Australian Government
Australian Fisheries Management Authority

Southern and Eastern Scalefish and Shark Fishery

South East Resource Assessment Group (SERAG)

2018 Assessment Meeting #2 – November 2018

14-16 November 2018

CSIRO - Hobart, Tasmania

Minutes

Chair: Mr Sandy Morison

Minutes
Chair: Mr Sandy Morison

DAY 1, Wednesday 14 November 2018

The Chair opened the meeting at 8:45am

Agenda Item 1 – Preliminaries

1.1. Welcome and Introductions

1. Mr Sandy Morison (Chair) welcomed members, invited participants and observers to the meeting including some new participants. There was an apology from Dr Simon Nicol who nominated Dr James Woodhams to attend in his place, on behalf of ABARES.

   The Chair advised there would be some late arrivals and introductions and declarations of interest would be tendered upon arrival. Attendees then introduced themselves and outlined their relevant background and/or experience.

2. The Chair formally notified the RAG that he is stepping down from the role of Chair for SERAG after this meeting.

Name	Membership
Members	
Mr Sandy Morison	Chair
Dr Rik Buckworth	Scientific Member
Mr Ross Winstanley	Recreational Member
Dr Sarah Jennings	Scientific (Economics) Member
Mr John Jarvis	Industry Member
Dr James Woodhams	Proxy for Dr Simon Nicol, ABARES
Mr Simon Boag	Industry Member
Dr Geoff Tuck	Scientific Member, CSIRO
Mr Andrew Penney	Scientific Member, Pisces Australis
Mr Dan Corrie	AFMA Member
Ms Mardi Albert	Executive Officer, AFMA
Invited Participants	
Mr George Day	Senior Manager, AFMA
Dr Ian Knuckey	Fishwell Consulting
Mr Tom Bibby	Industry Member
Mr Patrick Cordue	ISL Solutions, New Zealand
Dr Malcolm Haddon	CSIRO Honorary Fellow
Dr Miriana Sporcic	Assessment Scientist, CSIRO
Dr Robin Thomson	Assessment Scientist, CSIRO
Dr Jemery Day	Assessment Scientist, CSIRO
Dr Paul Burch	Assessment Scientist, CSIRO
Dr Claudio Castillo-Jordan	Assessment Scientist, CSIRO
Mr Kyne Krusic-Golub	Fish Ageing Services

Dr Veronica Silberschneider	Senior Fisheries Manager, NSW DPI
Dr Geoff Liggins	Senior Fisheries Scientist, NSW DPI
Dr Rowan Chick	Senior Fisheries Scientist, NSW DPI
Observers	
Dr Fay Helidoniotis	ABARES
Dr Nastaran Mazloumi	ABARES
Mr Will Mure[1]	Industry
Mr Les Scott	Industry
Mrs Sandra Curin-Osorio	Assessment Scientist, CSIRO

1.2. Declarations of interest

3. The RAG followed the conflict of interest declarations as outlined in Fisheries Administration Paper 12 (FAP12). A list of the full conflicts of interest declarations made is provided in Attachment A and has been updated from the previous meeting. As participants arrived during the meeting, their declarations were recorded.
4. The Chair reminded the RAG of the agreement from the previous meeting: those with potential conflicts of interest are permitted to remain during relevant discussions but would be required to leave the room while RBC advice is finalised.

1.3. Adoption of agenda

5. The Executive Officer advised that the minutes from the September meeting were uploaded to GovDex two weeks ago but acknowledged that further time may be required to review the minutes. The RAG agreed to allow an additional week for members to provide input to the minutes before they are finalised and published to the AFMA website.
6. Agenda item 2 (ISMP Discards and Catch Report) postponed to Day 2.
7. The agenda was adopted, the revised agenda is provided at Attachment B.

1.4. Action items review

8. Prior to the review of action items, Dr Tuck suggested the RAG discuss processes and timing of meetings. The RAG noted:
   - This was discussed at the SERAG September 2018 meeting and action item 16 (2018.09) requires AFMA and CSIRO to work on the issue and report into the SESSFRAG Chair's meeting in 2019.
   - CSIRO's workload between the SESSFRAG data meeting in July/August and the first SERAG assessment meeting in September each year is intensive and it would help to push the first SERAG meeting back by a week or two.
   - The RAG supported the timing proposed and agreed that AFMA and CSIRO would discuss further as part of action item 16 (2018.19).
9. The RAG noted the following updates to action items:

   Action item 2 (2017.11): CSIRO to provide advice on whether data as an input to stock assessments could be reviewed at SESSFRAG data meeting in July/August each year.

[1] Attended the Blue-eye trevalla section

Action item 3 (2017.11): CSIRO to provide advice on whether the most recent year's data needs to be included in stock assessments to give the assessment scientists more time to identify issues.

The RAG noted that the issues raised about timing of meetings and data provision to CSIRO for stock assessments have been incorporated into action item 16 (2018.09). The RAG agreed to mark as closed and remove from the current list.

Action item 7 (2017.11): AFMA to quantify the area of suitable deepwater shark habitat inside and outside closures as a proxy for stock protection.

The RAG agreed that this item remains pending advice from SESSFRAG after Dr Tuck presents the paper about the effects of marine spatial closures in risk/stock assessments to SESSFRAG in March 2019.

Action item 9 (2017.11): SESSFRAG to consider a standard approach to limiting the multiplier value (D/C+1) in Tier 4 assessments where estimated discard rates are high.

The RAG noted that this was included in the basket of issues concerning 'non-assessable' species that includes Tier 4 species with high discards. These issues will be considered by a working group outlined in Appendix A which is available on GovDex. The RAG agreed to remove this item noting it will be addressed by the working group.

Dr Chick commented that NSW DPI will be working more closely with AFMA in future regarding the interaction between NSW TACs and AFMA set TACs. He noted that some actions arising from these RAG meetings may involve further collaboration between AFMA and NSW DPI which they are keen to engage in. The Chair noted this engagement as positive and welcomed the involvement of NSW DPI in discussions at RAG meetings and in other groups where relevant.

Action item 4 (2018.09): AFMA/CSIRO to check whether observations of deepwater shark catch and/or discards are occurring in orange roughy zones (there are no records in the ISMP discards report). Also CSIRO (Paul Burch) to check ISMP strata definitions.

Over the 2016-2018 fishing seasons during the period June - August, for days where vessels recorded orange roughy catch >250kg, there were 1.2 t of platypus shark and 400 kg of brier shark landed, and no records of any discarded deepwater sharks. Observer records appear to be accurate. This action item is complete and will be closed.

Action item 5 (2018.09): AFMA to check pre 2017 observer reported discards of deepwater shark to confirm estimates in the ISMP discard report. Status: done for 2017 and large discard of deepwater shark confirmed as data punching error.

The large discard record of deepwater shark in 2017 was confirmed as a data punching error. All other records appear to be accurate. This action item is complete and will be closed.

Action item 12 (2018.09): AMFA to confirm species identification for southern octopus and giant cuttlefish in the Danish Seine ERA, and provide info to CSIRO.

These species were identified as high risk in the ERA but note that since the SERAG meeting in September 2018, Dr Sporcic has updated the ERA which has resulted in giant cuttlefish being removed from the high risk category and replaced with four other cuttlefish species. Further information will be provided at agenda item 10.

For this action item, species identification could not be confirmed. The observer section in AFMA advised that when observers are unsure of the species identification, the protocol is to record to family name only. Further discussion was deferred until agenda item 10.

Action item 13 (2018.09): AFMA to confirm the protocol for recording unknown species by observers.

The observer section in AFMA advised that when observers are unsure of the species identification, the protocol is to record to family name only. Further discussion was deferred until agenda item 10.

__Action item from SESSFRAG__:

Action item 2 (1.4 SESSFRAG Data 2018): Mr Krusic-Golub to locate methods paper for running a simulation to develop ageing targets and discuss with CSIRO including the general method and the requirements for a single species (initially alfonsino).

Mr Krusic-Golub advised that he located the method paper used as the basis of the early CV analysis and provided a pdf copy to relevant CSIRO staff (Paul Burch, Robin Thompson, Geoff Tuck). CSIRO are reviewing the method to determine if it is still applicable for our application and to provide an estimate of the amount of work required and the potential cost. Initial thoughts are that it is likely still an appropriate method assuming samples are representative of the stock. They are considering whether to exclude the last 6-7 year's data due to issues with ISMP coverage. Alfonsino is generally well observed. This could possibly be included in the data contract between CSIRO and AFMA.

Dr Thomson added that this may not necessarily be the best method and there are concerns about data not being representative, but this approach can be used in the interim until a better method is developed. Mr Krusic-Golub advised that N = 1000 was in the ISMP data collection plan and the age target was borrowed off a like-species, gemfish, and this is likely an appropriate number to proceed with. CSIRO and AFMA will further discuss the contractual arrangements noting that the work required to run the simulations would be part of the data contract for the next period (in 12 months' time).

The RAG agreed to proceed with 1000 age samples for alfonsino as an interim target, pending additional work planned.

10. The list of ongoing action items was updated and is included at Attachment D. The list of action items arising from this meeting is included at Attachment C.

Agenda Item 2 – ISMP Discards and Catch Reports

2.1 Revisions to ISMP Discards and Catch Reports

11. Dr Burch provided an update on the issues raised at the 2018 SESSFRAG data meeting – calculations were requested relating to the estimation of discards within the SESSF. The points below indicate the issue and then Dr Burch's proposed resolution and approach for which the RAG is invited to have input to:

- Do a comparison of Bergh Method A which uses an arithmetic mean with a geometric mean.

  Response: compare arithmetic and geometric mean estimates discarded catches by:

  a. estimating uncertainty (CVs, CIs) using each method.

  b. determining whether Wald based CIs are appropriate, or if bootstrapping should be considered.

- Do an annual time-series of performance of ISMP against achievement of on board strata sampling.

  Response: This will involve two components (1) analyse how well the ISMP targets matched the effort in each strata (i.e. were the targets correctly set), and (2) analyse how well ISMP sampling within each stratum matched the targets for each stratum - effectively a time series version of Table 1 in the ISMP discard report.

- Remove strata with only one sample for the relevant species in data from 2019 onwards.

  Response: Undertake sensitivities on the minimum sample size to include for a strata (note the RAG agreed to minimum of 2), do sensitivities on 3, 5, 8, 10 observations. This was discussed but no recommendations were made. This suggestion was agreed by the RAG.

- Review the rules for accepting discard estimates, including consideration of adopting a rule based on CVs.

  Response: Identify potential bias due to lack of coverage (this will simply compare catch and observer coverage by sector) including removal of observers from GHAT, retrospective application to historical time-series when one component does not have observers and identify poor sampling coverage.

  RAG discussion: it may be useful to separate out the GHAT species from Trawl. For elephant fish, discards are not in logbooks so need to work to get electronic monitoring (EM) to capture discards and consistent on-deck operations. Dr Knuckey noted EM is used to look at discards of school shark, gummy shark and saw shark.

- A CV validity rule to be added to the package of changes to discard calculations for next year. There should be a discussion between CSIRO and AFMA to add additional time in the contract to consider these issues properly.

  Response: Review the validity rules used in the 2017 discard report and the suggestions to improve them to propose validity rules for the RAG(s) to consider in 2019

- CSIRO to include hit rate (proportion of ISMP shots catching that species group) within the discard report for 2019 and graphically present the information on observed discards.

  Response: These will be added to the discard report in 2019.

- CSIRO to ascertain possible methods for calculating total discards/discard rate for all quota and non-quota species and the associated variance on each.

  Response: Report back to the RAG on options for target and bycatch and whether they wish to proceed (also relevant is the EM trial underway in the trawl which may change the approach to estimating an overall discard rate).

  RAG discussion: Start looking at e-logs for reported discards of non-quota species groups including any issues with the use of e-logs and how this data will be used. There is now one year of data for trawlers and four years for gillnetters except for elephant fish.

- Dr Burch advised he will present the updated discards report to the SESSFRAG Data Meeting in 2019 and the results potentially applied retrospectively to the time-series of discard estimates.

Action item 4: Review industry recording of non-quota discard groups in electronic logbooks to identify any reporting issues that require a management response. Consider whether reporting is sufficient to allow fishery wide estimates of total non-quota species discards. (AFMA, Paul Burch and Ian Knuckey)

Agenda Item 3: Pink Ling - Tier 1 Stock Assessment

3.1 Assessment Summary

12. Mr Cordue provided an overview of the Pink Ling Tier 1 assessment:

    - The 2018 assessment is an update of the 2015 assessment and covers two stocks: east and west. New data was added to existing models and (as far as possible) the same methods were applied.
    - Full Bayesian estimation – Mode of Posterior Distribution (MPD) runs for diagnostics followed by Markov chain Monte Carlo (MCMC) runs for final estimates, noting the MCMC results are not that different from MPD results.
    - The main technical problem was dealing with the impacts of trip limits in the east since 2013 (discard estimates and CPUE correction/interpretation),
    - The main new data were Fishery Independent Survey (FIS) biomass indices and length frequencies included in base models, as well as additional composition data and CPUE updates.

13. Points about FIS length frequencies:

    - The FIS length frequencies are stratified by zone and scaled by catch rate (because of various tow durations, catch rate as a proxy for density).
    - For every trawl that was sampled for length, the length sample was scaled by the catch rate for the trawl (number caught/distance towed).
    - Trawl samples not sampled for length were given the scaled length frequency for the relevant zone.
    - They were scaled across zones assuming ‘effective area’ proportional to number of trawls in each zone (LF for each zone scaled by average catch rate * number of trawls).

14. Points about model structure:

    - Same for east and west noting two fisheries: trawl, non-trawl
    - Single-area, two-sex, age-structured
    - Von Bertalanffy growth, single M
    - Fixed maturity and steepness (h=0.75)
    - Spawning stock biomass: female only, mid-year
    - Time-blocked selectivities for trawl (3 time blocks in east, 2 in west)
    - Estimated lots of parameters: B_0, growth, recruitment strengths, M, selectivities

15. Data preparation – east:

    - Length frequencies:
      - Trawl stratified by depth and zone (Z: 10, 20, 30); non-trawl stratified by zone (Z: 20 & 30)
      - Trawl port-based data was not used (no depth information)
      - Non-trawl port-based data was used
    - Age-length data:
      - Trawl sexed data was stratified by zone (Z: 10 & 20); non-trawl was not stratified; used as individual fish

  - Unsexed data from Zone 20 was used as an age-length-key to convert recent LFs to age-frequencies
- Data weighting following Francis method (except age-length was not fully down-weighted)
- New composition data for 2018:
  - FIS (winter, 2008, 2010, 2012, 2014, 2016)
  - East: trawl LFs: 2016, 2017; age-length: 2015; trawl age frequency 2015

16. Data preparation – West:
    - Length frequencies:
      - 2013 data analysis suggested that stratification was not needed
    - Age-length data:
      - 2013 data analysis suggested that stratification was not needed
      - Sexed age-length data used as individual fish
    - Data weighting following Francis method (except age-length not fully down-weighted)
    - New composition data for 2018:
      - FIS (winter, 2008, 2010, 2012, 2014, 2016)
      - West: trawl LFs: 2015, 2016, 2017; non-trawl LF: 2015; age-length: 2015

17. Summary of MPD model runs:

    East: Three variations to the base case were presented:

    - The 'reference' variation includes the CPUE trawl indices, as agreed at September 2018 meeting using an estimated M=0.25
    - The 'period CPUE' variation incorporates CPUE which accounts for avoidance under the SETFIA management arrangements, and M fixed at 0.23
    - The 'linkall CPUE' variation does not account for avoidance in the CPUE and has M fixed at 0.23

    West:

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

18. Dr Tuck reminded the RAG about the issues raised in 2017 where an alternative base case was presented at the second SERAG meeting for the orange roughy stock assessment.
    - CSIRO was criticised for presenting an alternative to what was agreed at the first assessment meeting.
    - Mr Cordue was not present during the discussion last year so is unaware of this issue.
    - Mr Day recalled SESSFRAG advice that alternative base case models can be presented however the RAG needs adequate warning so they can review the papers ahead of the meeting.

19. Mr Cordue provided an outline of the audit trail (also referred to as bridging analysis) with step changes:

	M	B_0 (t)	B_{2015} (t)	B_{2018} (t)	SS_{2015} (%B_0)	SS_{2018} (%B_0)
Mpd15	0.24	5420	1540	-	29	-
Final15	0.24	5380	1510	-	28	-
+ catch	0.24	5380	1460	1650	27	31
+ CPUE	0.24	5390	1520	1680	28	31
Low M	0.20	6910	1320	1450	19	21
High M	0.28	4720	1730	1910	37	40
+ FIS	0.24	5390	1570	1720	29	32
+ comp	0.25	5390	1620	1810	30	34
+ 2 YCS	0.25	5400	1630	1870	30	35

	M	B_0 (t)	B_{2015} (t)	B_{2018} (t)	SS_{2015} (%B_0)	SS_{2018} (%B_0)
Mpd15	0.22	5110	3630	-	71	-
+ catch	0.22	5110	3570	3450	70	68
+ CPUE	0.22	5140	3760	3750	73	73
Low M	0.20	5020	3230	3240	64	65
High M	0.28	6980	6510	6420	93	92
+ FIS	0.23	5310	4130	4160	78	78
+ comp	0.23	5060	3760	3720	74	73
+ 2 YCS	0.23	5410	3810	4730	71	87

Figure 1 East (left) and west (right) audit trails. MPD estimates of natural mortality (M), virgin female spawning biomass (B_0), female spawning biomass in 2015 (B_{2015}) and 2018 (B_{2018}) and stock status in 2015 (SS15 =%B_0) and 2018 (SS15=%B_0)

The RAG noted the following regarding the MPD model runs:

East

- Current stock status is not well estimated. It varies across model runs and is heavily dependent on M.
- Getting an estimate of M is a trade-off between age-length data for trawl and non-trawl.
- The posterior of the western M estimate is used to estimate M in the east with tight priors.
- The best estimate of M comes from the model, however likelihood profiles and confidence intervals suggest that M is not well estimated in the east, even with the tight priors.
- The RAG noted the M value, while poorly estimated, is consistent with what is known about the maximum age of ling and this result is reasonable in that context.

West

- Fits to CPUE showed the model was not estimating 2011 and 2012 year class strengths. However, recruitment from composition data was supported by CPUE and there was no other data to suggest the recruitment was not good in these two years.
- There were very good fits to FIS length frequencies, so the observed LFs must be consistent with the model as they step from year to year.

20. Mr Cordue presented the MCMC results and highlighted key points:

- 10 medium length chains were run instead of long chains noting the first 400 samples were discarded.
- The combination of chains is important - they don't behave the same.
- Detailed chain diagnostics are provided in the report.
- The range of M found by the MCMC is narrow.
- There is some confounding between year class strengths but they cancel out.

The RAG discussed the results of the MCMC estimates in the east:

	M	B_0 (t)	ss_{2018} ($\%B_0$)	P(ss_{2018} < 0.2)	P(ss_{2015} < 0.3)	P(ss_{2015} ≥ 0.48)
Reference	0.25 0.23–0.27	5350 4730–6070	35 25–47	0.00	0.19	0.02
M=0.23	0.23	5900 5540–6450	30 22–42	0.01	0.51	0.00
M=0.20	0.20	7010 6620-7510	24 17-36	0.17	0.86	0.00
Period CPUE M=0.23	0.23	6110 5680–6730	36 28–48	0.00	0.06	0.02
Linkall CPUE	0.25 0.22-0.27	5270 4620-6060	28 19-41	0.05	0.66	0.00

Figure 2 Table of MCMC estimates for Pink Ling eastern stock

- The RBC for the 'reference' model is 450 t however this is not well estimated. The long-term yield is 580 t and is well estimated.
- The 'reference' model does not account for avoidance in the CPUE (so is conservative) and there are issues with estimating M.
- The constant catch projections show that even at 550 t per year, spawning stock biomass trajectory is increasing – with minimal risk at 2020 and 2025 of being below $20\%B_0$.
- Stock status is between 22-48% B_0 based on 3 potential models (reference + 2 alternatives)

21. The rebuilding timeframe to B_{targ} under constant annual catches for the three potential models are shown below:

	Years until rebuild		
Catch (t)	Ref.	M=0.23	Per. CPUE M=0.23
0	4	5	3
300	6	8	6
400	8	12	7
450	11	15	9
500	16	22	14
550	>32	>32	23
Gen time (years)	8.6	9.0	9.0

Figure 3 Table of base models with years until rebuild for Pink Ling eastern stock

22. Catches in 2017-18 were around 540 t and SEMAC has supported a 517 t RBC for the remainder of the 2018-19 season. Mr Cordue suggested 517 t presented little additional risk to a 500 t RBC given the outcomes of projections.
23. The RAG discussed the results of the MCMC estimates in the west:

- The FIS selectivity data suggests poor sampling in the west.
- Spawning stock biomass has increased in the west is currently estimated at $84\%B_0$, noting the last two years could be revised down when more data comes in.

	M	B_0 (t)	ss_{2018}($\%B_0$)	P(ss_{2018} < 0.2)	P(ss_{2018} < 0.3)	P(ss_{2018} ≥ 0.48)
Base	0.23 0.20–0.26	5360 4720–6220	84 69–100	0.00	0.00	1.00

Figure 4 Table of MCMC estimates for Pink Ling western stock

- The 2019 RBC is 1150 t (95% CI: 770-1660 t) with a long term yield of 690 t (95% CI: 550-860 t).
- There is little (or no) risk to the stock to the year 2025 for annual catches of 900 t.
- Current catch including discards is approximately 570 t.
- Mr Bibby advised the quota was not caught in the west this season due to two major vessels not operating.
- Mr Boag advised he is satisfied with the assessment and noted the importance of NSW's engagement and signing-on to the assessment process now and into the future.
- NSW representatives noted the opposed philosophies of choosing a base case and then running calculations versus accounting for a spectrum of possibilities revolving around M, and that the RAG should agree on the approach moving forward.
- Mr Jarvis said it would be useful to review and confirm the reported catches of pink ling by NSW operators. He also noted that Ling catches in the east is improving but is concerned about the avoidance constraint and how that impacts on data going into the models.

3.2 RBC Advice

24. Key points for the east included:
    - The RAG has previously relied on model-estimated M but when it crept up to M=0.26 it was not accepted by the RAG. The increase was caused by the shift to using MCMC and this also changed the shape of the selectivity.
    - The RAG agreed previously that M would be estimated using the posterior from the west which was M=0.25.
    - Estimating M in the east produces some unexpected results (to the upper bounds) so something is not right with the data and needs an informed prior.
    - Mr Cordue suggested it would be reasonable to fix M in the east based on what is used in the West. There is no reason to believe it's different and so the best approach may be to use the western point estimate.
    - There is significant uncertainty in the model scenarios and perhaps this uncertainty is not properly accounted for in the RBC setting process. The Harvest Control Rule (HCR) has been MSE-tested which incorporates uncertainty but this is only relevant if the RAG uses the SESSF agreed HCR when setting RBCs.
    - The Commission wants a specific RBC recommendation from SERAG as the group best placed to provide that advice and consider the models, sensitivities and uncertainties.
    - A previous approach that was well received was providing a 'table of advice' that outlined options with guidance, associated risks and the consequences of each option. However, the RAG should select a base case to go forward with.
    - 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.

25. Industry left the room and the RAG finalised the RBC advice:

Eastern Stock

- The RAG agreed to use the base case reference model (three linked vessels) with a fixed M=0.23 which estimates the current spawning biomass as 30%B0 (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.
- 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 the basis for determining the TAC. It shows probabilities of being below the limit reference point or approaching the target reference point under constant catch scenarios from 0 – 650 t.
- A similar approach was taken in 2015 to provide advice regarding risks associated with setting multi-year TACs at constant catches. The RAG noted there has been an increase in biomass since then and it is reasonable that a similar approach is taken this time.

Table 1 MCMC projection results for the base model (M=0.23) showing the expected SSB in 2021 and 2028, relative to unfished (as %), under different constant catch scenarios with the associated probabilities of being below 20% or 30% B_0 and at or above the target of 48% B_0.

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

- Should the constant catch scenarios be used to consider management options or future TAC recommendations for the eastern zone, constant catches in excess of 550 t lead to a greater than 10 per cent probability of eastern pink ling declining to below the limit reference point by 2028 and substantially increase the time taken to rebuild the stock to the management target.

