Centroscyrnus* spp), Lantern shark (*Etmopterus* spp), Dogfish Family *squalidae* and other sharks.

Tier 4: last assessed by SERAG in 2018.

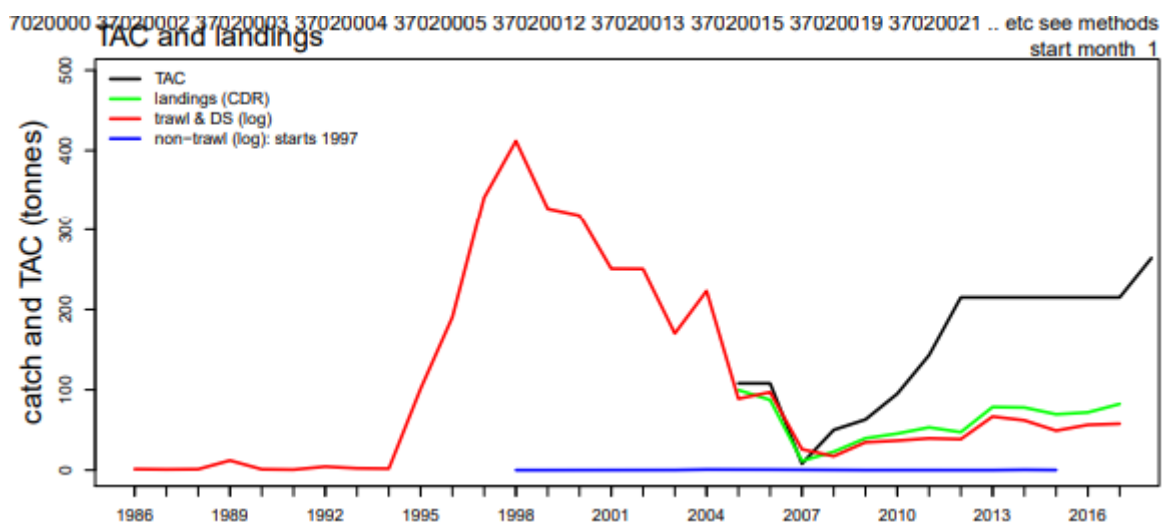
Summary																											
<b>Stock Structure</b>	<p>Little is known about the stock structure of deepwater sharks. They are benthic-pelagic species that have been sampled in oceanic environments over the abyssal plains and are distributed widely across ocean basins and along the middle and lower continental shelves. The western management area extends from the Tasmanian west coast Latitude 42° S (approximately Strahan), around to Western Australia.</p>																										
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 Target reference point is the level of CPUE assumed to produce a spawning biomass of 48% of unfished levels.</p> <p>The limit reference point is 40% of the target reference point.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1995-2004</td> <td>Scaling</td> <td>1.3442</td> </tr> <tr> <td>CE_Targ</td> <td>0.6073</td> <td>Last Yr TAC</td> <td>264</td> </tr> <tr> <td>CE_Limit</td> <td>0.253</td> <td>C<sub>targ</sub></td> <td>174.849</td> </tr> <tr> <td>CE_Recent</td> <td>0.7292</td> <td>RBC</td> <td>235.036</td> </tr> <tr> <td>Wt_Discard</td> <td>-</td> <td></td> <td></td> </tr> </tbody> </table> <p>CPUE trend: CPUE has increased in recent years which has brought the recent average up.</p> <p>A large proportion (&gt;54%) of the catch of the entire fishery (east &amp; west combined) was previously taken in waters &gt;700m and most of these areas are now closed. (AFMA report 2008-836).</p>			Parameter	Value	Parameter	Value	Reference Years	1995-2004	Scaling	1.3442	CE_Targ	0.6073	Last Yr TAC	264	CE_Limit	0.253	C <sub>targ</sub>	174.849	CE_Recent	0.7292	RBC	235.036	Wt_Discard	-		
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<b>ABARES most recent assessment (2017)</b>	<p><b>Biomass</b></p> <p>Uncertain</p>	<p><b>Fishing Mortality</b></p> <p>Not subject to overfishing</p>																									
<b>GVP Figures (2016-17 season)</b>	<p><b>GVP</b></p> <p>N/A</p>	<p><b>% Fishery GVP</b></p> <p>N/A</p>																									
<b>Is a MYTAC in place this season?</b>	No.	<b>Have breakout rules been triggered?</b>	N/A																								

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	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.
<b>Key model technical assumptions/ parameters</b>	<p>Major assumption that the CPUE represents the status of the whole stock, uncertain given the large closures.</p> <p>Assessed as a separate east and west stock.</p> <p>Basket of species (see stock structure), hence a key assumption is that the combined species CPUE at least broadly reflects the trends in CPUE for all the contributing species. Noted that approximately 80 % of the catch was one species; <i>Deania calcea</i> (brier shark). AFMA funded a project to look at the breakdown of deepwater shark species at Sydney Fish Market and found that 86 per cent of the catch were <i>Deania calcea</i> (brier shark) and six per cent were <i>D. quadrispinosa</i> (platypus shark).</p>
<b>Changes to model structure/assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	If there is a change in discard estimates over time the RAG should consider including them in the Tier 4.
<b>RAG Comments on assessment</b>	<p>The RAG noted the recent increase in CPUE and the correlation with the modification to the deepwater closures in 2016.</p> <p>Only the stock outside the closures is assessed and there is little understanding of the effect of the closures.</p>

RAG Recommendations		
<b>Recommended Biological Catch (2019-20)</b>	235 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	No.	Future MYTAC subject to Feb 2019 SESSFRAG review of assessment approaches.
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. P&lt;10%).</i>		Tier 4 assessments do not assess the probability of being below the limit reference point. If the standardised CPUE series is a reasonable index of relative abundance catches up to the RBC are considered to have a very low probability of causing the stock to decline to below the limit reference point. <b>Alternative Catch Scenarios:</b> N/A
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A	

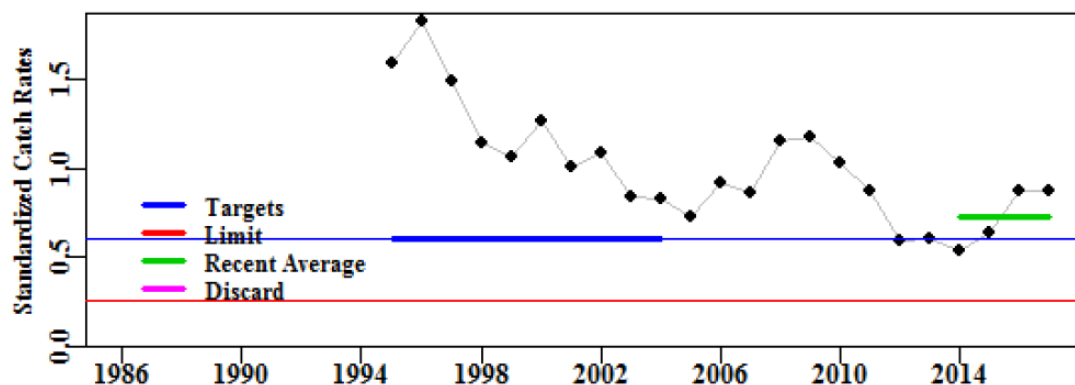
Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	Tier 4
<b>Stock Status</b>	CPUE between target and limit	Not assessed	Not assessed	Not assessed	Above target	Above target
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	263	263	263	263	313	235
<b>Agreed TAC</b>	215	215	215	215	264	
<b>TAC after unders/overs</b>	230	231	232	232	281	
<b>% TAC caught</b>	35%	30%	32%	34%		

## Catch Trends



## Standardised Catch Rates

Deepwater Shark Basket (west) 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.



## 9 Elephant fish (*Callorhynchus milii*)



Ken Graham DPI Fisheries (1984)

Tier 4 for slope stock and catch-MSY, last assessed by SharkRAG 2018.

Summary									
<b>Stock Structure</b>	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.								
<b>Stock status against reference points and trend</b>	<table border="1"> <thead> <tr> <th>Current</th> <th>Target</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>CPUE = 0.8656</td> <td>CPUE = 0.844</td> <td>CPUE = 0.422</td> </tr> </tbody> </table> <p>Tier 4 for slope stock</p> <p>Tier 4 species use CPUE targets as a proxy for biomass targets.</p> <p>Current CPUE is 0.8656, target CPUE is 0.844 and limit CPUE is 0.422</p> <p><b>Stock status:</b> standardised CPUE has decreased over the last three years from above the target reference point in 2014 to a point between the limit and the target reference point in 2017.</p>			Current	Target	Limit	CPUE = 0.8656	CPUE = 0.844	CPUE = 0.422
Current	Target	Limit							
CPUE = 0.8656	CPUE = 0.844	CPUE = 0.422							
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished		<b>Fishing Mortality</b> Not subject to overfishing						
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.98 million		<b>% Fishery GVP</b> 0.12%						
<b>Is a MYTAC in place this season?</b>	No	<b>Have breakout rules been triggered?</b>	N/A						

Assessment Summary	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	N/A



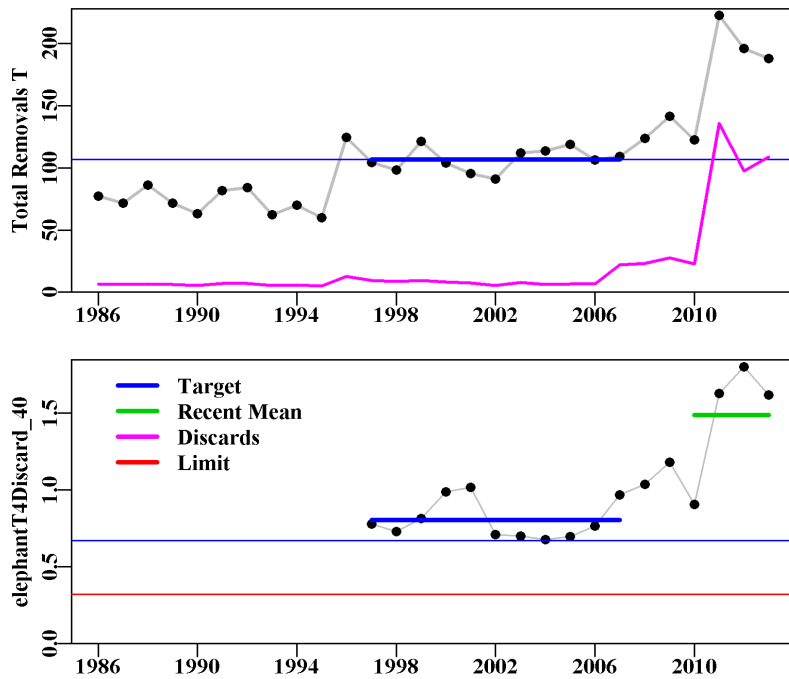
<b>Key model technical assumptions/ parameters</b>	Four year weighted average of discards are used for assessment and deducted from RBC. Recreational catch is included.
<b>Significant changes to data inputs</b>	Yes, model now includes discards data.
<b>RAG Comments on data</b>	<p>In 2014 SharkRAG changed the model to include discards in the assessment but noted that further refinements were required. Further work to incorporate discards in the assessment was recommended for 2015.</p> <p>Shark RAG has expressed concerns that changes in fishing behaviour such as intentional avoidance cannot be accounted for in the Tier 4 assessment, and can ultimately drive RBC/TACs downwards.</p> <p>There is some uncertainty about how reliable the Tier 4 assessment is as an index of abundance for Elephantfish because we are using gillnet data and there appears to be avoidance behaviour by fishers. However, SharkRAG 2014 did not have concerns about the current status of the stock based on the available catch and effort information.</p>
<b>RAG Comments on assessment</b>	SharkRAG recommended maintaining the TAC at the current level of 114 t, noting that the assessment will be updated after receiving advice from SESSFRAG in 2019 on species are currently difficult to assess. RAG industry members have previously expressed that a precautionary long term RBC should be set for elephantfish as the TAC level does not influence landings.
<b>Projected Biomass</b>	

<b>RAG Recommendations</b>		
<b>Recommended Biological Catch (2019/20)</b>	114 t	<p><b>Undercatch:</b> 10%</p> <p><b>Overcatch:</b> 10%</p> <p><b>Discount Factor:</b> 15 %</p> <p>(A discount factor is applied to tier 4 species)</p>
<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	SharkRAG recommended maintaining the TAC at the current level of 114 t for this year.	

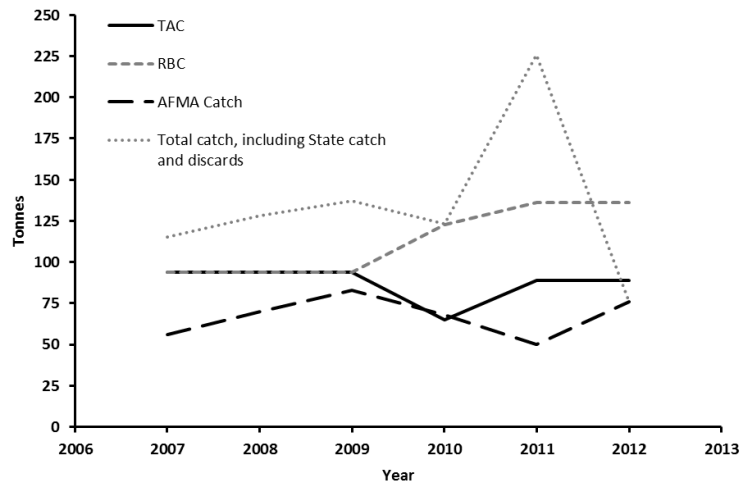
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. P&lt;10%).</i></p>	RBC recommendation = <10% (very unlikely)
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	0 t
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	N/A

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	Tier 4	Tier 4	Tier 4	Tier 4	Tier 4
Stock Status	CPUE above target	CPUE above target	Not assessed	Not assessed	Not assessed	Not assessed
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (t)	116	357	306	306	206	
Agreed TAC	109	163	92	114	114	
TAC after Unders/Overs	117.43	172	108	122	122	
% TAC caught	52%	32%	59%	38%		

### Catch Trends



**Figure 4.** Top panel is the total removals with the fine line illustrating the target catch. Bottom panel represents the standardized catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represent the reference period for catches, catch rates (1996 – 2007), and the recent average catch rate (last four years).



**Figure 2** Elephantfish TAC, RBC, AFMA catch and total catch are detailed above. The spike in total catch for 2011 can be attributed to the high level of discards recorded for that year which is incorporated into the total catch.

## 10 Flathead



**Common names:** Deep sea flathead, flathead, king flathead, spiky flathead, trawl flathead.

Tier 1 assessed by SERAG in 2016, species summary updated in 2017.

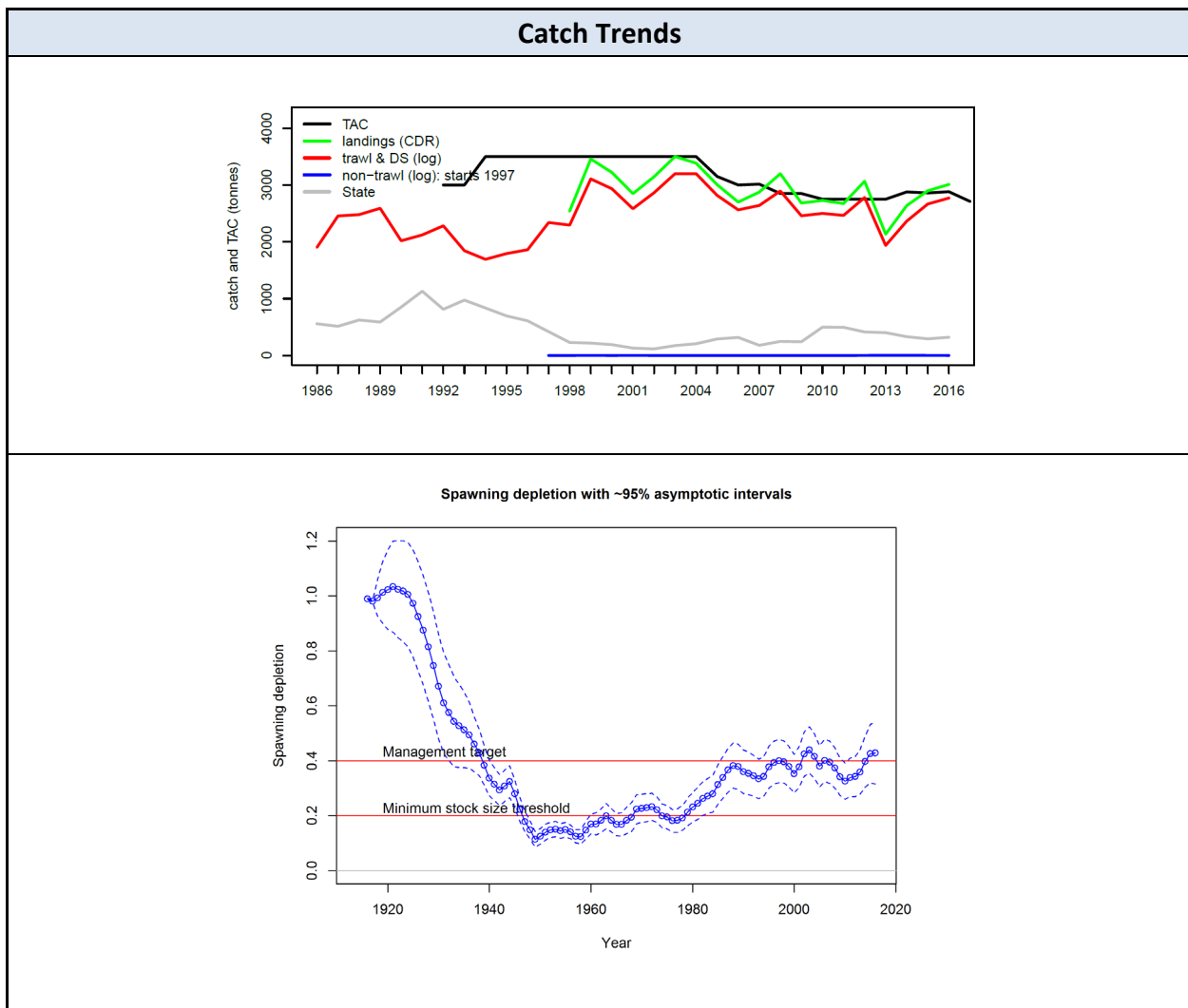
Summary									
<b>Stock Structure</b>	<p>For management purposes a single continuous stock has been assumed throughout all zones of the SESSF.</p> <p>The minimum codend mesh size for Danish seine vessels will increase from 70mm to 75mm in the 2019-20 fishing year to reduce the catch of small flathead.</p>								
<b>Stock status against reference points and trend</b>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Current</th> <th>Target</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>2016: 42% B<sub>0</sub></td> <td>40% B<sub>0</sub></td> <td>20% B<sub>0</sub></td> </tr> </tbody> </table> <p>Limit Reference Point is 20% of estimated unfished female spawning biomass. Target reference point is 40% of estimated unfished female spawning biomass.</p> <p>Trend: The last assessment in 2013 estimated the spawning biomass at 50% of unexploited stock biomass. The 2016 assessment estimates the stock has fluctuated around 40% of unexploited stock biomass since around 1990 with a slight increase in the last few years.</p> <p>Stock status: The 2016 assessment estimated current spawning stock biomass as 42% of unexploited stock biomass. The projections based on the implementation of a step-down in TAC in 2017-18 estimates the spawning stock biomass as 41.2% of unexploited stock biomass in 2018-19 and 40.9% in 2019-2020.</p>			Current	Target	Limit	2016: 42% B <sub>0</sub>	40% B <sub>0</sub>	20% B <sub>0</sub>
Current	Target	Limit							
2016: 42% B <sub>0</sub>	40% B <sub>0</sub>	20% B <sub>0</sub>							
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing							
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$18.6 million	<b>% Fishery GVP</b> 40.1%							
<b>Is a MYTAC in place this season?</b>	Yes	<b>Have breakout rules been triggered?</b>	No.						

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	Refer to Tier 1 assessment.
<b>Key model technical assumptions/ parameters</b>	The current assessment assumes a single growth curve for the whole stock, an assumption also made in previous assessments.
<b>Significant changes to data inputs</b>	Both port and onboard length frequency data were included. Length frequency data from the fishery independent surveys from 2008, 2010, 2012 and 2014 was included.
<b>RAG Comments on data</b>	Need to investigate spatial differences in growth parameters between eastern TAS and other regions. The 2016 model outputs are robust to a range of sensitivities. The assessment indicated there has been better than average recent recruitments.
<b>RAG Comments on assessment</b>	<p><b>November 2016 SERAG meeting</b></p> <p>The 2016 model outputs are robust to a range of sensitivities.</p> <p>The assessment indicated there has been better than average recent recruitments.</p> <p>The RBC has been reduced (approx. 15 per cent) because:</p> <ul style="list-style-type: none"> <li>- 2013 model over estimated recent recruitment</li> <li>- The 2013 assessment estimated biomass at 50 per cent, which has been fished down towards the target.</li> </ul> <p>Flathead are a key economic species, and there are implications for fishery GVP in reducing the RBC.</p> <p><b>12 January 2017 SERAG teleconference:</b></p> <p>Corrections made to the assessment with adjusted RBCs as described above.</p> <p>Industry raised concerns over Danish seine gear selectivity estimates not being included in the model and requested a phased approach in reducing TAC until the assessment is updated.</p> <p>The RAG considered modeled projections under adjusted RBCs (to allow for higher TACs) which result in a biomass above target (<math>B_{40}</math>) over five years.</p> <p>The RAG recommended a single year RBC for 2017-18 and the assessment to be updated in 2017. If the assessment is not completed in 2017, 2<sup>nd</sup> year RBCs have been calculated which are dependent on the TAC set by SEMAC.</p> <p>A Danish seine gear survey should be conducted to inform the 2017 assessment.</p>

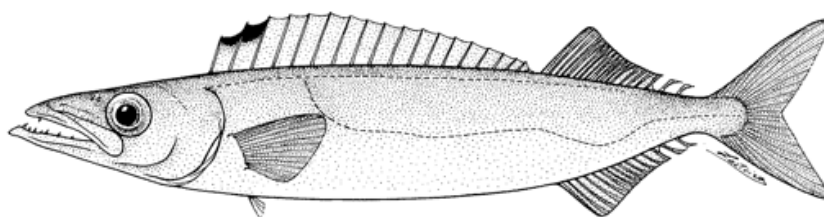
	<p><b>18 September 2017 SERAG Meeting:</b></p> <p>Danish seine gear survey showed little change in mesh size over time. SERAG agreed not to update the assessment and recommended single year RBCs from the projections for the remainder of the MYTAC period.</p> <p>Assessment to be updated in 2019.</p>
<b>Projected Biomass</b>	

RAG Recommendations	
<p><b>Recommended Biological Catch (2019/20)</b></p>	<p>2826 t</p> <p><b>Undercatch:</b> 10%</p> <p><b>Overcatch:</b> 10%</p> <p><b>Discount Factor:</b> N/A</p>
<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p>No. Single year RBCs:</p> <p style="padding-left: 40px;">2018: 2837 t</p> <p style="padding-left: 40px;">2019: 2826 t</p> <p>Recommended by SERAG for the remainder of the MYTAC period.</p> <p>Assessment to be updated 2019.</p>
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i></p>	<p>RBC recommendation = &lt;10% (very unlikely)</p>
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>10 t from the 2019 FIS.</p>
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>N/A</p>

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 1	MYTAC	MYTAC	Tier 1	MYTAC	Not assessed
Stock Status	50%	Not assessed	Not assessed	42%	Not assessed	Not assessed
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (t)	1yr: 3428 2yr: 3334 5yr: 3252	3334	3334	1yr: 3089	2837	
Agreed TAC	2878	2860	2882	2712	2507	
TAC after Unders/Overs	3143	3092	2992	2850		
% TAC caught	81%	90%	94%	86%		



## 11 Gemfish East (*Rexea solandri*)



ABARES (2012): Line Drawing – Shane Weidland

**Obsolete common names:** Hake, Common gemfish, Deepsea Kingfish, King barracouta, King couta, Silver Gemfish, Southern Kingfish

Under a [Stock Rebuilding Strategy](#).

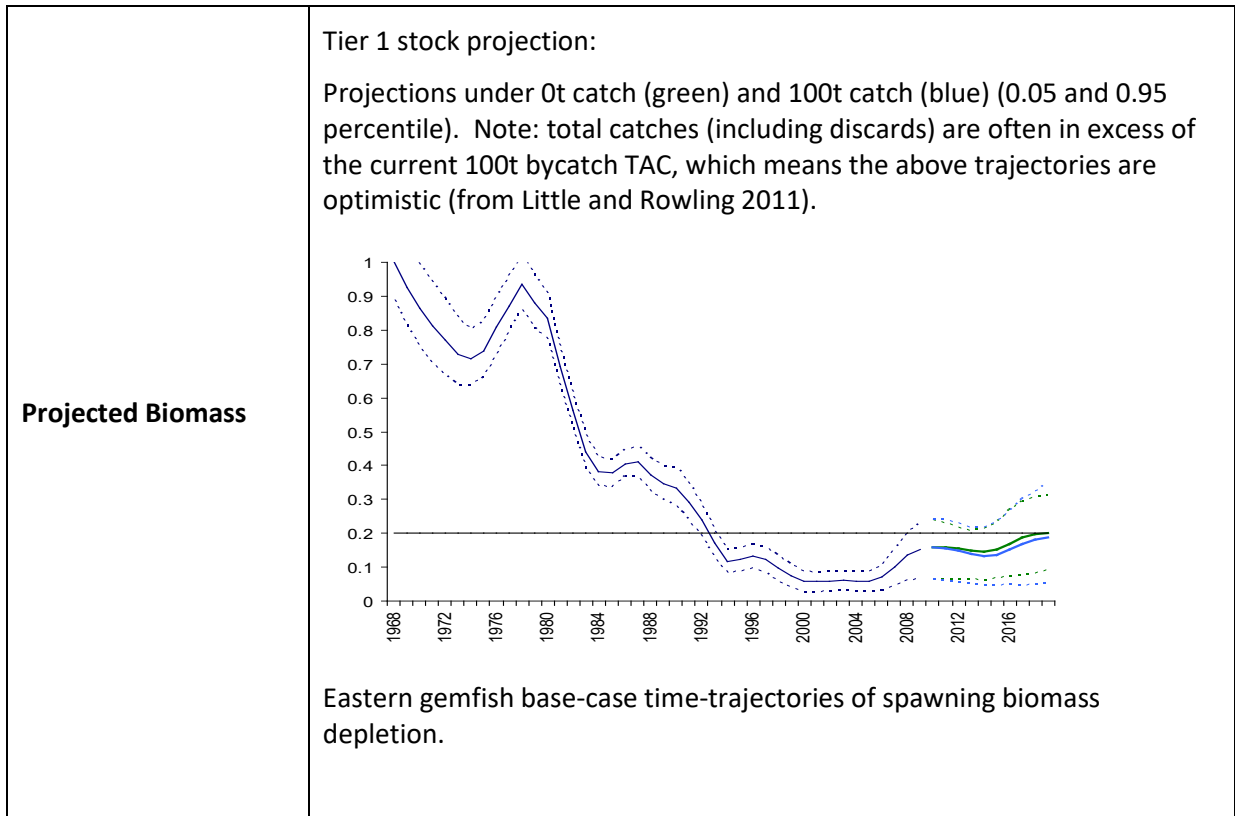
**Tier 1 assessed by ShelfRAG in 2010, species summary updated in 2016.**

Summary								
<b>Stock Structure</b>	<p>There are considered to be two stocks of <i>R. solandri</i> 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).</p> <p>The current assessment is based solely on eastern gemfish, caught south of Latitude 43° south off western Tasmania, and east of longitude 146° 22'.</p>							
<b>Stock status against reference points and trend</b>	<table border="1"> <thead> <tr> <th>Current</th> <th>Target</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>2009: 16% B<sub>0</sub></td> <td>48% B<sub>0</sub></td> <td>20% B<sub>0</sub></td> </tr> </tbody> </table> <p>Limit reference point is 20 per cent of unfished biomass.</p> <p>Target reference point is 48 per cent of unfished biomass.</p> <p>Stock status: The last updated assessment in 2009 (updated from 2008), assessed eastern gemfish to be at 16 per cent of its unfished biomass, and hence to be below the limit reference point.</p> <p>The Eastern gemfish Stock Rebuilding Strategy has been updated and was released in early 2015. The current rebuilding strategy is located <a href="#">here</a>.</p> <p>Biomass trend: While a revised assessment was not undertaken, the 2008 assessment model was updated with more recent data. The updated assessment was not accepted by the RAG, however, the RAG noted that the outcome did not provide any evidence of stock rebuilding.</p>		Current	Target	Limit	2009: 16% B <sub>0</sub>	48% B <sub>0</sub>	20% B <sub>0</sub>
Current	Target	Limit						
2009: 16% B <sub>0</sub>	48% B <sub>0</sub>	20% B <sub>0</sub>						
<b>ABARES most recent assessment (2017)</b>	<b>Biomass Overfished</b>	<b>Fishing Mortality Uncertain</b>						
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> < \$0.1 million	<b>% Fishery GVP</b> < 0.15%						



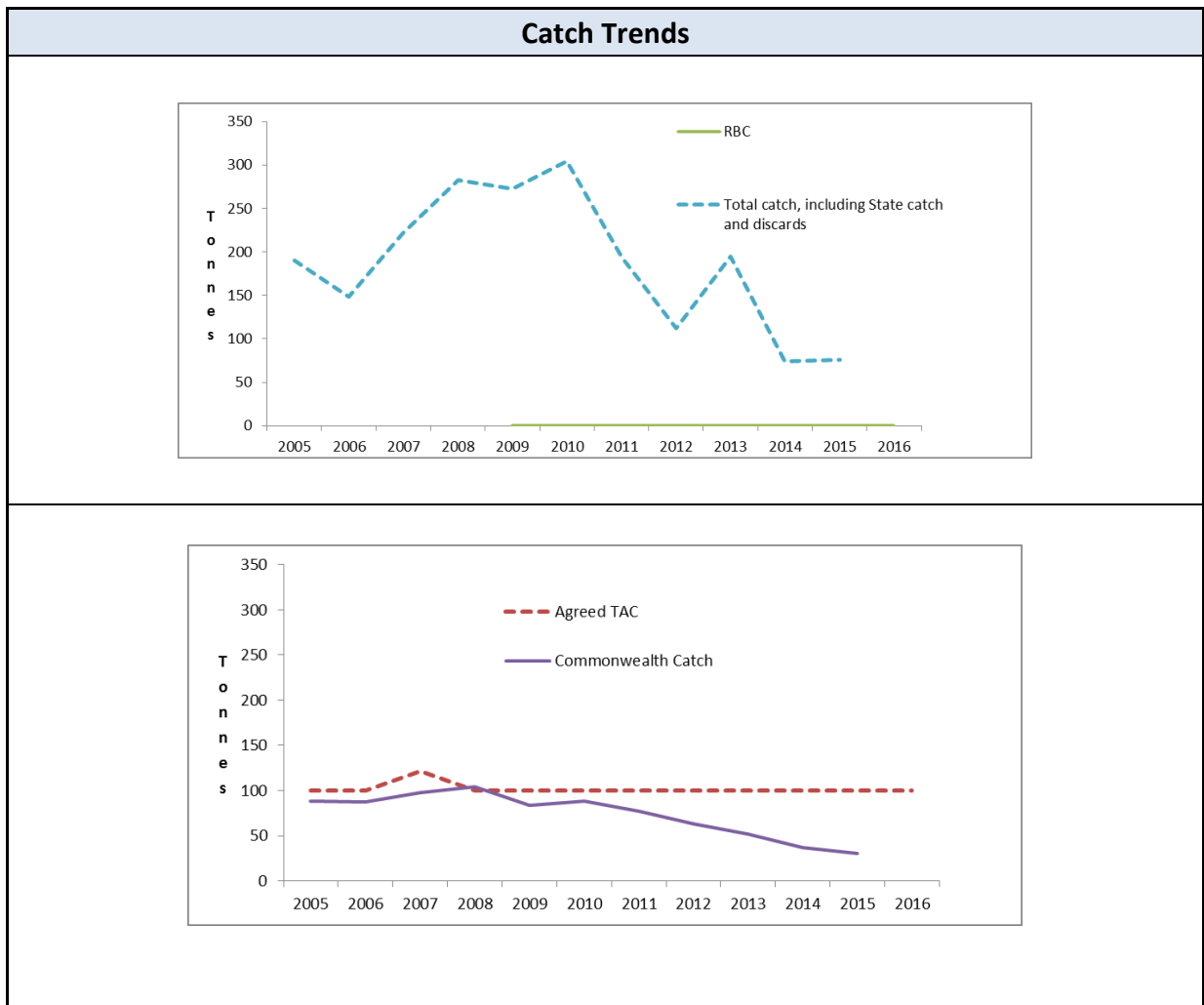
Is a MYTAC in place this season?	No	Have breakout rules been triggered?	N/A
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Assessment Summary	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	<p>Landed catches remain well below the incidental catch TAC and have been declining. Aggregated landings and discards are less than the TAC and declining.</p> <p>In 2016, the 2008 assessment model was updated with more recent data. The updated assessment was not accepted by the RAG, however, the RAG noted that the outcome did not provide any evidence of stock rebuilding.</p>
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	Standardised CPUE cannot be used as a reliable index of abundance due to avoidance behaviour of operators.
<b>RAG Comments on assessment</b>	<p>The RAG reviewed the 2015 calendar year data and noted:</p> <ul style="list-style-type: none"> <li>• discard rates remain high at between 40-60 per cent</li> <li>• the non-targeted spawning standardized CPUE has decreased</li> <li>• there has been low recruitment since 2002 and biomass is tracking down since that 2002 cohort entered the fishery</li> </ul> <p>Projections from the most recent assessment, updated during 2010, indicate that with average recruitment the stock would recover within 13 years which is within the rebuilding timeframe specified in the HSP.</p> <p>CSIRO reviewed the available data for eastern gemfish in August 2016 and prepared a preliminary update of the eastern gemfish assessment, in order for the SESSFRAG to provide advice on whether an assessment is completed in 2016 or deferred to 2017.</p> <p>The RAG recommended that an assessment be postponed until 2017 and that the data should be assessed during 2017 to determine whether an updated assessment would inform stock status.</p> <p>The RAG has previously pointed out the eastern gemfish stock may now be at a new equilibrium and the stock may not rebuild under current conditions meaning the Eastern Gemfish Rebuilding Strategy under the Harvest Strategy Policy may not achieve its objectives. The RAG noted the importance of the planned project looking at declining and non-recovering stocks.</p> <p>The RAG agreed that continuing with the 100 t incidental catch MYTAC was appropriate.</p>

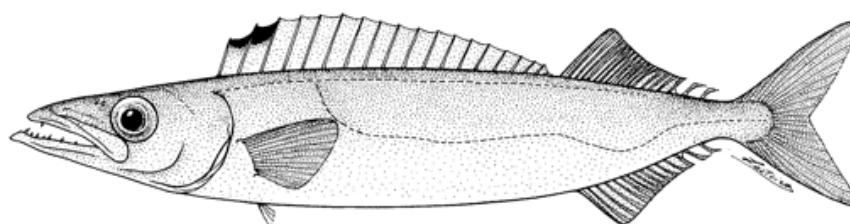


RAG Recommendations	
<b>Recommended Biological Catch (2019/20)</b>	0 t (under a bycatch TAC) Incidental TAC of 100 t <b>Undercatch:</b> 0% <b>Overcatch:</b> 0% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>	No.
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation = N/A, already considered to be below the limit reference point.
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t
<b>Implications for companion species / TEPs / multi-species fisheries</b>	Historically there were reports of a companion species relationship between mirror dory and eastern gemfish which is likely to have changed due to avoidance of fishing the areas and depths that these species inhabit during the eastern gemfish spawning season.