Western Stock

- The likelihood profile for M suggests 0.23 is appropriate, although there is some conflict between trawl and non-trawl length frequencies.
- The RAG accepts the final western pink ling base case stock assessment noting the estimated current western zone spawning stock biomass of 84%B_0 (69-100, 95% CI), and the 2019 median RBC estimate of 1150 t (770-1660, 95% CI).
- The 2020 and 2021 RBCs were 1060 t and 970 t respectively.

3.3 Species Summary

26. The species summary report was updated and is provided with the minutes.

Agenda Item 4 – Tier 4 Stock Assessments

4.1 Smooth Oreos RBC rollover

27. The RAG considered the proposal to rollover the RBC for smooth oreos and agreed there was no basis for changing advice on this species since the last assessment and there was minimal risk in rolling over the RBC for one further year. 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.

OUTCOME: The RBC for Smooth Oreos will be rolled over into fourth year.

4.2 Mirror Dory

28. Dr Sporcic presented the updated assessment to the RAG which used the previous discard series and included updates for 2016 and 2017. The RAG previously agreed on application of the Tier 4 HCR to the CPUE series to produce the RBCs.
29. The RAG noted the CPUE for this stock is cyclical and is currently low.
30. The RAG agreed to an eastern RBC of 140 t including discards and 95 t in the West excluding discards. The discount factor is 15 per cent.

4.3 Deepwater Shark Eastern

31. Dr Sporcic noted that while there are discards reported, they are not being used in the CPUE series or C_{targ}. She will clarify in the assessment report that this statement does not mean there are no discards. Discards do not get deducted from the RBC.
32. The Tier 4 assessment produced an RBC of 10 t.
33. The RAG discussed key points:
    - The assessment no longer includes catches from the closed areas. While this is a significant change from the last assessment, the resulting RBC is still low. A 10 t TAC is likely to lead to discarding.
    - Industry questioned why the TAC has continued to decrease even after the deepwater has been closed to protect the stock.
    - The CPUE series with and without closures are very similar. They have decreased since the reference period and remained low. Accordingly, the RBC should be reduced to manage depletion.
    - This is not believed to be a highly migratory stock and the question arises as to whether a stock should be managed to a target within areas that remain open to fishing while there are substantial closures in place.
    - Under the revised Commonwealth Harvest Strategy Policy, bycatch species are not required to be managed to a target reference point. The SESSF Harvest Strategy is being revised as part of an FRDC project, however it will be several years before this is implemented.
    - While it is uncertain whether CPUE is tracking abundance, there have been stable catches for six years and CPUE has been stable but low.
    - Noting the low catches and issues with CPUE, one option is to set the TAC at current catch levels until a multi-species harvest strategy is developed.
34. The RAG accepted the results of the eastern deepwater shark Tier 4 assessment and the 2019 RBC of 10 t.

35. The RAG supported a three-year TAC noting because of the bycatch nature of the fishery, a reduction in TAC will likely lead to discarding which will have implications for the CPUE series. Catches and CPUE have been relatively stable over the past eight years, and there would be minimal risk in maintaining catches at current levels.
36. On day 3 of the meeting, Dr Sporcic reported back on further analysis in response to questions from the RAG.
    - After comparing the previous analyses, the values presented are correct and the reason for the CPUE change is due to the scaling factor and the lower indices - the average CPUE and the limit got closer together which reduced the scaling factor substantially. As CPUE decreases, the average across the series decreases as well. CPUE standardisation changes the numbers.
    - The RAG agreed to continue with the existing methodology.

4.4 Deepwater Shark Western

37. Dr Sporcic advised that the analysis excluded discards as agreed at the previous meeting and there were larger catches in the west.
38. The assessment produced a 2019 RBC of 235 t.
39. The RAG discussed noted that the increase in CPUE might be driven by recent access to grounds that were previously closed.
40. The RAG considers a variety of factors when deciding whether to include discards and in this case they were excluded from the CPUE series because they were poorly estimated.
41. For the Deepwater Shark Western stock, the RAG accepted the 2019 RBC of 235 t.

4.5 Species Summary

42. The species summary report was updated and is provided with the minutes.

Agenda Item 5 – Blue Grenadier Tier 1 Stock Assessment

5.1: Assessment Summary

43. Dr Castillo-Jordan presented the updated blue grenadier Tier 1 assessment to the RAG:
    - Discard lengths for 1993, 1995 and 1996 were removed due to poor fits and scaling issues.
    - FIS indices were included for the non-spawning area and selectivity was mirrored in the non-spawning fleet.
    - The base case outcomes for 2018 show that virgin female biomass is 53,909 t compared to 36,815 t in 2013 and the stock status in 2019 is estimated to be 122%B_0.
    - The RBC produced for 2019 is 13,260 t.
    - The size of the stock is likely being driven by the large estimates of recruitment since 2010 which is a positive sign for the stock and fishery.
44. Key discussion points from the updates to the base case included:
    - Concern was raised about the estimated 2010 recruitment in the last assessment. This now appears to be supported by subsequent age/length data.
    - Mr Scott commented that there are no discards in his factory trawler operation.

- Mr Cordue suggested that variable growth rates and cohort-dependent growth in the model may be having an impact on the discard estimates – noting the estimates seem counter-intuitive.
- The risk of exceeding the RBC because the non-spawning fleet do not have the capacity to catch the TAC. i.e. even the undercaught TAC plus discards would not be exceeding the RBC. The RAG noted this issue may arise in future if factory trawlers return and the TAC is close to fully caught.
- If the non-spawning fleet cannot take more than the current catches, a suggestion was made to cap the discards as a proportion of the fresh fleet's catch rate, and assume that catches above this amount do not have any discards.
- Dr Knuckey raised concerns with different rationales for choosing how to estimate natural mortality across different assessments.
- There are good fits to age and length data, as well as to egg and acoustic survey data. CPUE and discard fits are poor and in the longer term, focus should be given to looking at the poor CPUE fit and differences in length distributions for port vs. on-board, and consequent fits.
- Given that the stock is estimated to be above B0 and with predicted catches at F, 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.
- Mr Bibby commented that the maximum TAC for this fishery has been 10,000 t historically. Factory trawlers entered the fishery and it was reduced down to 3000 t. This provided no stability for industry and he would not support the tabling of such a high TAC.
- Industry emphasised the point that if a factory/freezer vessel entered the fishery, it would have no discards.

45. After industry left the room, members discussed the assessment and points raised:
    - There are data to suggest a recent recruitment pulse and given the stock is well above B_0 and projected to take up to 15 years to be fished down to the target under the HCR, there may be economic benefits to higher catches in the short term.
    - Dr Tuck issued a point of caution that recruitment pulses apparent in the assessment model are often not realised in future years and suggested a shorter MYTAC so that recruitment can be monitored. The non-spawning CPUE series is influential and is not fitting well.
46. The RAG accepted the base case noting the potential economic opportunities for industry in adopting a higher TAC. The RAG recommended a 3-year MYTAC using either the yearly RBCs of 13,260 t, 12,238 t and 11,052 t or the three-year average RBC of 12,183 t.
47. The RAG also highlighted the potential implications for the silver warehou bycatch with an increase in effort for blue grenadier. The RAG recommended looking at the proportion of silver warehou bycatch in the fishery, including factory vessel catches. The ratio of silver warehou to blue grenadier is probably lower now than in the past.
48. The RAG discussed the importance of a precautionary approach and monitoring of catches when approaching the RBC. Breakout triggers should provide a level of precaution between assessments.

Action item 1: AFMA to investigate the quantity of Silver Warehou likely to be caught if catches of Blue Grenadier increase under the proposed increase to the RBC. Consider the different fishing and discard practices of wet boats and freezer trawlers and the current status and RBC for Silver Warehou.

5.2 Species Summary

49. The species summary report was updated and is provided with the minutes.

DAY 2, Thursday 15 November 2018

The Chair reconvened the meeting at 8:30am

Agenda Item 6 – Blue-eye Trevalla Assessments

6.1 Blue-eye Trevalla - Tier 4 assessment (slope)

50. Dr Sporcic presented the updated Tier 4 assessment for the slope stock of blue-eye trevalla. The RAG noted the following:

- The assessment is for zones 20-50 and excludes the seamounts.
- Catches from zone 10-83 are included in C_{targ}. Only non-trawl catches from zones 20-83 are included in the CPUE analysis.
- It was agreed at the previous meeting to include catches from the GAB and NSW zone 10 in C_{targ}. Table headings in the stock assessment report will be updated to make explicit what data/zones are included.
- The updated assessment produced an RBC of 439 t. This analysis was completed with a better measure of effort and the previously noted steep decline in CPUE has levelled out now confirming that the 2014 Tier 4 assessment was conservative in nature and that blue eye trevalla are less depleted than the assessment indicated. However the CPUE is still between the target and limit reference points.
- Early records of high discards are likely from trawl. There are no significant discards in recent years from the non-trawl sector and so they are not included in the Tier 4 assessment.

6.2 Blue-eye Trevalla - Tier 5 assessment (seamounts)

51. Dr Haddon presented the updated Tier 5 assessment for the seamount stock of blue-eye trevalla. The RAG noted the following:

- There were issues with catch-MSY projections and questions about whether the median is the best estimate to use. There is inadequate data to use an alternative method.
- Industry have noted it is an episodic fishery because of how far they must travel to fish. 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.
- Dr Haddon recommended ascertaining what ISMP data is available and then considering what further data is required. It is important to link data requirements to trajectory, identify some options for AFMA and make research requirements clear.
- 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.

52. Industry left the room and the RAG made its RBC advice:

- Since a global TAC will be set, the RAG's advice should include management arrangements that ensure catches don't exceed the RBCs for each stock noting the RAG's concern about risks to the seamounts stock.
- 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.
- The RAG recommended 2019 RBCs of 439 t for the slope stock and 36 t for the seamount stock and supported a three year TAC.
- The RAG recommended allowing up to 50 per cent of the combined 3-year RBC for the seamounts (54 t) 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.
- 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.
- The RAG indicated an interest in the close kin project but noted that population dynamics modelling would be required to progress and Tier 4 is insufficient in this regard.

6.2 Species Summary

53. The species summary report was updated. The Chair requested that the final draft of the species summary document be circulated with the minutes for RAG review and input.

Agenda Item 7 – Silver Warehou Tier 1 Assessment

7.1 Updates to the base case

54. Dr Burch provided an overview of the updated Tier 1 assessment for silver warehou noting it is a single sex model split into eastern (10-30) and western (40-50) with natural mortality fixed at 0.3.
55. At its September 2018 meeting, the RAG discussed the discarding practices of factory trawlers questioning whether they discard silver warehou. The fish can't go through fishmeal plants on freezer boats because the flesh oxidises and spoils the other fish. Mr Scott had previously advised they don't discard.
56. Previous discussions have focussed on continued below average recruitment estimates.
57. The changes to the 2018 base case since the September 2018 meeting include:

    - removal of the FIS abundance index from the base case and not estimating recruitment in 2015 (SERAG request)
    - correction of an error in the catch time series that arose from removal of discarded catches in the 2015 assessment
    - updating the catches from 1994 onwards to account for updates to the database made by AFMA. Catches prior to 1994 were retained due to problems in distinguishing silver warehou from blue warehou in logbooks
    - inclusion of catches from the GHAT and the small pelagic fishery (SPF) in the assessment. SPF catches comprised 7 per cent and 14 per cent of total silver warehou catch in 2015 and 2016.

- removal of length frequency data collected from the SPF in 2015 and 2016 (included in the demersal trawl fleets).
- separating the estimates of discarded catch into eastern and western trawl fleets (the 2015 assessment used combined series) and updating time series.
- incorporating discarded catch estimates from factory trawlers into overall discard estimates where these vessels had ISMP observer coverage. Mr Bibby suggested that sometimes the factory boats record silver warehou as retained and then discard later.
- assuming a lognormal error structure when fitting to the estimated discard fractions in the assessment (previously normal errors were incorrectly assumed).

58. The results indicate that fits to CPUE are good in the west but poor in the east. The assumption is that targeting practices haven't changed over time in the standardisation of CPUE. Mr Bibby commented that the large trawlers have left the fishery since the buyout in the west and left with a smaller fleet that catches less. Mr Jarvis added that markets have been lost too (demand dropped) so there is less targeting.
59. The fits to length composition (aggregated over time) show the 2018 assessment is very similar to 2015 assessment. Fits to retained catch in the west are good but in the east retained length distribution is bimodal and fits are poor. It may be worth investigating a deep/shallow split for the east in future assessments.
60. Fits to discards are good in the east but poor in the west. The bimodality might suggest that the splitting of the single fleet into east and west is not completely accounting for the changes in length frequency due to depth. Splitting further into deep and shallow fleets might improve this.
61. The discards are very high in some years and the model doesn't fit very well to the high values, particularly for the east prior to 2002. To get the model to fit the discard series it was necessary to increase the arbitrary CV on the discards from 0.25 to 0.35.
62. The model shows that average recruitment hasn't been observed since 2003 and the last eleven recruitments are below average. This is consistent with the pattern of poor recruitment in the 2015 and 2012 assessments.
63. Under the assumption of average recruitment, the return to target is estimated at approximately 2030 and predicted RBCs under average recruitment are well above current catch levels.
64. Projections under low recruitment indicate that spawning biomass continues to increase but more slowly than the base case. Under the low recruitment scenario, projections show spawning biomass plateaus at 27 per cent of virgin stock biomass between 2019 and 2023.
65. Given the changes to the silver warehou assessment since 2012, a retrospective analysis was undertaken to identify whether this pattern was present with the 2018 assessment structure, data and tuning methods. Key points include:
    - The results for biomass and depletion indicated that the 2018, 2016 and 2014 scenarios all saw increases in estimated stock depletion levels in the final two or three years of the assessment but this pattern was not present in the 2012 scenario.
    - The results for recruitment indicated that the estimated recruitment deviations from the 2014 and 2016 scenarios are revised downwards in subsequent assessments. Recruitments from the 2012 scenario changed little in subsequent assessments.
    - This retrospective analysis corroborates the pattern of overly optimistic recent recruitments and trends in stock depletion levels seen in previous assessments of silver warehou under the 2018 assessment structure, data and tuning methods.
66. Regarding assessment uncertainty, there is a possibility the current spawning biomass is below the limit reference point (LRP). The Tier 1 harvest control rule does not incorporate uncertainty in spawning biomass.

67. An alternative used is Bayesian analyses which can better accommodate the uncertainties relating to models and parameter values but they still remain computationally intensive and require the specification of appropriate prior distributions. In the comparison among MCMC chains, there was very little variability among the 7 chains. Chains mixed well and passed standard diagnostic tests.

68. A comparison of the MCMC versus MLE analyses shows the spawning biomass time-series are virtually identical.

69. Dr Burch summarised the assessment outcomes as follows:

    - The assessment is less optimistic than in 2015 - mostly due to the tuning giving more weight to the CPUE (Francis weighting).
    - Catch and CPUE are at historical low levels and the last 11 recruitments have been below average.
    - The stock was around the LRP from 2013-2016.
    - Noting the uncertainty around the estimated increase in stock size in 2016 and 2017 and assuming that recruitment will return to average, the estimated depletion in 2019 is 31%B_0 with an RBC of 942 t in 2019.
    - Under the ‘low’ and ‘very low’ recruitment scenarios, the stock biomass is predicted to increase or remain stable if current catches are maintained 350 t each year. Under ‘low recruitment’ stock biomass increases more slowly (~ 31% in 2021) and under ‘very low’ recruitment is predicted to stabilise at approximately 27%B_0.
    - The retrospective analysis suggests that the estimated increase in spawning biomass from 2016-2019 may be overly optimistic, possibly due to over-estimating CPUE in recent years.

70. Dr Burch suggested future work should examine the CPUE series for evidence of changes in targeting practices, the retrospective pattern in the assessment and the relationship between depth and the length structure of the catch in the east.

71. The RAG discussed the assessment results and noted the following:

    - There are recurring issues around CPUE indexing abundance and uncertainty about what’s causing the retrospective pattern.
    - There have been changes in the dynamics of the silver warehou stock and recruitment may continue to be below average. Using dynamic reference points may be better, however this is not currently provided for in the SESSF Harvest Strategy.
    - There was agreement that the assessment is robust enough to provide RBC advice, however alternative low recruitment scenarios should be considered.
    - Previously the RAG chose to use the recruitment scenario using the mean of the last 5 years (low recruitment).
    - Industry members noted that there has been an increase in the jellies observed over the last 2-3 years in the east and west, which silver warehou feed on.

72. Industry left the room while the RAG finalised the RBC advice. The RAG noted the following:

    - Consistent with the previous approach, the RAG agreed to use the low recruitment scenario (with the mean of the last 5 years).
    - There may be an increase in silver warehou caught as a bycatch species in the blue grenadier fishery if blue grenadier catches increase.
    - There is a recurring pattern in the retrospective analyses that shows an overly optimistic trend in biomass estimates in the most recent 2 or 3 years of the assessment.

- The issue of a regime shift should be considered further for silver warehou, but also for other species where appropriate (e.g. jackass morwong) including appropriate use of dynamic reference points. This will be referred to SESSFRAG and could be considered as a research priority.
- To assist SEMAC in setting the TAC, the RAG agreed to provide constant catch projections under the low recruitment scenario for 348 t, 450 t, 500 t, 550 t, 600 t (close to current TAC), 750 t and the RBC from the base case model which assumes average recruitment.
- Under constant catches of 348 t the stock slowly rebuilds to target then levels out. The figures in the table below are landed RBCs and discards do not need to be deducted to calculate the TAC.
- Projections indicate that at 750 t, the stock starts to decline and the RBC will hit the LRP by 2023. Catches at 348 t allow the stock to rebuild under the low recruitment scenario whereas catches at the current TAC (around 600 t) causes a decline.
- A 600 t TAC does not allow for adequate rebuilding and the RAG did not support the RBC at this level.
- The RAG requested Dr Burch include projections for 400 t, 500 t and 550 t in the table of advice and to include discards figures for clarity. The table below was not presented at the meeting but is provided in the minutes for clarity, and will be available in the final Silver Warehou assessment report.

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%

Action item 2: Request SESSFRAG consider the issues associated with regime shifts in stock assessments including: (1) use of dynamic reference points (including triggers), (2) how this analysis may then feed into the longer term multi-species harvest strategy/project, (3) issues relating to the Jackass Morwong productivity shift.

Agenda Item 8 – Jackass Morwong Tier 1 assessment

8.1 Jackass Morwong - West

73. Dr Day presented the updated western jackass morwong assessment and noted the following key points:

- A revised spawning stock biomass for 2019 of 68%B_0.
- Revisions to the assessment included growth parameters updated to match the new 2018 eastern parameters (estimated) and the removal of 1994 discard length frequencies.
- Only one additional year of recruitment was estimated despite three more years of data (insufficient information to estimate more recruitment events).

- New data resulted in revising recruitment estimates upwards for 2009-2011, with above average recruitment in 2012 and the last five years of estimated recruitment are now above average (compared to three out of the last five years for the 2015 assessment).
- Recent recruitments are sufficiently well estimated, but still with considerable uncertainty.
- Updated data suggest a change in trajectory for female spawning biomass and that the stock was below the target reference point for a number of years.
- The revised estimate of female equilibrium spawning biomass in 1986 was 1,371 t (1,501 t in 2015 assessment) and the female spawning biomass is projected to be 934t in 2019.
- Dr Day suggested the Tier 1 assessment for the west is very uncertain due to limited and unrepresentative sampling.

74. The following sensitivities were performed:

  - *M* = 0.1 and 0.2
  - *h* = 0.6 and 0.8
  - 50% maturity occurs at length 22 cm
  - σ_R = 0. 65 and 0.75
  - Estimate growth parameters
  - Double and halve the weighting on the length composition data
  - Double and halve the weighting on the age-at-length data
  - Double and halve the weighting on the CPUE series
  - No FIS abundance indices
  - FIS length frequencies (+ FIS abundance indices)

75. Results from sensitivities indicated:

  - the assessment is most sensitive to natural mortality, *M*
  - estimating growth improves likelihood profiles – but poor growth curve
  - changes to the other fixed parameters result in little change to the overall likelihood and only minor changes to the depletion estimates
  - changing the weighting on various data sources has only minor impacts on the depletion estimates – more for age and CPUE than for length
  - there is conflict between the discard likelihood and other components
  - including the FIS makes little difference (mostly due to the short time series of the FIS).

76. RBC estimates for the provisional base case are below:

  - 2019 1-year RBC: 235 t
  - 3-year RBC: 235 t, 223 t, 211 t (mean 223 t)
  - 5-year RBC: 235 t, 223 t, 211 t, 201 t, 192 t (mean 212 t)
  - Long term RBC: 158 t
  - Reaches target reference point (B_{48}) by 2040 (assuming average recruitment)

77. Dr Day noted the following:

  - Length and age data may not be representative and improved biological sampling would help. The results should be treated with considerable caution.

- 2011 and 2015 length data should be reviewed as part of the next assessment.
- The 2015 assessment estimated the biomass had remained above the target reference point however the 2018 assessment estimated a strong recovery from below the target reference point in 2012 to well above the target reference point in 2019.
- In analysing the CPUE series, Sporcic and Haddon (2018) noted the vessel factor changed its influence from 2001 onwards, suggesting a change in the fishery at that time.
- Fits to the FIS abundance are poor however the trend in FIS abundance indices looks clear.

78. The RAG noted the following:
    - Industry suggested that poor fits to the FIS may not be surprising since the FIS is undertaken in winter when this is a summer aggregating stock.
    - While it was noted in the bridging analysis at the September 2018 meeting, the RAG suggested there is a need to better understand what factors in the updated assessment have caused the estimate of biomass to fall below the target reference point prior to 2012.
    - The RAG suggested including some context about what drove uncertainty in the assessment noting that the confidence intervals alone don't explain what drove the uncertainty.

8.2 Jackass Morwong East

79. Dr Day provided an overview of the updated eastern jackass morwong Tier 1 assessment:
    - There are six fleets in the east and natural mortality is fixed at 0.15.
    - Recent recruitments are sufficiently well estimated, but still with considerable uncertainty.
    - Only one additional year of recruitment estimated despite three more years of data (insufficient information to estimate more recruitment events).
    - New data resulted in revising several of the recent recruitment estimates upwards, with the last four recruitment events now estimated to be close to average recruitment.
    - Seven of the last nine recruitments are estimated to be below average (compared to eight of the last eight years for the same period in the 2015 assessment)
    - The CPUE fits to eastern trawl are good with a small increase at the end of the series (not for TAS trawl).
    - There was a productivity shift in 1988 and this was accepted in the assessment for the eastern stock when the last assessment was run.
    - The female equilibrium spawning biomass in 1988 is 3,523 t (compared to 3,977 t in 2015 assessment) and the female spawning biomass is projected to be 1,237 t in 2019 and 35%B_0 (previously 37%).
80. Dr Day questioned whether the productivity shift could be modelled in a better way using something other than the step function. This can be considered as part of the broader work to consider regime shifts/productivity shifts (under action item 2). This issue is noted as a form of uncertainty in this assessment.
81. The following sensitivities were performed:
    - M = 0.1 and 0.2
    - h = 0.6 and 0.8

- 50% maturity occurs at length 22 cm
- σ_R = 0. 65 and 0.75
- Double and halve the weighting on the length composition data
- Double and halve the weighting on the age-at-length data
- Double and halve the weighting on the CPUE series
- No FIS abundance indices
- FIS length frequencies (+ FIS abundance indices)

82. Results from sensitivities indicated:
    - most sensitive to natural mortality, M.
    - changes to the other fixed parameters produce little change to the overall likelihood and only minor changes to the depletion estimates.
    - changing the weighting on various data sources has only minor impacts on the depletion estimates – more for length and CPUE than for age.
    - conflict between the discard likelihood and other components.
    - Including the FIS makes little difference (mostly due to short time series).

83. RBC estimates for the provisional base case are below:
    - 2019 1-year RBC: 261 t
    - 3-year RBC: 261 t, 271 t, 280 t (mean 270 t)
    - 5-year RBC: 261 t, 271 t, 280 t, 288 t, 296 t (mean 279 t)
    - Long term RBC: 356 t
    - Reaches target reference point (B_{48}) by 2045 (assuming average recruitment)

84. Dr Day noted the following:
    - There are good fits to CPUE, length and age data.
    - Fits to FIS are poor however the trend in FIS abundance indices looks clear.
    - There are limited recent data and the results should be treated with caution. Representative biological data should be a key focus.
    - The 2015 assessment estimated a decline in biomass in the years leading up to the assessment, however the 2018 assessment estimates a slight recovery in the last four years.
    - Seven of the last nine recruitment events are estimated to be below average.
    - The structural adjustment altered the effect of the vessel factor on the standardised CPUE. However, log(CPUE) has also changed in character from 2014-2017, with spikes of low catch rates arising (Sporcic and Haddon 2018).

85. The RAG noted the following:
    - The lack of representative data is impacting on the assessment.
    - The estimated stock status is sensitive to values for M and there is uncertainty in M, as highlighted by the sensitivity tables. Sensitivity to M is an ongoing discussion topic for the RAG.
    - A sensitivity with the recruitment shift removed was run during the meeting. There was some doubt about whether it would be a ‘plausible’ scenario.

8.3 RBC Recommendation

West

- Noting the uncertainty in the assessment, the RAG accept the base case and recommends 3-year RBC of 235 t, 223 t and 211 t or the average 223 t each year.

East

- The RAG accepts the base case assessment and recommends a 3-year RBC of 261 t (2019), 271 t (2020) and 280 t (2021) or the average 270 t each year
- While the assessment is more robust in the east, the outcome is heavily dependent on the assumed value of natural mortality. The RAG noted the question around the use of a step function to model the regime shift in this assessment.

Combined

- The combined RBCs for each year are 496 t (2019), 494 t (2020) and 491 t (2021) with a three year average of 494 t each year.

Agenda Item 9 – Orange roughy RBC advice

9.1 Industry Proposal

86. Mr Boag provided an overview of the industry proposal to limit orange roughy catches below the RBC in the eastern zone. He recalled that last year, SERAG provided a number of recommendations to the Commission based on two base case assessments. The Commission was uncomfortable setting any more than a single year TAC without further advice from the RAG and this caused issues for industry from an economic certainty perspective. He suggested providing clearer advice would make the decision making process easier for the Commission.
87. Two models were presented to the Commission; a high productivity model with a 2018 RBC of approximately 1400 t and a low productivity model with a 2018 RBC of approximately 700 t. The industry proposal considered the two scenarios and proposed a 900 t RBC for the final two years of the three-year MYTAC. This was closer to the low productivity model and creates more certainty for industry. Mr Boag emphasised that uncertainty is very hard for industry to deal with. Industry doesn't necessarily want a higher TAC, they want good science that provides better certainty and noted that by the next assessment there will be more data including another Acoustic Optical Survey (AOS).

9.2 Risk Assessment – Deterministic Projections

88. Dr Tuck provided some background on eastern orange roughy and the development of a cross-catch risk assessment based on the model structure of Haddon (2017). A cross-catch risk assessment is done when there is uncertainty around which model structure to proceed with in the stock assessment.
89. Dr Tuck made the following points:
    - As part of the 2017 Tier 1 stock assessment, Dr Haddon completed a likelihood profile analysis that estimated an M value lower than what was being used in the previously agreed base case assessment. The value of M used in the final base case (0.036) was not the lower value chosen for this risk assessment (which was selected as the most likely value based on the likelihood profile).
    - In this cross-catch risk assessment, two models were considered that differ only by the assumed value of natural mortality, M=0.04 (base case) and M=0.032. The alternative value for natural mortality was chosen to define a low productivity model, and used the value with highest likelihood from the likelihood profile of Haddon (2017).

- The deterministic projections presented here consider the risk to the stock under various catch scenarios by taking the projected catches from the alternative base cases and the fixed 3-year catch series proposed by industry and input to the two model structures. The outcome is six projected catch scenarios.
- Results showed that the low productivity model (M=0.032) with catches from the higher productivity model (M=0.04) had the lowest long-term biomass series.
- The differences between biomass trajectories across catch series were minimal within a model structure. For example, by 2025, the depletion ranged between 0.40 and 0.42 for the M=0.04 models, whereas the depletion ranged between 0.31 and 0.34 for the M=0.032 model (Figure 5).
- The Industry proposed catches showed little difference from the model trajectories with the corresponding model catches. This is not too surprising as the catches return to the standard HCR after the three years of industry proposed catches.

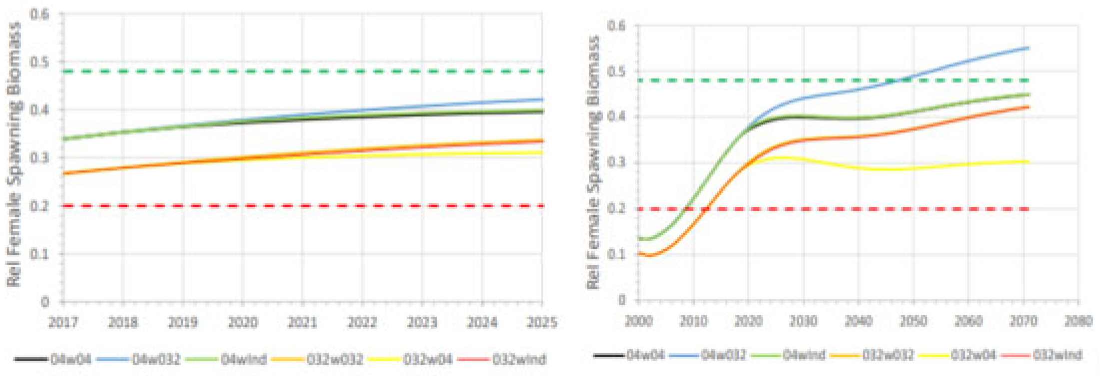


Figure 5 The relative female spawning biomass for eastern orange roughy under each of the six catch scenarios up to 2025 (left) and 2070 (right)

90. The RAG discussed the results noting that the next assessment for orange roughy is scheduled for 2020 and results from another AOS survey should be available by then:
    - The current TAC is 698 t.
    - The results indicate that the risk of continuing with the RAG's proposed 3-year MYTAC for the next two years is very low.
    - Industry has an interest in this RAG investigating and getting M right so allowing another 2 years in order to do that will be useful for the RAG.
    - There appears to be no reason to shift from M=0.04 in the short term because the consequences of getting it wrong are not severe.
    - Mr Cordue noted the suggestion to hold a joint Australian/New Zealand workshop to explore and address common issues with orange roughy assessments, including natural mortality and stock recruitment relationships (action item 3). The RAG agreed that if this went ahead, a significant amount of work should be done in the lead up to the meeting to make it worthwhile.
    - Commissioner Sainsbury commented that this new analysis was what the Commission was looking for. They were trying to understand the consequences of setting high catches under a low productivity scenario and this analysis responds to the concerns they had with the original advice.
    - Mr Boag reiterated that industry is looking for certainty.
91. Industry members left the room while the RAG finalised its RBC advice. Discussion included:

- Between now and the next assessment, more age data can be collected for inclusion in the models. The joint workshop with New Zealand will be valuable, noting they will have much more data this time.
- The RAG agreed to advise the Commission that there is low risk of stock depletion associated with the industry proposal and while lower than SERAG's recommendation, it doesn't increase the risks. The RAG upheld its original RBC advice based on the base case assessment (M=0.04 with h=0.75) and noted that adopting a TAC based on the industry proposal represents little risk to the stock in the short term.
- The RAG recommended the following timeline of activities for the coming three years to improve understanding and feed into the next assessment:
  - Undertake an MCMC analysis over the first six months of 2019.
  - Undertake the acoustic survey in 2019.
  - Undertake the stock assessment in 2020.
  - Hold the joint Australian/New Zealand orange roughy data workshop prior to the 2020 assessment.
  - Then after 2020, proceed to undertake an MSE analysis/proposal noting this would require dedicated staff and budget allocation.
  - The RAG noted the importance of increasing the collection of age composition data.
- The Chair noted the good work done by Dr Tuck in completing this analysis. The RAG noted that there is a low risk of taking catches associated with the base case even with mortality as low as M=0.032.

> **Action item 3:** AFMA to approach NZ Fisheries regarding the holding of a joint Australian/New Zealand workshop to address common issues with Orange Roughy assessments, including natural mortality and stock recruitment relationships.

Agenda Item 10 – ERA Assessments

10.1 Otter Board Trawl ERA Assessment

92. Dr Sporcic advised there had been revisions to the otter board trawl ERA presented to SERAG in September 2018 because of an update to the database which contains the attributes used in the assessments. The most significant changes were to the SAFE results
93. Dr Sporcic presented the list of (potentially) high risk species from the updated analyses (Attachment E).
94. The RAG noted the following with regards to the PSA assessment:
    - Identifying octopus and cuttlefish to species level is difficult. Cuttlefish are found at different depths and if logbook data exists, they can be identified by depth.
    - Under the Integrated Scientific Monitoring Program (ISMP) if the observer can't accurately identify the species, they are recorded to family level. If the RAG identifies that certain species or groups are high risk then observers can be asked to undertake targeted species identification.
    - The catch of Gould's squid is well below the trigger of 2000 t. The trigger was set by SquidRAG and is not a stop fishing trigger.

- Mr Boag clarified that the analysis uses relatively low resolution fishing effort footprints and - fine-scale analysis are difficult. There was a query- about how representativeness of spatial data was used in the assessments. One option would be to consider moving to eSAFE which incorporates spatial intensity. This will be raised at the SESSFRAG Chair's meeting.
- Given the difficulty with assessing some of the SESSF Tier 4 species, the RAG questioned whether an ERA might be an appropriate alternative.

Action item 5: Refer question to the technical WG – should Tier 4 species be included in Ecological Risk Assessments, noting there are some issues around assessing particular Tier 4 species (i.e. those in the 'not assessable' basket).

95. The RAG noted the following with regards to the bSAFE assessment:
    - The southern sleeper shark is large in size and has a wide distribution. The Patagonian tooth-fish boats are known to catch them. While catches in the CTS might be low, the risk remains high because of issues with reporting catches to the family level.
    - Whitefin swellshark is high risk because of low productivity and the default low post-capture mortality score for byproduct species. This species is largely discarded and post capture mortality is believed to be low.
    - The four species protected under the Upper-slope Dogfish Management Strategy (greeneye spurdog, Harrison's dogfish, southern dogfish and endeavour dogfish) are all high risk. Under the Strategy, 25 per cent of their key habitats are closed to fishing. While there seems to be a logical inconsistency between management arrangements and the outcomes of risk analysis, there are species identification issues with these sharks and so determining the level of interaction (landed and discarded) is difficult.
    - The RAG suggested the level of assessment undertaken to determine closures under the Strategy should be recognised in the residual risk assessment.
    - There should be a focus on mitigating the risk to skates and rays in the SESSF Fisheries Management Strategy.

Action item 6: Ian Knuckey to provide Miriana Sporcic with information regarding use of habitat closures in the upper slope dogfish management strategy as a proxy for stock protection. Info to be used in residual risk assessment for greeneye spurdog, Harrison's dogfish, southern dogfish and endeavour dogfish. Provide the rationale/justification for reducing the ERA risk ratings of white warehou, whitefin swellshark, Gould's squid, gulper sharks and southern sleeper shark, to feed into the residual risk analysis.

10.2 Danish Seine ERA Assessment

96. Dr Sporcic presented the list of (potentially) high risk species from the updated PSA analysis. The RAG noted the following:
    - The high risk species in the Danish seine ERA are - cephalopod species.
    - Species identification is an issue and it would be worthwhile getting an expert such as Ken Graham down to Lakes Entrance to assist with species identification of octopus and to improve knowledge of observers.

Action item 7: Refer to the ERA Technical working group: consider providing better guidance to observers to address species identification issues for cephalopods in order to assist with future ERAs.

- AFMA suggested this could be captured in the bycatch and discard workplan and noted that the species will remain high risk until there is sufficient information to review the results.
- The RAG agreed that the ERAs will be finalised out-of-session by a smaller group i.e. AFMA, Miriana Sporcic and Ian Knuckey.

Agenda Item 11 - SESSF Annual Research Statement 2020-21

97. Mr Corrie outlined the purpose of the SESSF Annual Research Statement noting that it is updated each year to reflect research priorities, in this case for the period 2020-2021. The RAG can make suggestions for inclusion and it then will be finalised at SESSFRAG in February/March 2019 before it is submitted to the AFMA Research Committee and the Commonwealth Research Advisory Committee for consideration.

98. The RAG discussed the following points in considering options for inclusion:

    - The issues around industry recording of discards do not need to be included as it can be added to other work AFMA is progressing with.
    - Investigation of options for use of dynamic reference points for SESSF species that indicate long term productivity change or trends. This needs to consider the implications for harvest strategies and other multi-species work.
    - For addition to the ‘future work’ section noting timing of early 2020: analysis of orange roughy assessments issues and the choice of parameters for natural mortality and steepness including the holding of a joint workshop between Australia and New Zealand.
    - The suite of issues with orange roughy and the review of M – while this has been looked at many times before and there is the risk of rehashing the same analyses. New Zealand are now collecting much more age data. Mr Cordue noted the issue of how to estimate M in the models has not been looked at for a long time. There would need to be time to allow for analysis of New Zealand age data and to coordinate a workshop with New Zealand Fisheries.
    - There would be value in obtaining blue-eye trevalla lengths through electronic monitoring on hook boats. This is important and can be extended to other species later on. AFMA needs to finalise the SESSF data plan, which will be partly driven by policy requirements, before deciding what other data is needed.
    - The RAG’s role is not to dictate how electronic monitoring is administered, rather to establish data needs. The data plan should be updated at the SESSFRAG data needs workshop in 2019. The RAG agreed that collecting size composition data for blue-eye trevalla on seamounts should be added to the SESSF data plan.

Action item 8: Incorporate data collection for blue-eye trevalla (seamounts) into the data plan.

- Mr Cordue suggested there is value in undertaking intersessional work to determine the full extent of the structural adjustment and the impact on CPUE. Dr Tuck supported this suggestion and notes this has been raised before. Dr Tuck suggested any CPUE analysis should involve consultation with Dr Malcolm Haddon.

- Implementing the SMARP recommendations is crucial. It was noted that a SMARP implementation plan is in place and this will be reviewed as part of the declining indicators workshop in February 2019. There are a number of projects underway with a lot of pressure on resources at AFMA. Dr Knuckey flagged his concern that RAG priorities and requirements with regards to data requirements will not be factored into AFMA's ICT transformation project.

- Mr Corrie outlined the proposal to submit a joint industry proposal with SETFIA to develop a monitoring program for western roughy in the CTS. It will be a similar approach to the GABT Orange Roughy Research Plan whereby research quota is allocated under scientific permits with targeted data collection. The RAG supported this approach and agreed to review a proposal in September 2019.

Action item 9: Daniel Corrie and Simon Boag to develop a western roughy research plan and present to SERAG in September 2019. Consult Rudy Kloser.

- Dr Liggins asked the RAG to consider observer coverage for the NSW Southern Fish Trawl area which is expected to be absorbed into the Commonwealth. There is an opportunity for temporary observer coverage to establish the catch and species mix of flathead and to better understand the selectivity of the fleet. CSIRO noted it would be useful to collect discard rate estimate for the zone. It was noted that this zone would become a new stratum for the observer program.

- Mr Corrie noted the school whiting stock structure proposal and the quantification of bycatch and discards in the SESSF proposal had recently been supported by FRDC.

99. Dr Knuckey noted his conflict of interest and referred to his proposal to review inter-survey variation in the FIS.

    - One of the reasons the FIS was put on hold for 2018 were due to the high costs and the inter-survey variation in abundance for some key species.

    - The proposal is to have a forensic look at the data to better understand these issues and to assess other factors like ocean currents and environmental factors and their impact on inter-survey variation.

    - A decision will be made in February 2019 about whether the FIS will be discontinued and this work will be valuable in making an informed decision.

100. The RAG noted the following:

    - If the inter-survey variation can be explained then it could be standardised for.

    - There are approaches to including sensible trends through a highly variable time-series such as the Bayesian probability approach using covariates taken by the USA with marine mammal surveys.

    - Noting that the fishery only has about 30 trawl boats and declining revenue, Mr Boag recognised that the FIS is expensive and does not provide a useful index of abundance in its current form.

    - Dr Liggins suggested considering the timing of the surveys and intensity which might spread costs but still render the data valuable to the time-series.

- Mr Bibby suggested broadening the efforts and costs to include other relevant departments (e.g. Department of the Environment, IMOS) to spread the costs.
- There has been a significant investment into collecting the data for the time-series and it would be a shame to waste that and not try to make better use of the available data.
- In the scaled back form now it's not providing an index for all species. It is important to consider what the FIS has been able to do well.
- Mr Cordue commented that future points in the time series are important so stock assessments can be done in the absence of commercial CPUE.

101. After members with conflicts of interest left the room, the RAG prioritised the list of research projects noting the following points:
   - The RAG supported the proposal from Dr Knuckey with the caveat that it would need to be implemented outside of the research cycle, in order to feed into the February 2019 meeting.
   - For the project to investigate options for use of dynamic reference points for SESSF species, Mr Penney will assist with writing the scoping document to accompany the submission to COMRAC. The RAG noted his previous involvement in this work and his desire to be involved in future.
   - Due to time constraints, the RAG noted the final research statement would be circulated with the minutes.

---

102. The Chair noted that with time running out, Dr Sporcic's FIS presentation could not be presented but suggested it be circulated for RAG comment out-of-session. Members suggested putting some key points with the presentation and members could comment. Dr Sporcic's report will be finalised ahead of the February 2019 meeting.

Agenda Item 12 – Rebuilding strategy reviews

103. Due to time constraints, the RAG only discussed the blue warehou rebuilding strategy.

104. Mr Corrie highlighted key points from the report and advised there were unusually high discards in 2017 and the 2013 assessment suggested the biomass was under 20%. Dr Burch will compare CDR data and logbook discards. The updates will be made after the meeting and circulated with the minutes.

> **Action item 10:** CSIRO and AFMA to investigate the apparent high discards of Blue Warehou as indicated in the Blue Warehou rebuilding strategy report.

105. Mr Day noted Mr Morison's notification that he would be stepping down from the role of chairperson after this meeting and on behalf of the RAG, thanked him for his great service to this and other RAGs over the years. CSIRO and other members added their appreciation.

106. The Chair thanked all attendees and closed the meeting.

Attachment A

List of member and invited participants declarations of interest

Updated as at November 2018

Member	Declared Interest
Mr Sandy Morison (Chairperson)	**Director** of Morison Aquatic Sciences. **Chair** of SharkRAG, SERAG and the Tropical Rock Lobster WG. **Scientific member** on SEMAC. Contracted by government departments, non-government agencies and companies for a range of fishery related matters including research and (by SCS Global Services) for MSC assessments of AFMA managed and other Australian and international fisheries. No pecuniary or other interest in the SESSF.
Mr Daniel Corrie	Employed by AFMA. Manager of Southern Trawl and Coral Seas Fisheries. No pecuniary or other interest in the SESSF.
Dr Sarah Jennings	**Economics member** on SESSFRAG. Invited **economics participant** on SEMAC. Economics coordinator, FRDC Human Dimensions Research Subprogram. **Member** of AFMA Economics Working Group. Adjunct Senior Researcher, TSBE, University of Tasmania. Independent economics consultant. No pecuniary or other interest.
Dr Rik Buckworth	**Director**, Sea Sense Australia Pty Ltd **Director**, Aquatic Remote Biopsy Pty Ltd (independent fisheries research consultants). **Scientific Member** - NPRAG, SERAG, TSFRAG. **Chair** - NT Research Advisory Committee, FRDC. University Professorial Fellow - Charles Darwin University. No pecuniary or other interests in this fishery.
Mr Andrew Penney	**Sole Director** of Pisces Australis Pty Ltd, an Australian registered marine/coastal research and management consultancy based in Canberra - interests in any opportunities in this regard. **Principal Investigator** on FRDC Project No 2017-180: Design and implementation of an Australian National Bycatch Report: Phase 1 - Scoping **Scientific Member** of AFMA Tropical Rock Lobster RAG and Small Pelagic Fishery Scientific Panel **Member** of AFMA ERA Technical Working Group. No shareholding and holds no positions relating to any other companies, including any fishing companies or industry associations. Interests in potential research opportunities.
Mr Ross Winstanley	No pecuniary interest in SESSF however declares he has a brother-in-law that holds a Victorian Inshore Trawl Licence.
Dr James Woodhams *(proxy member)*	ABARES. Interest in obtaining funding for future ABARES research. No pecuniary interest.
Mr John Jarvis	Commonwealth Trawl Sector boat and quota SFR holder. Owns a seafood retail shop. **Member** of SETFIA. **Member** of CommFish NSW.

Dr Geoff Tuck	CSIRO, assessment scientist. Interest in obtaining funding for future research. **Principle investigator** on the SESSF stock assessment project.
Mr Simon Boag	Runs a fisheries consulting firm Atlantis Fisheries Consulting Group. Clients include associations such as SETFIA, SSIA, SPFIA but also other private clients. Has recently been engaged by AFMA to collect biological data in the shark fishery. Non-beneficiary **Director** of two fishing companies in the SESSF one of which is a significant quota owner. **Industry member** on SERAG and SEMAC.
Ms Mardi Albert	Employed by AFMA. Executive Officer of SERAG. No interest, pecuniary or otherwise.
Invited Participant	**Declared Interest**
Dr Ian Knuckey	**Positions:** Director – Fishwell Consulting Pty Ltd Director – Olrac Australia (Electronic logbooks) Deputy Chair – Victorian Marine and Coastal Council Chair / Director – Australian Seafood Co-products & ASCo Fertilisers (seafood waste) Chair – Northern Prawn Fishery RAG Chair – Tropical Rock Lobster RAG Chair – Victorian Rock Lobster and Giant Crab Assessment Group Scientific Member – Northern Prawn Management Advisory Committee Scientific Member – SESSF Shark RAG Scientific Member – Great Australian Bight RAG Scientific Member – Gulf of St Vincents Prawn Fishery Management Advisory Committee Scientific participant – SEMAC, SERAG **Current projects:** AFMA 2018/08 - Bass Strait Scallop Fishery Survey – 2018 and 2019 FRDC 2017/069 - Indigenous Capacity Building FRDC 2017/122 - Review of fishery resource access and allocation arrangements FRDC 2016/146 - Understanding declining indicators in the SESSF FRDC 2016/116 - 5-year RD&E Plan for NT fisheries and aquaculture AFMA 2017/0807 - Great Australian Bight Trawl Survey – 2018 Traffic Project - Shark Product Traceability FRDC 2018/077 - Implementation Workshop re declining indicators in the SESSF FRDC 2018/021 - Development and evaluation of SESSF multi-species harvest strategies AFMA 2017/0803 - Analysis of Shark Fishery E-Monitoring data AFMA 2016/0809 - Improved targeting of arrow squid
Mr George Day	AFMA, Demersal and Midwater Fisheries Manager. No interest, pecuniary or otherwise.
Dr Robin Thomson	CSIRO, assessment scientist. Acquiring funding for research purposes. **Principal Investigator** on data services contract and close kin project for school shark.

Dr Malcolm Haddon	CSIRO Honorary Fellow, stock assessment scientist actively involved in the development of new methods and processes. Actively making research proposals for obtaining funding for research deemed of high priority by the RAGs and MACs. Former **member** of GABRAG, Northern Prawn RAG and sub-Antarctic RAG; also **scientific member** of the sub-Antarctic MAC.
Dr Miriana Sporcic	CSIRO, assessment scientist. Acquiring funding for research purposes.
Dr Jemery Day	CSIRO, assessment scientist. Acquiring funding for research purposes. Interests in promoting good science.
Mr Kyne Krusic-Golub	Director – Fish Ageing Services. Fish Ageing Services is currently contracted for the provision of fish age estimates to support SESSF stock assessments. Other interests include sourcing funding for research projects related to fish ageing. No other interests pecuniary or otherwise.
Dr Paul Burch	CSIRO, assessment scientist. Acquiring funding for research purposes.
Dr Claudio Castillo-Jordan	CSIRO, assessment scientist. Acquiring funding for research purposes.
Mr Patrick Cordue	Innovative Solutions Ltd, assessment scientist based in New Zealand. Acquiring funding for research purposes.
Mr Tom Bibby	Commonwealth Trawl Sector boat and quota SFR holder.
Dr Veronica Silberschneider	Cross-jurisdictional research and management interests for DPI NSW, no pecuniary interests.
Dr Geoff Liggins	Cross-jurisdictional research and management interests for DPI NSW, no pecuniary interests.
Dr Rowan Chick	Cross-jurisdictional research and management interests for DPI NSW, no pecuniary interests.
Observer	**Declared Interest**
Prof Keith Sainsbury	AFMA Commissioner
Dr Fay Helidoniotis	ABARES. Interests in obtaining funding for future ABARES research. No pecuniary interests.
Dr Nastaran Mazloumi	ABARES. No pecuniary interests.
Mrs Sandra Curin-Osorio	Student/assessment scientist, CSIRO. Research interests.
Mr Will Mure	Permits and quota holder in the SESSF.
Mr Les Scott	Managing Director of Petuna Sealord Deepwater Fishing, 56% quota owner for Blue Grenadier fishery and operates a factory trawler.