Catch and TAC						
Assessment Year	2012	2013	2014	2015	2016	2017
Tier / MYTAC	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	
Stock Status	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	
SESSF Season	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
RBC (t)	0	0	0	0	0	
Agreed TAC	100	100	100	100	100	
TAC after Unders/Overs	100	100	100	100	100	
% TAC caught	52%	37%	30%	30%	32%	



## 12 Gemfish West (*Rexea solandri*)



ABARES (2012): Line Drawing – Shane Weidland

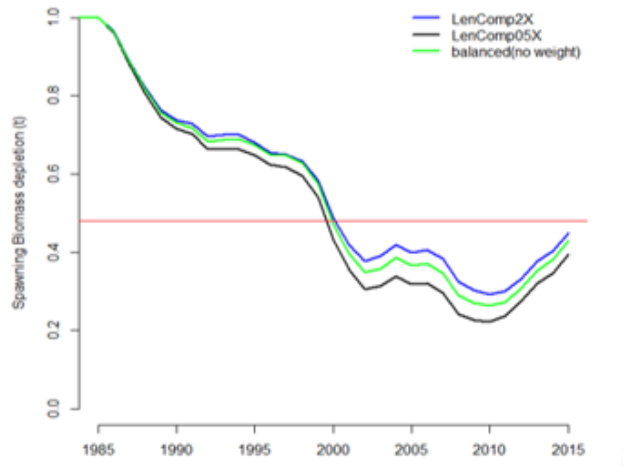
**Obsolete common names:** Hake, Common gemfish, Deepsea Kingfish, King barracouta, King couta, Silver Gemfish, Southern Kingfish

**Tier 4 last assessed by GABRAG in 2016 (a Tier 1 assessment was also considered).**

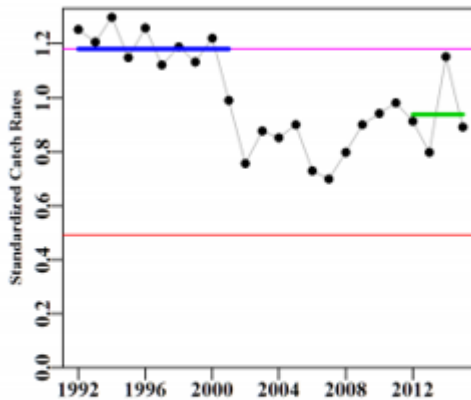
Summary									
<b>Stock Structure</b>	<p>There are considered to be two stocks of <i>R. solandri</i> in Australia, an eastern and a western stock bordered by a boundary in the south west of Tasmania (west of 146°22'E, north of 42°43'S).</p> <p>Currently available data indicate a single biological stock of western gemfish.</p>								
<b>Stock status against reference points and trend</b>	<table border="1"> <thead> <tr> <th>Current</th> <th>Target</th> <th>Limit</th> </tr> </thead> <tbody> <tr> <td>CPUE<sub>current</sub> = 0.9378</td> <td>CPUE<sub>targ</sub> = 1.1816</td> <td>CPUE<sub>lim</sub> = 0.4923</td> </tr> </tbody> </table> <p>Limit reference 20% of unfished biomass. Target reference 48% of unfished biomass.</p> <p>An integrated assessment model and CPUE analysis were used to estimate depletion and changes in catch rate. Both analyses identified deficiencies in the data which prevented precise estimates of stock status.</p>			Current	Target	Limit	CPUE <sub>current</sub> = 0.9378	CPUE <sub>targ</sub> = 1.1816	CPUE <sub>lim</sub> = 0.4923
Current	Target	Limit							
CPUE <sub>current</sub> = 0.9378	CPUE <sub>targ</sub> = 1.1816	CPUE <sub>lim</sub> = 0.4923							
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing							
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.19 million	<b>% Fishery GVP</b> 0.41%							
<b>Is a MYTAC in place this season?</b>	Yes.  2019-20 is the final year of the MYTAC.	<b>Have breakout rules been triggered?</b>	N/A.  Observed standardized CPUE or FIS (when run) falls outside the 95% confidence intervals projected from the assessment.						

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	The RAG considered a weight of evidence approach using Tier 1 and Tier 4 assessments as well as catch history. These indicated that there was a low risk of the stock declining below the limit reference point.
<b>Key model technical assumptions/ parameters</b>	<p>In relation to the Tier 4 assessment which includes discards, the RAG noted the key assumption was that no shots of western gemfish were completely discarded. If some shots were completely discarded, the Tier 4 (no discards) assessment will be biased high.</p> <p>If discards are not included in the Tier 4 assessment, then it will be biased low. As such, the actual CPUE will be bounded by the Tier 4 discard CPUE and Tier 4 no discards CPUE assessments.</p>
<b>Significant changes to data inputs</b>	<p>The Tier 1 stock synthesis assessment model was updated (to SSv24z).</p> <p>In the previous Tier 1 assessment, decisions regarding model structure and tuning were based on the views of the GABRAG and standard procedures employed in Tier 1 assessments in the SESSF. In the current Tier 1 assessment the tuning and balancing was determined from the software.</p>
<b>RAG Comments on data</b>	<p>The RAG noted that limited data availability restricted its ability to assess the stock. In particular:</p> <ul style="list-style-type: none"> <li>• There is a paucity of length frequency data for the GAB and more recently (since 2006) for the CTS.</li> <li>• There has been no biological data collected specifically for western gemfish and the assessment relies on characteristics from eastern gemfish.</li> <li>• There is a need to better understand the effect of high levels of discarding on CPUE.</li> </ul> <p>The RAG recommended that future data collection for western gemfish be considered by AFMA, the RAG, GABIA, SETFIA, recognising the current and likely future economic contribution of the species.</p>
<b>RAG Comments on assessment</b>	<p>The RAG 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.</p> <p>There were insufficient data to provide a reliable understanding of productivity of western gemfish in the GAB. Accordingly, the RAG based its advice on the CTS component of the Tier 1 in the context of the outcomes of the three assessments and current catches relative to TAC.</p> <p>The RAG noted that market restrictions were limiting the landed catch of western gemfish.</p> <p>The RAG noted discards were high compared to landed catch and recommended AFMA engage with industry associations to develop approaches to reduce discards.</p>

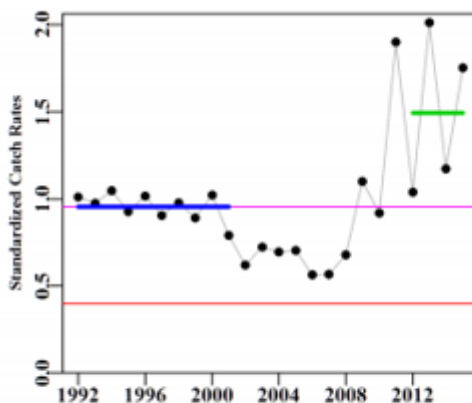
**Projected Biomass**



Western gemfish depletion estimates from the Tier 1 assessment (green line is the base case).



Western Gemfish (Zones 40 and 50) CPUE without the inclusion of discards with the upper thin line representing the target catch rate and the lower line representing the limit catch rate.

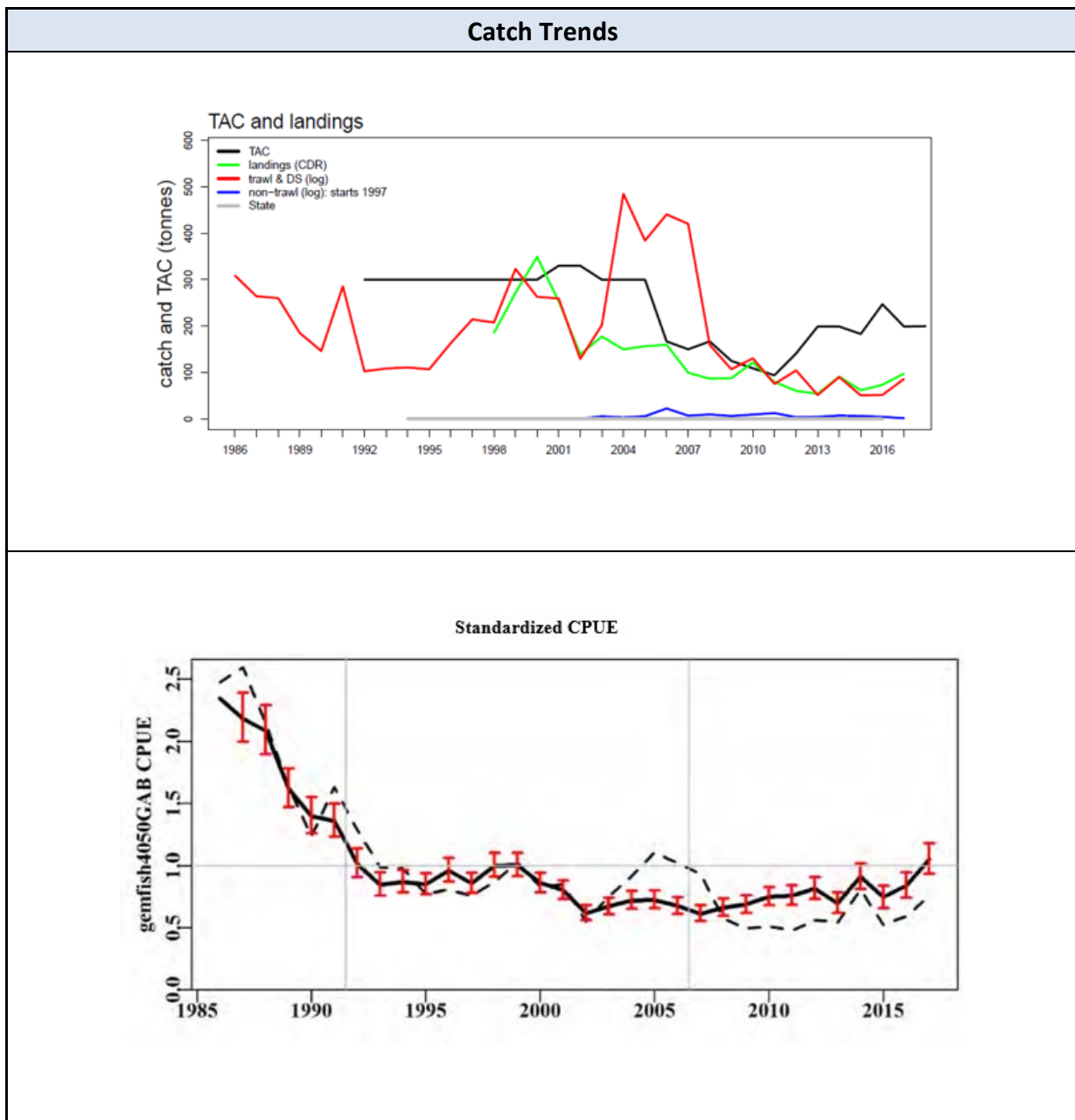


Western Gemfish (Zones 40 and 50) CPUE including discards with the upper thin line representing the target catch rate and the lower line representing the limit catch rate.

RAG Recommendations	
<b>Recommended Biological Catch (2019/20)</b>	200 t  <b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>	Yes. 3 year: 200 t (RBC for Zones 40 and 50 only) The RAG noted there were significant uncertainties with the assessments reflecting limited data availability. The RAG recommended a multi-year RBC to allow targeted data collection.
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. P&lt;10%).</i>	The RAG considered a Tier 1 assessment, Tier 4 assessment, and catch history in a weight of evidence approach to recommend an RBC. These indicated that there was a low risk of the stock declining below the limit reference point. Over the last five years catch and discards have remained below the RBC.  <b>Alternative Catch Scenarios = N/A</b>
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	N/A
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Tier 1 (Tier 4 used to set CTS TAC)	2 <sup>nd</sup> Year of 3-year MYTAC	3 <sup>rd</sup> year of 3-year MYTAC	Tier 1/4	2 <sup>nd</sup> year of 3-year MYTAC	3 <sup>rd</sup> year of 3-year MYTAC
<b>Stock Status</b>	Tier 1 – 74% Tier 4 – CPUE between the target and limit	Not assessed	Not assessed	Tier 1 – 43% Tier 4 (CTS) Above the limit (no discards) and above the target (discards)	Not assessed	Not assessed

SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (t)	676 (T1) 346 (T4)	247 (T4)	247 (T4)	200 (T1) 139 (T4) 423 (T4 discards)	200	200
Agreed TAC	199	183	247	200	200	200
TAC after Unders/Overs	217	200	261	223	218	
% TAC caught	33%	41%	28%	35%		





# 13 Gummy Shark (*Mustelus antarcticus*)



Fisheries Research & Development Corporation (2012)

## Tier 1: Last assessed by SharkRAG in 2016

Summary	
<p><b>Stock Structure</b></p>	<p>Gummy shark is endemic to southern Australia. It is considered a single genetic stock across the SESSF extending from Bunbury in Western Australia 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 South Australia...</p>
<p><b>Stock status against reference points and trend</b></p>	<p>Limit reference point is 20 per cent of unfished biomass (pup production is used as a proxy for breeding biomass)</p> <p>Target reference point is 48 per cent of unfished biomass (pup production is used as a proxy for breeding biomass)</p> <p>The 2016 assessment estimates that each of the three sub-stocks are above the target reference point.</p> <div style="text-align: center;"> </div> <div style="text-align: center;"> </div> <p>Figure 1. Catch trends for gummy shark ( RBC and total catch are calendar year : TAC and commonwealth catch are fishing season</p>

<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$17.93 million	<b>% Fishery GVP</b> 21.87 %	
<b>Is a MYTAC in place this season?</b>	Yes	<b>Have breakout rules been triggered?</b>	No

<b>Assessment Summary</b>	
<b>Tier Level</b>	Level 1
<b>Stock indicator trends</b>	All three assessment stocks remain above target, with no evidence that stocks were ever below the management target.
<b>Key model technical assumptions/ parameters</b>	<p>The model uses three management regions which are assessed simultaneously.</p> <p>Differing availability to gear by age is incorporated into model reflecting the varying ability to target gummy shark. Although this approach improves fits to data, for the next gummy shark assessment, SharkRAG agreed to investigate estimating selectivity separately for each region and allowing it to be a more flexible form. This may allow the differing availability function to be removed from the assessment.</p>
<b>Changes to model structure/assumptions</b>	<p>The following changes were made to the 2013 model:</p> <ul style="list-style-type: none"> <li>• catches by various gear types are assumed to occur simultaneously rather than sequentially</li> <li>• the 'hook fleet' is now separated into shark longline, trawl, and scalefish longline gear type</li> <li>• allowance is made for age reading error.</li> </ul>
<b>Significant changes to data inputs</b>	<p>The following data were added to the 2016 model:</p> <ul style="list-style-type: none"> <li>• landings for the seven gear types included in the assessment</li> <li>• length composition data for the seven gear types</li> <li>• age composition data for 1995, 1997, 2002 and 2003</li> <li>• updated catch rate data.</li> </ul>
<b>RAG Comments on data</b>	<p>Standardised CPUE from South Australia is no longer used in the assessment.</p> <p>At the 2018 SESSFRAG meeting there was concern that there was insufficient new data (poor spatial coverage) to run an updated assessment for gummy shark on 201. The RAG also noted that there are issues with calculation of standardised CPUE by shot and work is being undertaken on changing this to be calculate by metre of net set in 2049.</p> <p>This was considered by SharkRAG in October 2018, Noting that a crew collected data program as introduced in 2018 by the Southern Shark Industry Alliance and that work was underway to use electronic monitoring data for discard estimates.</p>

<b>RAG Comments on assessment</b>	<p>SharkRAG provided advice to consider delaying the assessment to at least 2020. This recommendation will be considered in SESSFRAG in February 2019.</p> <p>Previously the state allocations agreed under the shark memorandum of understanding with Southern Australia, Victoria and Tasmania have been deducted from the RBC. However in 2018 SharkRAG recommended deducting the weighted average state catch from the RBC, as is the case for other SESSF species. The AFMA commission will consider this amendment to the SESSF harvest strategy Framework for the 2019-20 season and the AFMA TAC recommendation is made on that basis.</p>
<b>Projected Biomass (including confidence intervals)</b>	

<b>RAG Recommendations</b>		
<b>Recommended Biological Catch (2019/20)</b>	1785 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes, AFMA management recommend a TAC of 175 t for the 2019-20 fishing year, the third year of a 3-year MYTAC.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	Alternative Catch Scenarios: The RAG considered 10 year projections where catch is taken by different gear types (pup production as a percentage of unfished pup production) Rag noted that even where all the RBC that even where all the RBC in South Australia (743.8t is taken by longline, the stock remains above target to 2026 (case 2). Even if longline catch in South Australia increased to the maximum historic catch ( all gear0 the stock would remain above target to 2021 ( case 3)	

Region	2017	2019	2021	2026
<b>Base case: catches equal RBCs</b>				
Bass Strait	53.2	53.0	52.4	50.9
South Australia	62.5	61.2	58.5	51.8
Tasmania	71.7	66.7	62.5	54.7
<b>Case 2: All catch by shark longline in South Australia</b>				
Bass Strait	53.2	53.0	52.4	50.9
South Australia	61.5	59.1	55.8	48.1
Tasmania	71.7	66.7	62.5	54.7
<b>Case 3: Longline catch in South Australia increases so total catch equals maximum historical catch</b>				
Bass Strait	53.2	53.0	52.4	50.9
South Australia	62.5	58.5	52.3	42.8
Tasmania	71.7	66.7	62.5	54.7
<b>Case 4: All catch by 6.5" gillnets</b>				
Bass Strait	53.2	53.1	52.4	50.9
South Australia	62.9	62.4	60.3	53.4
Tasmania	71.9	67.2	63.1	55.1
<b>Case 5: All catch by shark longline</b>				
Bass Strait	51.9	50.0	48.9	48.0
South Australia	63.4	63.2	61.3	56.8
Tasmania	71.3	66.2	62.4	56.0
<b>Case 6: All catch by scalefish longline</b>				
Bass Strait	50.3	46.6	44.2	40.1
South Australia	61.5	59.1	55.8	48.1
Tasmania	69.0	61.4	56.4	47.7
<b>Case 7: Total catch = 2052t; split by region and gear according to 2015 catch</b>				
Bass Strait	51.8	47.1	41.9	34.2
South Australia	63.9	63.9	61.8	57.2
Tasmania	75.3	76.9	79.3	82.3
<b>Case 8: Total catch = 1961t; split by region and gear according to 2015 catch</b>				
Bass Strait	52.1	48.2	43.9	37.6
South Australia	64.1	64.6	63.1	59.2
Tasmania	75.4	77.2	79.9	83.3
<b>Case 9: Total catch = 1922t; split by region and gear according to 2015 catch</b>				
Bass Strait	52.2	48.7	44.7	39.0
South Australia	64.2	64.9	63.6	60.1
Tasmania	75.5	77.4	80.1	83.8

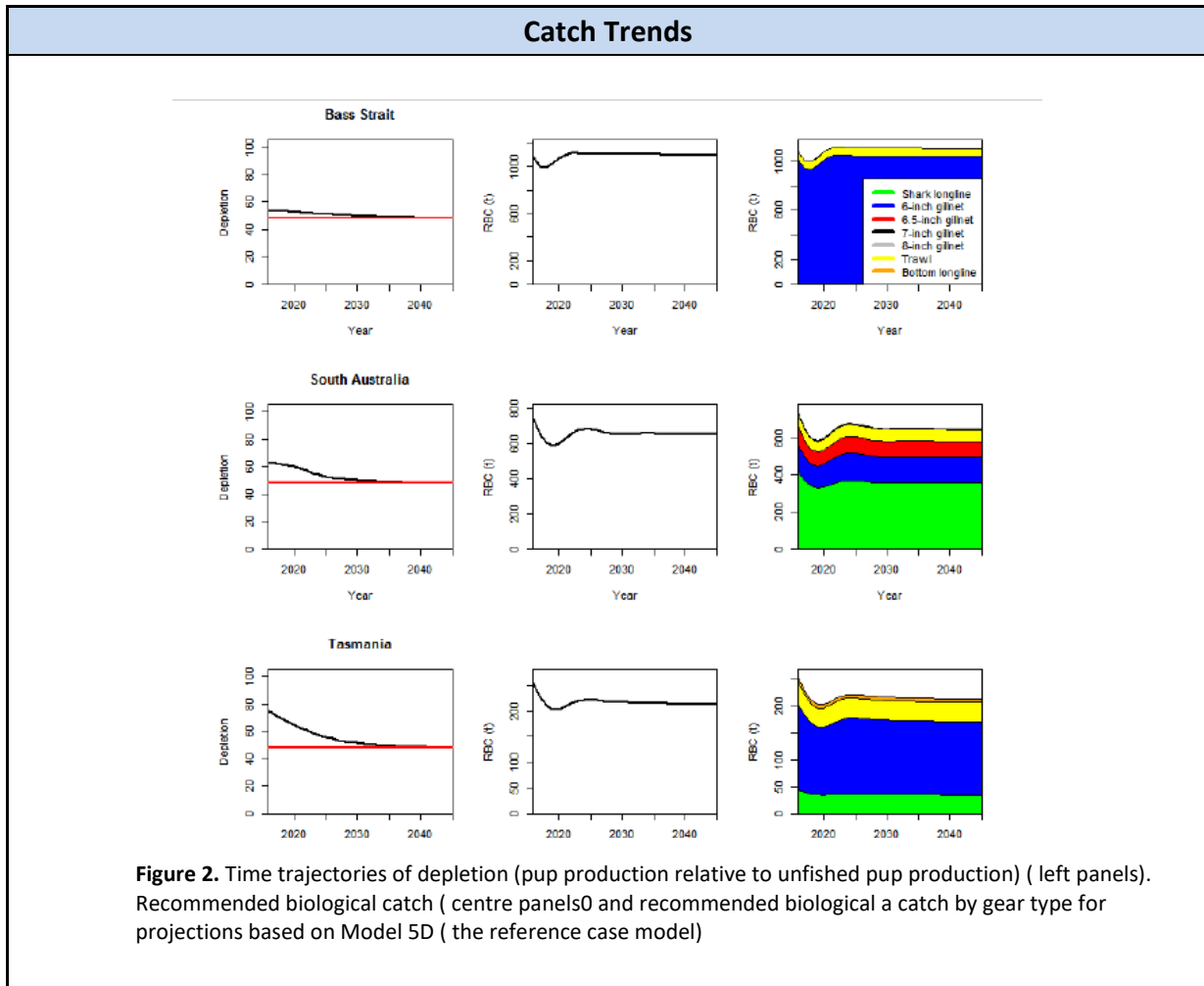
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t
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<b>Implications for companion species / TEPs / multi-species fisheries</b>	<p>The gillnet sector interactions with Australian sea lions in waters off South Australia. Interactions are mitigated by using trigger limits that close spatial zones for 18 months if an interaction occurs.</p> <p>Dolphin interactions are managed through the GHAT Dolphin Strategy which sets performance criteria for individual operators</p> <p>To reduce targeting of school shark, GHAT operators (excluding scalefish hook) must limit their school shark catch to 20% of their gummy shark catches.</p>
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Catch and TAC						
Assessment Year	2012	2013	2014	2015	2016	2017
<b>Tier / MYTAC</b>	Rollover	Tier 1	MYTAC	MYTAC	Tier 1	
<b>Stock Status</b>	>BTARG	>BTARG	>BTARG	>BTARG	>BTARG	

SESSF Season	2013/1	2014/15	2015/16	2016/17	2017/18	2018/19
RBC (retained)	1836	2010	2010	2010	1961	
Agreed TAC	1836	1836	1836	1836	1774	
TAC after unders/overs	1964	1986	1978	1935	1916	
% TAC caught	77%	77%	91%	87%	91%	



## 14 Jackass Morwong (*Nemadactylus macropterus*)



**Common Names:** Deep sea perch, deepsea perch, jackass fish, morwong, mowi, mowie, sea bream, silver perch, squeecker perch, tarakihi, terakihi.