Attachment B

ADOPTED AGENDA

Day 1: Wednesday 14 November 2018

Time: 08:45 to 17:00

Chair: Mr Sandy Morison

Time	Item	Presenter
08:45	**Agenda Item 1: Preliminaries** 1.1 Welcome and introductions/apologies 1.2 Declarations of interest 1.3 Adoption of agenda 1.4 Action items review	Sandy Morison
10:15	*Morning Tea*	
10:30	**Agenda Item 3: Tier 1 Stock Assessment – *Pink Ling*** 3.1 Presentation of base case – updates from Sept meeting 3.2 Update Species Summary and SESSF Data Summary 3.3 RBC recommendation	Patrick Cordue
12:15	*Lunch*	
12:45	**Agenda Item 4: Tier 4 Stock Assessments** 4.1 Smooth Oreos RBC rollover (Chair) 4.2 Mirror Dory 4.3 Deepwater Shark Eastern 4.4 Deepwater Shark Western 4.5 Finalise RBC advice for Tier 4s	Miriana Sporcic
15:15	*Afternoon Tea*	
15:30	**Agenda Item 5: Tier 1 Stock Assessment – *Blue Grenadier*** 6.1 Presentation of base case – updates from Sept meeting 6.2 Update Species Summary and SESSF Data Summary 6.3 RBC recommendation	Claudio Castillo-Jordan & Geoff Tuck
17:00	*Adjourn*	

Day 2: Thursday 15 November 2018

Time: 08:30 to 18:30

Chair: Mr Sandy Morison

Time	Item	Presenter
08:30	**Agenda Item 6: Blue-eye Trevalla** 5.1 Tier 4 stock assessment 5.2 Tier 5 stock assessment 5.3 RBC recommendation	Miriana Sporcic & Malcolm Haddon
10:00	*Morning Tea*	
10:15	**Agenda Item 7: Tier 1 Stock Assessment – *Silver Warehou*** 7.1 Presentation of base case – updates from Sept meeting 7.2 Update Species Summary and SESSF Data Summary 7.3 RBC recommendation	Paul Burch
12:00	*Lunch*	
12:30	**Agenda Item 8: Tier 1 Stock Assessment – *Jackass Morwong*** 8.1 Presentation of base case – updates from Sept meeting 8.2 Update Species Summary and SESSF Data Summary 8.3 RBC recommendation	Jemery Day
15:00	*Afternoon Tea*	
15:15	**Agenda item 9: Orange roughy RBC advice** 9.1 Industry proposal (Simon Boag) 9.2 Risk Assessment – Deterministic Projections 9.3 Update Species Summary and SESSF Data Summary 9.4 RBC recommendation	Geoff Tuck
17:00	**Agenda Item 2: ISMP Discards and Catch Reports** 2.1 Revisions to ISMP Discards and Catch Reports	Paul Burch
18:30	*Adjourn*	

Day 3: Friday 16 November 2018

Time: 08:30 to 13:00

Chair: Mr Sandy Morison

Time	Item	Presenter
08:30	**Agenda Item 10: ERA *Assessments*** 10.1 Otter Board Trawl ERA Assessment 10.2 Danish Seine ERA Assessment	Miriana Sporcic & Dan Corrie
10:00	*Morning Tea*	
10:15	**Agenda Item 11: SESSF Annual Research Statement 2019-20** 11.1 Identify research priorities – Orange Roughy West research program – Exploration of inter-annual variation in the FIS (Ian Knuckey) – Updating species biology	Dan Corrie
11:30	**Agenda Item 12: Rebuilding Strategy Reviews** 12.1 Eastern Gemfish 12.2 Redfish 12.3 Blue Warehou 12.4 Orange Roughy	Mardi Albert & Dan Corrie
13:00	*Close*	

Attachment C

List of action items from SERAG #2 – Nov 2018

• Complete/Redundant	• Underway	• Yet to start	• Need SERAG advice

	Meeting & agenda item ref	No.	Description	Responsibility	Timeframe
	2018.11 Agenda Item 5	1	Investigate the quantity of Silver Warehou likely to be caught if catches of Blue Grenadier increase under the proposed increase to the RBC. Consider the different fishing and discard practices of wet boats and freezer trawlers and the current status and RBC for Silver Warehou.	AFMA	As part of advice to SEMAC, Jan 2019
	2018.11 Agenda item 7	2	Request SESSFRAG consider the issues associated with regime shifts in stock assessments including: • use of dynamic reference points (including triggers) • how this analysis may then feed into the longer term multi-species harvest strategy/project • issues relating to the Jackass Morwong productivity shift.	AFMA	SESSFRAG Chairs meeting 2019
	2018.11 Agenda Item 9	3	AFMA to approach NZ Fisheries regarding the holding of a joint Australian/New Zealand workshop to address common issues with Orange Roughy assessments, including natural mortality and stock recruitment relationships.	AFMA	As soon as practical. Outcome preferred for 2020 assessment.
	2018.11 Agenda item 2	4	Review industry recording of non-quota discard groups in logbooks to identify any reporting issues that require a management response. Consider whether reporting is sufficient to allow fishery wide estimates of total non-quota species discards.	AFMA, Paul Burch and Ian Knuckey	As soon as practical

	2018.11 Agenda item 10	5	Refer question to ERA technical WG – should tier 4 species be included in Ecological Risk Assessments, noting there are some issues around assessing particular Tier 4 species (i.e. those in the 'not assessable' basket).	AFMA	Next ERA technical working group meeting? Ask Viki O'Brien.
	2018.11 Agenda item 10	6	Ian Knuckey to provide Miriana Sporcic with information regarding use of habitat closures in the upper slope dogfish management strategy as a proxy for stock protection. Info to be used in residual risk assessment for greeneye spurdog, Harrison's dogfish, southern dogfish and endeavour dogfish. Provide rationale/justification for reducing the ERA risk ratings of white warehou, whitefin swellshark, Gould's squid, gulper sharks and southern sleeper shark, to feed into the residual risk analysis.	Ian Knuckey and Dan Corrie	As soon as possible
	2018.11 Agenda item 10	7	Refer to the ERA Technical Working Group: consider providing better guidance to observers to address species identification issues for cephalopods in order to assist with future ERAs.	AFMA	Next ERA technical working group meeting? Ask Viki O'Brien.
	2018.11 Agenda item 11	8	Incorporate data collection for Blue-eye Trevalla (seamounts) into the Data Plan.	AFMA (Brodie)	Prior to SESSFRAG Data meeting. Ensure ISMP program is aware.
	2018.11 Agenda item 11	9	Dan Corrie and Simon Boag to develop a western orange roughy research plan and present to SERAG in September 2019. Consult Rudy Kloser.	Dan Corrie and Simon Boag	Present to SERAG 1 2019
	2018.11 Agenda item 12.3	10	CSIRO and AFMA to investigate the apparent high discards of Blue Warehou as indicated in the Blue Warehou rebuilding strategy report.	Dan Corrie and Paul Burch	As soon as practical

List of ongoing action items

Attachment D

• Complete/Redundant	• Underway	• Yet to start	• Need SESSFRAG advice

	Meeting & agenda item ref	No.	Description	Responsibility	Timeframe	Status
	2017.09 1.4	1	Dr Day to prepare a discussion paper regarding the inclusion of winter/ summer FIS surveys in future tiger flathead assessments.	AFMA and CSIRO	SESSFRAG Data Meeting 2018. To be raised at SESSFRAG Chairs meeting 2018	SESSFRAG agreed that this should be looked at as a sensitivity in the stock assessment update in 2019. **The RAG corrected the wording for this item to reflect the action required and requested this item remain open until the assessment is completed.**
	2017.11 Agenda item 4	2	CSIRO to provide advice on whether data as an input to stock assessments could be reviewed at SESSFRAG data meeting in July/August each year.	CSIRO Dr Thomson Dr Tuck	SESSFRAG Chairs meeting 2018.	**This was discussed at SERAG 1, 2018 and is covered by action item 16 (2018.09, 1.5). Suggest removing.**
	2017.11 Agenda item 4	3	CSIRO to provide advice on whether the most recent year's data needs to be included in stock assessments to give the assessment scientists more time to identify issues.		SESSFRAG Chairs meeting 2018.	**This was discussed at SERAG 1, 2018 and is covered by action item 16 (2018.09, 1.5). Suggest removing.**
	2017.11 Agenda item 4	4	AFMA to investigate the occurrence of 22cm+ school whiting recorded as discarded in 2016 ISMP records.		Prior to next stock assessment.	AFMA records indicate eleven 22cm+ fish (8*22cm, 1*24cm and 1*25cm) were discarded in 2016. Observer trip reports confirm this was the case. AFMA and CSIRO are resolving the issue.

	2017.11 Agenda item 5	5	Dr Thomson to include NSW recreational catch data in the SESSF catch and discard summary for redfish.		2018 Data Summary.	So far only included where estimates of recreational catch weight are available. This will eventually be extended to include numbers of fish, or using numbers to estimate weights. This is not an issue for redfish alone.
	2017.11 Agenda item 6.2	7	AFMA to quantify the area of suitable deepwater shark habitat inside and outside closures as a proxy for stock protection.		2018 Assessment period.	Dr Tuck will also present the paper "*Incorporating the effects of marine spatial closures in risk assessments and fisheries stock assessments*´ at SESSFRAG in March 2019. Subject to advice from SESSFRAG on using closures as proxies for protection, this item may be revisited. **Item will remain until resolved, or advice is received.**
	2017.11 Agenda item 6.3	9	SESSFRAG to consider a standard approach to limiting the multiplier value (D/C+1) in Tier 4 assessments where estimated discard rates are high.		2018 SESSFRAG data meeting.	SESSFRAG agreed that this was not a suitable approach and a working group has been established to propose a way forward for 'non-assessable' species, including Tier 4 species with high discard proportions. **Refer to Appendix A for overview of what this group is doing**
	2017.11 Agenda item 6.4	10	AFMA to investigate records of oxeye oreo dory in logbooks and CDRs.		Prior to 2020 assessment.	
	2017.11 Agenda item 8.2	12	AFMA to investigate the top redfish catching vessels to ensure targeting is not occurring.		As soon as possible.	This will be completed as part of the rebuilding strategy review for SERAG 2, Nov 2018. **This will be addressed as part of agenda item 12.2.** **Suggest removing.**

	Meeting & agenda item ref	No.	Description	Responsibility	Timeframe	Status
	2018.09 Agenda item: 3.2	1	CSIRO to add species specific discard proportion to the bottom row of the species-specific tables in the discards report.	Robin Thomson	By SERAG 2 (Nov 2018)	**This is completed – changes will be reflected in the revised report provided to 2019 data meeting.**
	2018.09 Agenda item: 5.2	2	Malcolm Haddon to scan the relevant pages of historical Blue-eye trevalla reports (e.g. Tilzey, 1997?) and circulate to SERAG.	Malcolm Haddon	ASAP	**Links to access the reports have been included in the minutes from SERAG 1.**
	2018.09 Agenda item: 5.2	3	AFMA/CSIRO to discuss whether ASPM age-structured production model for Blue-eye trevalla (seamount) can be completed prior to SERAG 2 (Nov 2018). NB. This may be considered for application to other species in future.	Geoff Tuck, Dan Corrie & George Day	By SERAG 2 (Nov 2018)	**This is completed - to be addressed at agenda item 6.2.**
	2018.09 Agenda item: 4.2	4	AFMA/CSIRO to check whether observations of deepwater shark catch and/or discards are occurring in orange roughy zones (there are no records in the ISMP discards report). Also CSIRO (Paul Burch) to check ISMP strata definitions.	Paul Burch & Dan Corrie	By SERAG 2 (Nov 2018)	**Over the 2016-2018 fishing seasons during the period June - August, for days where vessels recorded orange roughy catch >250 kg, there were 1.2t of platypus shark and 400kg of brier shark landed, and no records of any discarded deepwater sharks. Observer records appear to be accurate.**

	2018.09 Agenda item: 4.2	5	AFMA to check pre 2017 observer reported discards of deepwater shark to confirm estimates in the ISMP discard report. Status: done for 2017 and large discard of deepwater shark confirmed as data punching error.	Dan Corrie	By SERAG 2 (Nov 2018)	**Large discard record of deepwater shark in 2017 confirmed as data punching error. All other records appear to be accurate.**
	2018.09 Agenda item: 8	6	AFMA/Industry to clarify how observers have recorded discards of Silver Warehou on the factory boats (suggesting it was discarded but covered by quota, so should be in CDR records).	Dan Corrie	ASAP	**Logbook discard record books show 1t discarded by a factory trawler - AFMA will follow up with the observer section.**
	2018.09 Agenda item: 8	7	AFMA to rectify the issues with use of vessel call-signs in the AFMA database as boat identifiers, as it affects the assessments.	Dan Corrie & John Garvey	Check and rectify by 2019 (prior to AFMA sending data to CSIRO)	**This issue was raised with John Garvey (AFMA) and will be followed up prior to the 2019 data transfer.**
	2018.09 Agenda item: 11	8	Simon Boag to present paper regarding industry proposal to limit orange roughy TACs for 2nd and 3rd year of MYTAC, to SERAG 2.	Simon Boag	By SERAG 2 (Nov 2018)	**This is complete. To be addressed as part of agenda item 9.1.**
	2018.09 Agenda item: 10	9	AFMA to consult Ian Knuckey for a paper to SERAG 2, re: recommendation of prioritised species for inclusion in the scoping paper for 'Updating knowledge of key species biology' project.	Mardi Albert & Ian Knuckey	By SERAG 2 (Nov 2018)	**This is complete. To be addressed as part of agenda item 11.1.**
	2018.09 Agenda item: 12	10	AFMA and CSIRO to follow up on all queries raised in SERAG 1, 2018 regarding ERA high-risk species. Refer to agenda item 12 minutes for details.	Dan Corrie & Miriana Sporcic	By SERAG 2 (Nov 2018)	**This is in-progress and will be addressed as part of agenda item 10.**

	2018.09 Agenda item: 12	11	AFMA to prepare a document comparing results of 2018 ERA assessments with previous assessments and report back to SERAG 2, 2018.	Dan Corrie	By SERAG 2 (Nov 2018)	**This is in-progress and will be addressed as part of agenda item 10.**
	2018.09 Agenda item: 12.2	12	AMFA to confirm species identification for southern octopus and giant cuttlefish in the Danish Seine ERA, and provide info to CSIRO.	Mardi Albert	By SERAG 2 (Nov 2018)	**Species ID could not be confirmed. This will be addressed as part of agenda item 10.**
	2018.09 Agenda item: 12	13	AFMA to confirm the protocol for recording unknown species by observers.	Mardi Albert	By SERAG 2 (Nov 2018)	**This is complete. The protocol is to record to family name only.**
	2018.09 Agenda item: 12	14	AFMA to investigate missing ERA productivity attributes for southern octopus and giant cuttlefish, as well as distribution overlap of Danish Seine effort and green-eye spurdog.	Dan Corrie	By SERAG 2 (Nov 2018)	**This is underway. To be addressed as part of agenda item 10.**
	2018.09 Agenda item: 12	15	Ensure agenda item for ERA triggers is added to SESSFRAG Chair's meeting, 2019.	Mardi Albert	ASAP	**This is complete.**
	2018.09 Agenda item: 1.5	16	AFMA and CSIRO to review the TAC setting guidelines paper and due dates for data preparation and report back to SESSFRAG Chair's meeting in 2019.	Dan Corrie & Geoff Tuck	By SESSFRAG Chair's meeting, 2019	**This will be actioned in early 2019.**
	2018.09 Agenda item: 2	17	AFMA to correct units of Royal Red Prawn in database (sometimes in mm not cm).	Dan Corrie & John Garvey	Before 2019 data provision to CSIRO	**This is being addressed in SESSFRAG Data meeting's action items.**

	2018.09 Agenda item: 2	18	AFMA to incorporate traffic-light system in the ISMP coverage report for year-to-date tables.	AFMA (Observer team)	ASAP	**This will be incorporated into future reports. AFMA will follow up with Observer team.**
	2018.09 Agenda item: 11	19	Malcolm Haddon to clarify which length plus age frequencies time-series were used in the HOENIG method for orange roughy mortality estimation (generally relies on age frequency at start of exploitation). Report back to SERAG 2, 2018 as part of orange roughy agenda item.	CSIRO, Malcolm Haddon	By SERAG 2 (14/11/18)	**Dr Haddon advised:** *For the Hoenig calculations and the proportional distribution of ages I simply used most of the ageing data available to the assessment. Given the high degree of depletion this stock has undergone this ageing data is likely to be biased towards the younger fish, meaning any proportional distribution of older fish may well be under-represented relative to an unfished population.* *What this implies is that any estimate of maximum age (defined as at what age do we expect 1% of recruits to survive) is likely to be biased low. The effect of this would be to suggest lower M values than those indicated by the analysis.* *This discussion can be pursued in the RAG should you wish. I have attached an amended natural mortality document and am grateful for the opportunity to correct the algebra.* **Attachment uploaded to GovDex.**
	2018.09 Agenda item: 2	20	CSIRO to consider which factors (season depth zone) influence length frequencies for all species, to update data plans and targets for observer program and port sampling.	Robin Thomson	By SESSFRAG Chairs meeting, 2019	**This will be addressed as part of the data services contract between AFMA and CSIRO.**

LEVEL 2 ANALYSIS	ERA CLASSIFICATION	TAXA	NO. MISSING	SCIENTIFIC NAME	COMMON NAME	EXTREME RISK	HIGH RISK
PSA	C1	INV	1	*Nototodarus gouldi*	Gould's squid		x
	BP#	CH	6	*Chimaera ogilbyi*	Ogilby's ghostshark^		x
		CH	6	*Pavoraja arenaria*	Sandy skate		x
	BP	INV	10	*Melo miltonis*	Southern bailer shell		x
		INV	10	*Sepia braggi*	Cuttlefish		x
		INV	10	*Sepia cultrata*	Cuttlefish		x
		INV	10	*Sepia hedleyi*	Cuttlefish		x
		INV	10	*Sepia novaehollandiae*	Cuttlefish		x
bSAFE	BP	CH	-	*Squatina albipunctata*	Eastern angelshark	x	
		CH	-	*Dipturus gudgeri*	Bight skate^	x	
		CH	-	*Dipturus canutus*	Grey skate^	x	
		CH	-	*Dipturus grahami*	Graham's skate		x
		CH	-	*Pavoraja nitida*	Peacock skate		x
		CH	-	*Aptychotrema rostrata*	Eastern shovelnose ray		x
		CH	-	*Hypnos monopterygius*	Coffin ray		x
		CH	-	*Dentiraja australia*	Sydney skate		x
		CH	-	*Dentiraja cerva*	Whitespotted skate	x	
		CH	-	*Dipturus acrobelus*	Deepwater skate		x
		CH	-	*Trygonorrhina fasciata*	Eastern fiddler ray		x
		CH	-	*Urolophus sufflavus*	Yellowback stingaree^	x	
		CH	-	*Squalus megalops*	Piked spurdog	x	
		TEL	-	*Polyprion oxygeneios*	Hapuku	x	
		TEL	-	*Seriolella caerulea*	White warehou		x
		TEL	-	*Plagiogeneion macrolepis*	Bigscale rubyfish		x
		CH	-	*Cephaloscyllium albipinnum*	Whitefin swellshark^	x	
		CH	-	*Somniosus antarcticus*	Southern sleeper shark	x	
	BC	CH	-	*Torpedo macneilli*	Short-tail torpedo ray		x
		CH	-	*Squalus chloroculus*	Greeneye spurdog	x	
		CH	-	*Odontaspis ferox*	Smalltooth sandtiger shark		x
		CH	-	*Centrophorus squamosus*	Leafscale gulper shark^	x	
		CH*	-	*Centrophorus harrissoni*	Harrisson's dogfish^	x	
		CH*	-	*Centrophorus zeehaani*	Southern dogfish	x	
		CH	-	*Centrophorus granulosus*	Gulper shark	x	
		CH	-	*Heptranchias perlo*	Sharpnose sevengill shark	x	
		CH	-	*Hexanchus nakamurai*	Bigeye sixgill shark	x	
		CH	-	*Figaro boardmani*	Australian sawtail catshark	x	
		CH*	-	*Centrophorus moluccensis*	Endeavour dogfish	x	
		CH	-	*Chimaera lignaria*	Giant chimaera	x	
		CH	-	*Harriotta raleighana*	Bigspine spookfish	x	

Australian Government
Australian Fisheries Management Authority

Species Summaries for the Southern and Eastern Scalefish and Shark Fishery (SESSF) – 2018 assessments.

As assessed by SERAG in 2018.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Contents

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

1. Introduction

These species summaries provide information on quota species assessed by Southern and Eastern Scalefish and Shark Fishery (SESSF) South East Resource Assessment Group (SERAG).

These assessment summaries apply to stock assessments conducted in 2018 and made available for SERAG members in November 2018. These assessments will be incorporated into the complete *Species Summaries for the Southern and Eastern Scalefish and Shark Fishery (SESSF)* document that will be made publicly available.

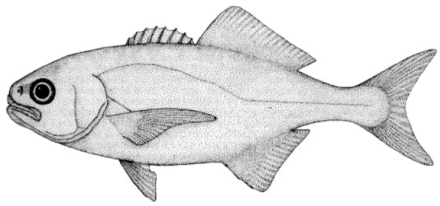
The summaries contain basic information on stock status, Total Allowable Catches (TACs) and catch trends, assessment details and RAG comments. The summaries are designed to be a quick reference, and should be read in conjunction with RAG minutes and the applicable species stock assessments.

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.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

2. 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.

<table>
<tr><th colspan="2">Summary</th></tr>
<tr><td>Stock Structure</td><td>Blue-eye trevalla (Hyperoglyphe antarctica) 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.

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.

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.</td></tr>
<tr><td>Stock status against reference points and trend</td><td><u>Tier 4 for slope stock</u>

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

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.

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.

Stock status: 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.

<table>
<tr><th>Parameter</th><th>Value</th><th>Parameter</th><th>Value</th></tr>
<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>
</table>
</td></tr>
</table>

	Tier 5 for seamount stock: **Catch-MSY** Analysis estimates the depletion to be approximately 33%B_0 although that is highly uncertain. **Age-structured stock reduction analysis** Deterministic estimates vary greatly depending on assumed exploitation rates and which values for natural mortality and steepness of the stock-recruitment relationship are used.

Projected Catches by Steepness and Natural Mortality			
	h=0.6	h=0.7	h=0.8
M=0.08	25	32	40
M=0.1	35	40	45
M=0.12	37	43	48

Figure 9 from report

ABARES most recent assessment (2018)	**Biomass** Not overfished	**Fishing Mortality** Not subject to overfishing	
GVP Figures (2016-17 season)	**GVP** $4.05 million	**% Fishery GVP** 8.7%	
Is a MYTAC in place this season?	No	**Have breakout rules been triggered?**	N/A

Assessment Summary	
Tier Level	Tier 4 for slope stock and Tier 5 for seamounts stock
Stock indicator trends	Tier 4 slope stock: 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. 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. Tier 5 seamount stock: **Catch-MSY** Analysis estimates the depletion to be approximately 33%B_0 although that is highly uncertain. The 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. **Age-structured MSY** Estimates vary greatly depending on exploitation rates and which values for natural mortality and steepness of the stock-recruitment relationship are used.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Key model technical assumptions/ parameters	Both assessments assume that biomass was unfished prior to 1985 (when fishing started). Tier 4 slope stock: Standardised CPUE from zones 20 to 83 is assumed to be proportional to abundance. The best assessment is obtained by using catch per hook as the effort metric for CPUE. Standardised blue-eye trevalla catch rates (Sporcic & 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. Tier 5 seamount stock: **Catch-MSY** 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 certainly a difficult fishery to assess. **Age-structured stock reduction analysis** Noting that not all of the seamounts would be fished in a given year, it is assumed that harvest rates never rose 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.
Significant changes to data inputs	Tier 4: Catches from zone 10-83 are included in C_{targ} Only non-trawl catches from zones 20-83 are included in the CPUE analysis Tier 5: No previous tier 5 assessment for seamounts.
RAG Comments on data	Tier 4: 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. Tier 5: It is difficult to get representative catch data from logbooks. There are a number of methods that make up the catch and uncertainty around accuracy of reporting. Most coming from automatic longline and drop-line.
RAG Comments on assessment	Tier 4: 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. 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_{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. <u>Tier 5:</u> **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_0. Constant catches of 40 t or less would maintain stock status at the proxy 48%B_0. **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=0.8 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. **Discussion** 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. 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. 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. This recognises the economics of the fishery and that catches up to this level do not represent a risk to the stock.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

	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.
Projected Biomass (Tier 5)	See figure 9. It is assumed that constant catches of 36 t would maintain stock stability or slow stock changes.

RAG Recommendations		
Recommended Biological Catch (2019/20)	Slope: 3-year RBC: 439 t per year Seamounts: 3-year RBC: 36 t per year (Total: 475 t)	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: 0% 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.
Is a MYTAC recommended for future seasons? *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)*	Slope: Yes. 3-Year MYTAC Seamounts: Yes. 3-Year MYTAC 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.	
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	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. 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. **Tier 5 RBC Recommendation:** The constant catch projections indicate that the risk of the stock declining tobelow the limit reference point is low. Alternative Catch Scenarios: N/A	
Research Catch Allowance *Included/Addition to TAC*	0 t	
Implications for companion species / TEPs / multi-species fisheries	Auto longline operators catch pink ling and blue-eye trevalla together. There may be implications to pink ling catch due to changes in TAC.	

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

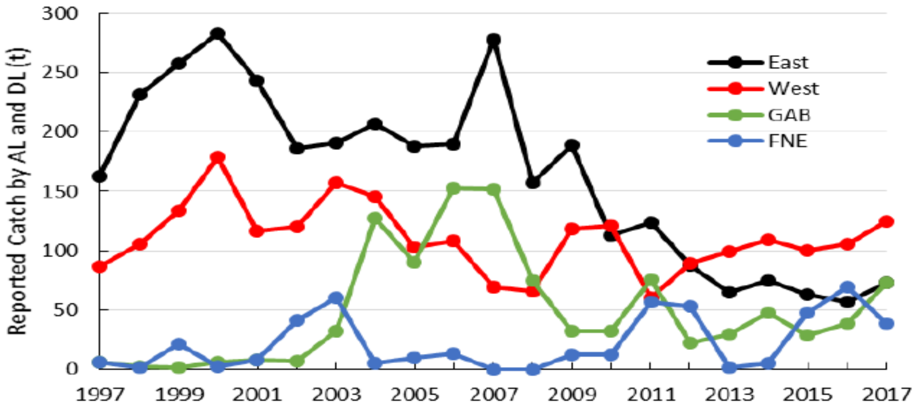


Figure 1. The total reported catches from 1997-2016 taken by autoline and drop-line combined across the east, west, the GAB and far north seast (black and red used for CPUE standardisation)

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

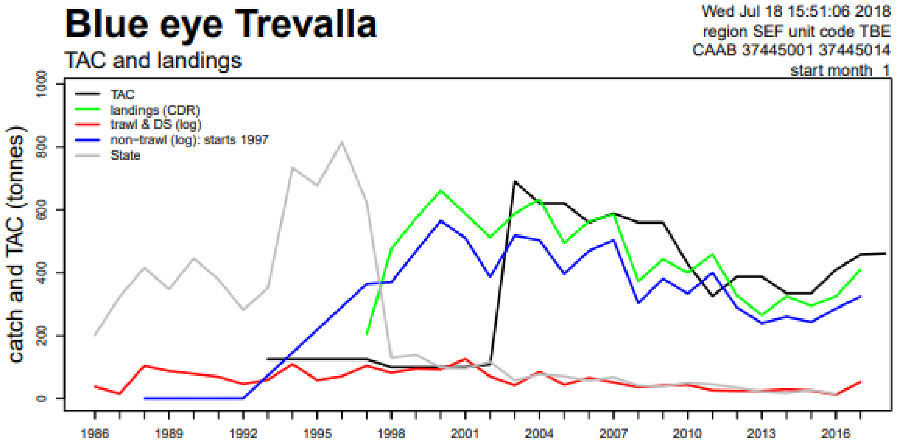


Figure 2 TAC and landings for blue-eye trevalla up to the 2017 calander year

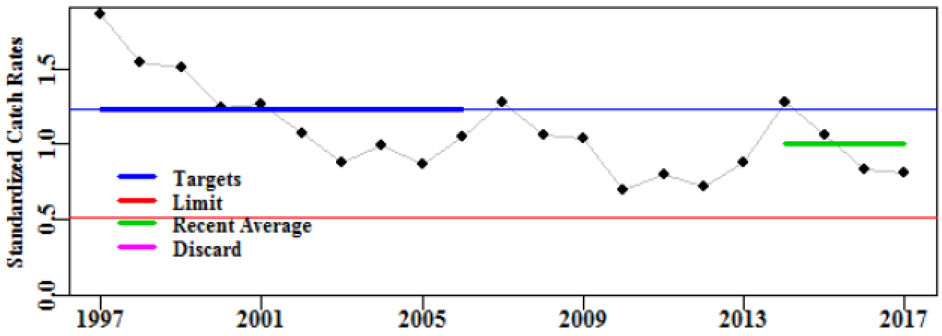
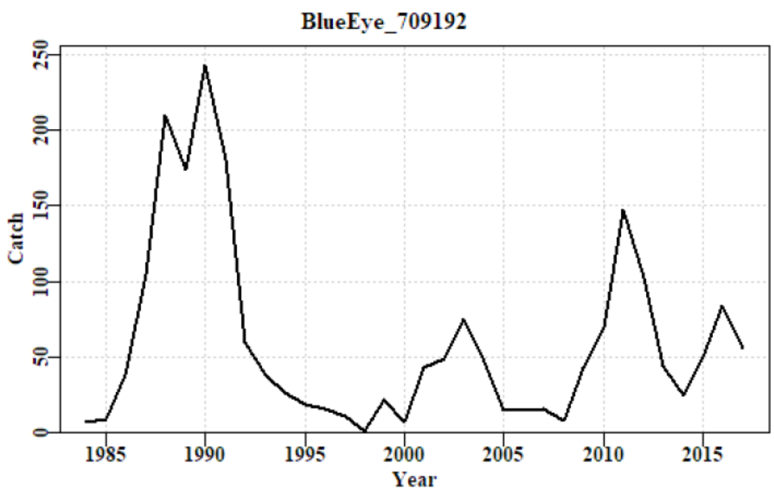
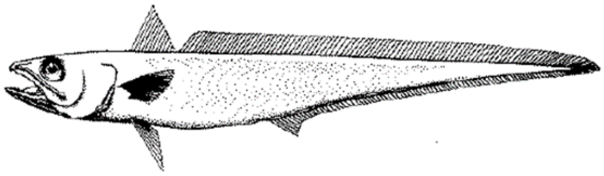


Figure 3 Standardised catch rates with the upper fine line represents the target catch rate and the lower line the limit catch rate. Thickened line (Blue line) represents the reference period for catches, catch rates, and the recent average catch rate (green line).

Tier 5 Seamounts:



3. Blue Grenadier (Macruronus novaezelandiae)



ABARES (2012) Line drawing - Rosalind Poole

Tier 1: last assessed by SERAG in 2018.

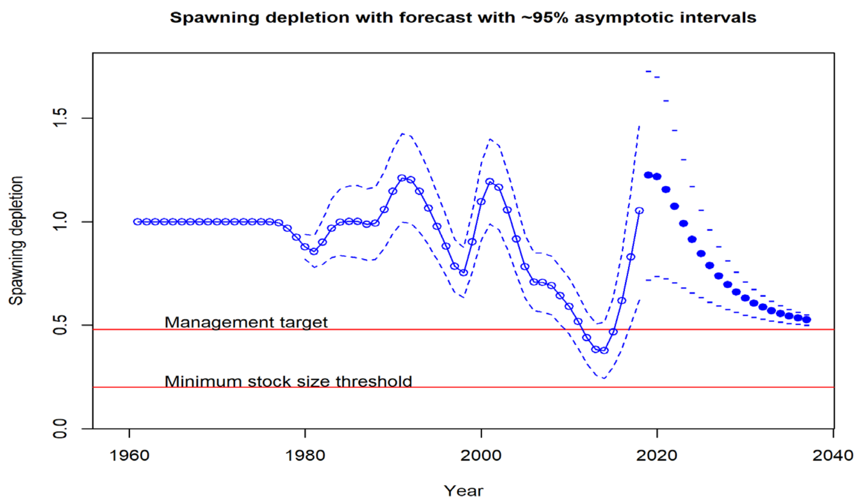
<table>
<tr><th colspan="4">Summary</th></tr>
<tr><td>Stock Structure</td><td colspan="3">Blue Grenadier is assessed as one stock however there is some evidence of separate stocks occurring across the SESSF. There are two defined sub-fisheries, the spawning fishery dominated by catches off western Tasmania and the widely spread catches of the non-spawning fishery.</td></tr>
<tr><td rowspan="3">Stock status against reference points and trend</td><td>Current</td><td>Target</td><td>Limit</td></tr>
<tr><td>2019: 122% B_0</td><td>48% B_0</td><td>20% B_0</td></tr>
<tr><td colspan="3">Updates to the model down-weighted the large recruitment estimated in 1993 which led to a decrease in the spawning biomass below the target (48%B_0) from around 2011 to 2015. Biomass has increased to be above virgin stock biomass (122%B_0) at the start of 2019 due to high recruitment from 2010 to 2015.

The catch in the Blue Grenadier spawning fishery is increasing but is still below 2000 levels. Catches in the non-spawning fishery have decreased.</td></tr>
<tr><td>ABARES most recent assessment 2018</td><td>Biomass
Not overfished</td><td colspan="2">Fishing Mortality
Not subject to overfishing</td></tr>
<tr><td>GVP Figures (2016-17 season)</td><td>GVP
$2.54m</td><td colspan="2">% Fishery GVP
3.1 %</td></tr>
<tr><td>Is a MYTAC in place this season?</td><td>Yes.</td><td>Have breakout rules been triggered?</td><td>No.</td></tr>
</table>

<table>
<tr><th colspan="2">Assessment Summary</th></tr>
<tr><td>Tier Level</td><td>Tier 1</td></tr>
<tr><td>Stock indicator trends</td><td>Biomass has increased to be above virgin stock biomass (122%B_0) at the start of 2019 due to high recruitment from 2010 to 2015. The model suggests the biomass decreased to below target in 2012.</td></tr>
</table>

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Key model technical assumptions/ parameters	2 sex model, age-structured Female *M* estimated. Male 20% larger (1.2*M_f) (estimated M_{males}) 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) (2015 in Sept) 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 (M) for females at 0.174 and uses 1.2M_f to provide M for male at 0.209
Changes to model structure/assumptions	N/A
Significant changes to data inputs	FIS non-spawning abundance index included
RAG Comments on data	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
RAG Comments on assessment	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 which 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 B_0 and with predicted catches at F, 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) M for males was also estimated and resulted in female M = 0.154 and male M = 0.230. This results in a small decrease in estimated spawning biomass. SERAG (2018) recommended looking at likelihood profiles for M as part of the next stock assessment.

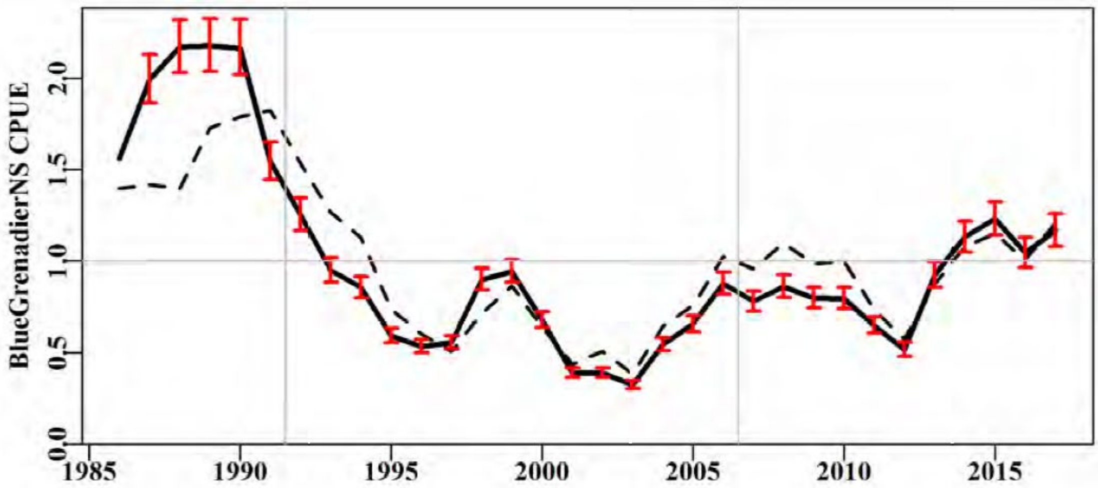
Projected Biomass (including confidence intervals)	

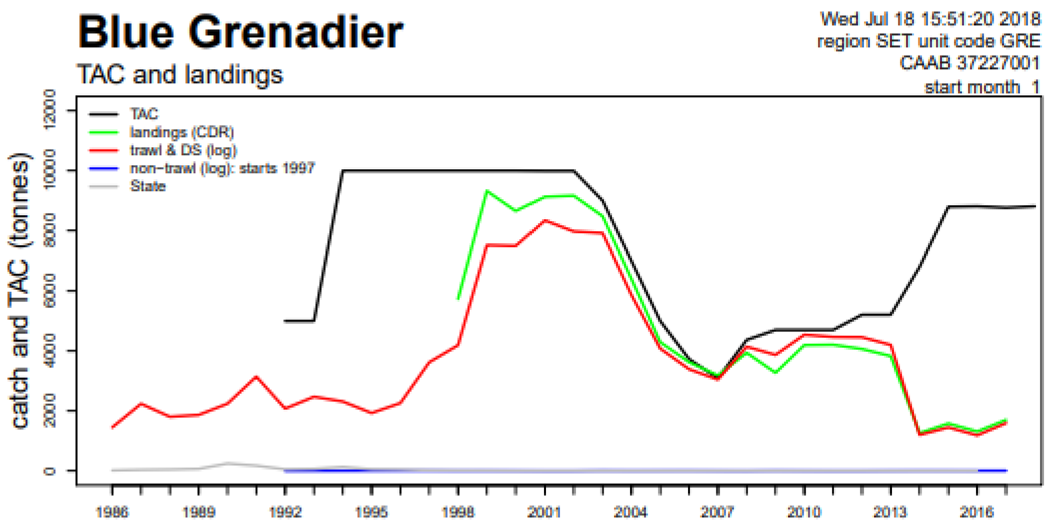
RAG Recommendations		
Recommended Biological Catch (2019/20)	2019 – 13260 2020 – 12238 2021 – 11052 3-year average = 12183 t	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: 0%
Is a MYTAC recommended for future seasons? *Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)*	Yes. 3-Year MYTAC. SEMAC to consider either the yearly RBC or the 3- year average.	
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	**RBC recommendation** = very unlikely to cause a decline below B_{LIM} **Alternative Catch Scenarios**: N/A	
Research Catch Allowance *Included/Addition to TAC*	0 t	
Implications for companion species / TEPs / multi-species fisheries	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_0
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%		

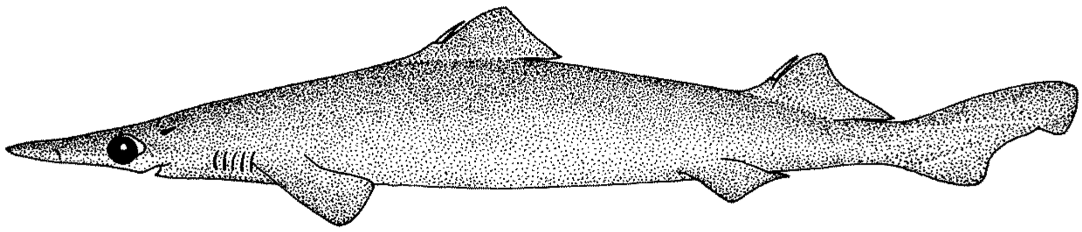
Catch Trends

Standardised CPUE





4. 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 (*Centroscymnus plunketi)*, Roughskin Shark (*Centroscymnus and Deania spp)*, Pearl shark (*D.calcea and D.quadrispinosa)*, Black shark (*Centroscymnus spp*), Lantern shark (*Etmopterus spp)*, Dogfish Family *squalidae* and other sharks.

Tier 4: last assessed by SERAG in 2018

<table>
<tr><th colspan="4">Summary</th></tr>
<tr><td>Stock Structure</td><td colspan="3">Little is known about the stock structure of deepwater sharks. They are bentho-pelagic species that have been sampled in oceanic environments over the abyssal plains and are distributed widely across ocean basins and along the middle and lower continental shelves.

The eastern management area extends from NSW around the Tasmanian east coast and up the Tasmanian west coast to 42º S (approximately Strahan), including to the centre of Bass Strait to 146º 22'E.</td></tr>
<tr><td>Stock status against reference points and trend</td><td colspan="3">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.

The limit reference point is 20% of the target reference point.

<table>
<tr><th>Parameter</th><th>Value</th><th>Parameter</th><th>Value</th></tr>
<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_{targ}</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>
</table>

CPUE trend: Standardised CPUE has been slowly declining since 2009, and has been flat since 2010.</td></tr>
<tr><td>ABARES most recent assessment (2016)</td><td>Biomass

Uncertain</td><td colspan="2">Fishing Mortality

Not subject to overfishing</td></tr>
<tr><td>GVP Figures (2014-15 season)</td><td>GVP

N/A</td><td colspan="2">% Fishery GVP

N/A</td></tr>
<tr><td>Is a MYTAC in place this season?</td><td>No.</td><td>Have breakout rules been triggered?</td><td>N/A</td></tr>
</table>

Assessment Summary	
Tier Level	Tier 4
Stock indicator trends	The CPUE trend in the eastern zone is slowly declining and is currently between the target and limit reference points.
Key model technical assumptions/ parameters	Major assumption that the CPUE represents the status of the whole stock, uncertain given the large closures. Assessed as a separate east and west stock. 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; Deania calcea (brier shark).
Changes to model structure/assumptions	Assessment based on open areas only. Reference period maintained at 1997-2004. 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.
Significant changes to data inputs	N/A
RAG Comments on data	Discards are not used in the CPUE series and are not included in C_{targ} and so will not be deducted from the RBC Catches have been stable between 20-30 t since 2012 and the CPUE has remained stable in the open areas.
RAG Comments on assessment	A large proportion (>54%) of the catch of the entire fishery was previously taken in waters >700m and most of these areas are now closed. (AFMA report 2008-836). The Tier 4 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. 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. 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 to the CPUE series. 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.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

RAG Recommendations		
Recommended Biological Catch (2018-19)	9 t	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: 0 %
Is a MYTAC recommended for future seasons? *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)*	Yes. 3-Year MYTAC 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. Recent catches: Year / Catch (t): 2013 – 23; 2014 – 23; 2015 – 19; 2016 – 26; 2017 – 22	
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	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. **Alternative Catch Scenarios**: Not available.	
Research Catch Allowance *Included/Addition to TAC*	0 t	
Implications for companion species / TEPs / multi-species fisheries	N/A	

Recent catches:

Year	Catch (t)
2013	23
2014	23
2015	19
2016	26
2017	22

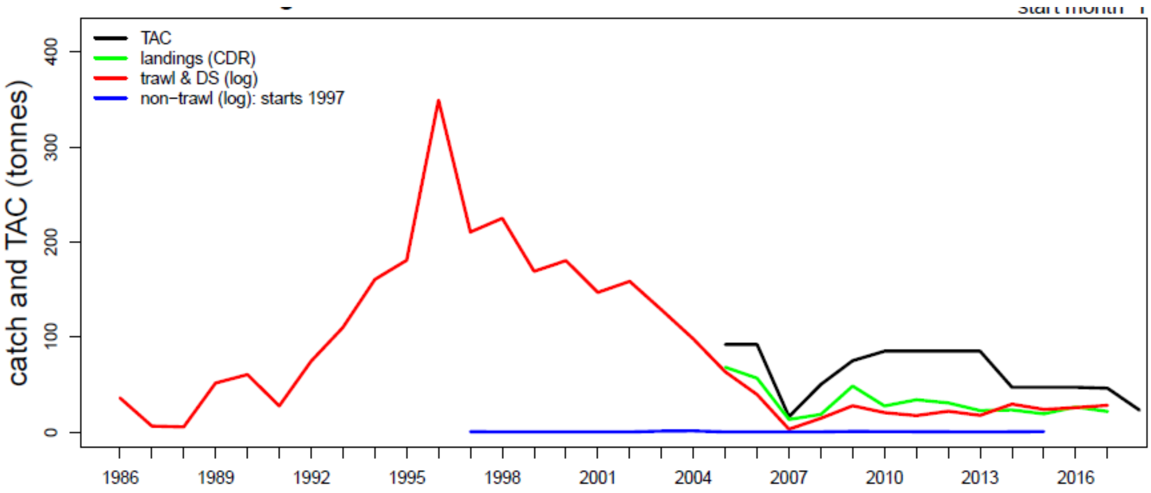
Catch and TAC

Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	Tier 4	Not assessed	Not assessed	Not assessed	Tier 4	Tier 4
Stock Status	CPUE between target and limit	Not assessed	Not assessed	Not assessed	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	78	47	47	47	9	9
Agreed TAC	47	47	47	46	23	
TAC after unders/overs	55	51	51	50	27	
% TAC caught	46%	44%	49%	46%		

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

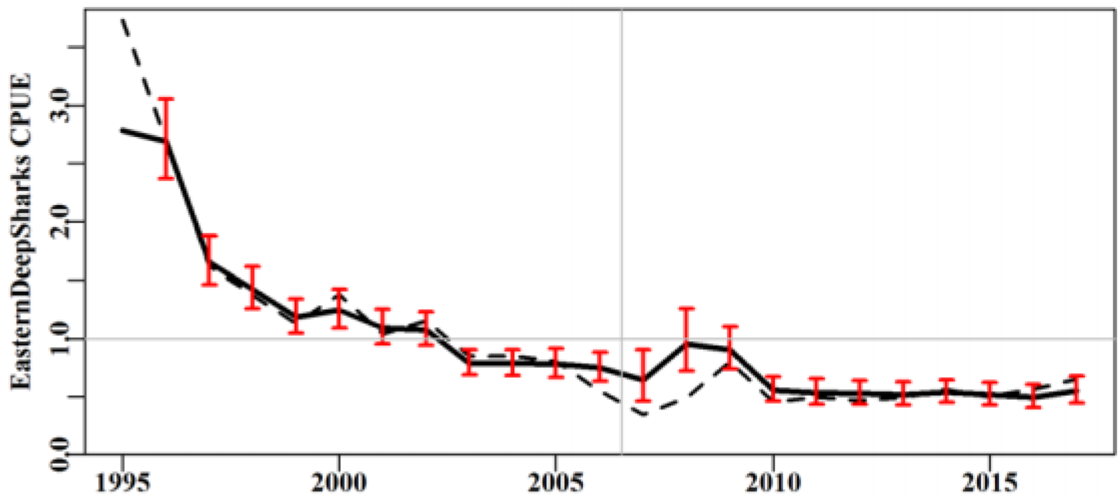
Catch Trends

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



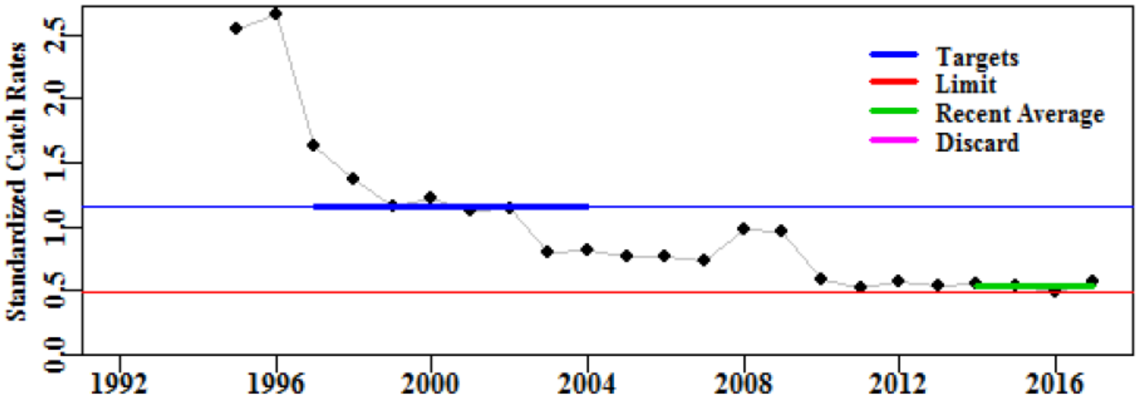
Standardised Catch Rates

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.