**Tier 1: last assessed by SERAG in 2018.**

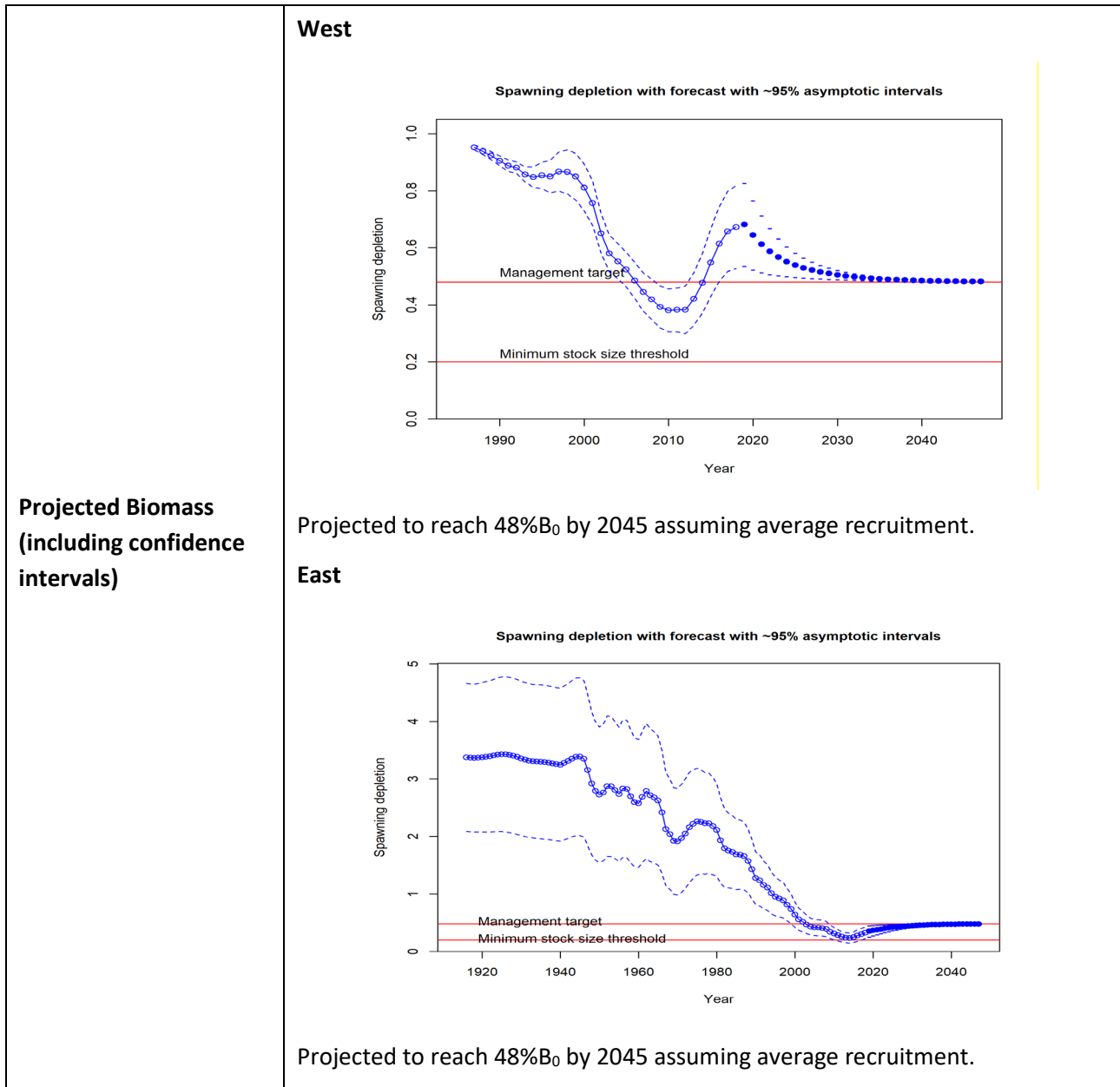
Summary			
<b>Stock Structure</b>	For assessment purposes it is assumed there are separate stocks of jackass morwong in the eastern and western zones.		
<b>Stock status against reference points and trend</b>	<b>Current</b>	<b>Target</b>	<b>Limit</b>
	E: 35% (1988 biomass) W: 68%B <sub>0</sub>	48% B <sub>0</sub>	20% B <sub>0</sub>
	<p><b>East</b></p> <p>In 2011 a productivity shift was accepted for eastern jackass morwong, with a lower productivity assumed from 1988 onwards. As a result, target and reference points were recalculated relative to the post productivity shift “virgin biomass”, rather than the 1915 “virgin biomass”.</p> <p>The limit reference point is 20 per cent of the 1988 equilibrium spawning biomass.</p> <p>The target reference point is 48 per cent of the 1988 equilibrium spawning biomass.</p> <p>Stock status at start of 2019: 35% of 1988 equilibrium spawning biomass compared to the last assessment which gave 37% at the start of 2016.</p> <p><b>West</b></p> <p>The limit reference point is 20 per cent of the unfished biomass.</p> <p>The target reference point is 48 per cent of the unfished biomass.</p> <p>Stock status at the start of 2019: 68 per cent of B<sub>0</sub> compared to the last assessment which gave 69% B<sub>0</sub> at the start of 2016.</p>		
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.47 million	<b>% Fishery GVP</b> 1.0%	

Is a MYTAC in place this season?	Yes.	Have breakout rules been triggered?	N/A for 2018
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Assessment Summary	
Tier Level	Tier 1
Stock indicator trends	<p><b>East</b> The estimated 2019 biomass is 35% of 1988 virgin biomass 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.</p> <p><b>West</b> The assessment suggests the biomass was below the target reference point between 2006 and 2014 and has increased to an estimated 2019 biomass of 68% B<sub>0</sub>. This is slightly lower than the 2015 estimated biomass of 69% B<sub>0</sub>. CPUE is increasing but the fit is poor and there are some questions about the quality of the CPUE data.</p>
Key model technical assumptions/ parameters	<p><b>West</b> Single stock in zones 40 and 50 Single sex model One fleet: trawl Selectivity estimated for this fleet Discard fraction is estimated for trawl fleet Natural mortality fixed at 0.15 (agreed by RAG) Recruitment estimated 1989 to 2011</p> <p><b>East</b> Single stock in zones 10, 20 and 30 Single sex model Six fleets:</p> <ul style="list-style-type: none"> <li>• eastern trawl: zones 10 and 20 (1986-2017)</li> <li>• Danish seine (1986-2017)</li> <li>• Tasmanian trawl: zone 30 (1986-2017)</li> <li>• steam trawl (1915-1961)</li> <li>• early Danish seine (1929-1967)</li> <li>• Mixed (DS + trawl) (1968-1985)</li> </ul> <p>Selectivity estimated for all fleets and retention for recent trawl fleets Discard fraction not estimated for Danish seine fleet (discards added to catch) Natural mortality fixed at 0.15 (agreed by RAG) Recruitment estimated 1945 to 2012</p>
Changes to model structure/assumptions	<p><b>West &amp; East</b> Same assumptions as 2015 assessment except: Discard rates included and retention estimated (change only for west).</p>
Significant changes to data inputs	N/A

<b>RAG Comments on data</b>	Poor data quality and quantity continues to be an issue, particularly in the west.
<b>RAG Comments on assessment</b>	<p><b>West</b></p> <p>The last assessment in 2015 (Tuck <i>et al</i>, 2015) estimated a 2016 spawning stock biomass of 69%B<sub>0</sub>.</p> <p>The 2018 base case estimates a 2019 spawning stock biomass of 68%B<sub>0</sub>.</p> <p>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.</p> <p>The last 5 recruitments are estimated to be above average.</p> <p>The RAG recommended including the FIS length frequencies in the base case for the next assessment. Fits to the FIS abundance are poor. It was noted that western jackass morwong are caught from February to April.</p> <p>The results should be treated with considerable caution due to the poor quality of the data.</p> <p><b>East</b></p> <p>The last assessment in 2015 (Tuck <i>et al</i>, 2015) estimated a 2016 spawning stock biomass of 37% of 1988 virgin biomass.</p> <p>The 2018 base case estimates a 2019 spawning stock biomass of 35% of 1988 virgin biomass.</p> <p>Exploration of model sensitivity showed variation in spawning biomass across all sensitivities ranging from 18% to 52% of <i>SSB</i><sub>0</sub> 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 <i>SSB</i>.</p> <p>Fits to Eastern trawl CPUE and Tasmanian trawl CPUE are remarkably good.</p> <p>FIS abundance index declines more than the model is able fit.</p> <p>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 mehtods for implementing a regime shift. This would constitute a change to the model structure, which is not a standard sensitivity.</p> <p>7 of the last 9 recruitment events are estimated to be below average, however the last 4 estimated recruitments are close to average. Industry noted they are seeing more small fish but not in large numbers.</p>





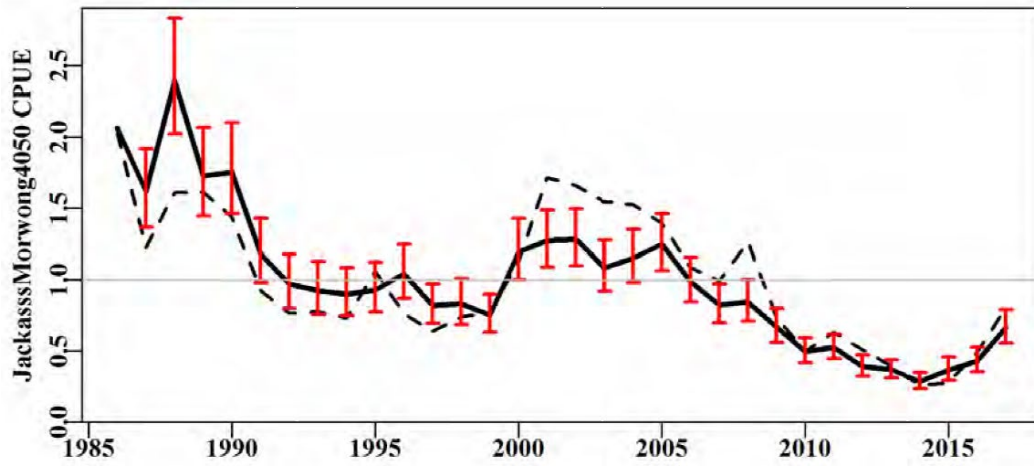
RAG Recommendations					
<b>Recommended Biological Catch (2019-20)</b>	<b>Year</b>	<b>RBC-east (t)</b>	<b>RBC-west (t)</b>	<b>Combined (t)</b>	<b>Undercatch: 10%</b> <b>Overcatch: 10%</b> <b>Discount Factor: N/A</b>
	2019	261	235	496	
	2020	271	223	494	
	2021	280	211	491	
	2022	288	201	489	
	2023	296	192	488	
	3-Year	270	223	494	
	Long-term	356	158	514	

<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p><b>Yes</b></p> <p><b>West:</b> 3-Year MYTAC using yearly RBCs or the 3-year average each year.</p> <p><b>East:</b> 3-Year MYTAC using yearly RBCs or the 3-year average each year.</p> <p><b>Combined:</b> 3-Year MYTAC using yearly RBCs or the 3-year average each year.</p>
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. <math>P &lt; 10\%</math>).</i></p>	<p><b>RBC recommendation = Very unlikely (&lt;10% chance)</b></p> <p><b>Alternative Catch Scenarios: N/A</b></p>
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	N/A
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	N/A

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 1	MYTAC	Tier 1	MYTAC	MYTAC	Tier 1
Stock Status	E: 40% W: 68%	Not assessed	E:37% W:69%	Not assessed	Not assessed	E:35% W:68%
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	692	624	563	551	543	496 (2019) 494 (3-year)
Agreed TAC	568	598	474	513	505	
TAC after unders/overs	654	654	533	554	556	
% TAC caught	20%	21%	40%	33%		

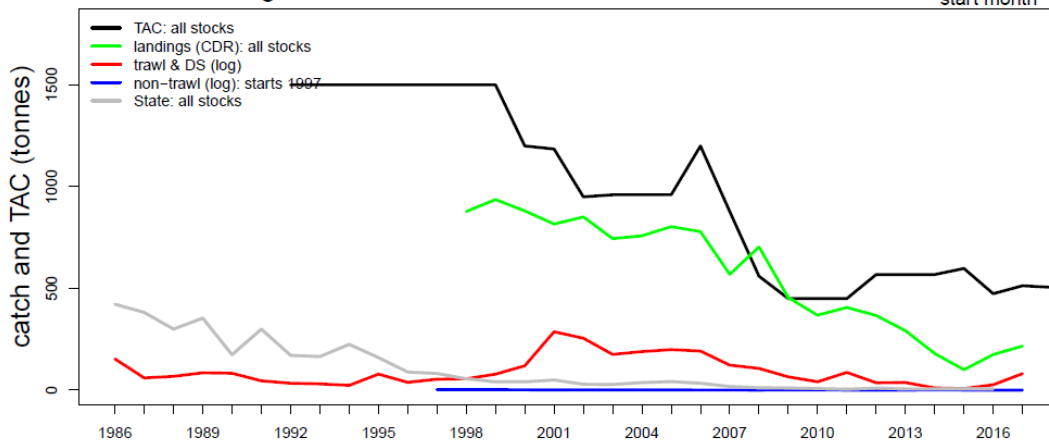
## Catch Trends

### Western

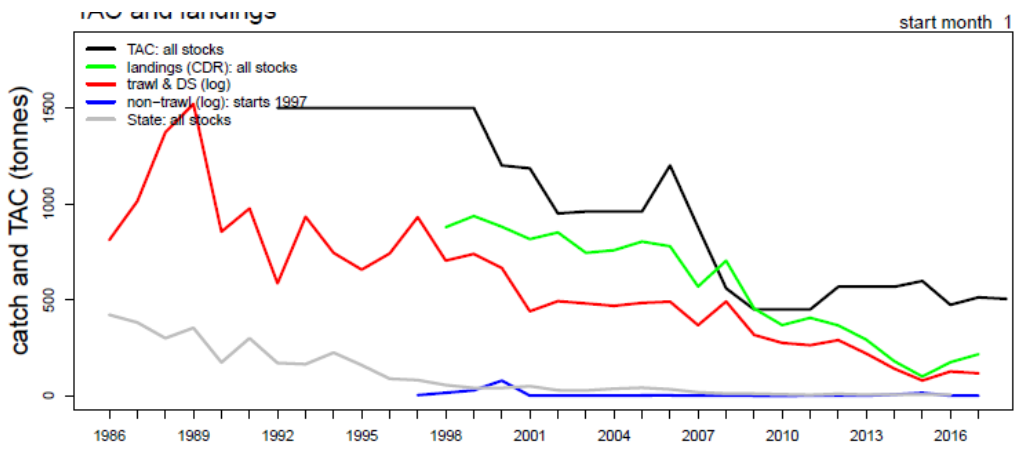
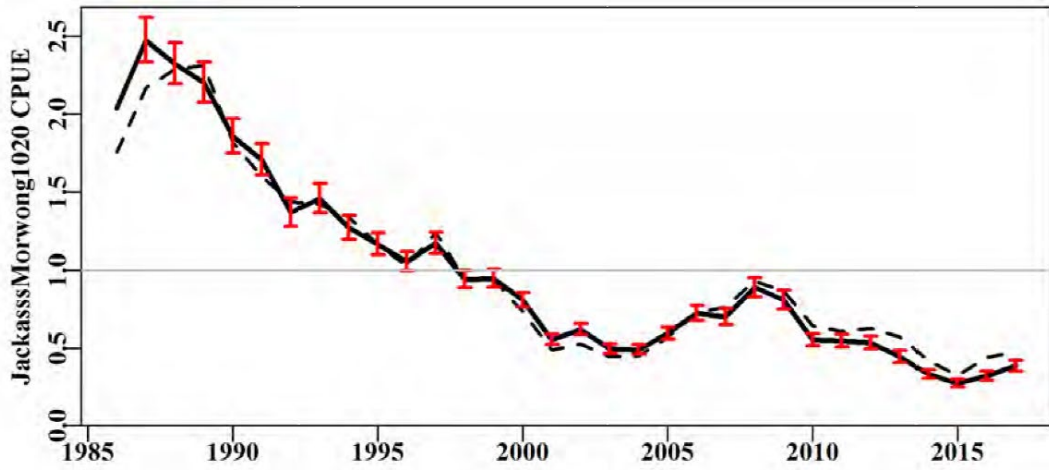


### TAC and landings

CAAB 37377003  
start month 1



Eastern



## 15 John Dory (Zeus faber)



**Common names:** Doorkeeper's Fish, Keparu, Kuparu, St. Peter's Fish.

**Tier 3 assessed by SERAG in 2017.**

Summary											
<b>Stock Structure</b>	For management purposes, a single stock is assumed for the SESSF.										
<b>Stock status against reference points and trend</b>	<p>Tier 3 species use estimates of fishing mortality (F) that will produce a spawning biomass at a given level as reference points.</p> <p>The Tier 3 target reference point recommended by the RAG 2017 for John Dory is the level of F that will produce a spawning biomass of 40% of unfished levels.</p> <p>The Tier 3 limit reference point for John Dory is the level of F that will produce a spawning biomass of 20% of unfished levels.</p> <table border="1" data-bbox="758 1108 1082 1258"> <thead> <tr> <th>F reference points</th> <th></th> </tr> </thead> <tbody> <tr> <td>Target (Fspr40)</td> <td>0.126</td> </tr> <tr> <td>Limit (Fspr20)</td> <td>0.198</td> </tr> <tr> <td>Fcur</td> <td>0.036</td> </tr> </tbody> </table> <p>Stock status: Currently F (0.036) is below the target (0.126) indicating that fishing mortality is at a level that would lead to spawning biomass being above target.</p> <p>Trend: Catches have been less than the allocated Total Allowable Catch (TAC), and fishing mortality rates have been below targets (i.e. no overfishing is occurring).</p>			F reference points		Target (Fspr40)	0.126	Limit (Fspr20)	0.198	Fcur	0.036
F reference points											
Target (Fspr40)	0.126										
Limit (Fspr20)	0.198										
Fcur	0.036										
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing									
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.72million	<b>% Fishery GVP</b> 1.6%									
<b>Is a MYTAC in place this season?</b>	Yes.  2019-20 is the final year of the MYTAC.	<b>Have breakout rules been triggered?</b>	N/A.								

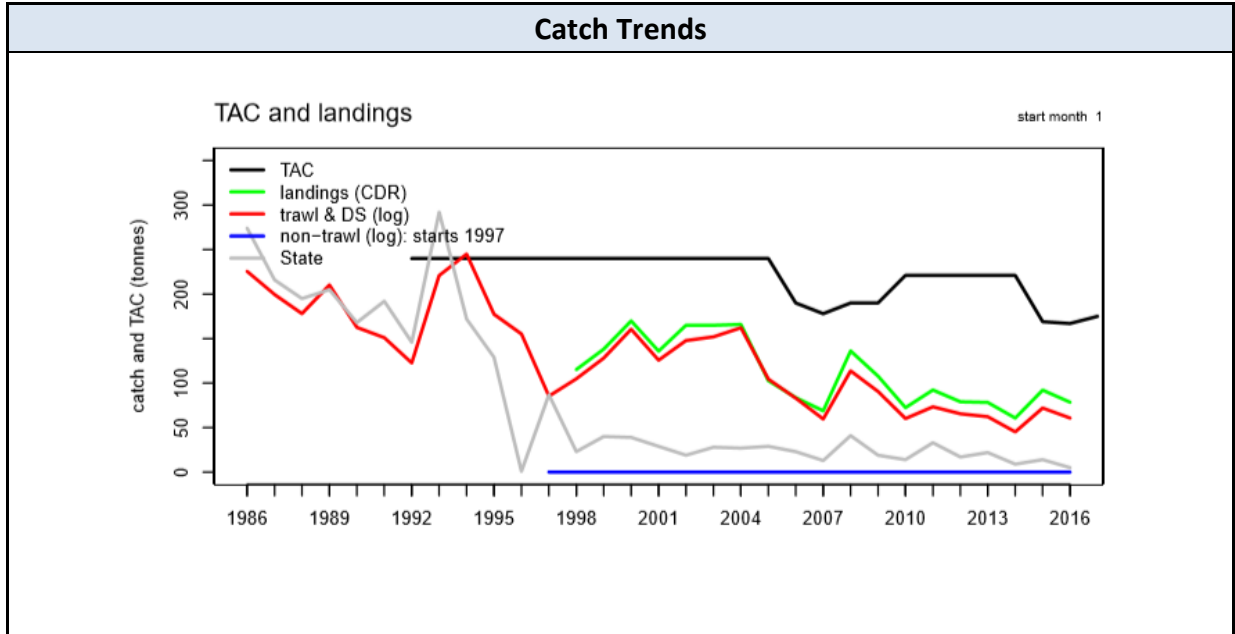
Assessment Summary																													
<b>Tier Level</b>	Tier 1																												
<b>Stock indicator trends</b>	<p>The 2017 Tier 3 assessment indicates fishing mortality rates (0.036) below the target fishing mortality rate (0.126).</p> <p>Standardised CPUE is again below the Tier 4 limit reference point.</p> <p>Total catches have been well below the TAC (&lt;50% caught) for the previous five fishing seasons.</p>																												
<b>Key model technical assumptions/ parameters</b>	<p>Yield per recruit (YpR) analyses are performed using the assumed biological parameter values shown in Table 1. The YpR analysis gives the fishing mortality rates that would hold the population (at equilibrium) at specified depletions (i.e. 20%, 40% and 48%).</p> <p><small>Table 1. Population parameters used for yield analysis: natural mortality (<math>M</math>), steepness (<math>h</math>), growth parameters (<math>L_{\infty}</math>, <math>k</math>, <math>t_0</math>), length-weight relationship (<math>a</math>, <math>b</math>), gear selectivity (<math>l_{25}</math>, <math>l_{50}</math>), length at first maturity (<math>l_{mat}</math>), maximum age for plus group (<math>a_{max}</math>), maximum age for inclusion in catch curve (<math>CC_{max}</math>).</small></p> <table border="1"> <thead> <tr> <th>Species</th> <th><math>M</math></th> <th><math>h</math></th> <th><math>L_{\infty}</math></th> <th><math>k</math></th> <th><math>t_0</math></th> <th><math>a</math></th> <th><math>b</math></th> <th><math>l_{25}</math></th> <th><math>l_{50}</math></th> <th><math>l_{mat}</math></th> <th><math>a_{max}</math></th> <th><math>CC_{max}</math></th> <th><math>S_{25}</math></th> </tr> </thead> <tbody> <tr> <td>John dory</td> <td>0.36</td> <td>0.45</td> <td>53.2</td> <td>0.15</td> <td>-1</td> <td>0.0458</td> <td>2.9</td> <td>15.54</td> <td>30</td> <td>31.5</td> <td>20</td> <td>19</td> <td>1.303</td> </tr> </tbody> </table> <p>The yield per recruit calculations are changed partially from those presented in Thomson (2014) because the model has been refined to fully comply with the method for calculating <math>F_{msy}</math> in Klaer (2006). The previous calculations multiplied female SSB times R, without accounting for the equilibrium nature of the calculation.</p>	Species	$M$	$h$	$L_{\infty}$	$k$	$t_0$	$a$	$b$	$l_{25}$	$l_{50}$	$l_{mat}$	$a_{max}$	$CC_{max}$	$S_{25}$	John dory	0.36	0.45	53.2	0.15	-1	0.0458	2.9	15.54	30	31.5	20	19	1.303
Species	$M$	$h$	$L_{\infty}$	$k$	$t_0$	$a$	$b$	$l_{25}$	$l_{50}$	$l_{mat}$	$a_{max}$	$CC_{max}$	$S_{25}$																
John dory	0.36	0.45	53.2	0.15	-1	0.0458	2.9	15.54	30	31.5	20	19	1.303																
<b>Significant changes to data inputs</b>	New age data for John Dory from 2010-2016																												
<b>RAG Comments on data</b>	Prioritise otolith collection on trawl vessels																												
<b>RAG Comments on assessment</b>	<p>The RAG noted that John Dory are not a target species in the fishery and substantially under-caught during the current MYTAC period.</p> <p>The RAG reaffirmed its previous recommendation that an MSY target (FSPR40) be applied to John Dory.</p> <p>The RAG considered the 2017 Tier 3 assessment would be suitable for setting a three year MYTAC. However noted issues with Tier 3 assessment methodology, alternative needed, RAG support for a Tier 4 analysis for consideration at first SERAG meeting 2018.</p> <p>The RAG recommended that although the 5% discount factor had not previously been applied, it would now be applied given SESSFRAG advice that stability in CPUE was no longer a reason to not apply the discount factor.</p>																												

<b>Projected Biomass</b>	
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<b>RAG Recommendations</b>	
<b>Recommended Biological Catch (2019/20)</b>	485 t (First year of a 3-year MYTAC)  <b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 5%  (Discount factor based on SESSFRAG advice that a stable CPUE was not an appropriate reason to not apply discount factors, as was previously the case.)
<b>Is a MYTAC recommended for future seasons?</b>	Yes. 3-year RBC = 485 t
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	Very unlikely (P < 10%)  <b>Alternative Catch Scenarios = N/A</b>
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	N/A
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A

<b>Catch and TAC</b>						
<b>Assessment Year</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Tier / MYTAC</b>	Tier 3	Tier 3	Not assessed	Not assessed	Tier 3	Not assessed
<b>Stock Status</b>	Fishing mortality less than target	Fishing mortality less than target	Not assessed	Not assessed	Fishing mortality less than target	Not assessed
<b>SESSF Season</b>	<b>2014/15</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>	<b>2019/20</b>
<b>RBC (t)</b>	MYTAC	203	203	203	485	Not assessed

<b>Agreed TAC</b>	221	169	167	175		Not assessed
<b>TAC after Unders/Overs</b>	243	189	181	191		Not assessed
<b>% TAC caught</b>	30%	46%	45%	43%		





## 16 Mirror Dory (*Zenopsis nebulosus*)



Tier 4: last assessed by SERAG in 2018.

Summary																																																	
<b>Stock Structure</b>	An eastern and western stock is currently assumed for assessment purposes. However mirror dory is managed under a global TAC.																																																
<b>Stock status against reference points and trend</b>	<p>Tier 4 assessment uses CPUE targets as a proxy for biomass targets. The Tier 4 target reference point is the proxy level of CPUE assumed to produce a target biomass consistent with the harvest strategy policy, and avoid the limit reference point.</p> <p><b>East</b></p> <p>Standardised CPUE has been cyclical since a peak in 1990 and has recently declined to between the limit and target reference point, with a small increase from 2016 to 2017.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1986-1995</td> <td>Scaling</td> <td>0.3723</td> </tr> <tr> <td>CE_Targ</td> <td>1.1408</td> <td>Last Year's TAC</td> <td>235</td> </tr> <tr> <td>CE_Limit</td> <td>0.4753</td> <td>C<sub>targ</sub></td> <td>377.051</td> </tr> <tr> <td>CE_Recent</td> <td>0.723</td> <td>RBC</td> <td>140.378</td> </tr> <tr> <td>Wt_Discard</td> <td>7.086</td> <td></td> <td></td> </tr> </tbody> </table> <p><b>West</b></p> <p>Standardised CPUE has been cyclical since the 1990s, though not as high and low as in the east. It is currently between the limit and target reference point.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1996-1995</td> <td>Scaling</td> <td>0.7114</td> </tr> <tr> <td>CE_Targ</td> <td>0.9841</td> <td>Last Year's TAC</td> <td>235</td> </tr> <tr> <td>CE_Limit</td> <td>0.41</td> <td>C<sub>targ</sub></td> <td>133.2</td> </tr> <tr> <td>CE_Recent</td> <td>0.8184</td> <td>RBC</td> <td>94.76</td> </tr> <tr> <td>Wt_Discard</td> <td>0</td> <td></td> <td></td> </tr> </tbody> </table>	Parameter	Value	Parameter	Value	Reference Years	1986-1995	Scaling	0.3723	CE_Targ	1.1408	Last Year's TAC	235	CE_Limit	0.4753	C <sub>targ</sub>	377.051	CE_Recent	0.723	RBC	140.378	Wt_Discard	7.086			Parameter	Value	Parameter	Value	Reference Years	1996-1995	Scaling	0.7114	CE_Targ	0.9841	Last Year's TAC	235	CE_Limit	0.41	C <sub>targ</sub>	133.2	CE_Recent	0.8184	RBC	94.76	Wt_Discard	0		
Parameter	Value	Parameter	Value																																														
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CE_Limit	0.4753	C <sub>targ</sub>	377.051																																														
CE_Recent	0.723	RBC	140.378																																														
Wt_Discard	7.086																																																
Parameter	Value	Parameter	Value																																														
Reference Years	1996-1995	Scaling	0.7114																																														
CE_Targ	0.9841	Last Year's TAC	235																																														
CE_Limit	0.41	C <sub>targ</sub>	133.2																																														
CE_Recent	0.8184	RBC	94.76																																														
Wt_Discard	0																																																

<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.99 million	<b>% Fishery GVP</b> 2.1%	
<b>Is a MYTAC in place this season?</b>	No.	<b>Have breakout rules been triggered?</b>	N/A

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	<p><b>East</b></p> <p>Standardised CPUE has been cyclical since a peak in 1990 and has recently declined to between the limit and target reference point, with a small increase from 2016 to 2017.</p> <p><b>West</b></p> <p>Standardised CPUE has been cyclical since the 1990s, though not as high and low as in the east. It is currently between the limit and target reference point.</p>
<b>Key model technical assumptions/ parameters</b>	Standard Tier 4 assumptions apply.
<b>Changes to model structure/assumptions</b>	N/A
<b>Significant changes to data inputs</b>	<p>CDR data only available from 1998. Catches have been converted from processed weights to whole weights resulting in small increases since 2008. There was a decrease in 2012 but this is not in any of the reference periods so does not affect the Tier 4.</p> <p><b>East</b></p> <p>New methodology for discard estimation has had significant impacts (increase) on discard rates from early 2000s. There will be additional changes in 2019 and until those changes are implemented and accepted by the RAG, the Tier 4 assessment is updated using the previous discard series and the Tier 4 is using an updated CPUE series to generate an RBC for 2019.</p> <p><b>West</b></p> <p>Given the issues with discard estimation, discards are not used in the western assessment, which is consistent with the previous Tier 4.</p>
<b>RAG Comments on data</b>	Otolith collection targets were removed from the data plan for mirror dory as it is a Tier 4 species and is unlikely to move to an assessment that requires age data.

<b>RAG Comments on assessment</b>	This Tier 4 has been applied consistently over time and there were no additional comments.
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<b>RAG Recommendations</b>	
<b>Recommended Biological Catch (2019-20)</b>	West: 95 t East: 140 t Total: 235 t  <b>Undercatch: 10%</b> <b>Overcatch: 10%</b> <b>Discount Factor: 15%</b>
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	No.
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	Tier 4 assessments do not assess the probability of being below the limit reference point. If the standardised CPUE series is a reasonable index of relative abundance catches up to the RBC are considered to have a very low probability of causing the stock to decline to below the limit reference point.  <b>Alternative Catch Scenarios: N/A</b>
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t
<b>Implications for companion species / TEPs / multi-species fisheries</b>	Restrictions on pink ling catches have likely driven the decrease in discarding for mirror dory east.

<b>Catch and TAC</b>						
<b>Assessment Year</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Tier / MYTAC</b>	Tier 4	Tier 4	Tier 4	Tier 4	Tier 4	Tier 4
<b>Stock Status</b>	CPUE higher than target	CPUE east above target, west between target and limit	CPUE east above target, west between target and limit	CPUE east/west between limit and target	CPUE east/west between limit and target	CPUE east/west between limit and target
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	680	684	East 362 West 129	East 198 West 104	East 199 West 123	East 140 West 95
<b>Agreed TAC</b>	808	437	325	235	253	

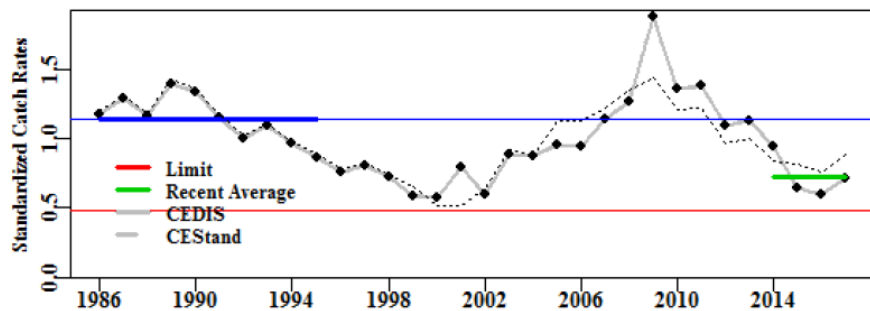
TAC after unders/overs	968	514	362	262	275	
% TAC caught	23%	49%	76%	84%		

### Catch Trends

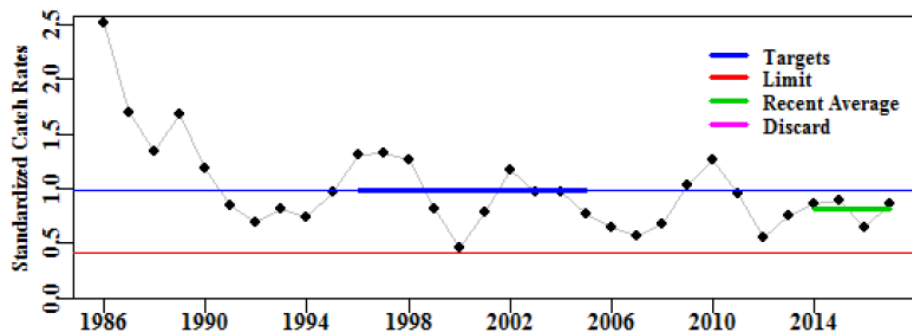
#### Standardised catch rates

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.

East:

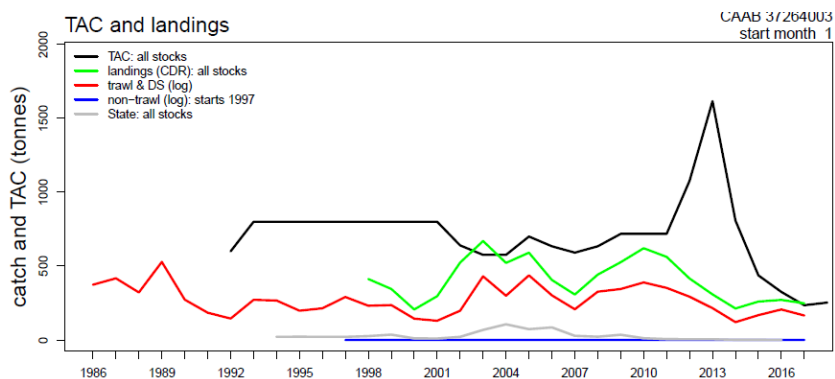


West:



#### Catch trends

(RBC and total catch are calendar year for east and west combined; TAC and Commonwealth catch are fishing season)



## 17 Offshore Ocean Perch (*Helicolenus barathri*)



**Common names:** Ocean Perch, Bigeye Ocean Perch, Coral Cod.

**Tier 4 assessed by SERAG in 2017.**

Summary																											
<b>Stock Structure</b>	A single TAC is set for the two distinct species: the inshore species ( <i>H. percooides</i> ), and the offshore species ( <i>H. barathri</i> ), however both are assessed separately.																										
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 Target reference point is the level of CPUE assumed to produce a spawning biomass of 40% of unfished levels.</p> <p>The limit reference point is 40% of the target reference point.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1986-1995</td> <td>Scaling</td> <td>1.2166</td> </tr> <tr> <td>CE_Targ</td> <td>0.9283</td> <td>Last Yr TAC</td> <td>190</td> </tr> <tr> <td>CE_Limit</td> <td>0.4642</td> <td>Ctarg</td> <td>283.369</td> </tr> <tr> <td>CE_Recent</td> <td>0.9668</td> <td>RBC</td> <td>344.74</td> </tr> <tr> <td>Wt_Discard</td> <td>37.193</td> <td></td> <td></td> </tr> </tbody> </table> <p>Stock status: In the 2017 Tier 4 assessment the recent average standardized CPUE proxy for biomass is above the target reference point.</p> <p>Trend: CPUE has been relatively stable since the mid 1990's but catch has been gradually declining to a point below that of the Tier 4 reference period.</p>			Parameter	Value	Parameter	Value	Reference Years	1986-1995	Scaling	1.2166	CE_Targ	0.9283	Last Yr TAC	190	CE_Limit	0.4642	Ctarg	283.369	CE_Recent	0.9668	RBC	344.74	Wt_Discard	37.193		
Parameter	Value	Parameter	Value																								
Reference Years	1986-1995	Scaling	1.2166																								
CE_Targ	0.9283	Last Yr TAC	190																								
CE_Limit	0.4642	Ctarg	283.369																								
CE_Recent	0.9668	RBC	344.74																								
Wt_Discard	37.193																										
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Uncertain																									
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.75 million	<b>% Fishery GVP</b> 1.8%																									
<b>Is a MYTAC in place this season?</b>	No.	<b>Have breakout rules been triggered?</b>	N/A.																								

Assessment Summary	
<b>Tier Level</b>	Tier 1

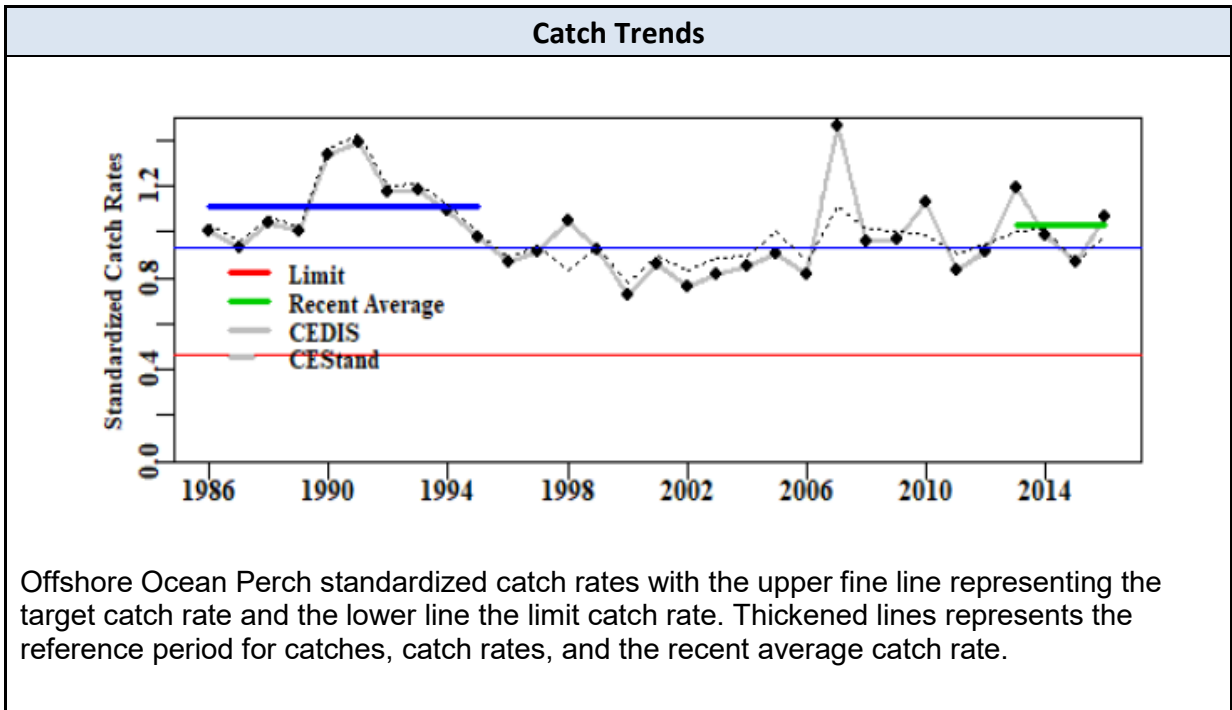
<b>Stock indicator trends</b>	CPUE has been relatively stable since mid-90s Catches have decreased over past 4 years
<b>Key model technical assumptions/ parameters</b>	The target reference point is 40% of unfished biomass. The 2017 Tier 4 uses zones 10 and 20 only, as per previous assessments. The assessment includes discards.
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	N/A
<b>RAG Comments on assessment</b>	The RAG determined a 3-year RBC of 345 t suitable. The RAG agreed Ocean Perch (inshore and offshore) are an obvious candidate for separate TACs; however it was noted that it would not be easy to administer as the species are separated by depth rather than by geographical distribution. Noted that most of the catch comes from zones 10 and 20.
<b>Projected Biomass</b>	

<b>RAG Recommendations</b>	
<b>Recommended Biological Catch (2019/20)</b>	345 t  <b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 15%
<b>Is a MYTAC recommended for future seasons?</b>	Yes. 3 year RBC = 345 t
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation = P < 10% <b>Alternative Catch Scenarios = N/A</b>
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t

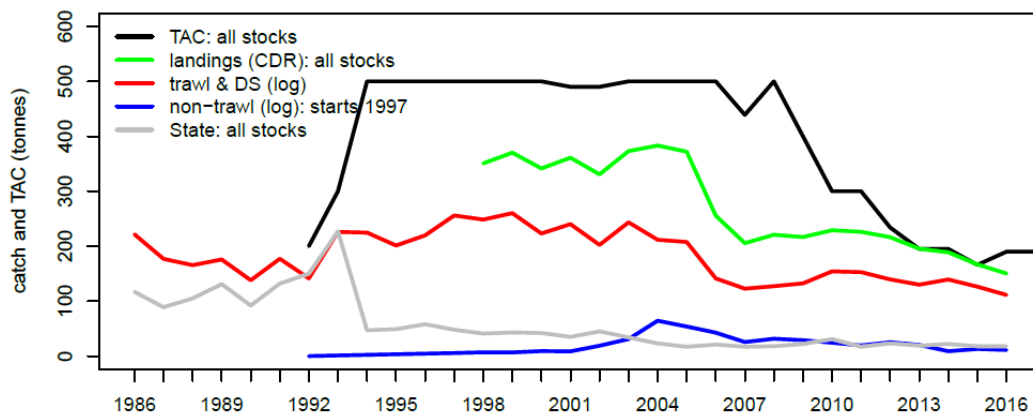
Implications for companion species / TEPs / multi-species fisheries	N/A
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Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	Not assessed
Stock Status	CPUE higher than target	Not assessed	Not assessed	Not assessed	CPUE above target	Not assessed
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (t)	285	283	283	283	345	
Agreed TAC	195	166	190	190		
TAC after Unders/Overs	208	179	194	204		
% TAC caught*	90%	95%	84%	28%		

Note: combined TAC for inshore and offshore ocean perch



\* Inshore and Offshore Ocean Perch are assessed separately, but managed under a single TAC and quota SFR.





## 18 Inshore Ocean Perch (*Helicolenus percoides*)



**Common names:** Ocean Perch, Bigeye Ocean Perch, Coral Cod.

**Tier 4 assessed by SERAG in 2017.**

Summary																											
<b>Stock Structure</b>	A single TAC is set for the two distinct species: the inshore species ( <i>H. percoides</i> ), and the offshore species ( <i>H. barathri</i> ), however both are assessed separately.																										
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 Target reference point is the level of CPUE assumed to produce a spawning biomass of 40% of unfished levels.</p> <p>The limit reference point is 40% of the CPUE assumed to produce a spawning biomass of 48% of unfished levels.</p> <table border="1" data-bbox="576 1081 1265 1294"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1986-1995</td> <td>Scaling</td> <td>1.2166</td> </tr> <tr> <td>CE Targ</td> <td>0.9182</td> <td>Last Yr TAC</td> <td></td> </tr> <tr> <td>CE Limit</td> <td>0.4591</td> <td>Ctarg</td> <td>101.875</td> </tr> <tr> <td>CE Recent</td> <td>0.9669</td> <td>RBC</td> <td>247.909</td> </tr> <tr> <td>Wt Discard</td> <td>247.909</td> <td></td> <td></td> </tr> </tbody> </table> <p>Stock status: In the 2017 Tier 4 assessment the recent average standardized CPUE proxy for biomass is above the 40% target reference point.</p> <p>Trend: CPUE has steadily increased over the past ten years, which is driven by variable but high discard rate estimates.</p>			Parameter	Value	Parameter	Value	Reference Years	1986-1995	Scaling	1.2166	CE Targ	0.9182	Last Yr TAC		CE Limit	0.4591	Ctarg	101.875	CE Recent	0.9669	RBC	247.909	Wt Discard	247.909		
Parameter	Value	Parameter	Value																								
Reference Years	1986-1995	Scaling	1.2166																								
CE Targ	0.9182	Last Yr TAC																									
CE Limit	0.4591	Ctarg	101.875																								
CE Recent	0.9669	RBC	247.909																								
Wt Discard	247.909																										
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> <b>Not overfished</b>	<b>Fishing Mortality</b> Uncertain																									
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.75 million	<b>% Fishery GVP</b> 1.8%																									
<b>Is a MYTAC in place this season?</b>	No.	<b>Have breakout rules been triggered?</b>	N/A.																								

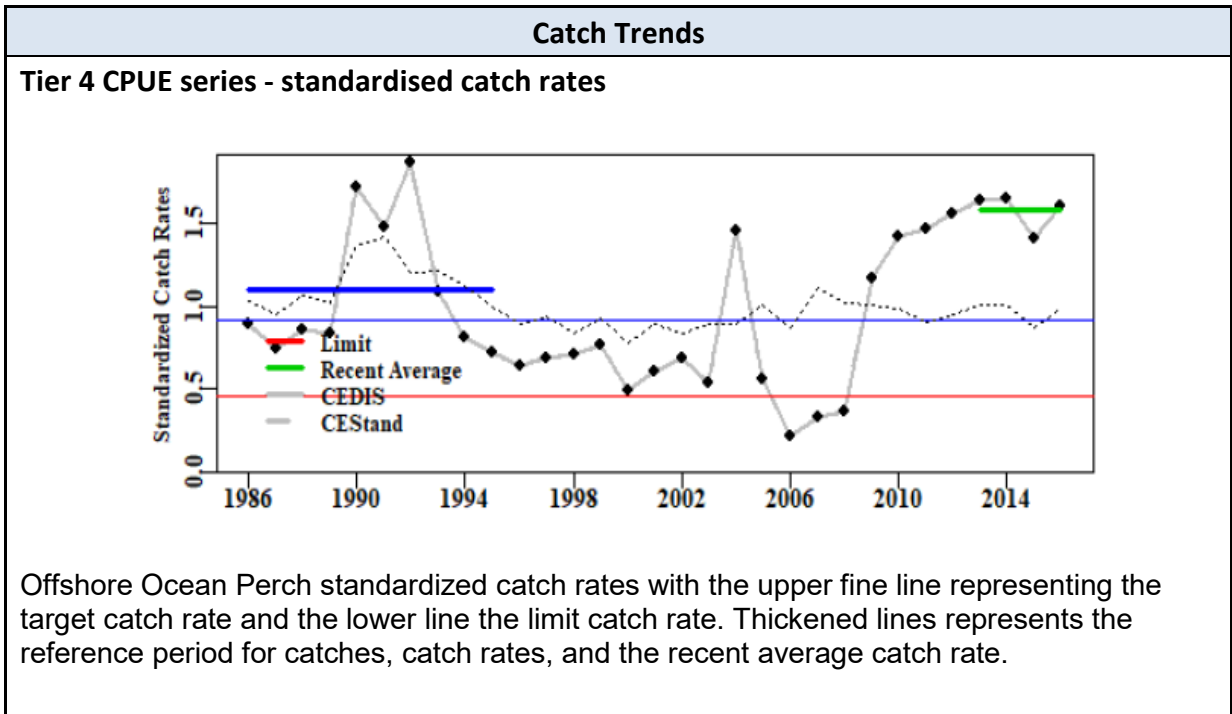
Assessment Summary	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	Large increase in standardised CPUE which is driven by high discard rate estimates.
<b>Key model technical assumptions/ parameters</b>	The assessment includes discards. The target reference point is 40 % of unfished biomass. Changes: Implemented an upper limit of 8 to the Tier 4 multiplier (D/C+1).
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	N/A
<b>RAG Comments on assessment</b>	Discards are very high (>80%) resulting in severe distortion of the RBC. An upper limit was applied to the Tier 4 multiplier to prevent large RBCs. RAG agreed that this species is a candidate for removing from the ocean perch basket and setting a catch trigger.
<b>Projected Biomass</b>	

RAG Recommendations	
<b>Recommended Biological Catch (2018/19)</b>	248 t <b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 15%
<b>Is a MYTAC recommended for future seasons?</b>	Yes. 3 year RBC = 248 t
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation = P < 10% <b>Alternative Catch Scenarios = N/A</b>
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t

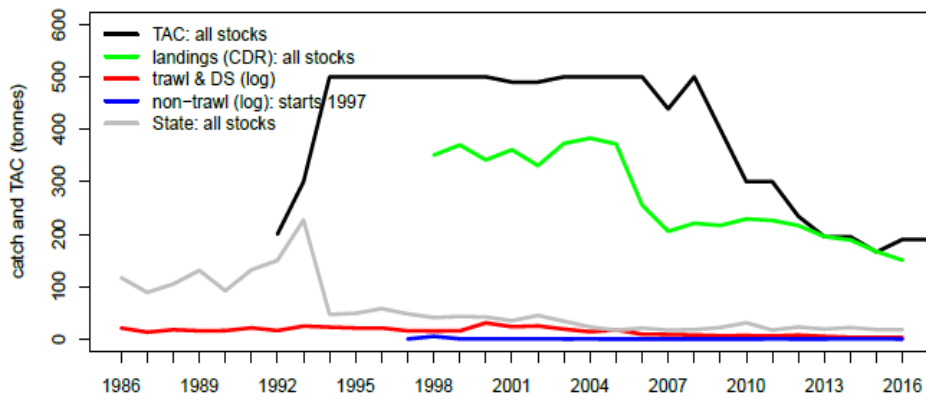
Implications for companion species / TEPs / multi-species fisheries	N/A
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Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	Not assessed
Stock Status	CPUE higher than target	Not assessed	Not assessed	Not assessed	CPUE higher than target	Not assessed
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC (t)	234	102	102	102	248	
Agreed TAC	195	166	190	190		
TAC after Unders/Overs	208	179	194	204		
% TAC caught*	90%	95%	84%	83%*		

Note: combined TAC for inshore and offshore ocean perch



\* Inshore and Offshore Ocean Perch are assessed separately, but managed under a single TAC and quota SFR.



## 19 Orange Roughy (*Hoplostethus atlanticus*) – Southern zone



ABARES (2012): Line Drawing – Rosalind Poole

Tier 2 in 2000, not assessed since. Last reviewed by SlopeRAG in 2015, species summary updated in 2015.

Summary		
<b>Stock Structure</b>	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.	
<b>Stock status against reference points and trend</b>	<p>Limit reference point is 20% of unfished biomass.</p> <p>Target reference point is 48% of unfished biomass.</p> <p>Stock status: unresolved in the southern zone but likely to be less than the limit reference point. The most recent accepted assessment (2000) concluded that the stock was less than the limit reference point. Orange Roughy southern is managed under the Orange Roughy Rebuilding Strategy.</p> <p>The component of the southern zone stock that resides in the Pedra Branca seamounts area is assessed as a part of the eastern zone stock assessment due to the stock structure assumptions. The eastern zone assessment in 2014 estimated the stock status in the Pedra Branca area to be 26% of unfished biomass.</p> <p>Biomass trend: The 2004 and 2006 updates of abundance indices and observations of possible spawning aggregations (from acoustic surveys) indicated that rebuilding may be occurring. The 2014 assessment of the eastern Orange Roughy stock also indicates that rebuilding is occurring in that area.</p> <p>Catches are extremely low therefore overfishing is unlikely to be occurring. The current TAC poses no impediment to stock recovery.</p>	
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Overfished	<b>Fishing Mortality</b> Not subject to overfishing
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> 0.43 million	<b>% Fishery GVP</b> 0.9%

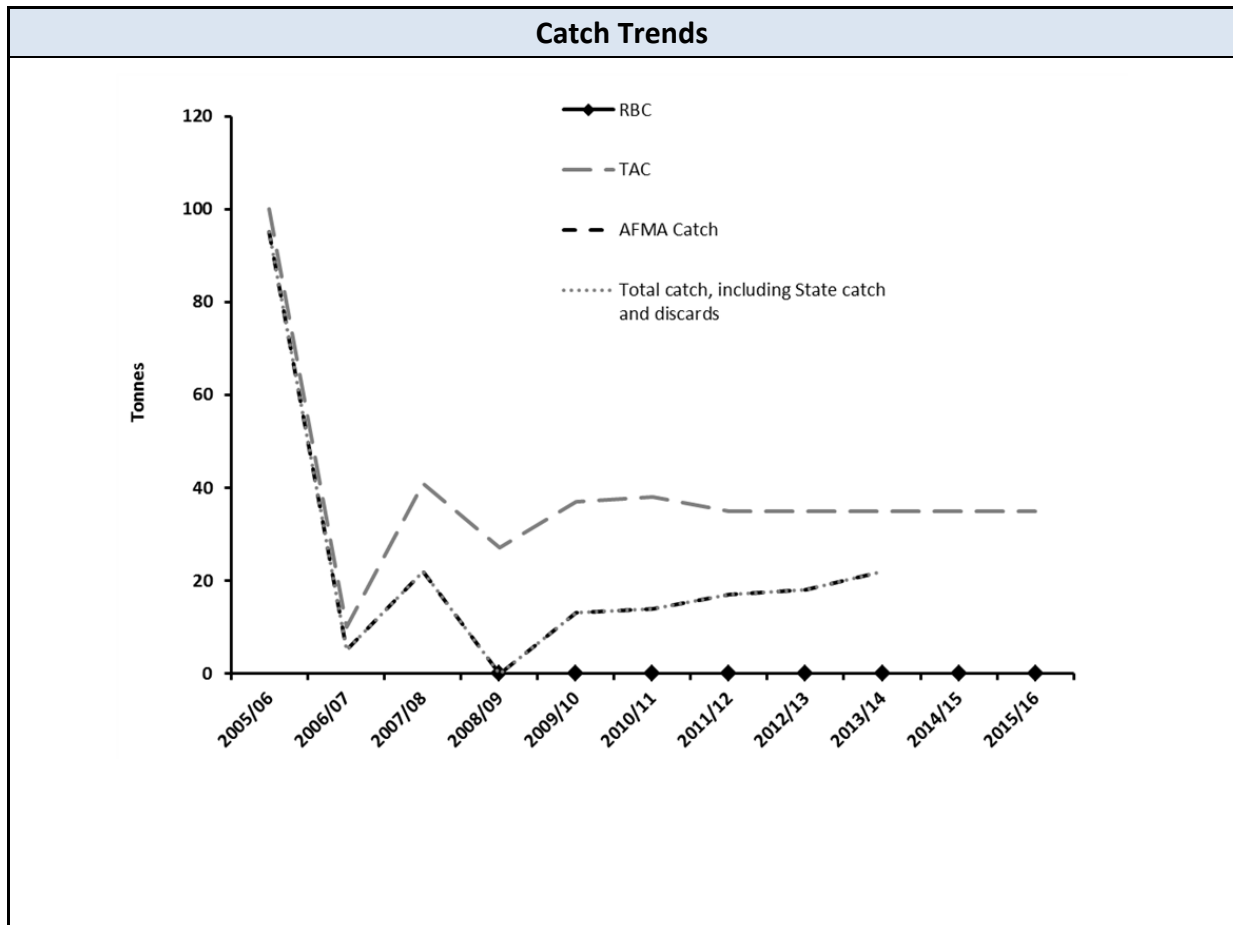
<b>Is a MYTAC in place this season?</b>	No.
<b>Have breakout rules been triggered?</b>	N/A. If 90% of the MYTAC is caught this will trigger exploration of options for updating the assessments.

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 2 in 2000, not assessed since.
<b>Stock indicator trends</b>	Due to incidental catch TAC with no targeted fishing, CPUE is not a reliable index of abundance. The 2014 eastern Orange Roughy assessment (which includes stock residing in the southern quota zone), indicates that the stock referenced by the assessment has rebuilt to 26% of unfished biomass.
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/ assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	N/A
<b>RAG Comments on assessment</b>	The RAG 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
<b>Projected Biomass (including confidence intervals)</b>	No biomass projection as there is no assessment for the southern zone outside of the Pedra Branca area. For a biomass projection for the eastern Orange Roughy stock (that includes the Pedra Branca area), see Orange Roughy – Eastern Zone in this document.

RAG Recommendations		
<b>Recommended Biological Catch (2014-15)</b>	0 t in the southern zone outside of the Pedra Branca area. No targeted fishing. 27 t inside the Pedra Branca area. Incidental catch TAC of 31 tonnes.	<b>Undercatch:</b> 0% <b>Overcatch:</b> 0% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. SlopeRAG recommended a 3-year bycatch TAC providing that the MYTAC does not restrict future work on the stock.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation = N/A</b> <b>Alternative Catch Scenarios:</b> Not assessed.	
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	Nil.	

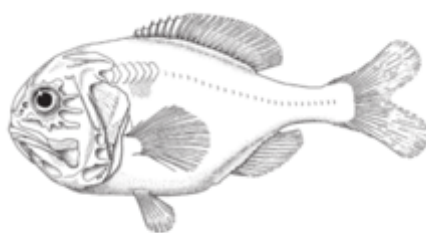
Catch and TAC								
Assessment Year	2011	2012	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
<b>Stock Status</b>	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
<b>SESSF Season</b>	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC (t)</b>	0	0	0	0*	0*	0*	0*	
<b>Agreed TAC (t)</b>	35	35	35	66	66	66		
<b>TAC (t) after unders/overs</b>	35	35	35	66	66	66		
<b>% TAC caught</b>	52%	62%	50%	87%	65%	81%		

\* Consideration is being given to apportioning the RBC arising from the Eastern Zone Stock Assessment (Upston and Punt 2014) which includes the Pedra Branca in the Southern Zone. This will be presented to SEMAC for consideration at the 2015 TAC-setting meeting.





## 20 Orange Roughy (*Hoplostethus atlanticus*) – Eastern zone

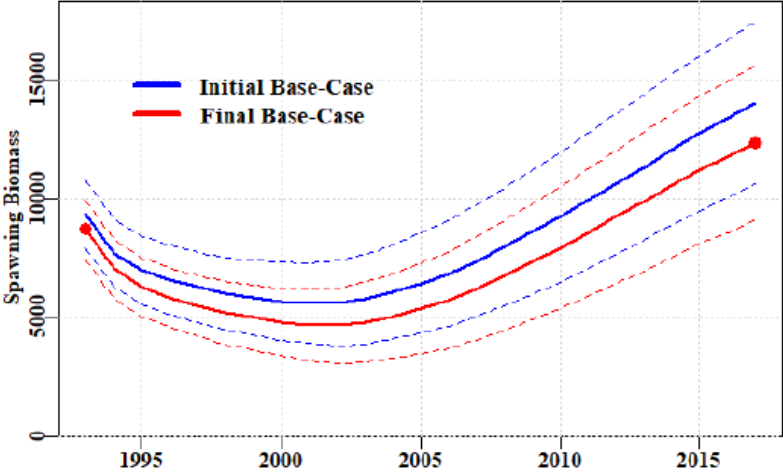


ABARES (2012): Line Drawing – Rosalind Poole

**Tier 1: last assessed by SERAG in 2018.**

Summary		
<b>Stock Structure</b>	<p>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.</p> <p>Recent genetic studies indicate little genetic diversity between all SE Australian stocks. However, they may be demographically separate.</p> <p>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.</p>	
<b>Stock status against reference points and trend</b>	<p>Limit reference point is 20% of unfished biomass.</p> <p>Target reference point is 48% of unfished biomass.</p> <p>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.</p> <p>Orange Roughy eastern is managed under the Orange Roughy Rebuilding Strategy 2014.</p> <p>Biomass trend. 2017 assessment indicates the biomass is continuing to increase. The acoustic survey abundance estimates (2013 recalibrated and 2016) support the model predicted spawning biomass estimates.</p>	
<b>ABARES most recent assessment (2017)</b>	<p style="text-align: center;"><b>Biomass</b></p> <p style="text-align: center;">Not overfished</p>	<p style="text-align: center;"><b>Fishing Mortality</b></p> <p style="text-align: center;">Not subject to overfishing</p>
<b>GVP Figures (2016-17 season)</b>	<p><b>GVP</b></p> <p>\$1.64 million</p>	<p><b>% Fishery GVP</b></p> <p>3.5%</p>
<b>Is a MYTAC in place this season?</b>	<p>Yes.</p> <p>465 t, 3-year MYTAC</p>	
<b>Have breakout rules been triggered?</b>		

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	Acoustic survey results undertaken in 1999, 2006, 2010, 2012, 2013 and 2016 at St. Helen's Hill and St. Patrick's Head indicate an increasing population.
<b>Key model technical assumptions/ parameters</b>	<p>The model assumptions include the single stock structure hypothesis; eastern zone spawning roughy and Pedra Branca non-spawning roughy.</p> <p>The biomass is assumed to have been unfished at the start of 1979.</p> <p>Recruitment is assumed to be distributed about a Beverton-Holt stock recruitment relationship.</p> <p>Plus group age was set at 80 years.</p> <p>Recruitment steepness and rate of M – refer to base case and alternate case below.</p> <p>Recruitment variability – 0.70</p> <p>Length at maturity – 35.8 cm</p> <p>VB growth co-efficient – 0.06</p>
<b>Changes to model structure/ assumptions</b>	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).
<b>Significant changes to data inputs</b>	See above
<b>RAG Comments on data</b>	<p>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.</p> <p>2017 assessment assumes a single stock that includes eastern zone plus Pedra Branca.</p> <p>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 the RAG 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.</p>

<p><b>RAG Comments on assessment</b></p>	<p>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.</p> <p>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.</p> <p>The RAG noted that the acoustic surveys provide key data for the assessment and it is important that they are continued every 2-3 years.</p> <p>The RAG noted the recent temporal changes in fishing effort and the effect this has on the age and length data.</p> <p>There are 2 scenarios: the base case and another scenario with alternate M and h. The RAG noted that based on a forecasts and cross-catch risk assessment, the spawning stock is not expected to decline before the next assessment under either scenario.</p> <p>The RAG 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.</p>
<p><b>Projected Biomass (including confidence intervals)</b></p>	<p>A comparison of the female spawning biomass trajectories from the initial base case and the alternate scenario over the years 1993 – 2017, along with the asymptotic 95% confidence intervals (the dashed lines).</p> <p>The intervals for the Initial base case were from 25.6% - 41.9% <math>B_0</math> and for alternative scenario were from 21.9% - 37.7% <math>B_0</math>.</p>  <p>The graph plots Spawning Biomass on the y-axis (0 to 15000) against years on the x-axis (1995 to 2015). Two solid lines represent the biomass trajectories: a blue line for the 'Initial Base-Case' and a red line for the 'Final Base-Case'. Both lines show a decrease from 1993 to a minimum around 2000, followed by an increase. The blue line starts at approximately 10000 in 1993 and ends at approximately 14000 in 2017. The red line starts at approximately 9000 in 1993 and ends at approximately 12000 in 2017. Dashed lines of corresponding colors represent the 95% confidence intervals, which are wider for the Initial Base-Case than for the Final Base-Case.</p>

## RAG Recommendations

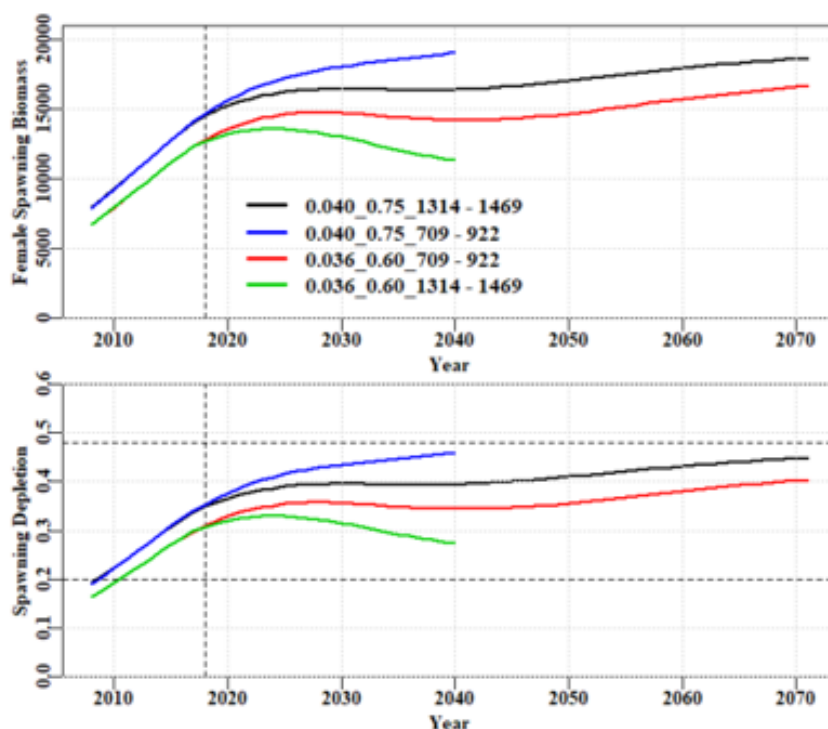
<p><b>Recommended Biological Catch (2018-19)</b></p>	<p>In 2017, the RAG recommended a 3-year MYRBC under the HCR 20:35:48.</p> <p>An initial likelihood profile analysis indicated that key productivity parameters may be lower than used in the initial base case. Alternative case varying M and h was considered as a sensitivity.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th colspan="2" style="background-color: #e6f2ff;">Initial base-case:</th> <th colspan="2" style="background-color: #e6f2ff;">Alternate case:</th> </tr> </thead> <tbody> <tr> <td>M = 0.04</td> <td></td> <td>M = 0.036</td> <td></td> </tr> <tr> <td>h = 0.75</td> <td></td> <td>h = 0.6</td> <td></td> </tr> <tr> <td>Year 1 RBC</td> <td>1314 t</td> <td>Year 1 RBC</td> <td>709 t</td> </tr> <tr> <td>Year 2 RBC</td> <td>1347 t</td> <td>Year 2 RBC</td> <td>776 t</td> </tr> <tr> <td>Year 3 RBC</td> <td>1375 t</td> <td>Year 3 RBC</td> <td>834 t</td> </tr> <tr> <td>Average</td> <td>1345 t</td> <td>Average</td> <td>773 t</td> </tr> <tr> <td>Long term</td> <td>1784 t</td> <td>Long term</td> <td>1276 t</td> </tr> </tbody> </table> <p>RAG recommends that the RBC is determined based on the initial base case and consideration to the sensitivity analysis noting that the large change limiting rule will apply in setting the TAC.</p> <p>In March 2018, the AFMA Commission accepted this advice for one year but requested further advice from SERAG regarding RBCs for the second and third years of the MYTAC.</p> <p>Details of the subsequent risk assessment are detailed in 'catch trends' below. There is little additional risk to future depletion associated with the industry proposed catches compared to the harvest control rule catches associated with the high and low productivity scenarios.</p> <p>SERAG maintained its previous advice that the RBCs be based on the initial base-case, noting that there is little additional risk to depletion in the short term even under the lower productivity scenario.</p>	Initial base-case:		Alternate case:		M = 0.04		M = 0.036		h = 0.75		h = 0.6		Year 1 RBC	1314 t	Year 1 RBC	709 t	Year 2 RBC	1347 t	Year 2 RBC	776 t	Year 3 RBC	1375 t	Year 3 RBC	834 t	Average	1345 t	Average	773 t	Long term	1784 t	Long term	1276 t	<p><b>Undercatch:</b> 100%</p> <p><b>Overcatch:</b> 10%</p> <p><b>Discount Factor:</b> 0%</p>
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<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p>Yes.</p> <p>Continuation of the 3-Year MYTAC with the following RBC each year.</p> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Year</th> <th>RBC</th> </tr> </thead> <tbody> <tr> <td>2018</td> <td>1314 t</td> </tr> <tr> <td>2019</td> <td>1347 t</td> </tr> <tr> <td>2020</td> <td>1375 t</td> </tr> </tbody> </table> <p>The RAG noted there was little risk in accepting industry's proposal to limit catches in the 2<sup>nd</sup> and 3<sup>rd</sup> year of the MYTAC to 900 t each year.</p>		Year	RBC	2018	1314 t	2019	1347 t	2020	1375 t																								
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2019	1347 t																																	
2020	1375 t																																	

<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. <math>P &lt; 10\%</math>).</i></p>	<p><b>RBC recommendation = Very low</b></p> <p><b>Alternative Catch Scenarios:</b></p> <p>Deterministic projections indicate that the stock is not predicted to decline below the limit reference under any of the 6 scenarios presented under ‘catch trends’.</p>
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>0 t</p>
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>Nil.</p>

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Not assessed	Tier 1	Not assessed	Not assessed	Tier 1	MYTAC
<b>Stock Status</b>	Not assessed	$>B_{LIM}$	Not assessed	Not assessed	$>B_{LIM}$	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC (t)</b>	0	465	465	465	1345	900
<b>Agreed TAC (t)</b>	25	465	465	465	698	
<b>TAC (t) after unders/overs</b>	25	465	494	584		
<b>% TAC caught</b>	12%	94%	73%	51%		

## Catch Trends

### Forecasts and Cross-catch Risk Assessment (Dec 2017):



The predicted female spawning biomass of Orange Roughy East projected for 55 years for the initial base-case ( $M = 0.04$   $h = 0.75$ ; black line) and the alternate base-case ( $M = 0.036$   $h = .60$ ; 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 alternate base-case (blue line) and of the alternate base-case using the predicted catches from the initial base-case (green line) (From Orange Roughy Tier 1 assessment report, Haddon 2017).