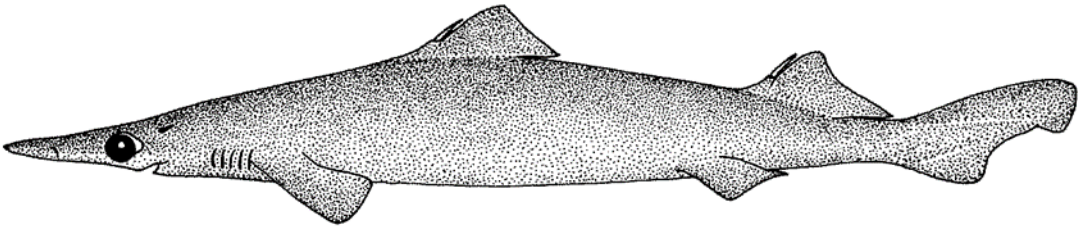
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

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.



Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

5. 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 (Centroscymnus plunketi), Roughskin Shark (Centroscymnus and Deania spp), Pearl shark (D.calcea and D.quadrispinosa), Black shark (Centroscymnus spp), Lantern shark (Etmopterus spp), Dogfish Family squalidae and other sharks.

Tier 4: last assessed by SERAG in 2018.

<table>
<tr><th colspan="3">Summary</th></tr>
<tr><td>Stock Structure</td><td colspan="2">Little is known about the stock structure of deepwater sharks. They are bentho-pelagic species that have been sampled in oceanic environments over the abyssal plains and are distributed widely across ocean basins and along the middle and lower continental shelves. The western management area extends from the Tasmanian west coast Latitude 42º S (approximately Strahan), around to Western Australia.</td></tr>
<tr><td>Stock status against reference points and trend</td><td colspan="2">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.

The limit reference point is 40% of the target reference point.

<table>
<tr><th>Parameter</th><th>Value</th><th>Parameter</th><th>Value</th></tr>
<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_{targ}</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>
</table>

CPUE trend: CPUE has increased in recent years which has brought the recent average up.

A large proportion (>54%) of the catch of the entire fishery (east & west combined) was previously taken in waters >700m and most of these areas are now closed. (AFMA report 2008-836).</td></tr>
<tr><td>ABARES most recent assessment (2016)</td><td>Biomass

Uncertain</td><td>Fishing Mortality

Not subject to overfishing</td></tr>
</table>

GVP Figures (2014-15 season)	GVP N/A	% Fishery GVP N/A	
Is a MYTAC in place this season?	No.	**Have breakout rules been triggered?**	N/A

Assessment Summary	
Tier Level	Tier 4
Stock indicator trends	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.
Key model technical assumptions/ parameters	Major assumption that the CPUE represents the status of the whole stock, uncertain given the large closures. Assessed as a separate east and west stock. 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; Deania calcea (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 Deania calcea (brier shark) and six per cent were D. quadrispinosa (platypus shark).
Changes to model structure/assumptions	N/A
Significant changes to data inputs	N/A
RAG Comments on data	If there is a change in discard estimates over time the RAG should consider including them in the Tier 4.
RAG Comments on assessment	The RAG noted the recent increase in CPUE and the correlation with the modification to the deepwater closures in 2016. Only the stock outside the closures is assessed and there is little understanding of the effect of the closures.

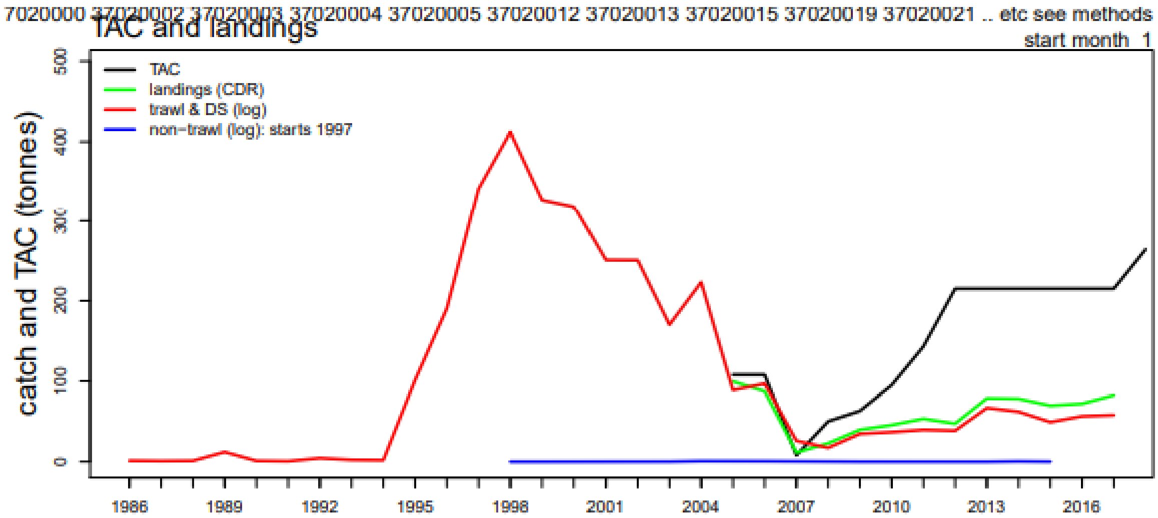
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

RAG Recommendations		
Recommended Biological Catch (2019-20)	235 t	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: 0%
Is a MYTAC recommended for future seasons? *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)*	No. Future MYTAC subject to Feb 2019 SESSFRAG review of assessment approaches.	
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	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. **Alternative Catch Scenarios**: N/A	
Research Catch Allowance *Included/Addition to TAC*	0 t	
Implications for companion species / TEPs / multi-species fisheries	N/A	

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

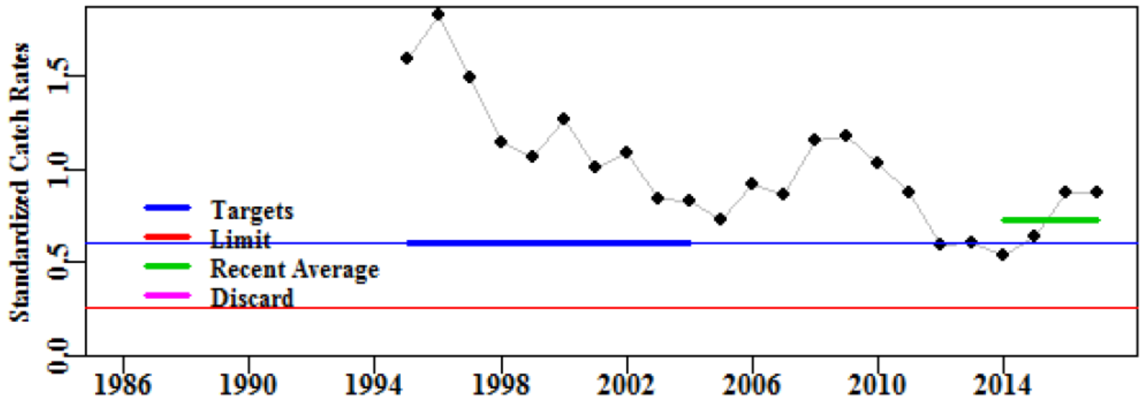
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

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.



Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

6. Jackass Morwong (Nemadactylus macropterus)

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

Tier 1: last assessed by SERAG in 2018.

Summary			
Stock Structure	For assessment purposes it is assumed there are separate stocks of jackass morwong in the eastern and western zones.		
Stock status against reference points and trend	**Current**	**Target**	**Limit**
	E: 35% (1988 biomass) W: 68%B_0	48% B_0	20% B_0
	East 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”. The limit reference point is 20 per cent of the 1988 equilibrium spawning biomass. The target reference point is 48 per cent of the 1988 equilibrium spawning biomass. 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. **West** The limit reference point is 20 per cent of the unfished biomass. The target reference point is 48 per cent of the unfished biomass. Stock status at the start of 2019: 68 per cent of B_0 compared to the last assessment which gave 69% B_0 at the start of 2016.		
ABARES most recent assessment (2016)	**Biomass** Not overfished	**Fishing Mortality** Not subject to overfishing	

<table>
<tr><td>GVP Figures (2014-15 season)</td><td>GVP
$0.47 million</td><td colspan="2">% Fishery GVP
1.0%</td></tr>
<tr><td>Is a MYTAC in place this season?</td><td>Yes.</td><td>Have breakout rules been triggered?</td><td>N/A for 2018</td></tr>
</table>

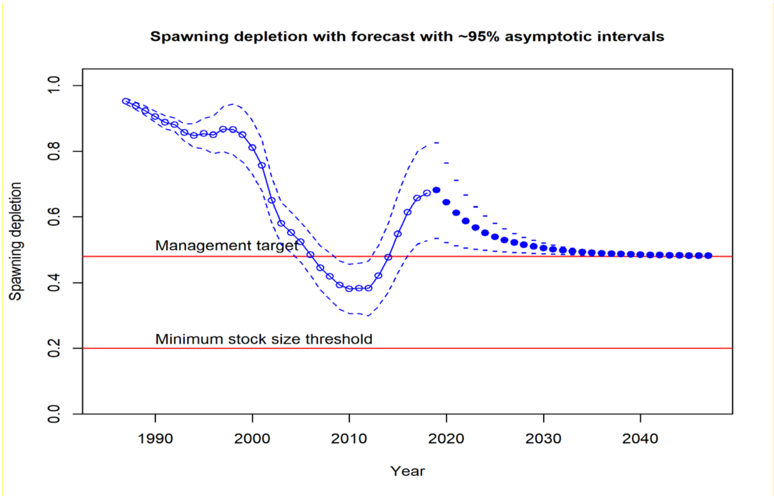
<table>
<tr><th colspan="2">Assessment Summary</th></tr>
<tr><td>Tier Level</td><td>Tier 1</td></tr>
<tr><td>Stock indicator trends</td><td>East
The estimated 2019 biomass is 35% of 1988 virgin biomass which is slightly lower than the 2015 estimated biomass of 37%. CPUE has been decreasing since 2008 although there has been a slight increase in the last two years for eastern trawl, but not for Tasmanian trawl.
West
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_0. This is slightly lower than the 2015 estimated biomass of 69% B_0. CPUE is increasing but the fit is poor and there are some questions about the quality of the CPUE data.</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td>West
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
East
Single stock in zones 10, 20 and 30
Single sex model
Six fleets:
eastern trawl: zones 10 and 20 (1986-2017)
Danish seine (1986-2017)
Tasmanian trawl: zone 30 (1986-2017)
steam trawl (1915-1961)
early Danish seine (1929-1967)
Mixed (DS + trawl) (1968-1985)
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</td></tr>
<tr><td>Changes to model structure/assumptions</td><td>West & East
Same assumptions as 2015 assessment except:
Discard rates included and retention estimated (change only for west)</td></tr>
<tr><td>Significant changes to data inputs</td><td>N/A</td></tr>
</table>

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

RAG Comments on data	Poor data quality and quantity continues to be an issue, particularly in the west
RAG Comments on assessment	**West** The last assessment in 2015 (Tuck *et al*, 2015) estimated a 2016 spawning stock biomass of 69%B_0. The 2018 base case estimates a 2019 spawning stock biomass of 68%B_0. The 2015 assessment did not estimate the biomass series to have fallen below the target reference point. The 2018 assessment suggests the biomass was below the target between 2006 and 2014. This was largely driven by updates to software and tuning procedures, but was also influenced by revisions to historical data on discard rates and additional new data. The last 5 recruitments are estimated to be above average. 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. The results should be treated with considerable caution due to the poor quality of the data. **East** The last assessment in 2015 (Tuck *et al*, 2015) estimated a 2016 spawning stock biomass of 37% of 1988 virgin biomass. The 2018 base case estimates a 2019 spawning stock biomass of 35% of 1988 virgin biomass. Exploration of model sensitivity showed variation in spawning biomass across all sensitivities ranging from 18% to 52% of SSB_0 with greatest sensitivity to natural mortality. Excluding the sensitivity to natural mortality, the other sensitivities showed a much narrower range of affect, from 29% to 40% of SSB. Fits to Eastern trawl CPUE and Tasmanian trawl CPUE are remarkably good. FIS abundance index declines more than the model is able fit. Recruitment deviations indicate that the regime shift may not have been a step change (as currently modelled) and it would be worth investigating whether this is the most appropriate way to model changes in productivity. There may be some value in running sensitivities looking at various stock recruitment relationships. This would constitute a change to the model structure, which is not a standard sensitivity. 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.

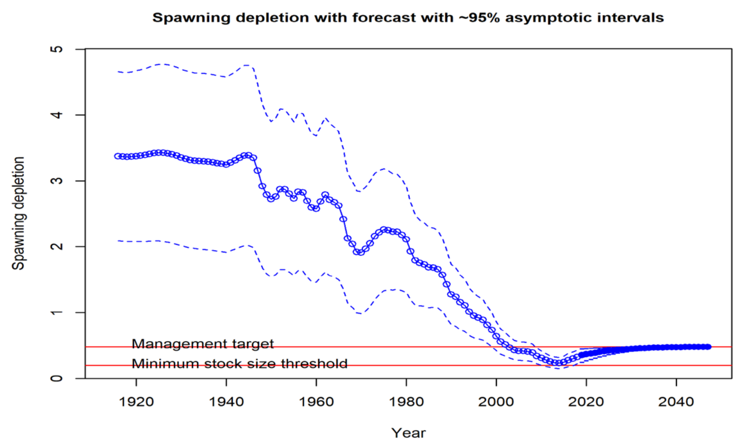
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

<table>
<tr>
<td>Projected Biomass (including confidence intervals)</td>
<td>
West



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

East



Projected to reach 48%B_0 by 2045 assuming average recruitment.
</td>
</tr>
</table>

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

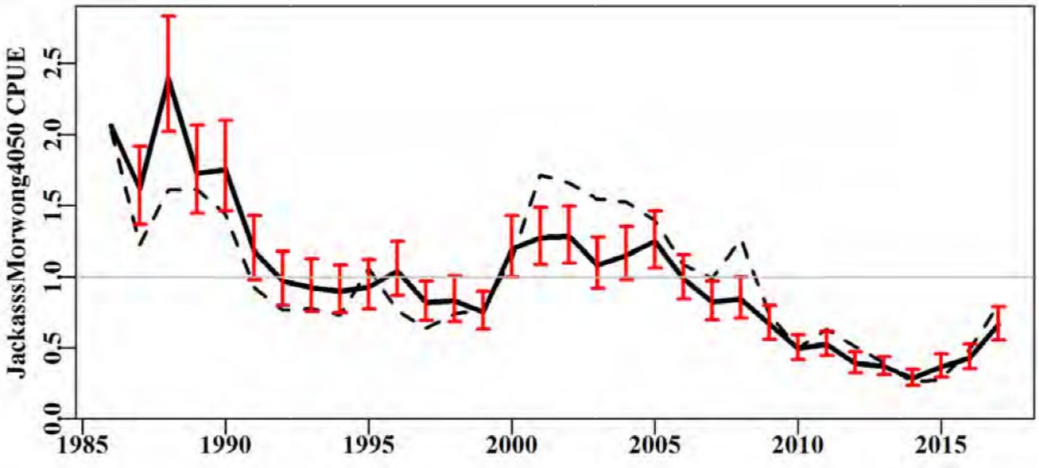
Is a MYTAC recommended for future seasons? *Indicate whether the multi-year recommendation is a RBC (e.g. based on Tier 1 model output) or TAC (e.g. a rollover of catch)*	**Yes** **West**: 3-Year MYTAC using yearly RBCs or the 3-year average each year. **East**: 3-Year MYTAC using yearly RBCs or the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

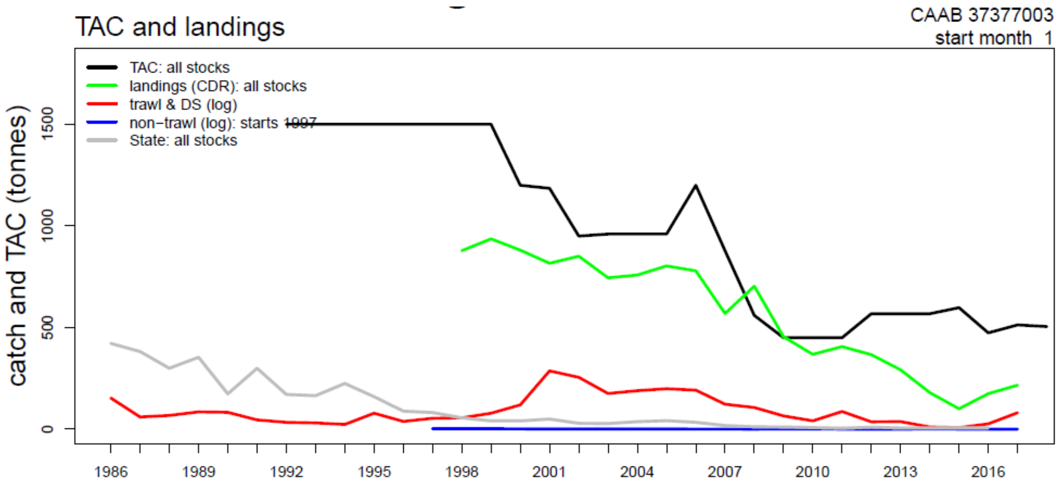
Catch and TAC						
Assessment Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Tier / MYTAC	Tier 1	MYTAC	Tier 1	MYTAC	MYTAC	Tier 1
Stock Status	E: 40% W: 68%	Not assessed	E:37% W:69%	Not assessed	Not assessed	E:35% W:68%
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	692	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%		

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Catch Trends

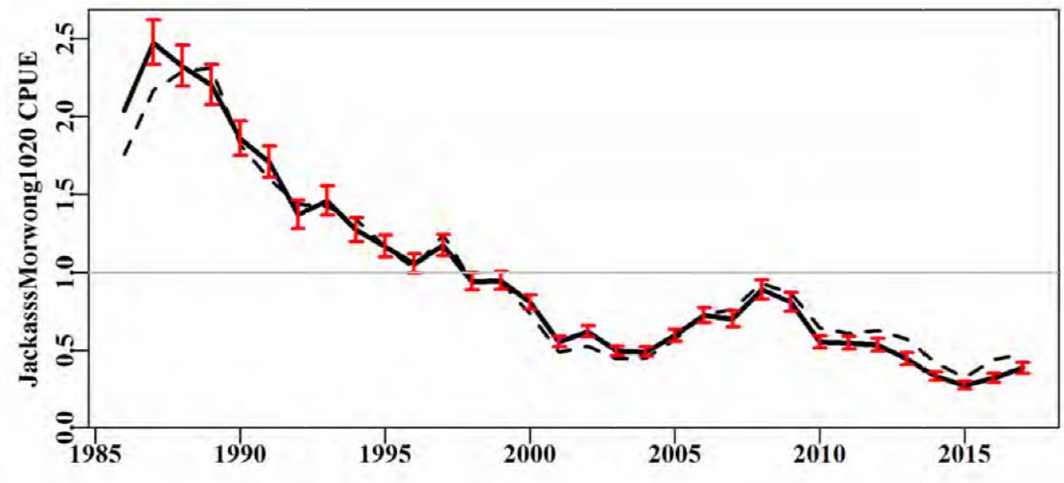
Western



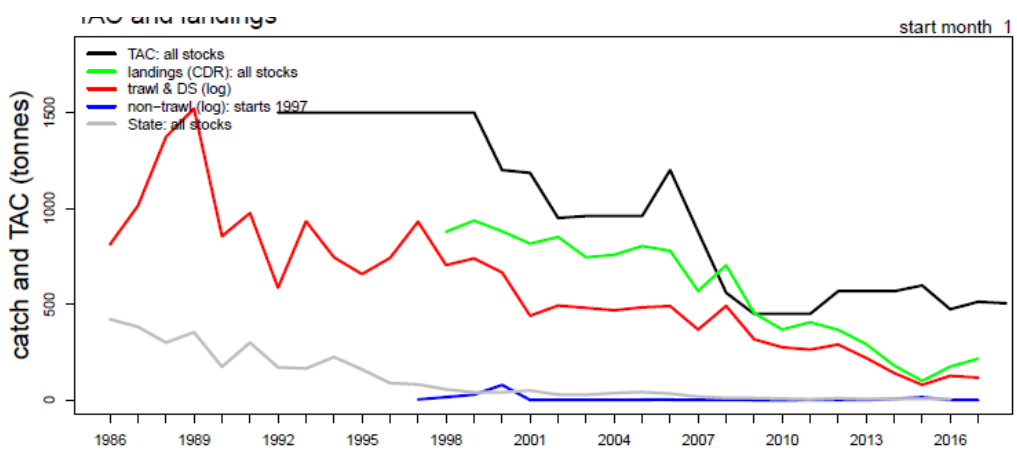


Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Eastern



JackassMorwong1020 CPUE
0.0
0.5
1.0
1.5
2.0
2.5
1985
1990
1995
2000
2005
2010
2015



start month 1
TAC: all stocks
landings (CDR): all stocks
trawl & DS (log)
non−trawl (log): starts 1997
State: all stocks
catch and TAC (tonnes)
0
500
1000
1500
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
2016

7. Mirror Dory (Zenopsis nebulosus)

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

Tier 4: last assessed by SERAG in 2018.

<table>
<tr><th colspan="3">Summary</th></tr>
<tr><td>Stock Structure</td><td colspan="2">An eastern and western stock is currently assumed for assessment purposes. However mirror dory is managed under a global TAC.</td></tr>
<tr><td>Stock status against reference points and trend</td><td colspan="2">
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.
East
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.
<table>
<tr><th>Parameter</th><th>Value</th><th>Parameter</th><th>Value</th></tr>
<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_{targ}</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>
</table>
West
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.
<table>
<tr><th>Parameter</th><th>Value</th><th>Parameter</th><th>Value</th></tr>
<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_{targ}</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>
</table>
</td></tr>
<tr><td>ABARES most recent assessment (2016)</td><td>Biomass

Not overfished</td><td>Fishing Mortality

Not subject to overfishing</td></tr>
</table>

GVP Figures (2014-15 season)	GVP $0.99 million	% Fishery GVP 2.1%	
Is a MYTAC in place this season?	No.	**Have breakout rules been triggered?**	N/A

Assessment Summary	
Tier Level	Tier 4
Stock indicator trends	**East** 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. **West** 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.
Key model technical assumptions/ parameters	Standard Tier 4 assumptions apply
Changes to model structure/assumptions	N/A
Significant changes to data inputs	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. **East** 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. **West** Given the issues with discard estimation, discards are not used in the western assessment, which is consistent with the previous Tier 4.
RAG Comments on data	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.
RAG Comments on assessment	This Tier 4 has been applied consistently over time and there were no additional comments.

RAG Recommendations		
Recommended Biological Catch (2019-20)	West: 95 t East: 140 t Total: 235 t	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: 15%
Is a MYTAC recommended for future seasons? *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)*	No.	
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	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. **Alternative Catch Scenarios**: N/A	
Research Catch Allowance *Included/Addition to TAC*	0 t	
Implications for companion species / TEPs / multi-species fisheries	Restrictions on pink ling catches have likely driven the decrease in discarding for mirror dory east.	