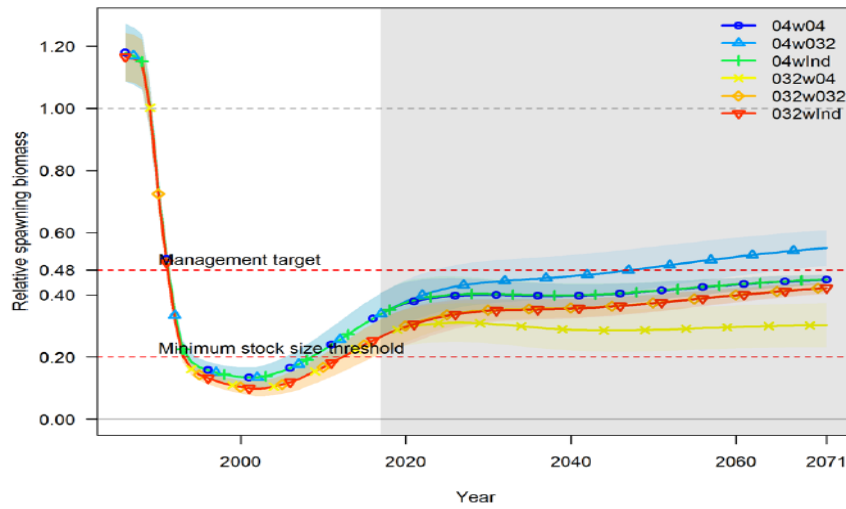
### Forecasts and Cross-catch Risk Assessment (Nov 2018):

At its September 2018 meeting, SERAG requested a cross-catch risk assessment for eastern orange roughy based upon the model structure of the 2017 assessment. There were six scenarios that differed only by the assumed values of natural mortality and the projected catches.

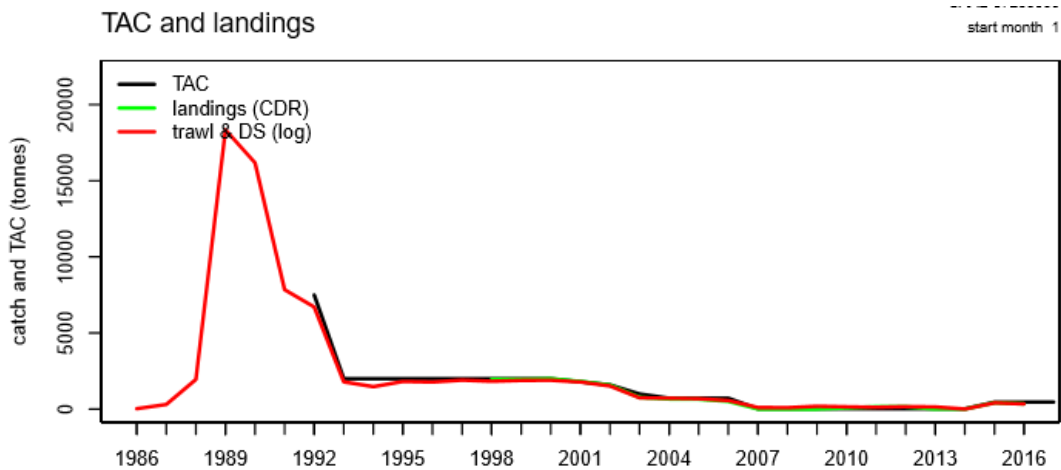
Scenarios		Model	
		Base-case ( $M=0.04$ )	Low productivity ( $M=0.032$ )
Catch	Base-case HCR	04w04	032w04
	Low productivity HCR	04w032	032w032
	Industry proposal	04wInd	032wInd

The model with the lower productivity ( $M=0.032$ ) and with highest catches had the lowest long-term biomass series in terms of annual tonnage of female spawning biomass. This series stabilised at approximately 30% $B_0$ . However, in the short-term there is still little difference in projected biomass between this scenario and those that use  $M=0.032$  with catches from the higher productivity scenarios.

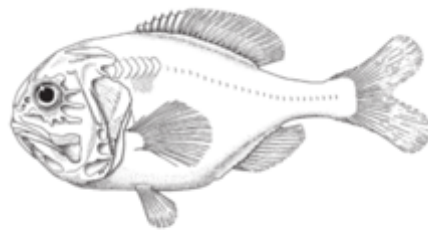
There was very little difference between the projected biomass for the low ( $M=0.032$ ) and high ( $M=0.04$ ) productivity scenarios with the industry proposed catches compared to the catches resulting from the harvest control rule. Noting this, the RAG saw little risk in accepting industry's proposal to limit catches in the 2<sup>nd</sup> and 3<sup>rd</sup> year of the MYTAC to 900 t each year.



**Landed catch against TAC:**



## 21 Orange Roughy (*Hoplostethus atlanticus*) – Western zone



ABARES (2012): Line Drawing – Rosalind Poole

Reviewed by SlopeRAG in 2015. Species summary updated in 2015.

Summary		
<b>Stock Structure</b>	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.	
<b>Stock status against reference points and trend</b>	<p>Orange roughy western is managed under the Orange roughy Rebuilding Strategy.</p> <p>Limit reference point is 20% of unfished biomass.</p> <p>Target reference point is 48% of unfished biomass.</p> <p>Stock status and biomass trend: The most recent assessment of western stock was in 2002 and estimated a biomass &lt;30% of 1985 biomass.</p> <p>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 not inconsistent to think that similar rebuilding may have occurred in the western zone.</p>	
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Overfished	<b>Fishing Mortality</b> Not subject to overfishing
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.11 million	<b>% Fishery GVP</b> 0.2%
<b>Is a MYTAC in place this season?</b>	Yes.	
<b>Have breakout rules been triggered?</b>		

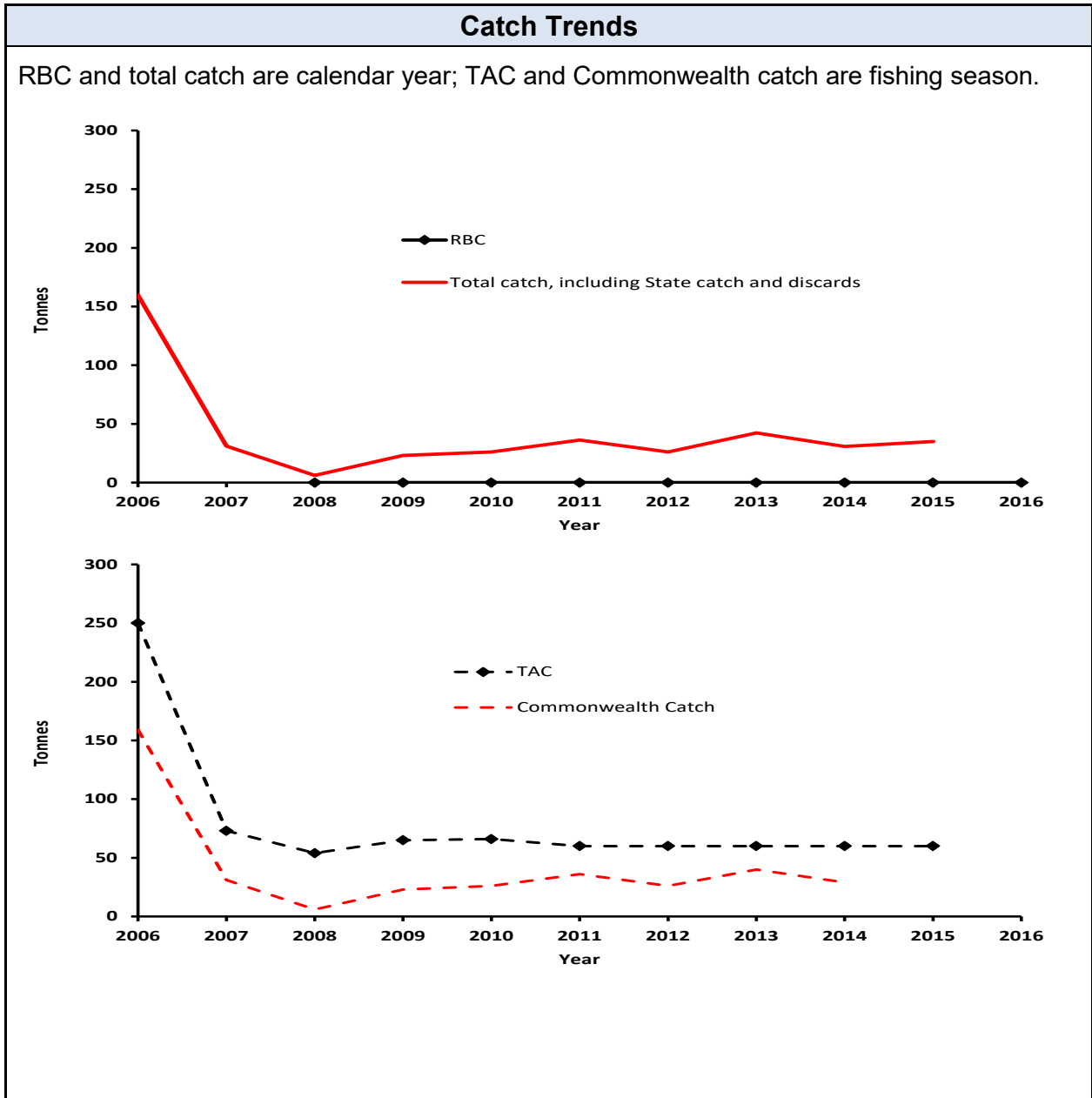


<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 2 in 2002, not assessed since.
<b>Stock indicator trends</b>	Due to incidental catch TAC with no targeted fishing, CPUE is not a reliable index of abundance.
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/ assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	N/A
<b>RAG Comments on assessment</b>	<p>The RAG 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.</p> <p>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.</p> <p>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.</p> <p>The RAG noted that the western zone continues to be on rebuilding incidental TAC and the RAG found there was no additional information that would provide a basis for the RAG to change its' previous TAC advice. The RAG recommended that the western zone orange roughy MYTAC remains unchanged.</p> <p>The RAG supported undertaking an externally reviewed desktop study of how evidence of rebuilding should be collected, is there currently any evidence/likelihood of rebuilding and identification of information gaps that preclude a stock assessment of the southern and western orange roughy stocks.</p>
<b>Projected Biomass (including confidence intervals)</b>	No biomass projections as there is no assessment.

RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	0 t. No targeted fishing. Incidental bycatch TAC of 60 t.	<b>Undercatch:</b> 0% <b>Overcatch:</b> 0% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>		
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation = N/A</b> <b>Alternative Catch Scenarios:</b> Not assessed.	
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A	

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	
<b>Stock Status</b>	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC (t)</b>	0	0	0			
<b>Agreed TAC (t)</b>	60	60	60	60		

<b>TAC (t) after unders/overs</b>	60	60	60	60		
<b>% TAC caught</b>	48%	37%	73%	38%		



## 22 Orange Roughy (*Hoplostethus atlanticus*) – Cascade Plateau



ABARES (2012): Line Drawing – Rosalind Poole

Tier 1 reviewed by SlopeRAG in 2013. Species summary updated in 2013.

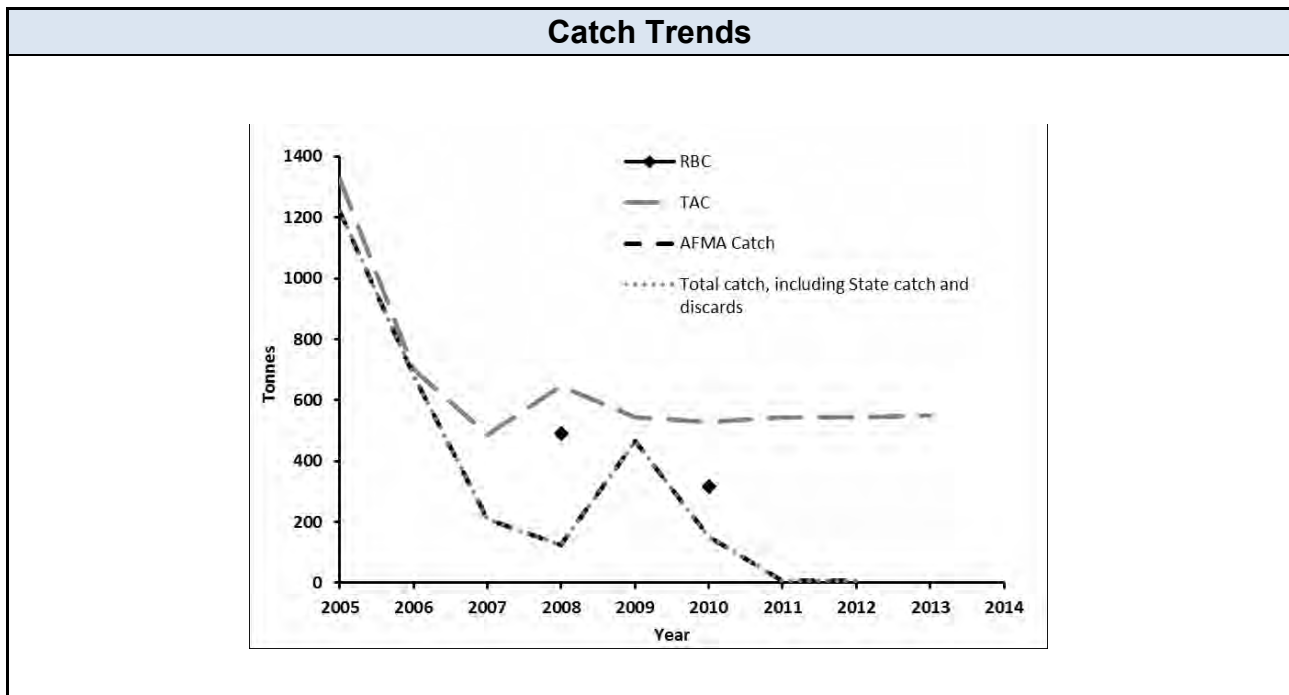
Summary		
<b>Stock Structure</b>	<p>The stock structure of Orange Roughy in the Australian Fishing Zone remains unresolved. Based on the existing data fishery dynamics multiple regional stocks of Orange Roughy are assumed.</p> <p>The Cascade Plateau, however, holds Orange Roughy with distinct morphometrics, parasite populations, size and age composition, and which also have a distinct spawning time from other adjacent stocks.</p> <p>For assessment and management purposes they are regarded as a separate stock.</p>	
<b>Stock status against reference points and trend</b>	<p>Limit reference point = 20% of unfished biomass</p> <p>Target reference point = 60% of unfished biomass</p> <p>Stock status: The last stock update of the stock assessment (2009) estimated the stock to be at 64% of unfished biomass which is above the target reference point.</p> <p>Biomass trend: Catches have remained below the RBC for the past 5 years so the stock is expected to be rebuilding..</p>	
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.00	<b>% Fishery GVP</b> 0.46%
<b>Is a MYTAC in place this season?</b>	Yes.	
<b>Have breakout rules been triggered?</b>	N/A	

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	N/A. Low levels of fishing has resulted in insufficient data being available to update the assessment.
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/ assumptions</b>	N/A
<b>Significant changes to data inputs</b>	Low levels of fishing has resulted in insufficient data being available to update the assessment.
<b>RAG Comments on data</b>	Low levels of fishing has resulted in insufficient data being available to update the assessment.
<b>RAG Comments on assessment</b>	<p>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.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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<sub>0</sub>) approximately 20% higher than the target reference point and 12% higher than the target under the Conservation Program.</li> <li>• In 2008 a DeepRAG member expressed concerns that the 2005 biomass estimate was biologically unfeasible. In 2009 the 2005 acoustic data were reanalyzed and as a result biomass estimates were downgraded. Using these data the assessment suggested that maintaining the TAC at 500t in 2010 would result in a depletion of 34% at the start of 2011.</li> </ul>

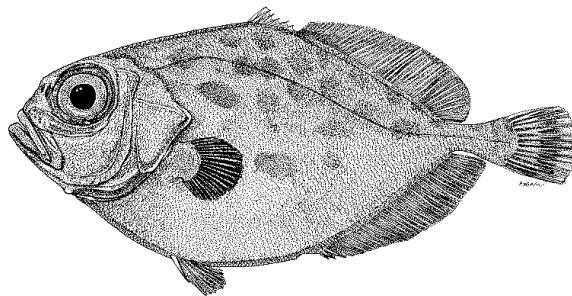
	<ul style="list-style-type: none"> <li>• There was low levels of fishing on the Cascade Plateau (&lt;1% of TAC caught) during 2011 and 2012.</li> <li>• An update to the assessment was due for 2012 but this was deferred due to the lack of new data and a higher priority being assigned to other species.</li> <li>• The RAG 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, the RAG would not be in a position to update the assessment.</li> <li>• 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.</li> </ul>
<b>Projected Biomass (including confidence intervals)</b>	N/A

<b>Catch and TAC</b>							
<b>Assessment Year</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>Tier / MYTAC</b>	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	
<b>Stock Status</b>	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	
<b>SESSF Season</b>	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
<b>RBC (t)</b>	N/A	N/A	N/A	N/A	N/A	N/A	
<b>Agreed TAC (t)</b>	500	500	500	500	500	500	
<b>TAC (t) after unders/overs</b>	543	550	550	550	550	550	
<b>% TAC caught</b>	1%	0%	0%	0%	0%	0%	

RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	Due to low fishing effort and therefore little data, there was no update to previously calculated RBCs.	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	No.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation = N/A</b> <b>Alternative Catch Scenarios:</b> Not assessed.	
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A	



## 23 Oreo Smooth (*Pseudocyttus maculatus*) - Cascade



Tier 4 assessed by SlopeRAG in 2009, reviewed in 2015.

Summary										
<b>Stock Structure</b>	Stock structure of Smooth oreodory is unknown. For assessment and management purposes the Cascade Plateau is regarded as a separate stock.									
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 target reference point is the level of CPUE assumed to produce a spawning biomass of 48 per cent of unfished levels.</p> <p>The limit reference point is the level of CPUE assumed to produce a spawning biomass of 20 per cent of unfished levels.</p> <p>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. Low catch and effort levels since 2009 have precluded any updates to the Tier 4 assessment.</p> <table border="1" data-bbox="852 1173 1062 1323"> <thead> <tr> <th colspan="2">CPUE</th> </tr> </thead> <tbody> <tr> <td>Target</td> <td>0.4989</td> </tr> <tr> <td>Limit</td> <td>0.1996</td> </tr> <tr> <td>Recent</td> <td>1.3575</td> </tr> </tbody> </table> <p>Biomass trend: When last assessed, CPUE had been extremely variable and the fluctuations were considered to be not indicative of changes in stock status.</p>		CPUE		Target	0.4989	Limit	0.1996	Recent	1.3575
CPUE										
Target	0.4989									
Limit	0.1996									
Recent	1.3575									
<b>ABARES most recent assessment (2017)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing								
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0	<b>% Fishery GVP</b> 0%								
<b>Is a MYTAC in place this season?</b>										
<b>Have breakout rules been triggered?</b>										



<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	
<b>Key model technical assumptions/ parameters</b>	
<b>Changes to model structure/ assumptions</b>	
<b>Significant changes to data inputs</b>	
<b>RAG Comments on data</b>	
<b>RAG Comments on assessment</b>	
<b>Projected Biomass (including confidence intervals)</b>	N/A

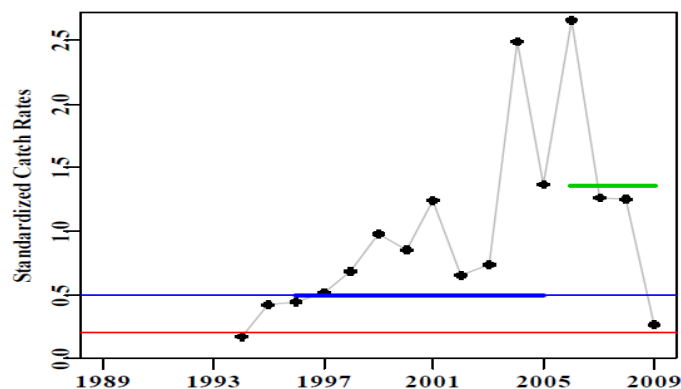
RAG Recommendations	
<b>Recommended Biological Catch (2014-15)</b>	<p>Catches of Smooth Oreos are now so low on the Cascade Plateau that the catch rate and Tier 4 analyses are unlikely to be valid.</p> <p>MYTAC 150 t.</p> <p><b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%</p>
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	<p>Yes. The RAG recommended rolling over the RBC into the fourth year of the 3-year MYTAC.</p>
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b> <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<p>See above comment.</p> <p>Alternative Catch Scenarios: N/A</p>
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	<p>0 t</p>
<b>Implications for companion species / TEPs / multi-species fisheries</b>	

Catch and TAC							
Assessment Year	2011	2012	2013	2014	2015	2016	2017
Tier / MYTAC	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
Stock Status	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
SESSF Season	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
RBC	Not estimated	Not estimated	Not estimated	Not estimated	Not estimated	Not estimated	
Agreed TAC	150	150	150	150	150	150	
TAC after unders/overs	165	165	161	165	150	169	
% TAC caught	0%	0%	0%	0%	0%	0%	

## Catch Trends

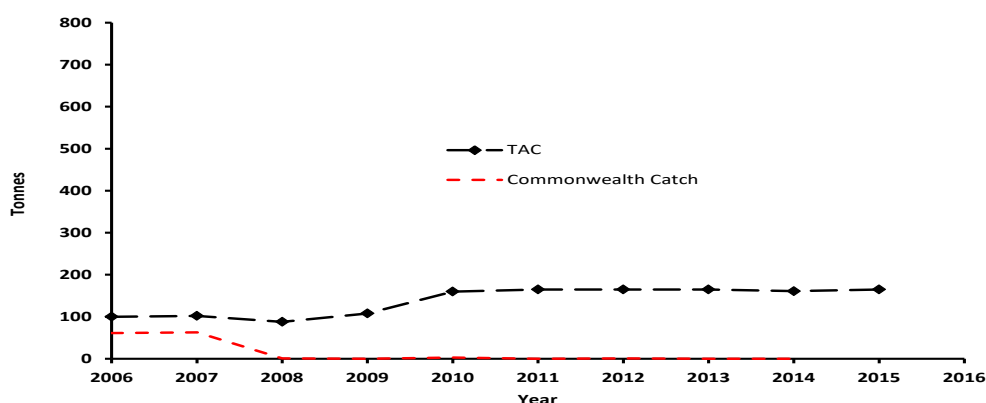
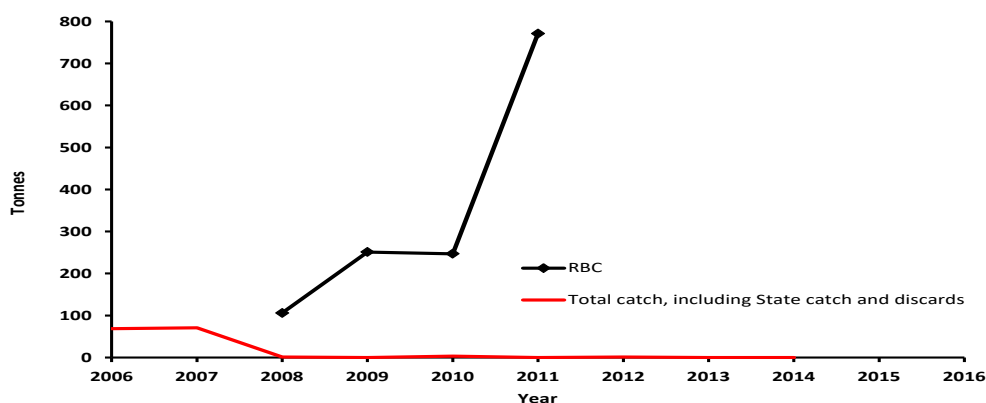
### Standardised Catch Rates

Smooth Oreo (Cascade) standardized catch rates from the most recent Tier 4 assessment completed (2010) 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.

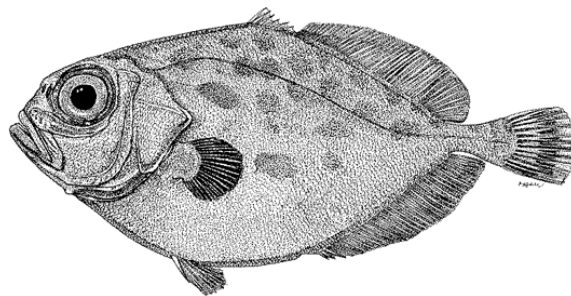


### Smooth oreodory - Cascade

(RBC and total catch are calendar year; TAC and Commonwealth catch are fishing season)



## 24 Oreo Smooth (*Pseudocyttus maculatus*) - Other



Tier 5: last assessed by SlopeRAG in 2015 – updated in 2018. Species summary updated in 2018.

Summary		
<b>Stock Structure</b>	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.	
<b>Stock status against reference points and trend</b>	<p>Smooth oreodory were assessed using a Tier 5 depletion based stock reduction analysis (DBSRA) for the first time in 2015.</p> <p>DBSRA is used to search for the level of yield (RBC) that would lead to a yield equivalent to a target depletion of 48 per cent of unfished biomass while maintaining the probability of the spawning biomass remaining above 20 per cent of unfished biomass above 0.9.</p> <p>Biomass trend: When last assessed, the CPUE was variable but with a slight positive trend. Low catch and effort levels since 2009 have precluded any updates.</p>	
<b>ABARES most recent assessment (2015)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing
<b>GVP Figures (2013-14 season)</b>	<b>GVP</b> \$0.19 million	<b>% Fishery GVP</b> < 0.4%
<b>Is a MYTAC in place this season?</b>	<p>Yes, MYTAC of 90 t.</p> <p>In 2018, the RAG agreed to roll over the RBC into the fourth year.</p>	
<b>Have breakout rules been triggered?</b>	No.	

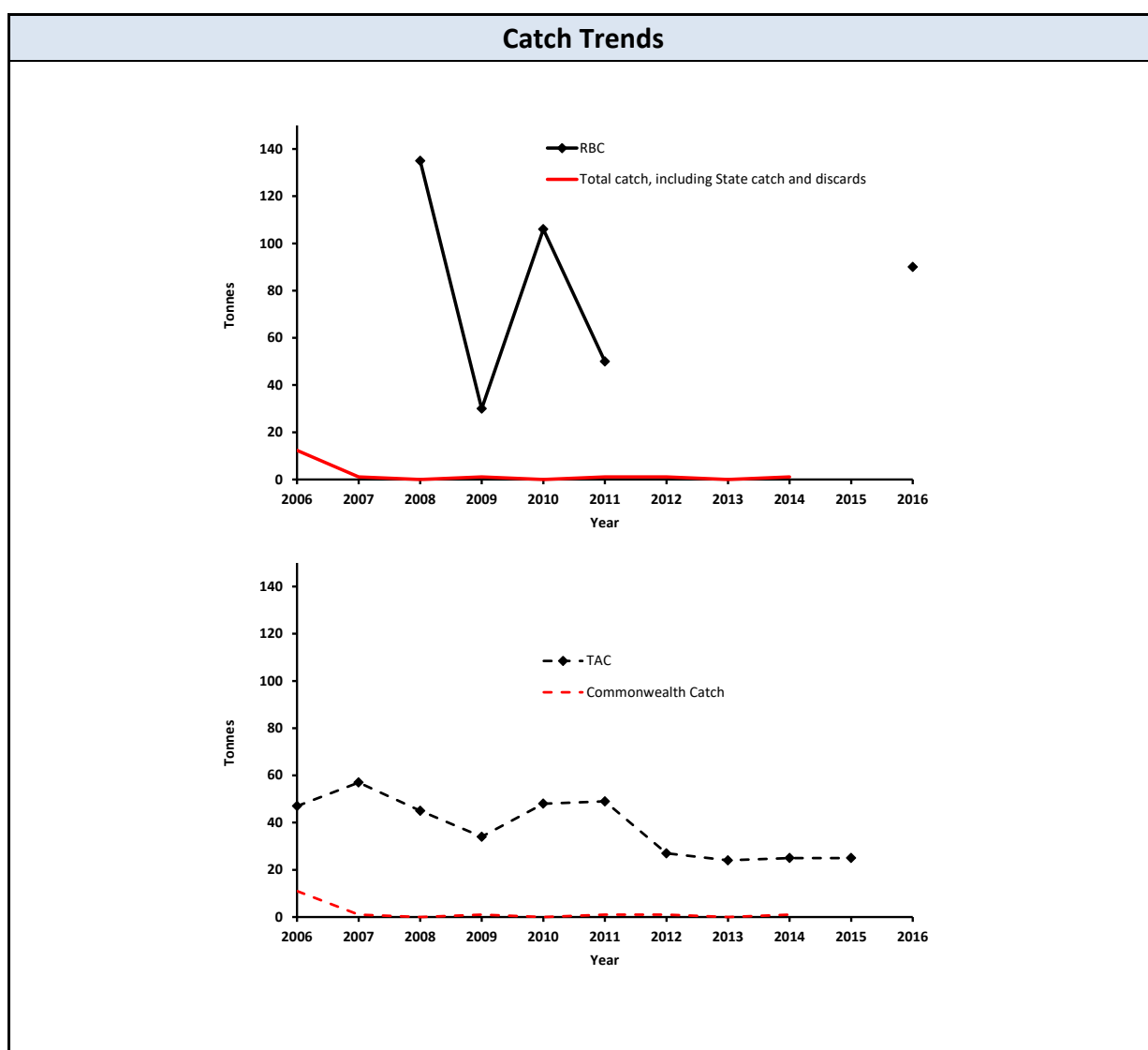
<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 5 – see note in RAG comments on assessment
<b>Stock indicator trends</b>	Unknown due to low effort and catches.
<b>Key model technical assumptions/ parameters</b>	<p>The requirements for DBSRA are:</p> <ul style="list-style-type: none"> <li>• catch time series; ideally from the start of the fishery</li> <li>• a simple model of the dynamics of the fishery.</li> </ul> <p>Plausible values are also required for:</p> <ul style="list-style-type: none"> <li>• the natural Mortality Rate: M, model input 0.05</li> <li>• the ratio of FMSY to the Natural Mortality: FMSY/M, model input 0.8</li> <li>• the most productive stock depletion level: BMSY/B0, model input 0.4</li> <li>• the age at maturity: model input 15</li> <li>• the final depletion level, model input 0.48</li> </ul>
<b>Changes to model structure/ assumptions</b>	Tier 5 (DBSRA) used to assess this species superseding the previous Tier 4 assessment.
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	<p>There is only a short time series of data when these fish were caught in any quantity.</p> <p><b>Standardised Catch Rates (Tier 4 CPUE series 2010):</b></p> <p>Smooth oreodory is an aggregating species and CPUE is not a reliable abundance index for aggregating species. DBSRA does not use catch rates in the assessment.</p>

<p><b>RAG Comments on assessment</b></p>	<p>In 2018, the RAG agreed to roll over the RBC into the fourth year as there was no basis for changing advice on this species since the last assessment and there was minimal risk. Members noted that the assessment will be updated after receiving advice from the SESSFRAG sub-working group recently tasked with considering the species in the ‘unassessable’ basket.</p> <p>Smooth oreodory are an aggregating bycatch species taken when fishing for orange roughy and the catch rate may not be a reliable index of abundance.</p> <p>Smooth oreodory are spatially structured and the model assumes some homogeneity that may not be a reliable estimation of stock distribution.</p> <p>The RAG agreed that a target depletion of 48 per cent of B0 is needed to be consistent with the SESSF Harvest Strategy Framework.</p> <p>The RBC is extremely conservative as 90 per cent of the smooth oreodory catch was taken from waters that are now closed.</p> <p>The previous TAC of 23 t was arbitrary and was set when the deepwater area of the fishery was closed to protect orange roughy. The RAG noted that under the large change limiting rule the maximum the TAC could be is 34.5 t. The RAG agreed that there are no sustainability issues in not applying the large change limiting rule in this instance.</p>
<p><b>Projected Biomass (including confidence intervals)</b></p>	<p>N/A</p>

RAG Recommendations	
<p><b>Recommended Biological Catch (2019-20)</b></p>	<p>90 t</p> <p><b>Undercatch:</b> 10%</p> <p><b>Overcatch:</b> 10%</p> <p><b>Discount Factor:</b> 0%</p> <p>The discount factor was not applied due to this method of calculating the RBC is extremely conservative and in combination with large trawl closures provides sufficient protection to the smooth oreodory stock.</p> <p>The RAG recommended that a discount factor is not applied.</p> <p>NB. There is no specific Tier 5 discount factor in the SESSF HSF.</p>
<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p>Yes. The RAG recommended rolling over the RBC into the fourth year of the 3-year MYTAC.</p>
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i></p>	<p>The constant catch projections indicate that the risk of the stock declining to below the limit reference point is low.</p> <p>Alternative Catch Scenarios: N/A</p>
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>0 t</p>
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>Smooth oreodory is a bycatch when targeting orange roughy. The previous TAC of 23 t constrained catches of orange roughy in the Pedra Branca area of the southern orange roughy zone. An increase in TAC should reduce/remove this constraint.</p>

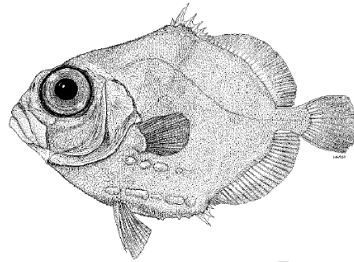
Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018

<b>Tier / MYTAC</b>	Not assessed	Not assessed	Tier 5	MYTAC	MYTAC	MYTAC
<b>Stock Status</b>	Not assessed	Not assessed	N/A	N/A	N/A	N/A
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	Not assessed	Not assessed	90	90	90	90
<b>Agreed TAC</b>	23	23	90	90		
<b>TAC after unders/overs</b>	25	25	90	99		
<b>% TAC caught</b>	3%	85%	53%	56%		





## 25 Oreo Basket (Warty, Spiky, Rough and Black Oreo Dory)



Tier 4 last assessed by SERAG in 2017. Species summary updated in 2017.

Summary																									
<b>Stock Structure</b>	<p>Little is known about the stock structure of the Oreo species in this basket quota. They are benthic-pelagic species that are caught mainly below 600m.</p> <p>For assessment and management purposes they are treated as a single unit of stock through the SESSF.</p>																								
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 target reference point is the level of CPUE assumed to produce a spawning biomass of 48% of unfished levels.</p> <p>The limit reference point is 40% of the target reference point.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1993-2001</td> <td>Scaling</td> <td>1.5947</td> </tr> <tr> <td>CE_Targ</td> <td>0.441</td> <td>Last Year's TAC</td> <td>128</td> </tr> <tr> <td>CE_Limit</td> <td>0.1837</td> <td>C<sub>targ</sub></td> <td>160.83</td> </tr> <tr> <td>CE_Recent</td> <td>0.4297</td> <td>RBC</td> <td>256.474</td> </tr> <tr> <td>Wt_Discard</td> <td>70.53</td> <td></td> <td></td> </tr> </tbody> </table> <p>CPUE trend (with discards): Standardized CPUE is above the target reference point and has been for the last three years.</p>	Parameter	Value	Parameter	Value	Reference Years	1993-2001	Scaling	1.5947	CE_Targ	0.441	Last Year's TAC	128	CE_Limit	0.1837	C <sub>targ</sub>	160.83	CE_Recent	0.4297	RBC	256.474	Wt_Discard	70.53		
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<b>Is a MYTAC in place this season?</b>	Yes.																								
<b>Have breakout rules been triggered?</b>	No.																								

Assessment Summary	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	Standardised CPUE is above the target reference point ( $F_{48}$ ) since 2014
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/ assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	Catches of oxeye oreodory have been reported. The RAG assumes an ID issue and that the reported oxeye species should be included in the assessment
<b>RAG Comments on assessment</b>	<p>High level of discards but not constant partly due to changes in fishing practices. The RAG agreed to now include discards in RBC calculation.</p> <p>Increased catch and discards are correlated with opening of deepwater closures and increased access to stock.</p> <p>Mixed oreos are a potential candidate for a lower target reference point to <math>B_{40}</math> and there is little biological risk to doing so. AFMA to consider as part of SMARP implementation.</p> <p>While mixed oreos are targeted they are not an economic driver in the fishery. A high proportion of the quota is caught and there is low quota latency.</p> <p>The majority of mixed oreo catches are spikey oreo.</p> <p>These species are suitable for a three year MYTAC because the stock is at approximately <math>40\%B_0</math> and closures provide protection.</p>
<b>Projected Biomass (including confidence intervals)</b>	N/A

RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	256 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-year RBC = 256 t.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	Very unlikely.  Alternative Catch Scenarios: N/A	
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	Smooth oreodory is a bycatch when targeting orange roughy. The previous TAC of 23 t constrained catches of orange roughy in the Pedra Branca area of the southern orange roughy zone. An increase in TAC should reduce/remove this constraint.	

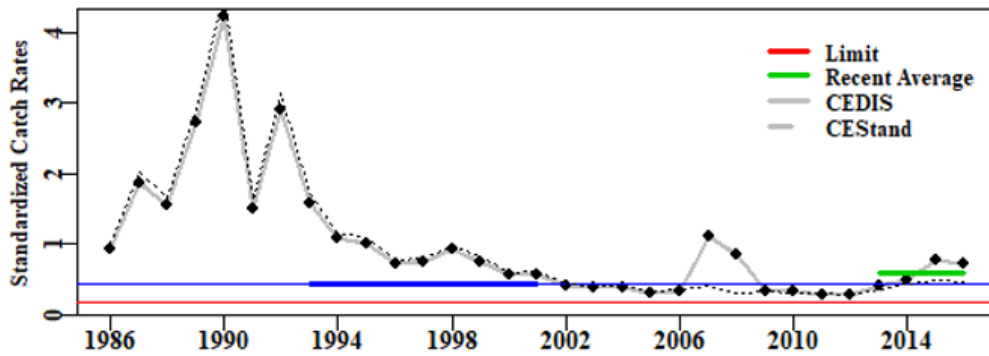
Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Tier 4	Not assessed	Tier 5	MYTAC	Tier 4	
<b>Stock Status</b>	Not assessed	Not assessed	Not assessed	Not assessed	CPUE above target	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	128	128	128	128	256	
<b>Agreed TAC</b>	132	128	128	128	12	

TAC after unders/overs	130	140	137	140		
% TAC caught	75%	79%	72%	63%		

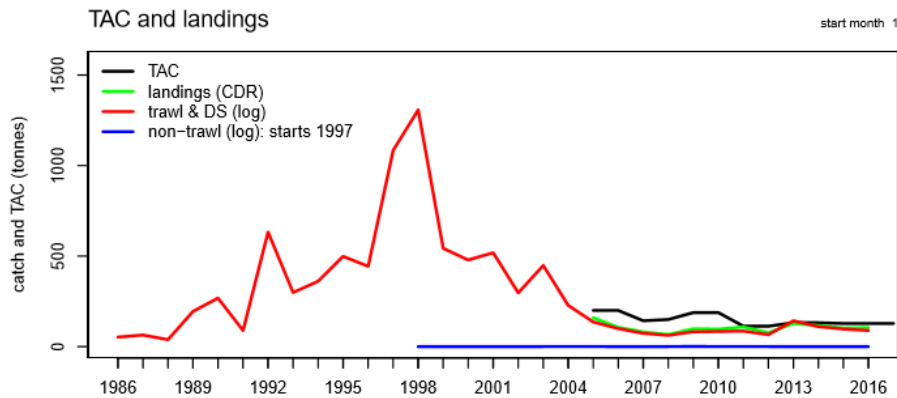
### Catch Trends

#### Standardised Catch Rates

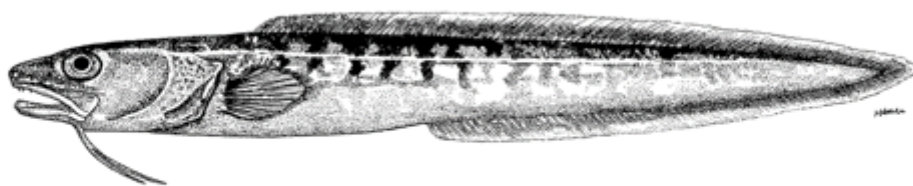
Mixed Oreo Basket (Discard) standardized catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate. The thin black dotted line is the unmodified standardized CPUE before the inclusion of discards.



#### Catch Trends



## 26 Pink Ling (*Genypterus blacodes*)



Common names: Pink cusk-eel, ling, Australian rockling, New Zealand ling, kingklip, northern ling

Tier 1: last assessed by SERAG in 2018

Summary				
<b>Stock Structure</b>	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.			
<b>Stock status against reference points and trend</b>		Current	Target	Limit
	East	30%B <sub>0</sub>	48%B <sub>0</sub>	20%B <sub>0</sub>
	West	84%B <sub>0</sub>		
East – biomass trend continuing recent increases. West – biomass increasing above management target.				
<b>ABARES assessment (2018)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing		
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$5.22 million	<b>% Fishery GVP</b> 11.2%		
<b>Is a MYTAC in place this season?</b>	Yes	<b>Have breakout rules been triggered?</b>	No	

Assessment Summary	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	<b>East:</b> 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).

	<b>West:</b> biomass increasing above management target.
<b>Key model technical assumptions/ parameters</b>	<p>Assessed using CASAL based stock assessment model. See Cordue (2018) for detailed technical assumptions and parameters.</p> <p>Single area, two sex, age-structured</p> <p>Von Bertalanffy growth, single M</p> <p>Fixed maturity and steepness (<math>h=0.75</math>)</p> <p>SSB: female only, mid-year</p> <p>Two fisheries: trawl, non-trawl</p> <p>Time-blocked selectivities for trawl</p> <p>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</p> <p>Estimate parameters: <math>B_0</math>, growth, recruitments strengths, M (E:0.25, W:0.23), selectivities</p> <p>Data weighting followed Francis (except age-length not fully down-weighted)</p> <p>A full Bayesian estimation was undertaken; MPD runs for diagnostics followed by MCMC runs for estimates.</p>
<b>Changes to model structure/ assumptions</b>	The 2018 pink ling assessment is as an update of ISL's 2015 assessment.
<b>Significant changes to data inputs</b>	<p>FIS indices and length frequencies were included in the assessment</p> <hr/> <p>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).</p> <p>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.</p> <hr/> <p>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'.</p>

<p><b>RAG Comments on data</b></p>	<p>The RAG agreed to include the FIS CPUE indices (east and west) and length frequencies at the first SERAG meeting. There is generally a good fit to FIS LF in the east and west.</p> <p>There is variation in the length of trawl shots, and so length frequencies are scaled by catch-rate, rather than catch.</p> <p>Non-trawl port length frequencies are not stratified by depth, based on 2013 analysis suggesting they're not required</p> <p>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.</p> <p>MDP estimated and MCMC estimates were very similar (not always the case).</p>
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<p><b>RAG Comments on assessment</b></p>	<p><b>East</b></p> <p>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:</p> <p><b>Reference:</b> CPUE series with no period/avoidance effect, est M of 0.25</p> <p><b>M-0.23:</b> CPUE series with no period/avoidance effect and M fixed at 0.23</p> <p><b>Period:</b> CPUE series with period/avoidance effect and M fixed at 0.23.</p> <p>The ‘signals’ in the data from the east make it difficult to estimate M and the RAG agreed that a fixed value of 0.23 should be used in the east.</p> <p>The RAG 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.</p> <p>The base-case model using the accepted CPUE series with a fixed M=0.23 estimates the current spawning biomass is 30%B<sub>0</sub> (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). The RAG noted these estimates are highly uncertain.</p> <p>SERAG accepted the final eastern pink ling base case stock assessment noting the estimated current eastern zone spawning stock biomass of 30%B<sub>0</sub> (22-42, 95% CI) and the 2019 median RBC of 260 t (36-560, 95% CI).</p> <p>The RAG recommended that if a TAC greater than the 2019 RBC was considered by the AFMA Commission then the table below 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.</p> <p>A similar approach was taken in 2015 to provide advice regarding risks associated with setting multi-year TACs at constant catches. The RAG noted there has been an increase in biomass since then and it is reasonable that a similar approach is taken this time.</p> <p><b>Table 1 Pink Ling MCMC projection results</b></p> <p>MCMC projection results for the base model (M=0.23) showing the expected SSB in 2021 and 2028 under different constant catch scenarios with the associated probabilities of being below 20% or 30% B<sub>0</sub> and at or above the target of 48% B<sub>0</sub>.</p> <table border="1" data-bbox="440 1518 1401 1845"> <thead> <tr> <th>Annual catch (t)</th> <th>E (B<sub>21</sub>/B<sub>0</sub>)</th> <th>E (B<sub>28</sub>/B<sub>0</sub>)</th> <th>P (SS<sub>21</sub>&lt;0.2)</th> <th>P (SS<sub>28</sub>&lt;0.2)</th> <th>Rebuild year to B<sub>48</sub></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>42</td> <td>72</td> <td>0.00</td> <td>0.00</td> <td>2023</td> </tr> <tr> <td>300</td> <td>37</td> <td>53</td> <td>0.01</td> <td>0.00</td> <td>2026</td> </tr> <tr> <td>400</td> <td>35</td> <td>47</td> <td>0.02</td> <td>0.01</td> <td>2030</td> </tr> <tr> <td>450</td> <td>34</td> <td>44</td> <td>0.02</td> <td>0.01</td> <td>2033</td> </tr> <tr> <td>500</td> <td>33</td> <td>41</td> <td>0.04</td> <td>0.02</td> <td>2040</td> </tr> <tr> <td>550</td> <td>32</td> <td>38</td> <td>0.05</td> <td>0.05</td> <td>&gt;2050</td> </tr> <tr> <td>600</td> <td>32</td> <td>35</td> <td>0.06</td> <td>0.11</td> <td>&gt;2050</td> </tr> <tr> <td>650</td> <td>31</td> <td>31</td> <td>0.08</td> <td>0.18</td> <td>&gt;2050</td> </tr> </tbody> </table> <p>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</p>	Annual catch (t)	E (B <sub>21</sub> /B <sub>0</sub> )	E (B <sub>28</sub> /B <sub>0</sub> )	P (SS <sub>21</sub> <0.2)	P (SS <sub>28</sub> <0.2)	Rebuild year to B <sub>48</sub>	0	42	72	0.00	0.00	2023	300	37	53	0.01	0.00	2026	400	35	47	0.02	0.01	2030	450	34	44	0.02	0.01	2033	500	33	41	0.04	0.02	2040	550	32	38	0.05	0.05	>2050	600	32	35	0.06	0.11	>2050	650	31	31	0.08	0.18	>2050
	Annual catch (t)	E (B <sub>21</sub> /B <sub>0</sub> )	E (B <sub>28</sub> /B <sub>0</sub> )	P (SS <sub>21</sub> <0.2)	P (SS <sub>28</sub> <0.2)	Rebuild year to B <sub>48</sub>																																																	
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650	31	31	0.08	0.18	>2050																																																		



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**

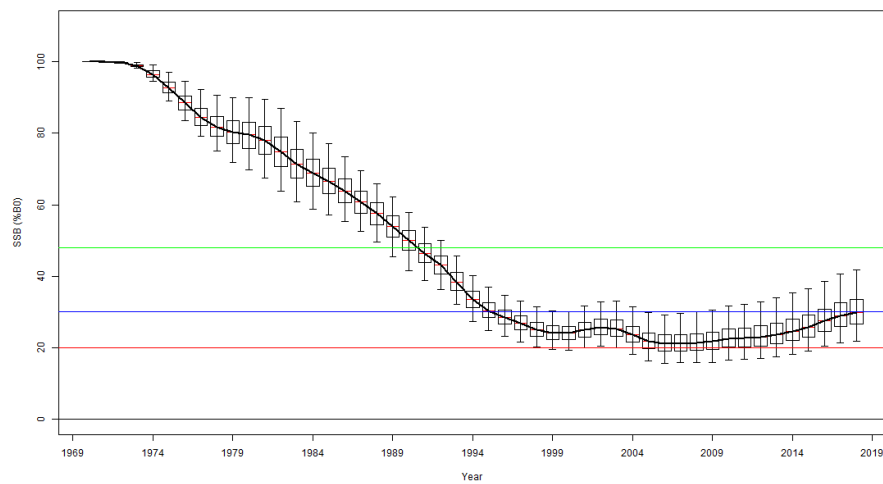
The likelihood profile for M suggests 0.23 is appropriate, although there is some conflict between trawl and non-trawl length frequencies.

SERAG accepts the final western pink ling base case stock assessment noting the estimated current eastern zone spawning stock biomass of 84%B<sub>0</sub> (69-100, 95% CI), and the 2019 median RBC estimate of 1150 t (770-1660, 95% CI).

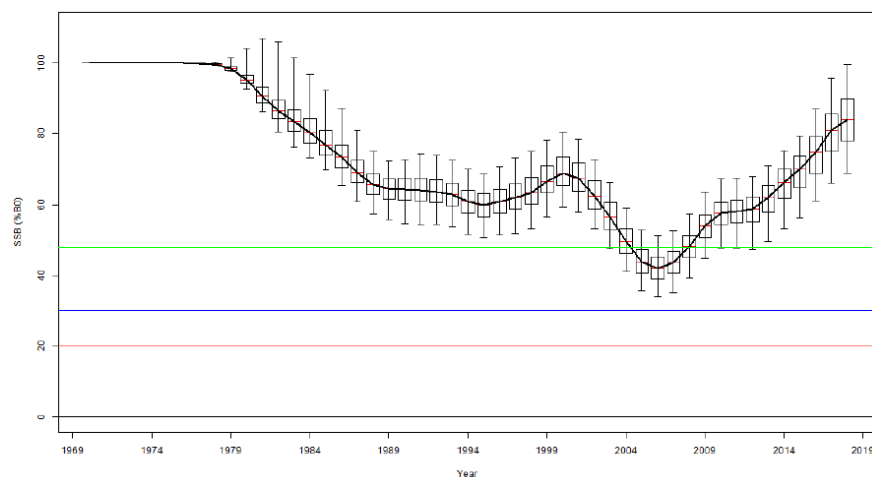
**Estimated Biomass  
(including  
confidence  
intervals)**

Pink ling base model Marcov Chain Monte Carlo (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<sub>0</sub>

**East:**



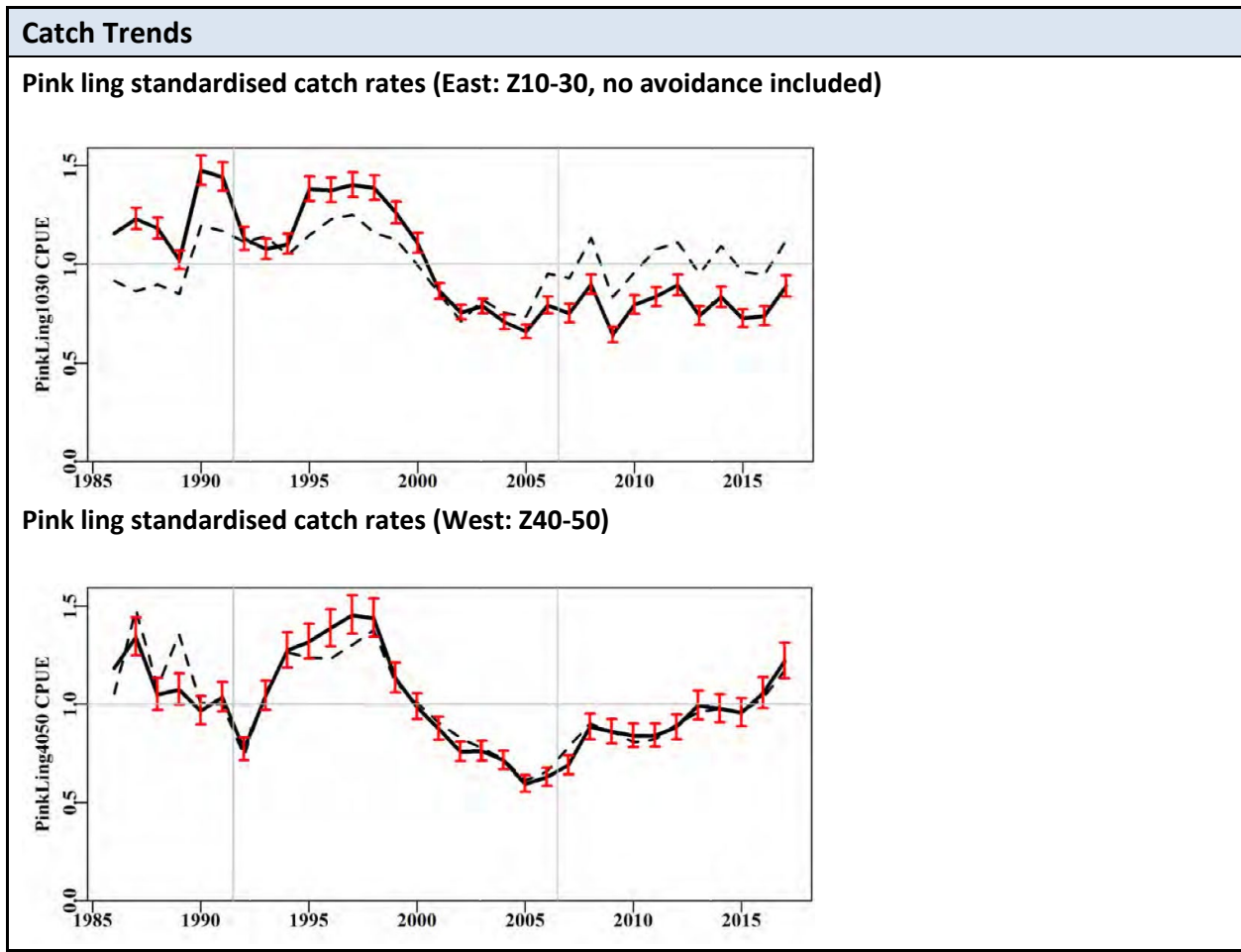
**West:**



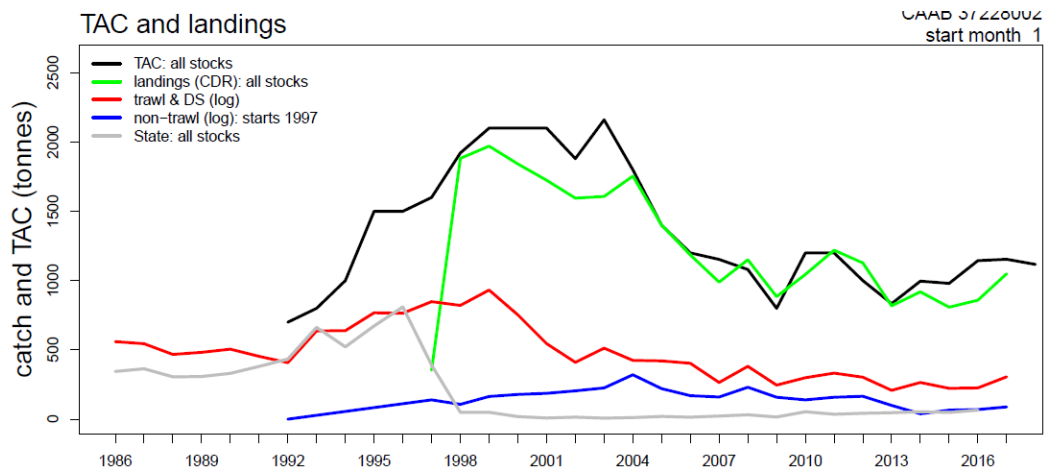
RAG Recommendations																																																								
<p><b>Recommended Biological Catch (2019-20)</b></p>	<p><b>East:</b> 2019: 260 t (36-560 t, 95% CI)</p> <p><b>West:</b> 2019: 1150 t (770-1660 t, 95% CI)</p>	<p><b>Undercatch:</b> 10%</p> <p><b>Overcatch:</b> 10%</p> <p><b>Discount Factor:</b> 15%</p>																																																						
<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p>Yes. 3-year MYTAC.</p> <p><b>East</b> 2019: 260 t</p> <p>The RAG recommended that if a TAC greater than the 2019 RBC was considered by the AFMA Commission then constant catch projections (below) should be used as basis for determining the TAC.</p> <p><b>West</b> 2019: 1150 t 2020: TBC 2021: TBC</p>																																																							
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. <math>P &lt; 10\%</math>).</i></p>	<p><b>RBC recommendation</b> = Very unlikely.</p> <p><b>Alternative Catch Scenarios</b> – eastern stock at constant catch:</p> <p>Alternative catch projections using the accepted <math>M=0.23</math> and CPUE series</p> <table border="1" data-bbox="501 1144 1385 1480"> <thead> <tr> <th>Annual catch (t)</th> <th>E (<math>B_{21}/B_0</math>)</th> <th>E (<math>B_{28}/B_0</math>)</th> <th>P (<math>SS_{21} &lt; 0.2</math>)</th> <th>P (<math>SS_{28} &lt; 0.2</math>)</th> <th>Rebuild year to <math>B_{48}</math></th> </tr> </thead> <tbody> <tr><td>0</td><td>42</td><td>72</td><td>0.00</td><td>0.00</td><td>2023</td></tr> <tr><td>300</td><td>37</td><td>53</td><td>0.01</td><td>0.00</td><td>2026</td></tr> <tr><td>400</td><td>35</td><td>47</td><td>0.02</td><td>0.01</td><td>2030</td></tr> <tr><td>450</td><td>34</td><td>44</td><td>0.02</td><td>0.01</td><td>2033</td></tr> <tr><td>500</td><td>33</td><td>41</td><td>0.04</td><td>0.02</td><td>2040</td></tr> <tr><td>550</td><td>32</td><td>38</td><td>0.05</td><td>0.05</td><td>&gt;2050</td></tr> <tr><td>600</td><td>32</td><td>35</td><td>0.06</td><td>0.11</td><td>&gt;2050</td></tr> <tr><td>650</td><td>31</td><td>31</td><td>0.08</td><td>0.18</td><td>&gt;2050</td></tr> </tbody> </table> <p><math>B_{21}</math> means the biomass estimate in 2021.  <math>B_0</math> means unfished biomass.  P means probability.  E means estimate  0.2 means 20 per cent of unfished biomass, the limit reference point.  Rebuild year means at least a 50 per cent probability of being at or above the target reference point of 48 per cent of the unfished biomass.  N.B. Uses Markov Chain Monte Carlo stochastic projections to determine performance indicators.</p>		Annual catch (t)	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	42	72	0.00	0.00	2023	300	37	53	0.01	0.00	2026	400	35	47	0.02	0.01	2030	450	34	44	0.02	0.01	2033	500	33	41	0.04	0.02	2040	550	32	38	0.05	0.05	>2050	600	32	35	0.06	0.11	>2050	650	31	31	0.08	0.18	>2050
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<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>0 t</p>																																																							

<b>Implications for companion species / TEPs / multi-species fisheries</b>	Pink ling is caught in close association with blue-eye trevalla in the line sector and blue grenadier in the trawl fishery.
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Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	East: Tier 1 West: Tier 1	Rollover MYTAC	East: Tier 1 West: Tier 1	Rollover MYTAC	Rollover MYTAC	East: Tier 1 West: Tier 1
Stock Status	East: 25% West: 58%	Not assessed	East: 30% West: 73%	Not assessed	Not assessed	East: 35% West: 84%
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	East: 122 t West: 807 t	Not assessed	East: 250 t West: 990 t	East: 250 t West: 990 t	East: 250 t West: 990 t	East: 260 t West: 1150 t
Agreed TAC	996	980	1144	1154	1117	
TAC after unders/overs	1016	1006	1233	1262	1203	
% TAC caught	95%	82%	74%	82%		



## Catch trends



## 27 Redfish (*Centroberyx affinis*)



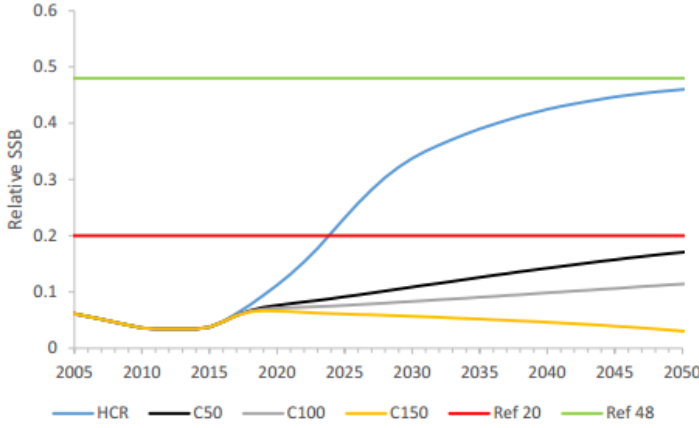
ABARES (2012)

**Common names:** Nannygai, red snapper, king snapper, golden snapper.

**Tier 1: last assessed by SERAG in 2017. Species summary updated in 2017.**

Summary		
<b>Stock Structure</b>	<p>No formal stock discrimination studies have been done in Australia.</p> <p>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).</p> <p>Previous assessments of the redfish stock have therefore also considered that the fishery exploits two separate populations, with the boundary between these 'stocks'.</p> <p>However for the 2017 assessment, the RAG agreed to use a single stock model with no split at 36°S.</p>	
<b>Stock status against reference points and trend</b>	<p>Limit reference point is 20 per cent of unfished biomass.</p> <p>Target reference point is 48 per cent of unfished biomass.</p> <p>The Redfish Stock Rebuilding Strategy was implemented in 2016.</p> <p>The 2017 assessment estimated that the stock is below the limit reference point at an estimated 2018 stock status of 8 per cent of unexploited levels.</p>	
<b>ABARES most recent assessment (2015)</b>	<p><b>Biomass</b></p> <p>Overfished</p>	<p><b>Fishing Mortality</b></p> <p>Uncertain</p>
<b>GVP Figures (2016-17 season)</b>	<p><b>GVP</b></p> <p>\$0.08 million</p>	<p><b>% Fishery GVP</b></p> <p>0.2%</p>
<b>Is a MYTAC in place this season?</b>	No.	
<b>Have breakout rules been triggered?</b>	N/A	