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 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
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	680	684	East 362 West 129	East 198 West 104	East 199 West 123	East 140 West 95
Agreed TAC	808	437	325	235	253	
TAC after unders/overs	968	514	362	262	275	
% TAC caught	23%	49%	76%	84%		

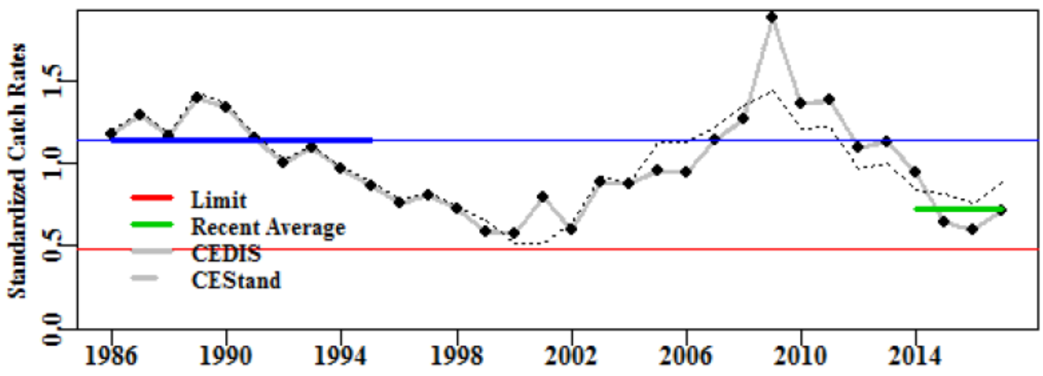
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Catch Trends

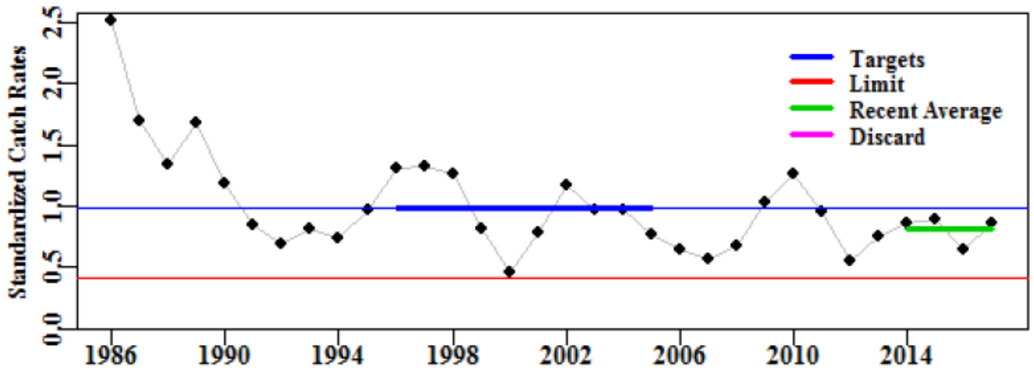
Standardised catch rates

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:

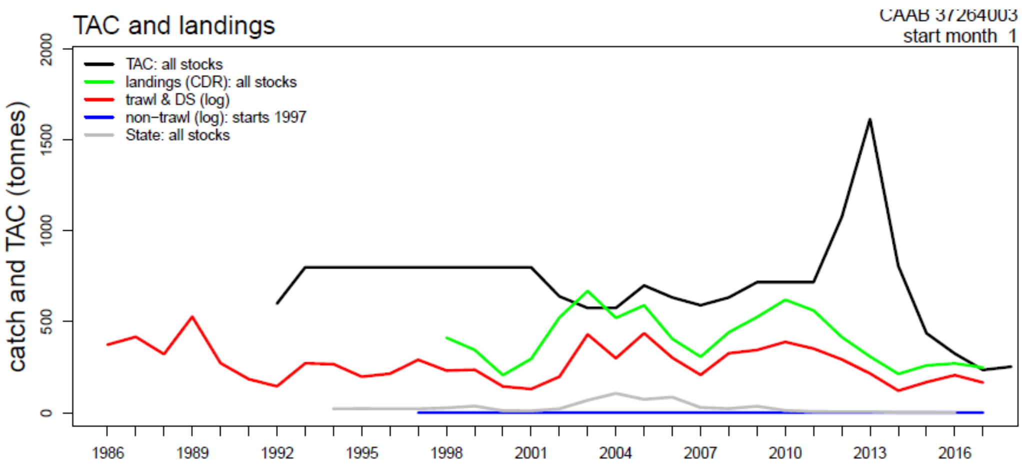


West:

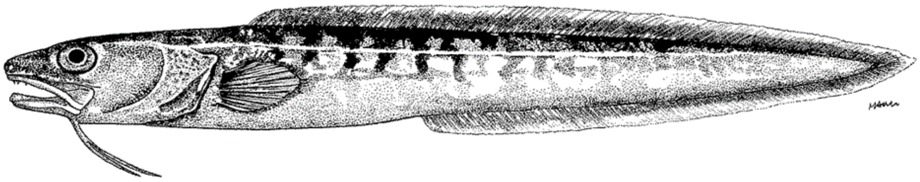


Catch trends

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



8. 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				
Stock Structure	Pink ling are assessed as separate stocks east and west of Longitude 147° East. Genetic variation between eastern and western pink ling has not been found, however, there are differences in size and age structure, growth and catch rates between the eastern and western zones. These differences suggest there is little mixing of pink ling between the zones, and that fishing in one area will have limited impact on fish in the other area.			
Stock status against reference points and trend		Current	Target	Limit
	East	$30\%B_0$	$48\%B_0$	$20\%B_0$
	West	$84\%B_0$		
	East – biomass trend continuing recent increases. West – biomass increasing above management target.			
ABARES assessment (2018)	**Biomass** Not overfished		**Fishing Mortality** Not subject to overfishing	
GVP Figures (2016-17 season)	**GVP** $5.22 million		**% Fishery GVP** 11.2%	
Is a MYTAC in place this season?	Yes		**Have breakout rules been triggered?**	No

Assessment Summary	
Tier Level	Tier 1
Stock indicator trends	**East:** biomass trend continuing recent increases and is between the limit and target reference point. There is some uncertainty around the rate given various estimates of M and which CPUE series is used (whether or not avoidance is accounted for).
	West: biomass increasing above management target.

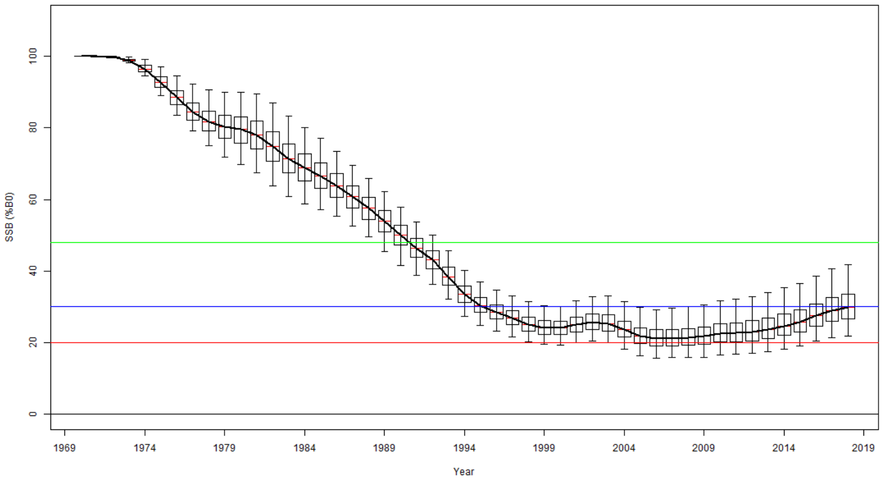
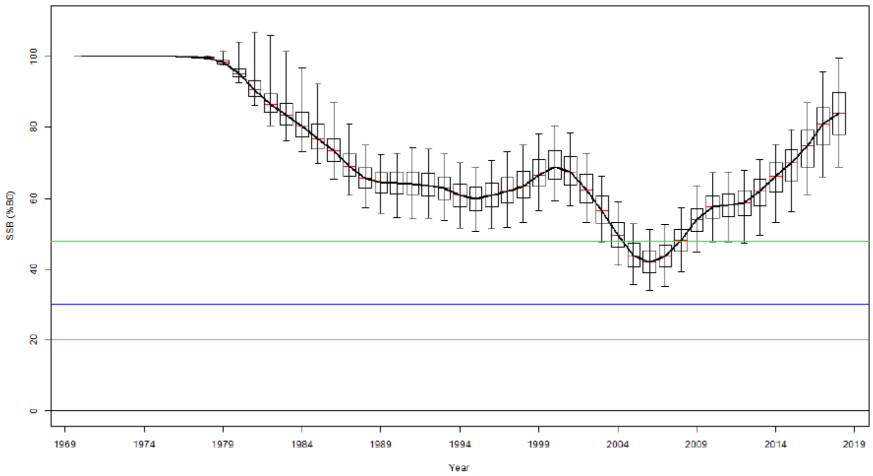
Key model technical assumptions/ parameters	Assessed using CASAL based stock assessment model. See Cordue (2018) for detailed technical assumptions and parameters. Single area, two sex, age-structured Von Bertalanffy growth, single M Fixed maturity and steepness (h=0.75) SSB: female only, mid-year Two fisheries: trawl, non-trawl Time-blocked selectivities for trawl Estimate parameters: B_0, growth, recruitments strengths, M (E:0.25, W:0.23), selectivities Data weighting followed Francis (except age-length not fully down-weighted) A full Bayesian estimation was undertaken; MPD runs for diagnostics followed by MCMC runs for estimates.
Changes to model structure/ assumptions	The 2018 pink ling assessment is as an update of ISL's 2015 assessment.
Significant changes to data inputs	FIS indices and length frequencies were included in the assessment Trip limits formed part of the management arrangements to constrain catches in the eastern zone and although trip limits will reduce landings is not so obvious whether they will reduce total fishing mortality (removals). Period effects were estimated to account for discard avoidance behaviour due to trip limits (see Cordue 2018 for details). The 'Period CPUE' series appeared to have an implausible increase from 2015 to 2017. Excluding it (linkall CPUE) generates a 'pessimistic' index. CPUE is likely somewhere in between. Variations to the base-case were presented; Three fixed-M, a uniform M, period CPUE with M fixed at 0.23, and a 'linkall CPUE'.
RAG Comments on data	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. There is variation in the length of trawl shots, and so length frequencies are scaled by catch-rate, rather than catch. Non-trawl port length frequencies are not stratified by depth, based on 2013 analysis suggesting they're not required Time-blocking on trawl selectivity suggests smaller fish were not caught during 'trawl 2' which is from 2000-2006. Industry suggested this is due to structural adjustment and vessel catching small fish leaving. MDP estimated and MCMC estimates were very similar (not always the case).

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

RAG Comments on assessment	**East** Current stock status is not well estimated. It varies across model runs and is heavily dependent on M. Three variations to the base-case are presented here: **Reference**: CPUE series with no period/avoidance effect, est M of 0.25 **M-0.23**: CPUE series with no period/avoidance effect and M fixed at 0.23 **Period**: CPUE series with period/avoidance effect and M fixed at 0.23 The 'signals' in the data from the east make it difficult to estimate M and the RAG agreed that a fixed value of 0.23 should be used in the east. 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. The base-case model using the accepted CPUE series with a fixed M=0.23 estimates the current spawning biomass is 30%B_0 (22-42, 95% CI) and under the 20:35:48 harvest control rule generates an RBC of 260 t in 2019 (36-560, 95% CI) and a long-term yield of 570 t (540-620, 95% CI). The RAG noted these estimates are highly uncertain. SERAG accepted the final eastern pink ling base case stock assessment noting the estimated current eastern zone spawning stock biomass of 30%B_0 (22-42, 95% CI) and the 2019 median RBC of 260 t (36-560, 95% CI). 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. 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. **Table 1 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% B0 and at or above the target of 48% B0.** (table below) Should the constant catch scenarios be used to consider management options or future TAC recommendations for the eastern zone, constant catches in excess of 550 t lead to a greater than 10 per cent probability of eastern pink ling declining to below the limit reference point by 2028 and substantially increase the time taken to rebuild the stock to the management target.

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

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

	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_0 (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_0 **East:**  **West:** 

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

RAG Recommendations

Recommended Biological Catch (2019-20)

East:

2019: 260 t (36-560 t, 95% CI)

West:

2019: 1150 t (770-1660 t, 95% CI)

Undercatch: 10%

Overcatch: 10%

Discount Factor: 15%

Is a MYTAC recommended for future seasons?

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)

Yes. 3-year MYTAC.

East

2019: 260 t

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.

West

2019: 1150 t

2020: TBC

2021: TBC

Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management

Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).

RBC recommendation = Very unlikely.

Alternative Catch Scenarios – eastern stock at constant catch:

Alternative catch projections using the accepted M=0.23 and CPUE series

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

B_{21} means the biomass estimate in 2021.
B_0 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.

Research Catch Allowance
Included/Addition to TAC

0 t

Implications for companion species / TEPs / multi-species fisheries

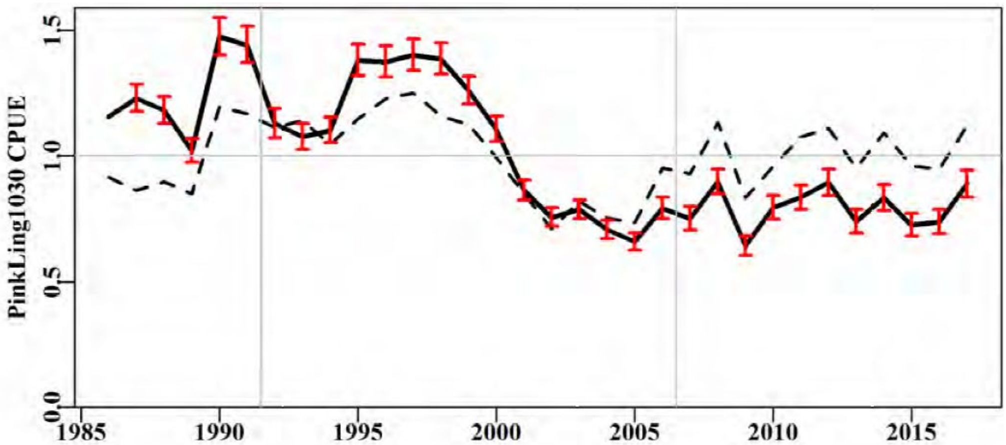
Pink ling is caught in close association with blue-eye trevalla in the line sector and blue grenadier in the trawl fishery.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

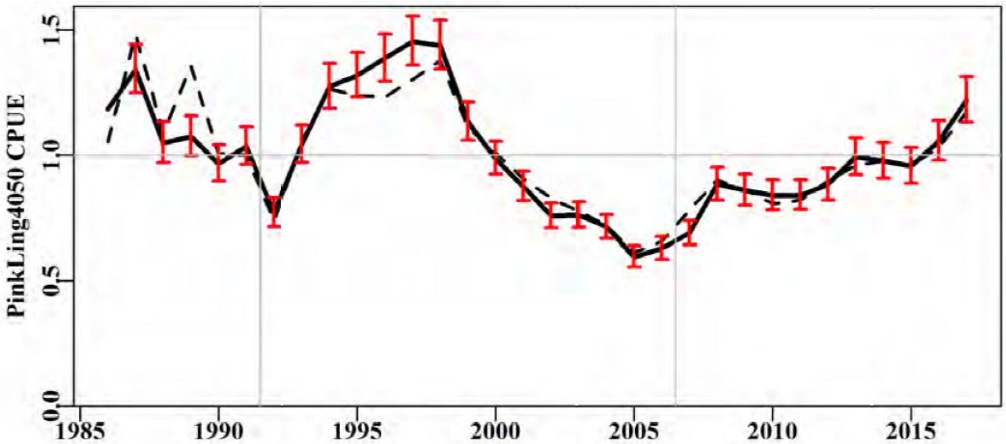
Catch and TAC						
Assessment Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Tier / MYTAC	East: Tier 1 West: Tier 1	Rollover MYTAC	East: Tier 1 West: Tier 1	Rollover MYTAC	Rollover MYTAC	East: Tier 1 West: Tier 1
Stock Status	East: 25% West: 58%	Not assessed	East: 30% West: 73%	Not assessed	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

Pink ling standardised catch rates (East: Z10-30, no avoidance included)

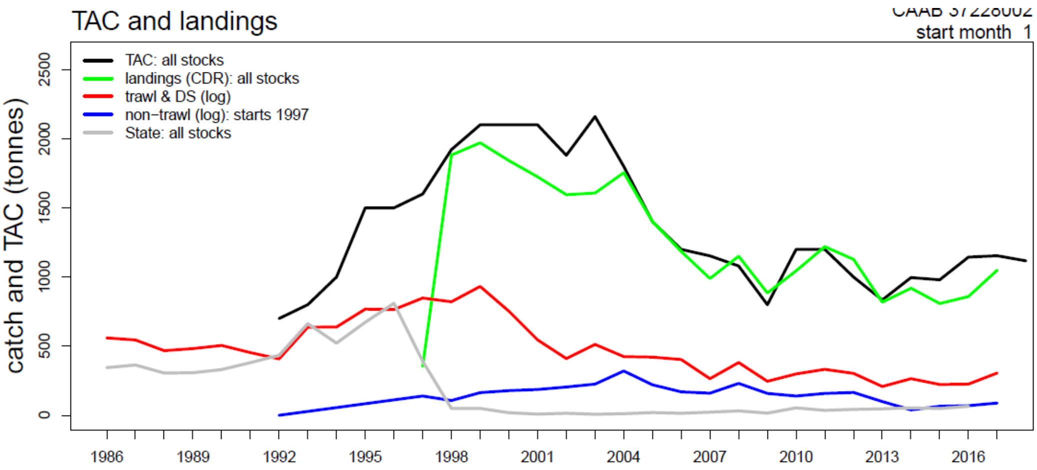


Pink ling standardised catch rates (West: Z40-50)



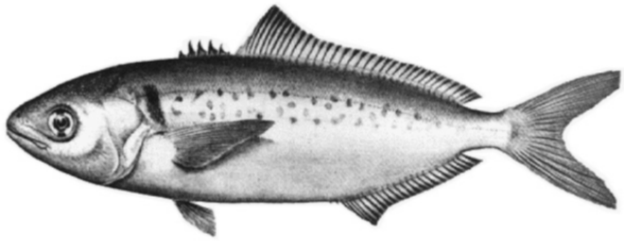
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Catch trends



Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

9. Silver warehou (Seriolella punctata)



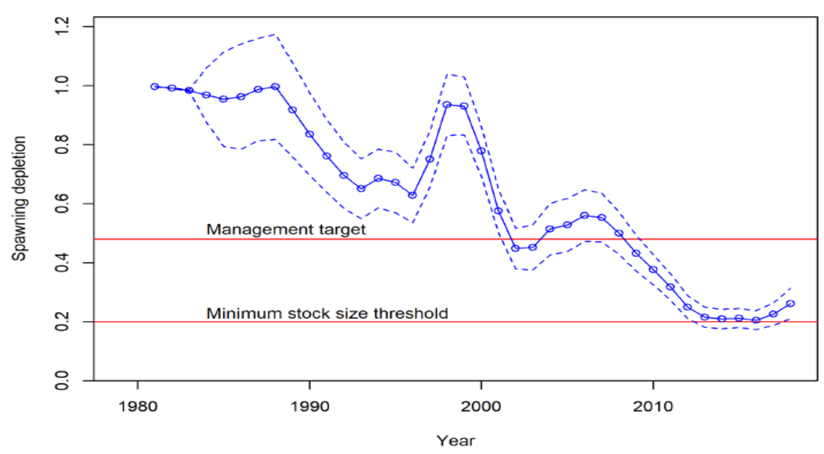
ABARES (2012): Line drawing – FAO

Tier 1: last assessed by SERAG in 2018

<table>
<tr><th colspan="4">Summary</th></tr>
<tr><td>Stock Structure</td><td colspan="3">Considered to be a single stock in the SESSF.</td></tr>
<tr><td rowspan="3">Stock status against reference points and trend</td><td>Current</td><td>Target</td><td>Limit</td></tr>
<tr><td>31%B_0</td><td>48%B_0</td><td>20%B_0</td></tr>
<tr><td colspan="3">Biomass Trend: The biomass has declined since the mid-2000s with the 2018 assessment estimating a recent increase from close to the limit reference point to the estimated biomass of 31%B_0.

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

Figure 15. Time-trajectory of spawning biomass depletion (with 95% confidence intervals) corresponding to the MPD estimates for silver warehou.


</td></tr>
<tr><td>ABARES most recent assessment (2015)</td><td>Biomass

Not overfished</td><td colspan="2">Fishing Mortality

Not subject to overfishing</td></tr>
<tr><td>GVP Figures (2013-14 season)</td><td>GVP

$0.45 million</td><td colspan="2">% Fishery GVP

1%</td></tr>
<tr><td>Is a MYTAC in place this season?</td><td>Yes</td><td>Have breakout rules been triggered?</td><td>No</td></tr>
</table>

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

<table>
<tr><th colspan="2">Assessment Summary</th></tr>
<tr><td>Tier Level</td><td>Tier 1</td></tr>
<tr><td>Stock indicator trends</td><td>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).</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td>
<table>
<tr><th>Parameter</th><th>Details</th><th></th></tr>
<tr><td>Natural mortality (M)</td><td>fixed</td><td>0.3</td></tr>
<tr><td>Steepness (h)</td><td>fixed</td><td>0.75</td></tr>
<tr><td>length-weight scale, a</td><td>fixed</td><td>6.50E-06</td></tr>
<tr><td>length-weight power, b</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 K</td><td>estimated</td><td>Female 0.312</td></tr>
<tr><td>Growth l_{min}</td><td>estimated</td><td>Female age 2 14.82</td></tr>
<tr><td>Growth l_{max}</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>ln(R_0)</td><td>estimated</td><td>9.379</td></tr>
</table>
</td></tr>
<tr><td>Changes to model structure/ assumptions</td><td>The ageing error matrix has been updated.

A new tuning procedure has been used to balance the weighting of each of the data sources that contribute to the overall likelihood function.</td></tr>
<tr><td>Significant changes to data inputs</td><td>Catches from the gillnet, hook and trap sector and the small pelagic fishery are now included.

Estimated annual discard rates that are fitted to by the model have been split into eastern and western components.

Factory trawlers are now included in the estimation of annual discard rates when there is observer coverage.

FIS abundance indices for east and west fleets are removed from the base-case and are considered as a sensitivity.</td></tr>
<tr><td>RAG Comments on data</td><td>There were questions regarding the discarding of silver warehou on factory trawlers. For this assessment discard estimates from factory trawlers were incorporated into the overall estimate where observers were present.

CPUE assumes targeting practices have not changed over time. Industry members suggested the larger vessels leaving the fleet have changed the dynamics of the fishery. CPUE standardisation does not account for this.</td></tr>
</table>

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

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.

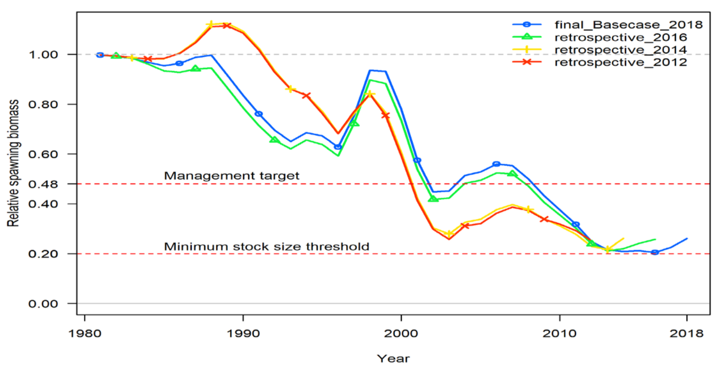
Mean of the lowest three of the last five years: spawning biomass stabilises at around 27%B_0

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 4 (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 he MLE estimate of 31.3%B_0.