<b>Assessment Summary</b>																						
<b>Tier Level</b>	Tier 1																					
<b>Stock indicator trends</b>	The 2017 Tier 1 assessment indicates 2000 – 2010 was a sustained period of below average recruitment. 2011 -12 estimates an increase in recruitment.																					
<b>Key model technical assumptions/ parameters</b>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Parameter</th> <th style="text-align: center;">Description</th> <th style="text-align: center;">Value</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><i>M</i></td> <td style="text-align: center;">Natural mortality</td> <td style="text-align: center;">0.1</td> </tr> <tr> <td style="text-align: center;">h</td> <td style="text-align: center;">“steepness” of the Beverton-Holt stock-recruit curve</td> <td style="text-align: center;">0.75</td> </tr> <tr> <td style="text-align: center;">x</td> <td style="text-align: center;">age observation plus group</td> <td style="text-align: center;">40 years</td> </tr> <tr> <td style="text-align: center;">a</td> <td style="text-align: center;">allometric length-weight equations</td> <td style="text-align: center;">0.0577 g<sup>1</sup>.cm</td> </tr> <tr> <td style="text-align: center;">b</td> <td style="text-align: center;">allometric length-weight equations</td> <td style="text-align: center;">2.77</td> </tr> <tr> <td style="text-align: center;"><i>l<sub>m</sub></i></td> <td style="text-align: center;">Female length at 50% maturity</td> <td style="text-align: center;">19cm</td> </tr> </tbody> </table>	Parameter	Description	Value	<i>M</i>	Natural mortality	0.1	h	“steepness” of the Beverton-Holt stock-recruit curve	0.75	x	age observation plus group	40 years	a	allometric length-weight equations	0.0577 g <sup>1</sup> .cm	b	allometric length-weight equations	2.77	<i>l<sub>m</sub></i>	Female length at 50% maturity	19cm
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<b>Changes to model structure/ assumptions</b>	Tier 1 assessment.																					
<b>Significant changes to data inputs</b>	N/A																					
<b>RAG Comments on data</b>	<p>Significant differences in the onboard length and port length data. EBass port lengths are considerably larger than NSW port lengths, with ascending limbs beginning at ~10cm for NSW and ~15-20 cm for EBass. This appears to be driven by different discard practices, as the distribution of caught fish lengths from the onboard length data are similar for EBass and NSW.</p> <p>Future models should consider data separated by zone, with a different discard function estimated for each zone.</p>																					

<p><b>RAG Comments on assessment</b></p>	<p>With regards to the 2017 Tier 1, the RAG noted:</p> <ul style="list-style-type: none"> <li>• The projected 2018 spawning biomass of 8% is lower than that in the 2014 assessment, which predicted a 2015 spawning biomass of 11%.</li> <li>• Under the very low recruitment scenario the constant catch of 100t there is slow rebuild.</li> <li>• Recruitment pulse predicted by the 2014 assessment had eventuated but not to the degree expected and that catches and catch rates in 2016 were the lowest recorded.</li> <li>• Climate factors may be influencing recruitment and recovery and further work was required to better understand and respond to these impacts.</li> <li>• Fishing mortality is unlikely to be the driver for slow recovery.</li> <li>• The 2014 model predicted the stock to rebuild above the limit reference point within five years regardless of whether total mortality was 50 tonnes, 100 tonnes or 150 tonnes. However, this was based on average recruitment and, despite combined Commonwealth and NSW catches and discards being below 150 tonnes in each year of the MYTAC, recovery had not occurred.</li> <li>• Recommended an RBC of 0 tonnes and requested stock projections under both average and low recruitment scenarios to assist in TAC setting.</li> <li>• Changes to gear (a bigger diamond mesh) should be considered to reduce the bycatch of juvenile redfish. However, the RAG noted that this may impact on the catches of other highly desirable species such as flathead.</li> <li>• Existing closed areas may provide some degree of protection for redfish however this has not been quantified.</li> <li>• Avoiding redfish is difficult because they occur across the entire fishery area.</li> <li>• Noted that the NSW recreational catch estimates have declined from 104,000 fish estimated through the 2001 survey to 21,000 fish in the 2016 survey</li> </ul>
<p><b>Projected Biomass (including confidence intervals)</b></p>	<p>The accepted basecase estimates the redfish spawning biomass to pass the limit reference point by approximately 2024.</p> 

RAG Recommendations		
<p><b>Recommended Biological Catch (2019-20)</b></p>	<p>The 2017 assessment estimated that the stock is below the limit reference point at an estimated 2018 stock status of 8 per cent of unexploited levels.</p> <p>The RAG recommended RBC of zero and an incidental catch TAC of 100 tonnes noting that the rebuild timeframes are based on recruitment estimates that have been below average since the early 2000's.</p> <p>Annual catches of 50 t take more than 50 years to recover to the limit reference point. An annual catch of 150 t is unsustainable for the stock. Under the standard harvest control rule and recruitment model (which uses recruitments from the stock-recruitment curve), the spawning biomass is estimated to pass the limit reference point by approximately 2024.</p>	<p><b>Undercatch:</b> 0%</p> <p><b>Overcatch:</b> 0%</p> <p><b>Discount Factor:</b> 0%</p>
<p><b>Is a MYTAC recommended for future seasons?</b></p> <p><i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i></p>	<p>No.</p>	
<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i></p>	<p>N/A – the stock is assessed as being below the limit reference point (8%)</p>	
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>0 t</p>	



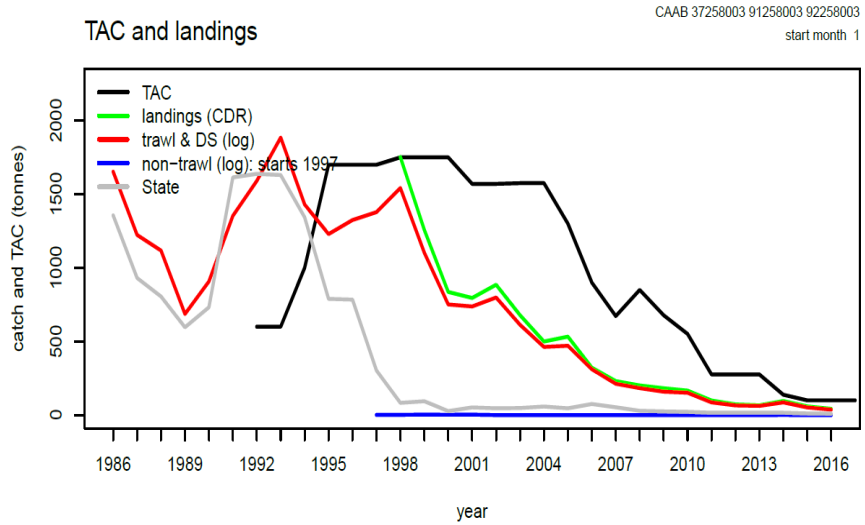
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>Companion species analysis indicates that the majority (64 per cent) of all redfish are taken in shots where redfish is not the most valuable component of the catch. This suggests it is not normally targeted.</p> <p>Flathead is the species most commonly being targeted when redfish are caught (31 per cent).</p> <p>The last companion species analysis (Klaer, 2010) indicated that of 156 t of redfish caught, 100 t was caught in shots where redfish was not main species taken.</p> <p>In the 2015 fishing season, 50 t of redfish was landed while 3095 t of flathead was landed, suggesting that full quota utilisation of flathead does not result in substantial redfish mortality (total redfish discards in 2015 was 74 t).</p> <p>Projections completed in the 2014 redfish stock assessment showed that redfish would rebuild by 2018 or 2019 at catches of 0 t, 50 t, 100 t and 150 t (i.e. catches up to 150 t made little difference to the projected rebuilding rate for redfish).</p>
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Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 3 Tier 4	Tier 1	Incidental TAC	Incidental TAC	Tier 1	
Target	B <sub>48</sub>	B <sub>48</sub>	B <sub>48</sub>	B <sub>48</sub>	B <sub>48</sub>	
Stock Status	Tier 3 - Fishing mortality less than target Tier 4 – CPUE lower than limit	< B <sub>Lim</sub>	< B <sub>Lim</sub>	< B <sub>Lim</sub>	8	
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	Tier 3 - 3791 Tier 4 - 0	0	0	0	0	
Agreed TAC	138	100	100	100		
TAC after unders/overs	164	100	100	100		
% TAC caught	48%	45%	39%	27%		

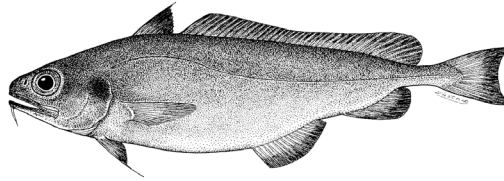
## Catch Trends

### Redfish

(RBC and total catch are calendar year; TAC and Commonwealth catch are fishing season)



## 28 Ribaldo (Mora mora)



Tier 4: last assessed by SERAG in 2017

Summary																											
<b>Stock Structure</b>	One stock of Ribaldo is assumed for the SESSF.																										
	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 Target reference point for ribaldo is the level of CPUE assumed to produce a spawning biomass of 40% of unfished levels.</p> <p>The limit reference point is 40% of the CPUE assumed to produce a spawning biomass of 48% of unfished levels.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1995-2004</td> <td>Scaling</td> <td>3.4355</td> </tr> <tr> <td>CE_Targ</td> <td>0.3597</td> <td>Last Year's TAC</td> <td>355</td> </tr> <tr> <td>CE_Limit</td> <td>0.1799</td> <td>C<sub>targ</sub></td> <td>125.251</td> </tr> <tr> <td>CE_Recent</td> <td>0.7978</td> <td>RBC</td> <td>430.304</td> </tr> <tr> <td>Wt_Discard</td> <td>6.518</td> <td></td> <td></td> </tr> </tbody> </table> <p>CPUE trend: Standardised CPUE has been relatively flat since the early 2000's and remains above the target reference point.</p>			Parameter	Value	Parameter	Value	Reference Years	1995-2004	Scaling	3.4355	CE_Targ	0.3597	Last Year's TAC	355	CE_Limit	0.1799	C <sub>targ</sub>	125.251	CE_Recent	0.7978	RBC	430.304	Wt_Discard	6.518		
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<b>ABARES assessment (2018)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing																									
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.31 million	<b>% Fishery GVP</b> 0.7%																									
<b>Is a MYTAC in place this season?</b>	Yes	<b>Have breakout rules been triggered?</b>	No																								

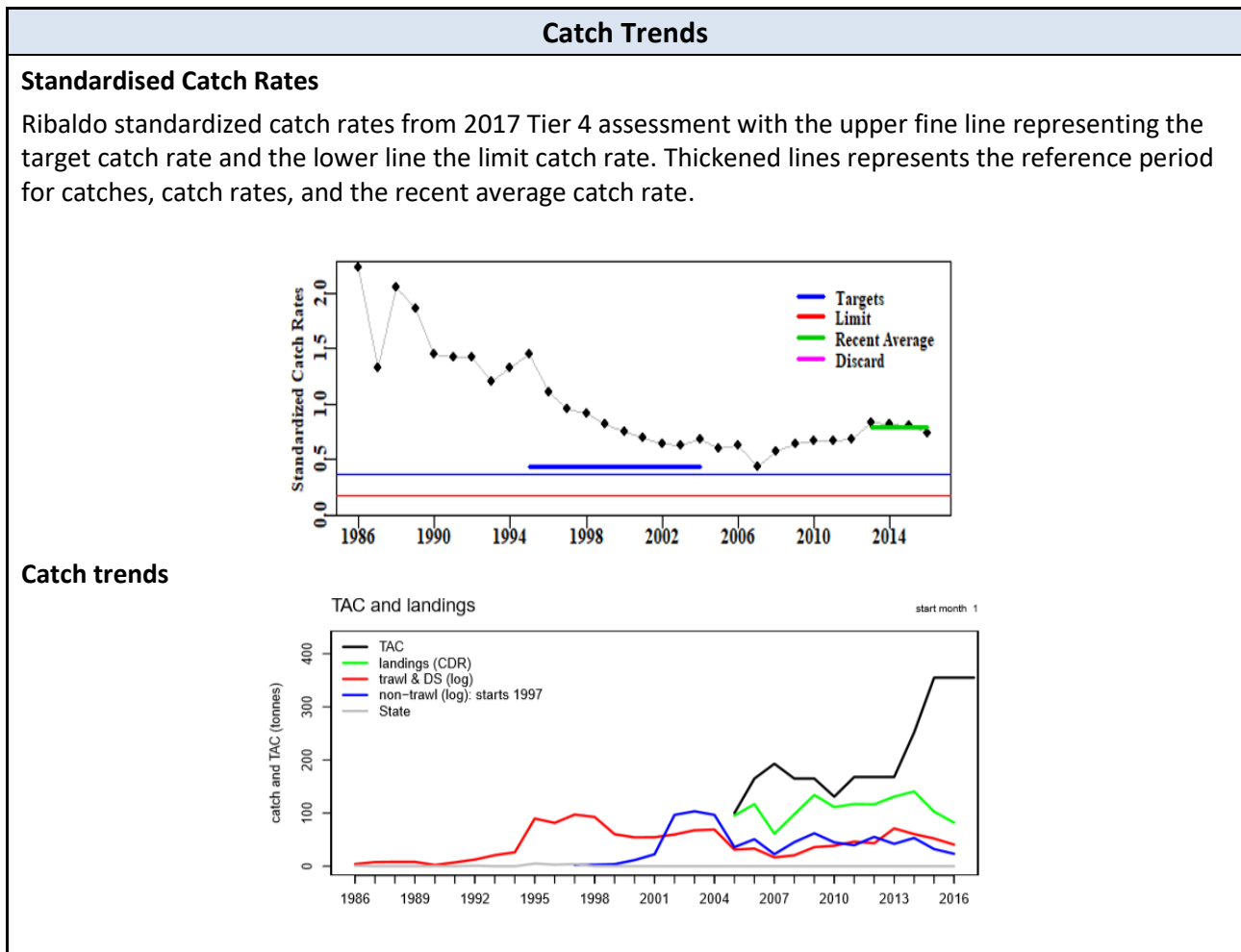
Assessment Summary	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	Trawl and non-trawl CPUE are flat and well above the Tier 4 target catch levels.

<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/ assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	Trawl only data is used in the assessment. Autoline catch is continuing to decline.
<b>RAG Comments on assessment</b>	Significant component of the catch in deeper water 500 m. Deepwater closures provide significant protection.
<b>Estimated Biomass (including confidence intervals)</b>	

<b>RAG Recommendations</b>		
<b>Recommended Biological Catch (2018-19)</b>	430 t.	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0% Deepwater closures are considered to provide a level of precaution that is at least equivalent to the default 15% discount factor for a Tier 4 species.
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-year RBC = 430 t.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a “very unlikely” score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation = Very unlikely.</b> <b>Alternative Catch Scenarios: N/A</b>	
<b>Research Catch Allowance</b>  <i>Included/Addition to TAC</i>	0 t	

Implications for companion species / TEPs / multi-species fisheries	N/A
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Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	
Stock Status	CPUE higher than target	Not assessed	Not assessed	Not assessed	CPUE higher than target	
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	355	355	355	355	430	
Agreed TAC	252	355	355	355		
TAC after unders/overs	266	376	389	389		
% TAC caught	53%	24%	23%	24%		



## 29 Royal Red Prawn (*Haliporoides sibogae*)



Tier 4 assessed by SERAG in 2017.

Summary																											
<b>Stock Structure</b>	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.																										
	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>The Tier 4 Target reference point is the level of CPUE assumed to produce a spawning biomass of 48% of unfished levels.</p> <p>The limit reference point is 40% of the target reference point.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1986-1995</td> <td>Scaling</td> <td>1.0676</td> </tr> <tr> <td>CE_Targ</td> <td>1.0692</td> <td>Last Year's TAC</td> <td>387</td> </tr> <tr> <td>CE_Limit</td> <td>0.4455</td> <td>C<sub>targ</sub></td> <td>403.512</td> </tr> <tr> <td>CE_Recent</td> <td>1.1114</td> <td>RBC</td> <td>430.788</td> </tr> <tr> <td>Wt_Discard</td> <td>1.908</td> <td></td> <td></td> </tr> </tbody> </table> <p>Stock status: The recent average standardised CPUE-based proxy for biomass is above but close to the target reference point.</p> <p>Trend: CPUE has fluctuated around target levels. Catches have been below the RBC in recent years, due to reported market constraints..</p>			Parameter	Value	Parameter	Value	Reference Years	1986-1995	Scaling	1.0676	CE_Targ	1.0692	Last Year's TAC	387	CE_Limit	0.4455	C <sub>targ</sub>	403.512	CE_Recent	1.1114	RBC	430.788	Wt_Discard	1.908		
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<b>ABARES assessment (2018)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing																									
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.89 million	<b>% Fishery GVP</b> 1.9%																									
<b>Is a MYTAC in place this season?</b>	Yes	<b>Have breakout rules been triggered?</b>	No																								

Assessment Summary	
<b>Tier Level</b>	Tier 4

<b>Stock indicator trends</b>	Standardised CPUE has displayed a cyclical trend around the target and generally increased from 2010. The population size structure has been relatively stable.
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/ assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	N/A
<b>RAG Comments on assessment</b>	The RAG recommended a research catch allowance of 40 tonnes for the Gulper Shark Grid Exclusion Device project to offset costs of research trips. The RAG will review the decision relating to the discount factor if significant changes to the deepwater closures occurs.
<b>Estimated Biomass (including confidence intervals)</b>	

RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	430 t.	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0% Discount factor does not apply due to the protection afforded by deepwater closures
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-year RBC = 431 t.	

<p><b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b></p> <p><i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i></p>	<p><b>RBC recommendation</b> = Very unlikely.</p> <p><b>Alternative Catch Scenarios:</b> N/A</p>
<p><b>Research Catch Allowance</b></p> <p><i>Included/Addition to TAC</i></p>	<p>40 t</p>
<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>The Royal Red Prawn fishing grounds off Sydney occur in areas of core habitat for Harrison's and Southern dogfish and much of the fishing grounds have been closed under the Upper Slope Dogfish Management Strategy. Industry has proposed to trial a Grid Exclusion Device in Royal Red Prawn nets to exclude Dogfish.</p>

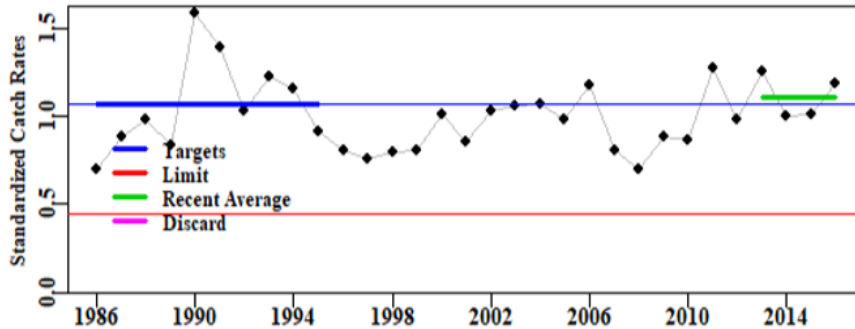
Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	
Stock Status	CPUE between target and limit	Not assessed	Not assessed	Not assessed	CPUE above target	
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	393	393	393	393	431	
Agreed TAC	344	386	387	384		
TAC after unders/overs	373	414	417	421		
% TAC caught	39%	44%	30%	53%		



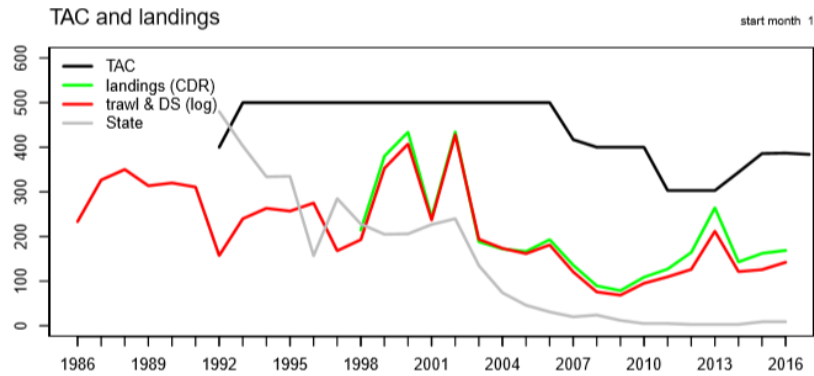
## Catch Trends

### Standardised Catch Rates

Royal Red Prawn standardized 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.



### Catch trends



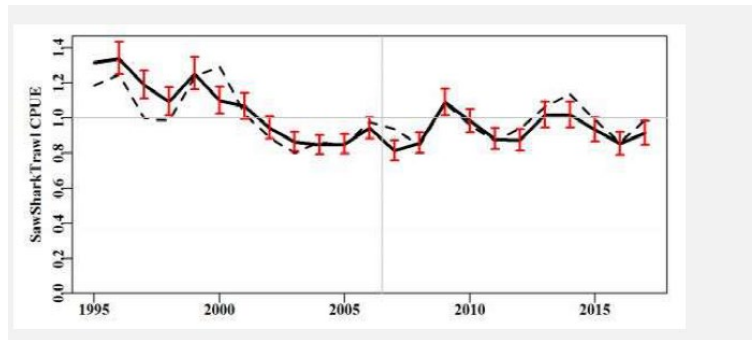
## 30 Sawshark (*Pristiophorus spp*)



CSIRO national Fish Collection (2009)

### Tier 4: last assessed by SharkRAG in 2017

Summary																									
<b>Stock Structure</b>	<p>Three endemic species of sawsharks occur off southern Australia, but their distributions have not been described precisely. Common Sawshark (<i>Pristiophorus cirratus</i>) is reported to range from Jurien Bay in WA to Eden in NSW, including Tasmania, to depths of 310 m.</p> <p>Southern Sawshark (<i>P. nudipinnis</i>) is reported to range from the western region of the Great Australian Bight to eastern Gippsland in Victoria, including Tasmania, to depths of 70 m. The Eastern Sawshark (<i>Pristiophorus sp. A</i>) 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).</p> <p>Little is known of stock structure or movement rates.</p> <p>For assessment purposes, all sawsharks 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.</p>																								
<b>Stock status against reference points and trend</b>	<p>Tier 4 species use CPUE targets as a proxy of biomass targets.</p> <p>Shark RAG reviewed the target reference point for sawshark and supported an MSY proxy target of <math>B_{40}</math>. This was based on consideration that sawshark is not targeted, it is considered sustainable and it is a secondary commercial species contributing about 1% to GVP. The limit reference point is 20% of the <math>B_0</math> proxy.</p> <table border="1" data-bbox="536 1536 1254 1760"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>2002-2008</td> <td>Scaling</td> <td>1.6098</td> </tr> <tr> <td>CE_Targ</td> <td>0.7236</td> <td>Last Year's TAC</td> <td>433</td> </tr> <tr> <td>CE_Limit</td> <td>0.3618</td> <td><math>C_{targ}</math></td> <td>322.13</td> </tr> <tr> <td>CE_Recent</td> <td>0.9443</td> <td>RBC</td> <td>518.555</td> </tr> <tr> <td>Wt_Discard</td> <td>39.714</td> <td></td> <td></td> </tr> </tbody> </table> <p>Stock status: in the 2017 Tier 4 assessment the recent average standardized CPUE-based proxy for biomass was above the target limit reference point.</p> <p>The standardised trawl CPUE which is used in a Tier 4 assessment has been relatively flat. In the 2017 Tier 4 assessment, the recent average standardised CPUE-based proxy for biomass is above the target reference point.</p>	Parameter	Value	Parameter	Value	Reference Years	2002-2008	Scaling	1.6098	CE_Targ	0.7236	Last Year's TAC	433	CE_Limit	0.3618	$C_{targ}$	322.13	CE_Recent	0.9443	RBC	518.555	Wt_Discard	39.714		
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CE_Recent	0.9443	RBC	518.555																						
Wt_Discard	39.714																								



Trend: the standardized gillnet-CPUE has been declining since 2004, while the standardized trawl-CPUE has been relatively flat.

<b>ABARES most recent assessment (2016)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.52 million	<b>% Fishery GVP</b> 2.6%	
<b>Is a MYTAC in place this season?</b>	Yes	<b>Have breakout rules been triggered?</b>	No

<b>Assessment Summary</b>	
<b>Tier Level</b>	Tier 4
<b>Stock indicator trends</b>	
<b>Key model technical assumptions/ parameters</b>	<p>Sawshark catches have been split primarily between gillnets and trawls (with a lesser quantity taken by Danish seine). The standardized gillnet-CPUE has been declining since 2004, with slight increases in recent years, although it does not account for the level of discarding that occurs.</p> <p>By contrast, the standardized trawl-CPUE has been relatively flat. Catches by trawl are now almost as high as those taken by gillnets, illustrating the uncertainty in this analysis and providing some evidence that there may be an element of avoidance by gillnet fishers.</p>
<b>Changes to model structure/assumptions</b>	None
<b>Significant changes to data inputs</b>	None
<b>RAG Comments on data</b>	None
<b>RAG Comments on assessment</b>	N/A

RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	430 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 15%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes, continue with the second year of a 3-year MYTAC.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>		
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>		

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Tier 4	Tier 4	Tier 4	Tier 4	Tier 4	Tier 4
<b>Stock Status</b>	CPUE between target and limit	CPUE between target and limit	Not assessed	Not assessed	CPUE above target	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	459	600	455	535	519	
<b>Agreed TAC</b>	459	482	433	442	430	
<b>TAC after unders/overs</b>	487.66	522	478	482		
<b>% TAC caught</b>	51%	36%	42%	42%		

### Catch Trends

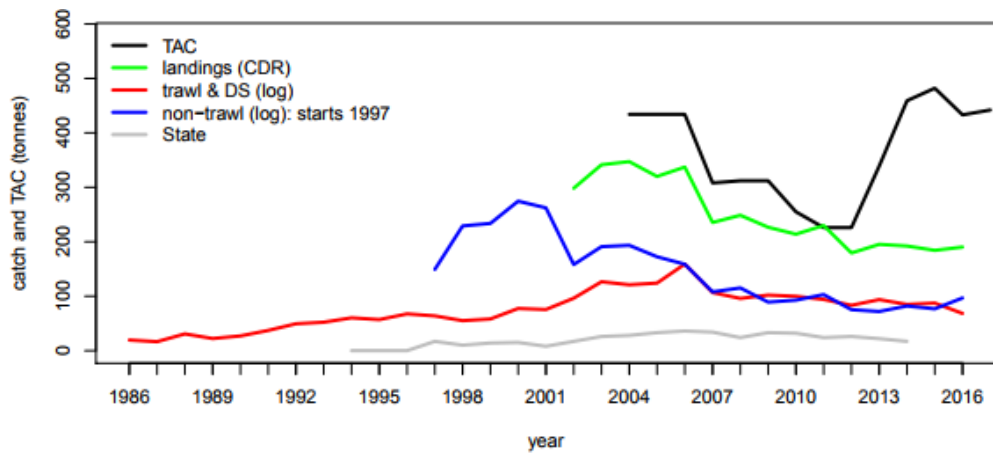
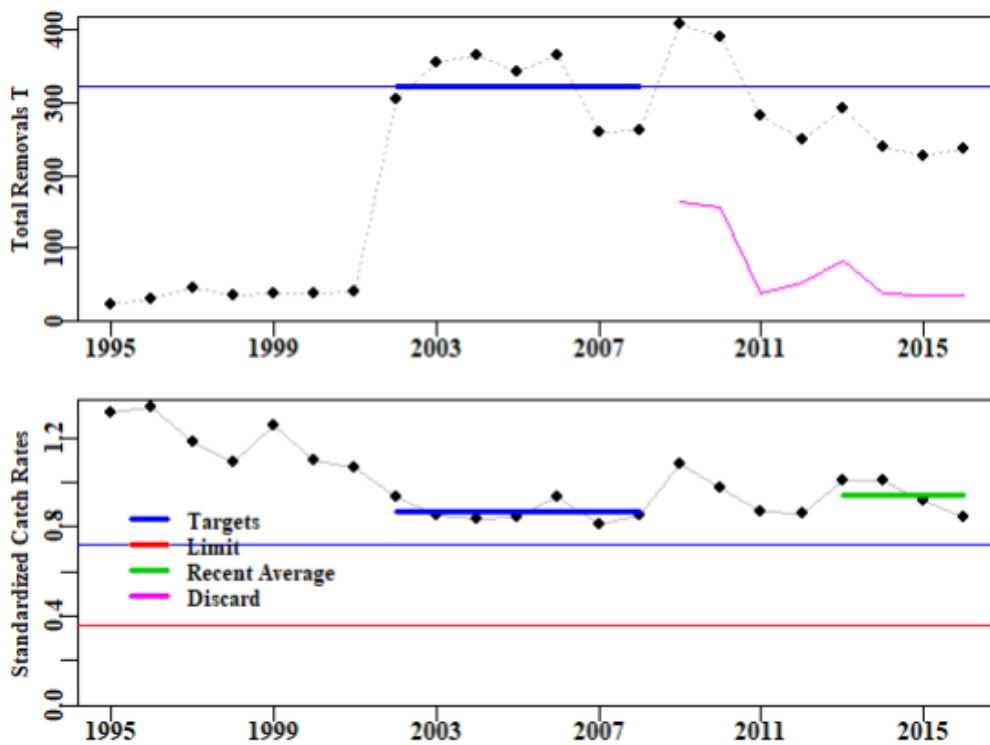


Figure 2. Sawshark TAC and landings



Figures 3 and 4. Sawsharks taken by trawl. Top plot is the total removals with the fine line illustrating the target catch. Bottom plot represents the standardised catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represent the reference period for catches, catch rates, and the recent average catch rate

## 31 Schoolshark (*Galeorhinus galeus*)



Fisheries Research & Development Corporation (2012)

Tier 1 under a stock rebuilding strategy. Last assessed by SharkRAG in 2018.

Summary			
<b>Stock Structure</b>	<p>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.</p>		
<b>Stock status against reference points and trend</b>	<p>Target reference point is 48 per cent of the unfished biomass (pup production is used as a proxy for breeding biomass).</p> <p>Limit reference point is 20 per cent of the unfished biomass (pup production is used as a proxy for breeding biomass).</p> <p>Gillnet CPUE is not considered a reliable index of abundance as school shark are actively avoided by gillnet fishers.</p> <p>In 2016 SharkRAG noted that there are continuing positive signs suggesting that the school shark is rebuilding. This is based on an overall increasing trend in trawl CPUE (since 2003). This is consistent with advice from industry that school shark, particularly juveniles, are in relatively high abundance.</p>		
<b>ABARES most recent assessment (2016)</b>	<b>Biomass</b> <b>Overfished</b>	<b>Fishing Mortality</b> <b>Uncertain</b>	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$1.70 million	<b>% Fishery GVP</b> 8.4 %	
<b>Is a MYTAC in place this season?</b>	No	<b>Have breakout rules been triggered?</b>	No

Assessment Summary	
<b>Tier Level</b>	Tier 1

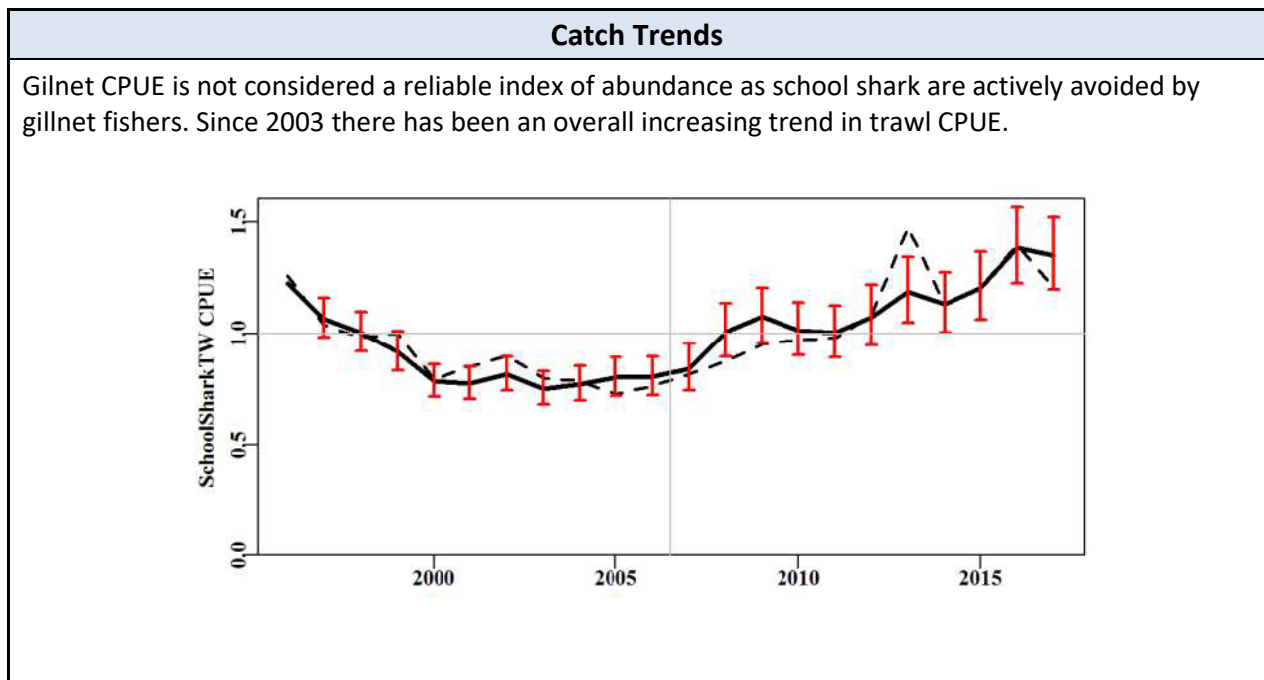
<p><b>Stock indicator trends</b></p>	<p>The CK model provides an estimate of current absolute abundance with trend back to 2000. It does not provide an estimate of depletion from <math>B_0</math>. The CK model indicates that the stock had recovered slightly during the period from 2000-2017.</p>
<p><b>Key model technical assumptions/ parameters</b></p>	<p>The assessment model assumes that there is one well mixed stock.</p>
<p><b>Changes to model structure/assumptions</b></p>	<p>The close in 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.</p>
<p><b>Significant changes to data inputs</b></p>	
<p><b>RAG Comments on data</b></p>	<p>The RAG accepted the close kin assessment model noting high confidence in the absolute estimate of abundance produced by the mode, but accepting lower confidence in the estimates of trend.</p>
<p><b>RAG Comments on assessment</b></p>	<p>Assessments (since 1991) have consistently estimated the school shark population to be below the limit reference point of 20 per cent of unfished levels.</p> <p>The RAG recommended setting an incidental catch TAC based on projections using the average fishery mortality rates over the last five years. The rate taking into account increasing stock size due to rebuilding give total fishing mortality estimate of 256t in 2019-20, 263 t in 2020-21 and 270t in 2021-2022. This level of fishing mortality rate would lead to an initial reduction in stock size before recovery due to effect of age class inputs into the model.</p> <p>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 close kin 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 smaller stock than the stock that was historically fished. Any future consideration of <math>B_0</math> and associated reference points will need to take this into account</p>

RAG Recommendations																																																																																																																
<b>Recommended Biological Catch (2019-20)</b>	189 t incidental bycatch only	<b>Undercatch:</b> 0% <b>Overcatch:</b> 0% <b>Discount Factor:</b> 0%																																																																																																														
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	N/A, as under rebuilding strategy.																																																																																																															
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation: N/A as currently assessed at below the limit reference point.  <b>Alternative Catch Scenarios:</b>  Table 1. Number of years after 2008 when the school shark stock is predicted to achieve limit (B20, B25) or target reference points (B40, B50) under future catches ranging between 0 and 275t. Results are shown for the assumption that the distribution of fishing effort in the future matches that if either 2011, or 2008.																																																																																																															
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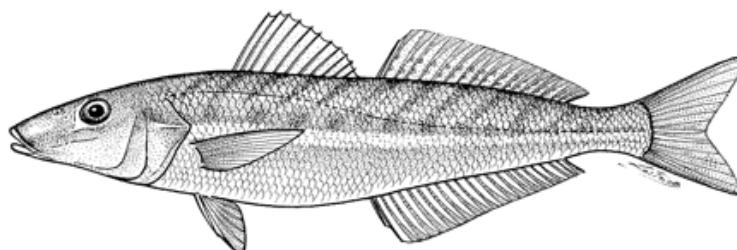


<p><b>Implications for companion species / TEPs / multi-species fisheries</b></p>	<p>The gillnet fishery interacts with Australian sea lions in waters off South Australia. Interactions are mitigated by using trigger limits that close spatial zones for 18 months if an interaction occurs.</p> <p>Dolphin interactions are managed through the GHAT Dolphin Strategy which sets performance criteria for individual operators.</p> <p>To reduce targeting, gillnet operators are subject to a rule that constrains their catches of school shark to 20 per cent of their gummy shark catches.</p>
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Catch and TAC						
Assessment Year	2012	2013	2014	2015	2016	2017
Tier / MYTAC	rollover	rollover	rollover	rollover	rollover	
Stock Status	<BLIM	<BLIM	<BLIM	<BLIM	<BLIM	
SESSF Season	2013/14	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	0	0	0	0	0	
Agreed TAC	215	215	215	215	215	
TAC after unders/overs	215	215	215	215	215	
% TAC caught	90%	94%	84%	96%		



## 32 School Whiting (*Sillago flindersi*)



**Common names:** Red spot whiting, spotted whiting, silver whiting, trawl whiting.

Tier 1 last assessed by SERAG in 2018.

Summary			
<b>Stock Structure</b>	<p>Early genetic studies suggested two stocks with the division between 'northern' and 'southern' stocks in the Sydney – Jervis Bay area.</p> <p>An investigation into stock structure will be proposed to FRDC in 2018.</p>		
<b>Stock status against reference points and trend</b>	<p>Limit Reference = 20% of unfished biomass.</p> <p>Target = 48% of unfished biomass.</p> <p>Stock status: base case estimates spawning stock biomass 47% of <math>B_0</math>.</p> <p>Trend: the most recent assessment estimated the stock to have dropped below the target reference point from 2009 to approximately 39%, and then increased to 47% at the start of 2018.</p>		
<b>ABARES most recent assessment (2016)</b>	<b>Biomass</b> <b>Not overfished</b>	<b>Fishing Mortality</b> <b>Not subject to overfishing</b>	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$1.49 million	<b>% Fishery GVP</b> 3.2%	
<b>Is a MYTAC in place this season?</b>	Yes.	<b>Have breakout rules been triggered?</b>	No

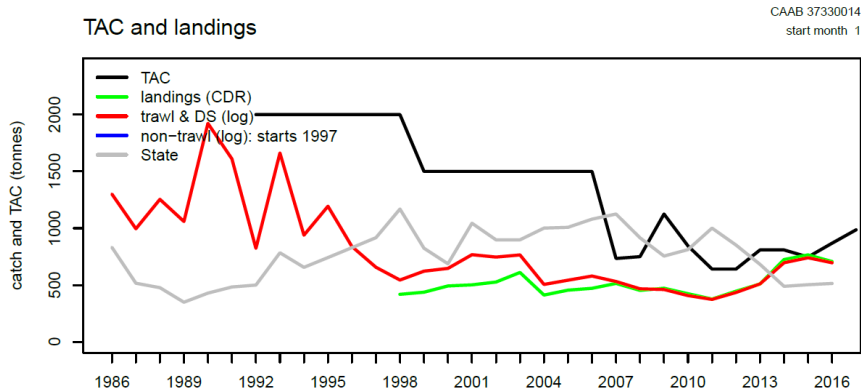
Assessment Summary	
<b>Tier Level</b>	Tier 1
<b>Stock indicator trends</b>	<p>Standardized catch rates have remained above the limit reference point and just below the target reference point.</p> <p>Landings have increased since 2013 with the TAC between 79-83% caught.</p>
<b>Key model technical assumptions/ parameters</b>	N/A
<b>Changes to model structure/assumptions</b>	The current assessment fits four growth parameters, whereas the last assessment only fitted three.

<b>Significant changes to data inputs</b>	New data in the assessment included revised conditional age-at-length data and ageing error based on sectioned otolith readings.
<b>RAG Comments on data</b>	The RAG accepted the close kin assessment model noting high confidence in the absolute estimate of abundance produced by the mode, but accepting lower confidence in the estimates of trend.
<b>RAG Comments on assessment</b>	<p>There were issues with updates to a new version of Stock Synthesis. These issues were rectified, and a final base case was presented to SERAG in December via teleconference.</p> <p>January spawning has been set as the base case with the following sensitivities:</p> <ul style="list-style-type: none"> <li>• July as the spawning month</li> <li>• January as the spawning month with improved growth fits to the model (Day 2017).</li> <li>• Exclusion of catches north of Barrenjoey Head.</li> </ul> <p>The RAG adopted the January spawning and the improved growth curves as the base case.</p> <p>The RAG noted that under the previous long-term RBC the stock declined below the target reference point. This was largely due to below-average recruitment during that time and the proposed long-term RBC was appropriate.</p> <p>The assessment outcome is very sensitive to assumptions about stock structure. Catches north of Barrenjoey Head are used in the assessment, but are not included when calculating standardised CPUE. When the catches are excluded as a sensitivity, the estimated biomass of the stock south of Barrenjoey Head is 39%.</p> <p>SERAG supported an investigation into stock structure. Stock structure work also needs to assess the latitudinal variation in seasonality of spawning.</p> <p>The recent NSW length, age, catch rate and some discard data should be made available for the next eastern school whiting assessment.</p>

RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	1615 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0%
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-year RBC	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation: P < 10%. Alternative Catch Scenarios: N/A	
<b>Research Catch Allowance</b>  <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A.	

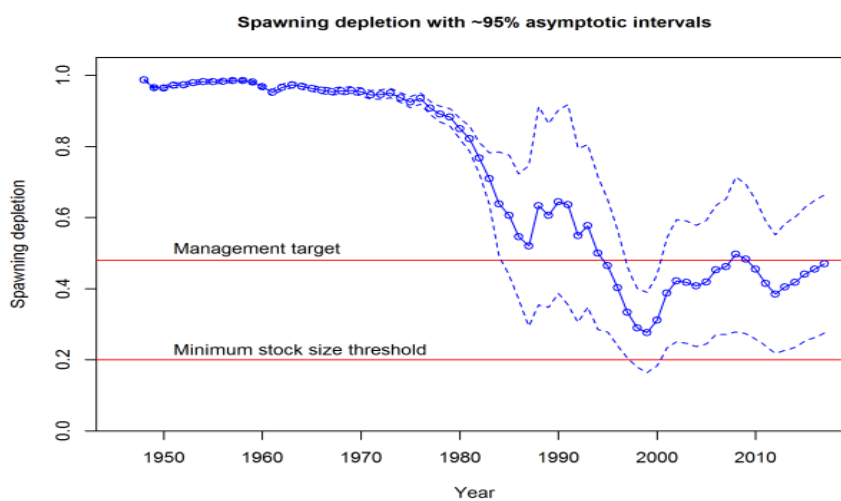
Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	Not assessed	Not assessed	Not assessed	Not assessed	Tier 1	
<b>Stock Status</b>	Not assessed	Not assessed	Not assessed	Not assessed	47%	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	1660 (long term RBC)	1660 (long term RBC)	1660 (long term RBC)	1660 (long term RBC)	1615 (first of 3-year)	
<b>Agreed TAC</b>	809	747	868	986		
<b>TAC after unders/overs</b>	873	790	911	1071		
<b>% TAC caught</b>	91%	93%	79%	69%		

## Catch Trends

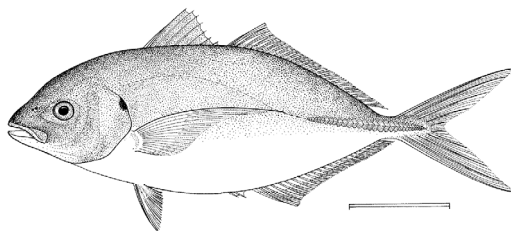


### Tier 1 stock projection - spawning biomass estimates

Spawning biomass depletion for the basecase analysis of school whiting.



### 33 Silver Trevally (*Pseudocaranx dentex*)



Tier 4 last assessed by SERAG in 2017.

Summary																											
<b>Stock Structure</b>	Preliminary research suggests that the Silver Trevally off south-eastern Australia represents a single stock.																										
<b>Stock status against reference points and trend</b>	<p>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% of unfished levels.</p> <p>The limit reference point is 40% of the target reference point.</p> <p>Stock status: In the 2017 Tier 4 assessment the recent average standardized CPUE-based proxy for biomass was between the target and limit reference point.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Reference Years</td> <td>1992-2001</td> <td>Scaling</td> <td>0.5624</td> </tr> <tr> <td>CE Targ</td> <td>0.9026</td> <td>Last Year's TAC</td> <td>588</td> </tr> <tr> <td>CE Limit</td> <td>0.3761</td> <td>C<sub>targ</sub></td> <td>791.278</td> </tr> <tr> <td>CE Recent</td> <td>0.6722</td> <td>RBC</td> <td>445.039</td> </tr> <tr> <td>Wt_Discard</td> <td>11.941</td> <td></td> <td></td> </tr> </tbody> </table> <p>Trend: CPUE has recently declined to between the target and limit reference point having been above the target in 2010 and 2011.</p>			Parameter	Value	Parameter	Value	Reference Years	1992-2001	Scaling	0.5624	CE Targ	0.9026	Last Year's TAC	588	CE Limit	0.3761	C <sub>targ</sub>	791.278	CE Recent	0.6722	RBC	445.039	Wt_Discard	11.941		
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<b>ABARES most recent assessment (2016)</b>	<b>Biomass</b> Not overfished		<b>Fishing Mortality</b> Not subject to overfishing																								
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.24 million		<b>% Fishery GVP</b> 0.5%																								
<b>Is a MYTAC in place this season?</b>	Yes.		<table border="1"> <tr> <td><b>Have breakout rules been triggered?</b></td> <td style="text-align: center;">No</td> </tr> </table>	<b>Have breakout rules been triggered?</b>	No																						
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Assessment Summary	
<b>Tier Level</b>	Tier 4

<b>Stock indicator trends</b>	The size composition of the landed catch shows a trend towards larger fish, but onboard measurements of the retained catch show little change. There is no information on the age composition of the catch in the CTS. CPUE over the last three years has been stable.
<b>Key model technical assumptions/ parameters</b>	The assessment excludes all the data from inside the Batemans Bay MPA. The recreational catch is significant, but as there are no data on trends in the recreational catch the assessment assumes that recent catches are similar to those during the reference period.
<b>Changes to model structure/assumptions</b>	N/A
<b>Significant changes to data inputs</b>	N/A
<b>RAG Comments on data</b>	Tier 4 assessment only uses catch rates outside the Batemans Bay marine park closure. The higher CPUE points from 2010 – 2013 are no longer used to calculate recent CPUE, this has resulted in a decrease in RBC.
<b>RAG Comments on assessment</b>	Discards to be deducted, noting single discard rate applied to total catch. Remove targets for otolith collection and maintain collection of length data to inform any subsequent changes in discards. Catches are well below the TAC. State catches in the last 2 years have been 90 – 147 tonnes with state discards estimated around 20%. The RAG discussed the use of a discount factor, and agreed that consistent with previous years, a discount factor is not required due to protection from the Batemans Bay MPA.

<b>Catch and TAC</b>						
<b>Assessment Year</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Tier / MYTAC</b>	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	
<b>Stock Status</b>	CPUE higher than target	Not assessed	Not assessed	Not assessed	CPUE between target and limit	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	3-year: 791	791	791	791	445	
<b>Agreed TAC</b>	615	602	588	613		
<b>TAC after unders/overs</b>	691	662	645	672		
<b>% TAC caught</b>	13%	11%	8%	8%		

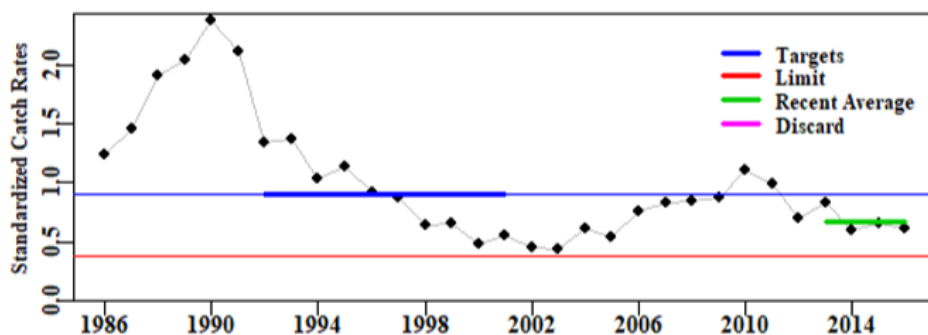
RAG Recommendations		
<b>Recommended Biological Catch (2018-19)</b>	445 t	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> 0% Appropriate protection is afforded by the Batemans Bay marine park closure.
<b>Is a MYTAC recommended for future seasons?</b>  <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes. 3-year RBC = 445 t	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	RBC recommendation: P < 10%. Alternative Catch Scenarios: N/A	
<b>Research Catch Allowance</b>  <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	N/A.	



## Catch Trends

### Standardised Catch Rates

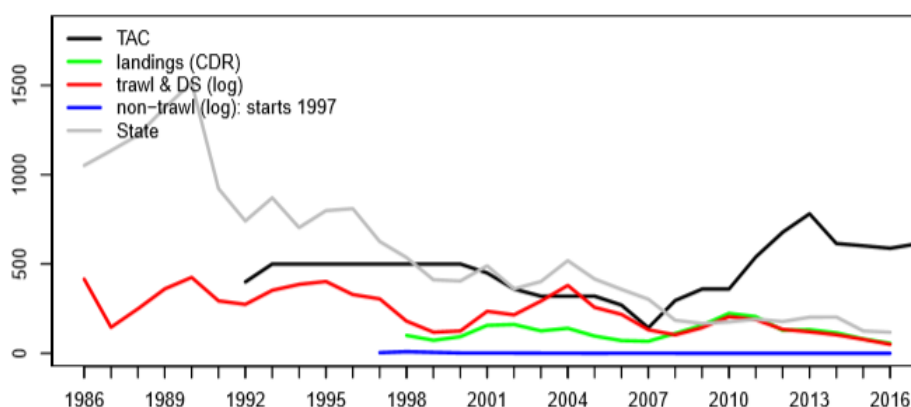
Silver Trevally standardized catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate.



### Catch Trends

TAC and landings

start month 1



## 34 Silver Warehou (*Seriolella punctata*)



ABARES (2012): Line drawing – FAO

Tier 1: last assessed by SERAG in 2018

Summary			
<b>Stock Structure</b>	Considered to be a single stock in the SESSF.		
<b>Stock status against reference points and trend</b>	Current	Target	Limit
	31%B <sub>0</sub>	48%B <sub>0</sub>	20%B <sub>0</sub>
	<p>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<sub>0</sub>.</p> <p>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.</p> <p><b>Figure 15. Time-trajectory of spawning biomass depletion (with 95% confidence intervals) corresponding to the MPD estimates for silver warehou.</b></p>		
<b>ABARES most recent assessment (2015)</b>	<b>Biomass</b> Not overfished	<b>Fishing Mortality</b> Not subject to overfishing	
<b>GVP Figures (2016-17 season)</b>	<b>GVP</b> \$0.45 million	<b>% Fishery GVP</b> 1%	

Is a MYTAC in place this season?	Yes	Have breakout rules been triggered?	No
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Assessment Summary																																														
<b>Tier Level</b>	Tier 1																																													
<b>Stock indicator trends</b>	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).																																													
<b>Key model technical assumptions/ parameters</b>	<table border="1"> <thead> <tr> <th>Parameter</th> <th colspan="2">Details</th> </tr> </thead> <tbody> <tr> <td>Natural mortality (<math>M</math>)</td> <td>fixed</td> <td>0.3</td> </tr> <tr> <td>Steepness (<math>h</math>)</td> <td>fixed</td> <td>0.75</td> </tr> <tr> <td>length-weight scale, <math>a</math></td> <td>fixed</td> <td>6.50E-06</td> </tr> <tr> <td>length-weight power, <math>b</math></td> <td>fixed</td> <td>3.27</td> </tr> <tr> <td>length at 50% maturity (cm)</td> <td>fixed</td> <td>37</td> </tr> <tr> <td>maturity slope</td> <td>fixed</td> <td>-6</td> </tr> <tr> <td>Recruitment deviations</td> <td>estimated</td> <td>1980-2014</td> </tr> <tr> <td>CV growth</td> <td>estimated</td> <td>0.0808</td> </tr> <tr> <td>Growth <math>K</math></td> <td>estimated</td> <td>Female 0.312</td> </tr> <tr> <td>Growth <math>I_{min}</math></td> <td>estimated</td> <td>Female age 2 14.82</td> </tr> <tr> <td>Growth <math>I_{max}</math></td> <td>estimated</td> <td>Female 51.21</td> </tr> <tr> <td>length at 50% selectivity (cm)</td> <td>estimated</td> <td>22.82 (east) 39.87 (west)</td> </tr> <tr> <td>selectivity spread (cm)</td> <td>estimated</td> <td>3.48 (east) 11.24 (west)</td> </tr> <tr> <td><math>\ln(R_0)</math></td> <td>estimated</td> <td>9.379</td> </tr> </tbody> </table>	Parameter	Details		Natural mortality ( $M$ )	fixed	0.3	Steepness ( $h$ )	fixed	0.75	length-weight scale, $a$	fixed	6.50E-06	length-weight power, $b$	fixed	3.27	length at 50% maturity (cm)	fixed	37	maturity slope	fixed	-6	Recruitment deviations	estimated	1980-2014	CV growth	estimated	0.0808	Growth $K$	estimated	Female 0.312	Growth $I_{min}$	estimated	Female age 2 14.82	Growth $I_{max}$	estimated	Female 51.21	length at 50% selectivity (cm)	estimated	22.82 (east) 39.87 (west)	selectivity spread (cm)	estimated	3.48 (east) 11.24 (west)	$\ln(R_0)$	estimated	9.379
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<b>Changes to model structure/ assumptions</b>	<p>The ageing error matrix has been updated.</p> <p>A new tuning procedure has been used to balance the weighting of each of the data sources that contribute to the overall likelihood function.</p>																																													
<b>Significant changes to data inputs</b>	<p>Catches from the gillnet, hook and trap sector and the small pelagic fishery are now included.</p> <p>Estimated annual discard rates that are fitted to by the model have been split into eastern and western components.</p> <p>Factory trawlers are now included in the estimation of annual discard rates when there is observer coverage.</p> <p>FIS abundance indices for east and west fleets are removed from the base-case and are considered as a sensitivity.</p>																																													
<b>RAG Comments on data</b>	<p>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.</p> <p>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.</p>																																													

**RAG Comments on assessment**

**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.

2019: 942 t                      2020: 1353 t                      2021: 1420 t  
 Long-term: 1773 t

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 SERAGs request (Sept 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% $B_0$  in 2021). This was used as the scenario in the 2015 assessment.

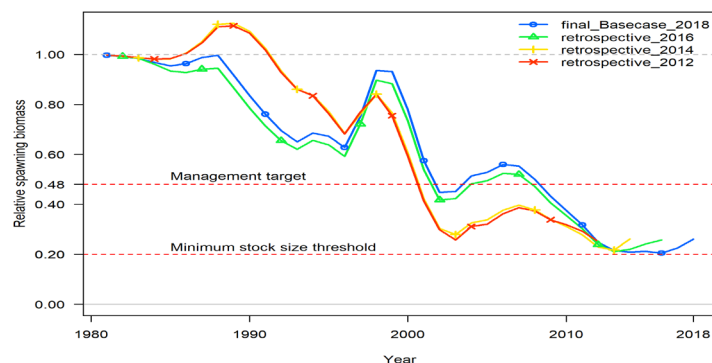
**Mean of the lowest three of the last five years:** spawning biomass stabilises at around 27% $B_0$

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.

Figure 5 (bottom panel). Retrospective analysis of relative spawning biomass. Two years of data were removed from the base case and the model retuned to produce the assessments for 2016, 2014 and 2012 using the same model structure at the 2018 base case



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<sub>0</sub>.

MCMC analysis suggests the probability that depletion was <20%B<sub>0</sub> between 2013 and 2016 was between 68% and 75%.

RBC advice

In forming RBC advice, the RAG 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, the RAG 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.

Catch scenario	mean RBC (t)	mean Discarded (t)	2019	2020	2021	2022	2023
348t	375.0	26.9	28.4%	30.1%	31.4%	32.6%	33.9%
400t	431.1	31.1	28.4%	29.9%	31.0%	32.0%	33.1%
450t	485.3	35.3	28.4%	29.6%	30.5%	31.4%	32.3%
500t	539.5	39.5	28.4%	29.4%	30.1%	30.7%	31.5%
550t	593.8	43.8	28.4%	29.2%	29.6%	30.1%	30.7%
600t	648.2	48.2	28.4%	29.0%	29.2%	29.5%	29.9%
750t	811.8	61.8	28.4%	28.3%	27.9%	27.6%	27.5%
Base case RBC	1334.7	110.3	28.4%	27.8%	25.3%	22.7%	20.4%

Under the low recruitment scenario, catches below 600 t mean the biomass is expected to gradually increase.

**Projected Biomass  
(including confidence  
intervals)**

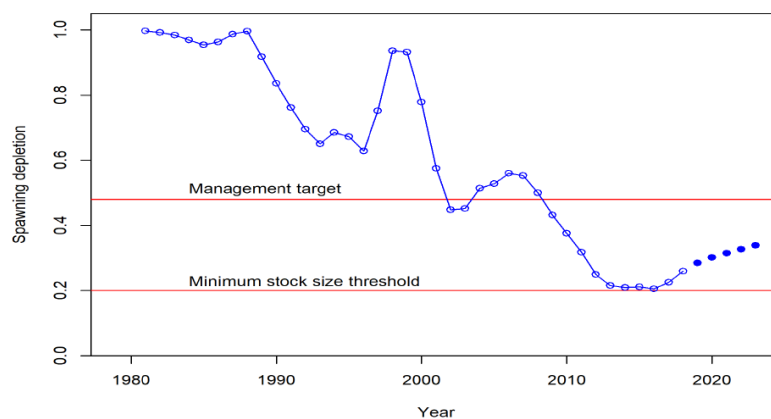
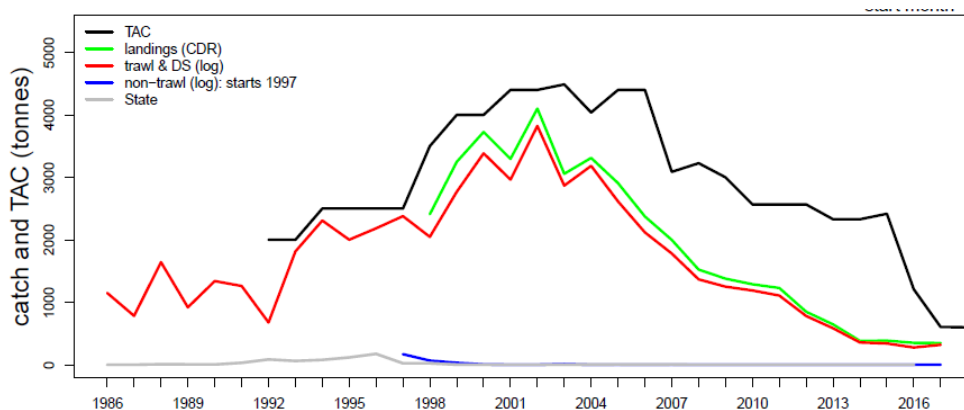


Figure 6 Time trajectory of spawning biomass depletion (with 95 per cent CI) under poor recruitment and catches maintained at current levels.

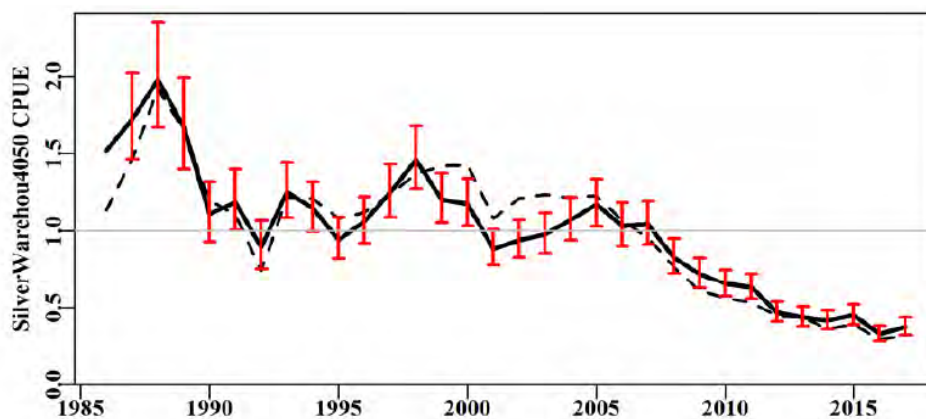
RAG Recommendations		
<b>Recommended Biological Catch (2019/20)</b>	N/A	<b>Undercatch:</b> 10% <b>Overcatch:</b> 10% <b>Discount Factor:</b> N/A
<b>Is a MYTAC recommended for future seasons?</b> <i>Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)</i>	Yes.  Under the low recruitment scenario, catches below 600 t mean the biomass is expected to gradually increase. The RAG recommended setting a 3-Year TAC based on the constant catch scenarios table copied above.	
<b>Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management</b>  <i>Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P&lt;10%).</i>	<b>RBC recommendation:</b>  <b>Alternative Catch Scenarios:</b>  Under the low recruitment scenario, catches below 600 t mean the biomass is expected to gradually increase and the risk of falling below the limit reference point is low.	
<b>Research Catch Allowance</b> <i>Included/Addition to TAC</i>	0 t	
<b>Implications for companion species / TEPs / multi-species fisheries</b>	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.	

Catch and TAC						
Assessment Year	2013	2014	2015	2016	2017	2018
<b>Tier / MYTAC</b>	MYTAC	MYTAC	Tier 1	MYTAC	MYTAC	Tier 1
<b>Stock Status</b>	Not assessed	Not assessed	40%	Not assessed	Not assessed	
<b>SESSF Season</b>	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
<b>RBC</b>	MYTAC	MYTAC	1958	604	604	
<b>Agreed TAC</b>	2326	2417	1209	605		
<b>TAC after unders/overs</b>	2553	2643	1449	716		
<b>% TAC caught</b>	14%	11%	25%	60%		

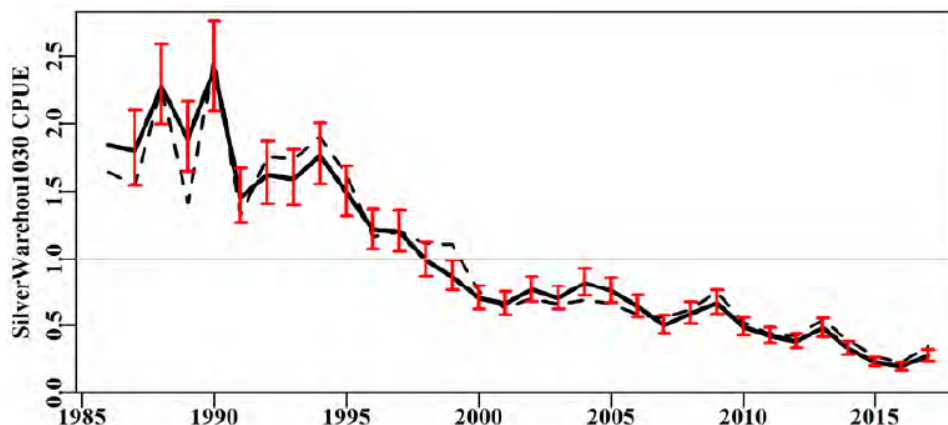
## Catch Trends



### Std CPUE Z40:50



### Std CPUE Z10:30



## Glossary

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**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<sub>LIM</sub> (biomass limit reference point)** – The point beyond which the risk to the stock is regarded as unacceptably high.

**B<sub>MEY</sub> (biomass at maximum economic yield)** – Average biomass corresponding to maximum economic yield.

**B<sub>MSY</sub> (biomass at maximum sustainable yield)** – Average biomass corresponding to maximum sustainable yield.

**B<sub>TARG</sub> (target biomass)** – The desired biomass of the stock.

**B<sub>0</sub> (mean equilibrium unfished biomass)** – Average biomass level if fishing had not occurred.

**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<sub>TARG</sub> (Catch target)** – The target catch level.

**CE<sub>LIM</sub> (CPUE limit reference point)** – the point below which CPUE is too low and can indicate stock depletion.

**CE<sub>TARG</sub> (CPUE target)** – The target CPUE rate.

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

**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<sub>LIM</sub> (fishing mortality limit reference point)** – The point above which the removal rate from the stock is too high.

**F<sub>MEY</sub> (fishing mortality at maximum economic yield)** – The fishing mortality rate that corresponds to maximum economic yield.

**F<sub>MSY</sub> (fishing mortality maximum sustainable yield)** – The fishing mortality rate that achieves maximum sustainable yield.

**F<sub>TARG</sub> (fishing mortality target)** – The target fishing mortality rate.

**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).

**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.