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

RBC advice

In forming RBC advice, 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)

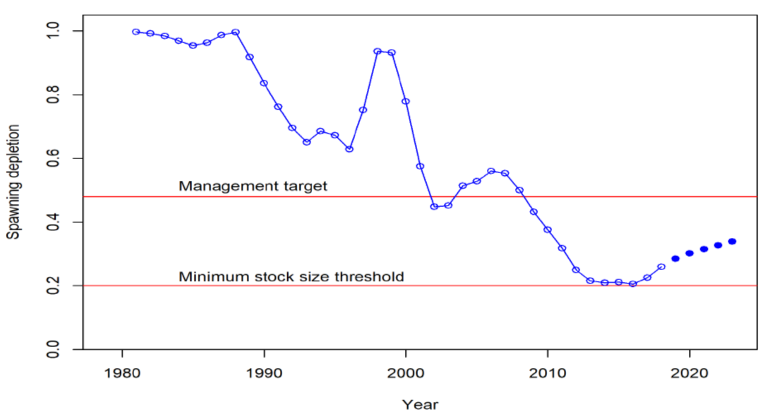


Figure 5 Time trajectory of spawning biomass depletion (with 95 per cent CI) under poor recruitment and catches maintained at current levels.

RAG Recommendations		
Recommended Biological Catch (2019/20)	N/A	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: N/A
Is a MYTAC recommended for future seasons? *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)*	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.	

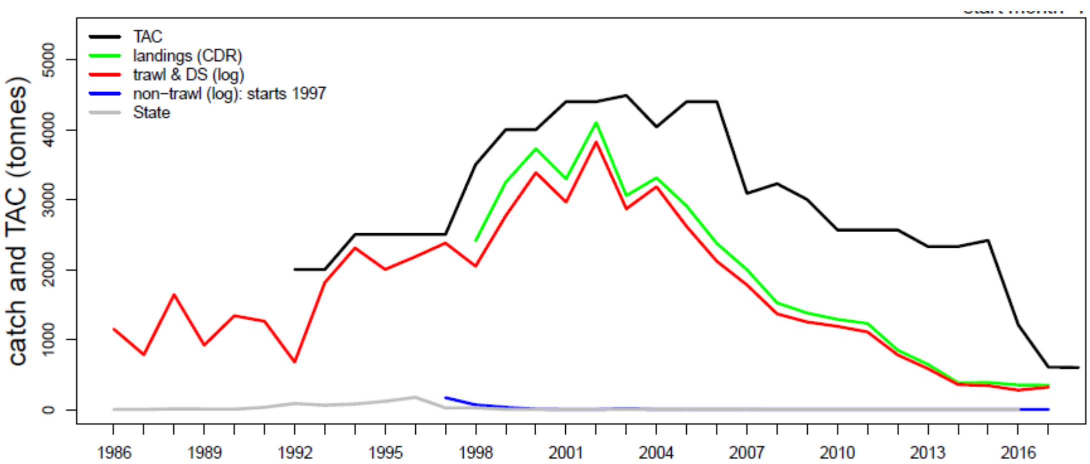
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	**RBC recommendation**: **Alternative Catch Scenarios**: Under the low 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.
Research Catch Allowance *Included/Addition to TAC*	0 t
Implications for companion species / TEPs / multi-species fisheries	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

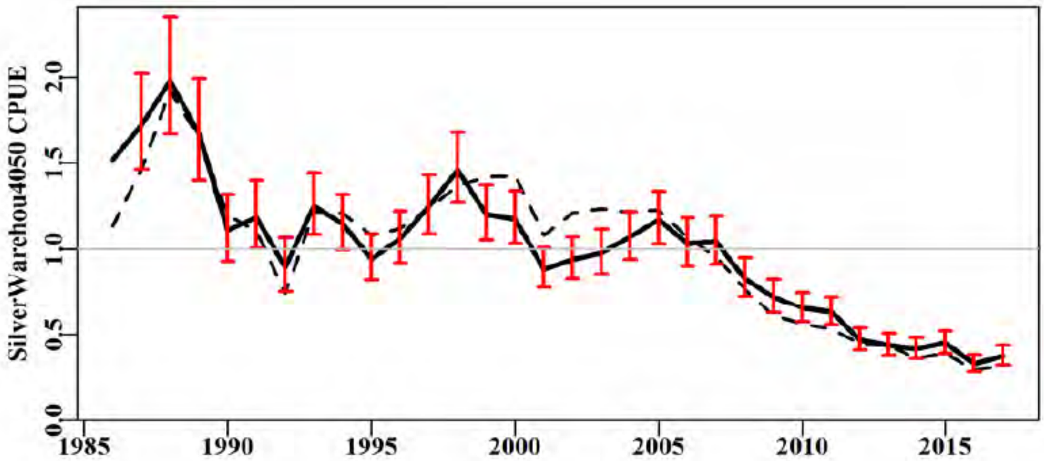
Assessment Year	2013	2014	2015	2016	2017	2018
Tier / MYTAC	MYTAC	MYTAC	Tier 1	MYTAC	MYTAC	Tier 1
Stock Status	Not assessed	Not assessed	40%	Not assessed	Not assessed	
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	MYTAC	MYTAC	1958	604	604	
Agreed TAC	2326	2417	1209	605		
TAC after unders/overs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

% TAC caught	14%	11%	25%	60%		

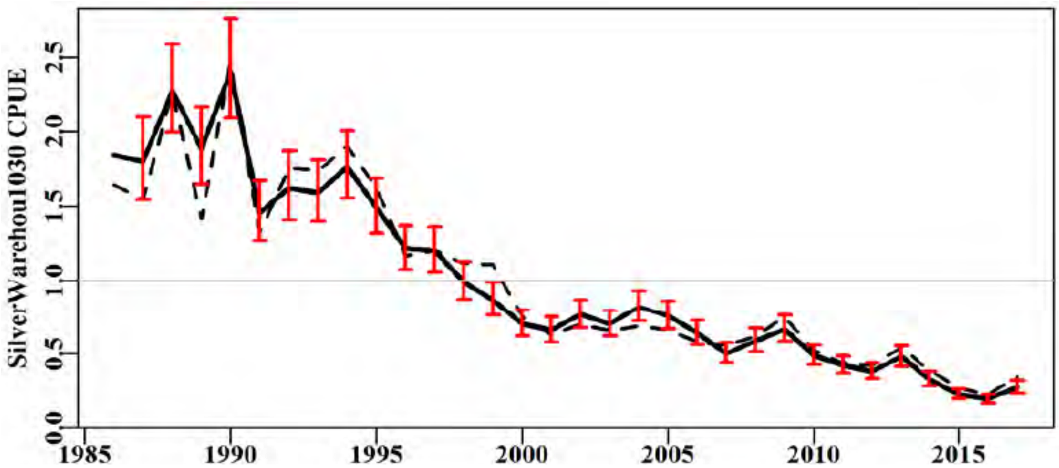
Catch Trends



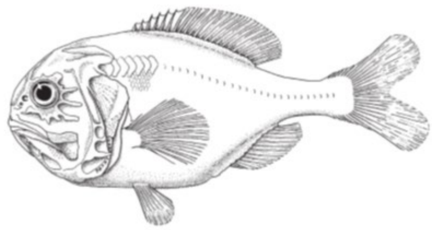
Std CPUE Z40:50



Std CPUE Z10:30



Orange Roughy (Hoplostethus atlanticus) - Eastern zone



ABARES (2012): Line Drawing – Rosalind Poole

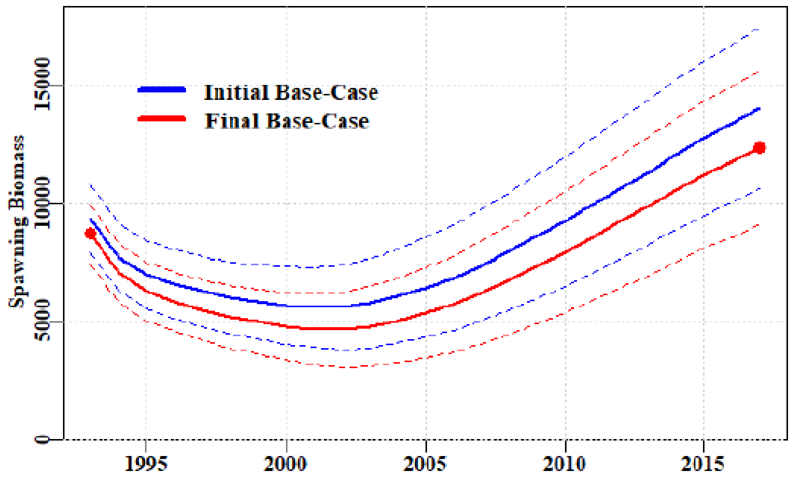
Tier 1: last assessed by SERAG in 2018

Summary		
Stock Structure	Based on the existing data and fishery dynamics, multiple regional stocks of Orange Roughy are assumed and the fishery is managed and assessed as a number of discrete regional stocks. Recent genetic studies indicate little genetic diversity between all SE Australian stocks. However, they may be demographically separate. For assessment purposes the eastern stock (primarily St Helens Hill and St Patricks Head) is assumed to also include catches taken from the Pedra Branca area in the southern zone.	
Stock status against reference points and trend	Limit reference point is 20% of unfished biomass. Target reference point is 48% of unfished biomass. 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. Orange Roughy eastern is managed under the Orange Roughy Rebuilding Strategy 2014. 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.	
ABARES most recent assessment (2015)	**Biomass** Not overfished	**Fishing Mortality** Not subject to overfishing
GVP Figures (2013-14 season)	**GVP** $1.64 million	**% Fishery GVP** 3.5%
Is a MYTAC in place this season?	Yes. 465 t 3-year MYTAC	
Have breakout rules been triggered?		

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Assessment Summary	
Tier Level	Tier 1
Stock indicator trends	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.
Key model technical assumptions/ parameters	The model assumptions include the single stock structure hypothesis; eastern zone spawning roughy and Pedra Branca non-spawning roughy. The biomass is assumed to have been unfished at the start of 1979. Recruitment is assumed to be distributed about a Beverton-Holt stock recruitment relationship. Plus group age was set at 80 years. Recruitment steepness and rate of M – refer to base case and alternate case below. Recruitment variability – 0.70 Length at maturity – 35.8 cm VB growth co-efficient – 0.06
Changes to model structure/ assumptions	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).
Significant changes to data inputs	See above
RAG Comments on data	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. 2017 assessment assumes a single stock that includes eastern zone plus Pedra Branca. Constants of M and Steepness: noted the wide range of M estimates that have been used in Orange Roughy assessments in other jurisdictions. Previous eastern Orange Roughy assessment used 0.04. Preliminary Likelihood analysis presented to 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.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

RAG Comments on assessment	Future assessments should consider the implications of temporal changes in distribution of fishing effort. This will have implications for data collection and data plan. Future assessment to consider mechanism for considering changes in fecundity. Even though the model fits to the available data were reasonable the model remains uncertain with relatively wide confidence intervals around the median stock estimates. Despite uncertainties in input parameters the model was stable. 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. The RAG noted the recent temporal changes in fishing effort and the effect this has on the age and length data. There are 2 scenarios: initial base case and a sensitivity 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 projections. 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. griding of different parameters should be investigated prior to the next assessment.
Projected Biomass (including confidence intervals)	A comparison of the female spawning biomass trajectories from the initial and alternate (final) base cases over the years 1993 – 2017, along with the asymptotic 95% confidence intervals (the dashed lines). The intervals for the alternate (final) base case were from 21.9% - 37.7% B_0 and for the Initial base case from 25.6% - 41.9% B_0. 

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

<table>
<tr><th colspan="3">RAG Recommendations</th></tr>
<tr>
<td>Recommended Biological Catch (2018-19)</td>
<td>
In 2017, the RAG recommended a 3-year MYRBC under the HCR 20:35:48.
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.
<table>
<tr><td colspan="2">Initial base-case:
M = 0.04
h = 0.75</td><td colspan="2">Alternate case:
M = 0.036
h = 0.6</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>
</table>
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.
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.
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.
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.
</td>
<td>Undercatch: 100%
Overcatch: 10%
Discount Factor: 0%</td>
</tr>
<tr>
<td>Is a MYTAC recommended for future seasons?
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)</td>
<td colspan="2">
Yes. Continuation of the 3-Year MYTAC with the following RBC each year.
<table>
<tr><td>Year</td><td>RBC</td></tr>
<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>
</table>
The RAG noted there was little risk in accepting industry’s proposal to limt catches in the 2nd and 3rd year of the MYTAC to 900 t each year.
</td>
</tr>
</table>

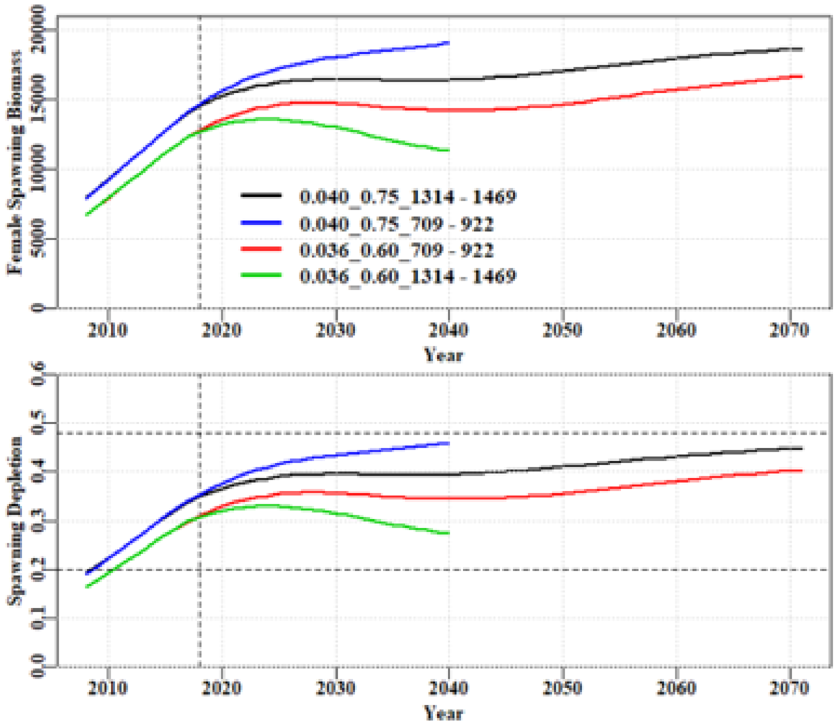
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	**RBC recommendation** = Very low **Alternative Catch Scenarios**: Deterministic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

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

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

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):

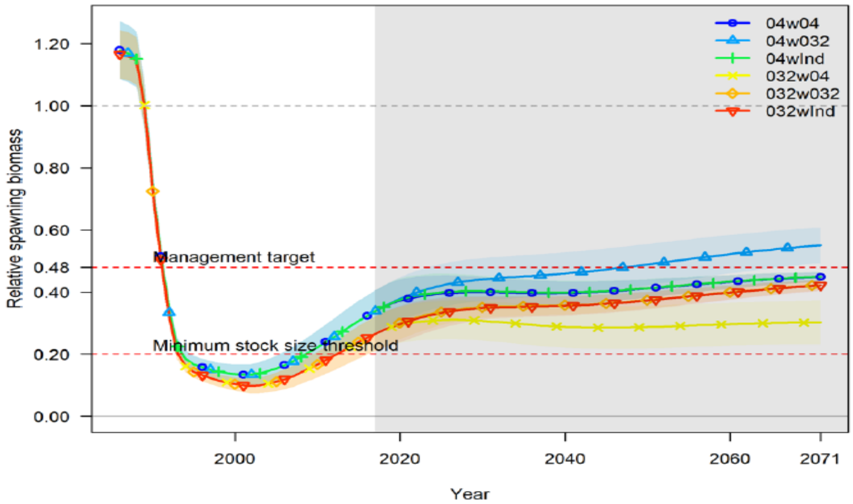
At it's September 2018 meeting, SERAG requested a cross-catch risk assessment for eastern orange roughy based upon the model structure of the 2017 assessment. There were six scenarios that differed only by the assumed values of natural mortality and the projected catches.

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

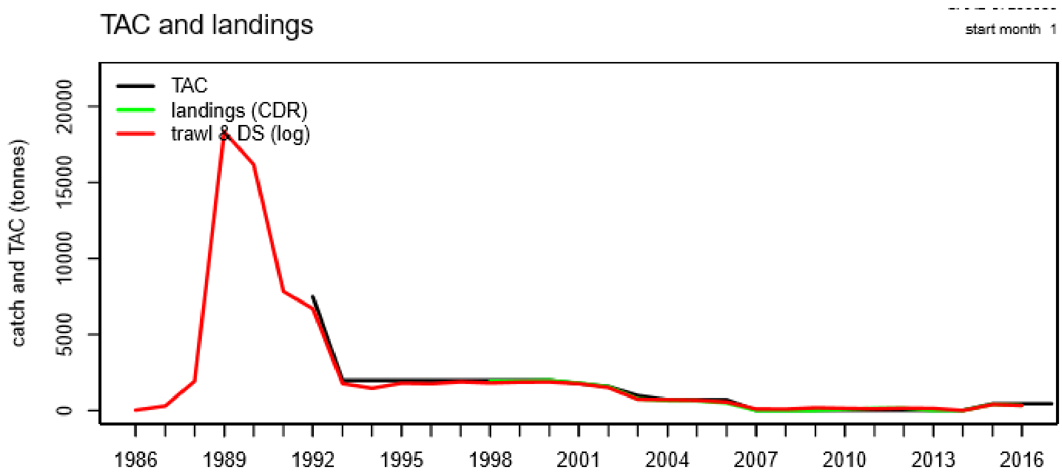
The model with the lower productivity (M=0.032) and with highest catches had the lowest long-term biomass series in terms of annual tonnage of female spawning biomass. This series stabilised at approximately 30%B_0. However, in the short-term there is still little difference in projected biomass between 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 limt catches in the 2nd and 3rd year of the MYTAC to 900 t each year.

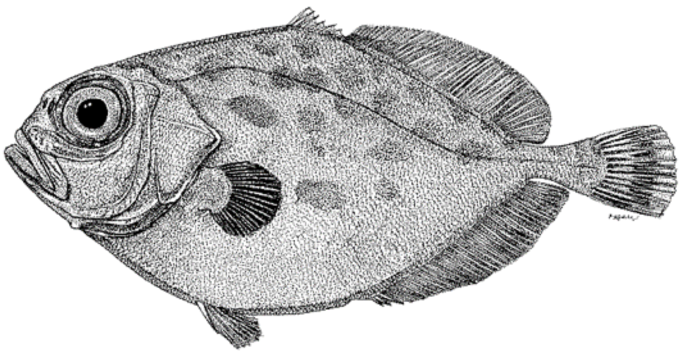
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au



Landed catch against TAC:



10. Oreo Smooth (Pseudocyttus maculatus) – Other



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

Summary		
Stock Structure	Little is known about the stock structure of smooth oreodory. For assessment and management purposes they are treated as a single unit of stock through the SESSF excluding the Cascade Plateau and South Tasman Rise.	
Stock status against reference points and trend	Smooth oreodory were assessed using a Tier 5 depletion based stock reduction analysis (DBSRA) for the first time in 2015. 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. 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.	
ABARES most recent assessment (2015)	**Biomass** Not overfished	**Fishing Mortality** Not subject to overfishing
GVP Figures (2013-14 season)	**GVP** $0.19 million	**% Fishery GVP** < 0.4%
Is a MYTAC in place this season?	Yes, MYTAC of 90 t. In 2018, the RAG agreed to roll over the RBC into the fourth year.	
Have breakout rules been triggered?	No.	

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Assessment Summary	
Tier Level	Tier 5 – see note in RAG comments on assessment
Stock indicator trends	Unknown due to low effort and catches.
Key model technical assumptions/ parameters	The requirements for DBSRA are: • catch time series; ideally from the start of the fishery • a simple model of the dynamics of the fishery. Plausible values are also required for: • the natural Mortality Rate: M, model input 0.05 • the ratio of FMSY to the Natural Mortality: FMSY/M, model input 0.8 • the most productive stock depletion level: BMSY/B0, model input 0.4 • the age at maturity: model input 15 • the final depletion level, model input 0.48
Changes to model structure/ assumptions	Tier 5 (DBSRA) used to assess this species superseding the previous Tier 4 assessment.
Significant changes to data inputs	N/A
RAG Comments on data	There is only a short time series of data when these fish were caught in any quantity. **Standardised Catch Rates (Tier 4 CPUE series 2010):** 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.
RAG Comments on assessment	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. 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. Smooth oreodory are spatially structured and the model assumes some homogeneity that may not be a reliable estimation of stock distribution. The RAG agreed that a target depletion of 48 per cent of B0 is needed to be consistent with the SESSF Harvest Strategy Framework. The RBC is extremely conservative as 90 per cent of the smooth oreodory catch was taken from waters that are now closed. 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.

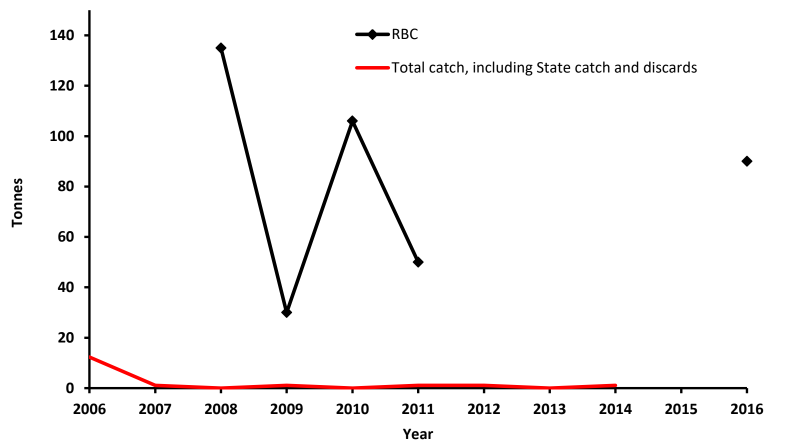
Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

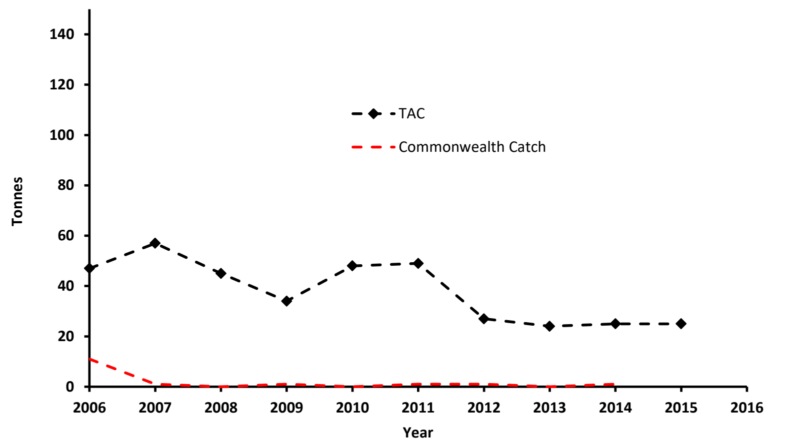
Projected Biomass (including confidence intervals)	**N/A**

RAG Recommendations		
Recommended Biological Catch (2019-20)	90 t	**Undercatch:** 10% **Overcatch:** 10% **Discount Factor**: 0% 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. The RAG recommended that a discount factor is not applied. NB. There is no specific Tier 5 discount factor in the SESSF HSF.
Is a MYTAC recommended for future seasons? *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)*	Yes. The RAG recommended rolling over the RBC into the fourth year of the 3-year MYTAC.	
Probability of RBC (or other levels of catch) causing a decline below limit reference under proposed management *Species that follow a HS rule that has been MSE tested will have a "very unlikely" score in this section (i.e. P<10%).*	The constant catch projections indicate that the risk of the stock declining to below the limit reference point is low. Alternative Catch Scenarios: N/A	
Research Catch Allowance *Included/Addition to TAC*	0 t	
Implications for companion species / TEPs / multi-species fisheries	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**
Tier / MYTAC	Not assessed	Not assessed	Tier 5	MYTAC	MYTAC	MYTAC
Stock Status	Not assessed	Not assessed	N/A	N/A	N/A	N/A
SESSF Season	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBC	Not assessed	Not assessed	90	90	90	90
Agreed TAC	23	23	90	90		
TAC after unders/overs	25	25	90	99		
% TAC caught	**3%**	**85%**	**53%**	**56%**		

Catch Trends





Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

11. Glossary

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

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

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

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

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

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

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

catch-per-unit effort (CPUE) – the number or biomass of fish caught as by a unit of fishing effort. Often used as a measure of fish abundance.

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

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

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

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

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

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

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

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.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

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.

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au