Australian Government
Australian Fisheries Management Authority

Southern and Eastern Scalefish and Shark Fishery
Shark Resource Assessment Group (SharkRAG)

SharkRAG 9 Meeting minutes

Date: 03 and 04 December 2020

Teleconference

Attendees

Name	Membership
Mr Sandy Morison	Chair
Dr Ian Knuckey	Scientific Member
Dr Charlie Huveneers	Scientific Member
Dr Robin Thomson	Scientific Member
Mr Jamie Papas	Industry Member
Mr Craig Harris	Industry Member
Mr Kyriakos Toumazos	Industry Member
Dr Leonardo Guida	Conservation Member
Ms Natalie Couchman	AFMA Member
Ms Lou Cathro	Executive Officer
Mr Ross Bromley	Invited Participant (Industry)
Mr James Woodhams	Invited Participant (ABARES)
Ms Miriana Sporcic	Invited Participant (CSIRO, presenter)
Dr Paul Burch	Invited Participant (CSIRO, presenter)
Ms Fiona Hill	Observer (AFMA)
Ms Natalie Manahan	Observer (Industry)

Meeting Minutes

1. Preliminaries

1.1. Welcome and apologies

1) The Chair opened the meeting at 9:35 with an acknowledgement of country and welcomed attendees to the meeting. The Chair noted apologies from Dr Julian Morison and Mr Leigh Castle.

1.2. Adoption of agenda

2) The RAG adopted the agenda (**Attachment A**). The Chair noted that agenda item 3.2 would be move to the morning of day 2 and agenda item 4 would be moved to the afternoon of day 1. The minutes will maintain the order of the original agenda.

1.3. Declaration of interests

3) Declarations of interest were received from RAG members prior to the meeting (**Attachment B**). The Chair requested members disclose agenda items for which they may hold a conflict of interest. The AFMA member reminded RAG members that declared conflicts of interest are for both perceived and actual conflicts of interest. This is outlined in section 4.1.3 of *Fisheries Administration Paper No. 12*.

4) The following conflicts of interest were declared:

   a) Mr Papas, Mr Harris and Mr Toumazos noted conflicts of interest for agenda item 3.

   b) Dr Guida noted a perceived conflict of interest for agenda item 3.

   c) Dr Knuckey and Dr Huveneers noted conflicts of interest for agenda item 4.

d) Dr Thomson noted conflicts of interest for agenda items 4 and 6.

e) Mr Bromley noted conflicts of interest with agenda items 3 and 4.

f) Dr Sporcic noted a conflict of interest with agenda item 4.

5) The remaining RAG members agreed that members who had declared a conflict of interest could participate in discussions but not take part in the formulation of advice and recommendations.

1.4. Adoption of Meeting Minutes

6) The RAG adopted the meeting minutes from SharkRAG7, held on 29-30 September 2020, as final.

1.5. Status of Action Items

7) The AFMA member introduced the Agenda Item, noting many of the action items will be discussed during the course of the meeting. The RAG noted the action items as read (**Attachment C**), with discussion on the following items:

a) SharkRAG 2 2016, action item 1 – the advice of the RAG was sought on the continued need for this action. Dr Thomson clarified that the action should be retained and included in the forward work plan for the gummy shark assessment, noting an initial examination of data should be undertaken to determine feasibility. The RAG noted that the Shark Industry Data Collection (SIDaC) program will have collected some of the required data since its inception in 2018. It was also noted that data collected during the trial of automatic longline gear in the Bass Strait may also be of use.

2. Updates from Members

2.1. AFMA update

8) The AFMA member provided an update on the management of shark species in the Gillnet, Hook and Trap (GHAT) sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF) since the last RAG teleconference held on 6 November 2020:

a) Multi-Species Harvest Strategy (MSHS) project - the Fisheries Research and Development Corporation (FRDC) project 2018-021 Development and evaluation of multi-species strategies in the SESSF (MSHS project) is currently underway with Dr Rich Little as the principle investigator. The project team has been meeting fortnightly with the relevant steering groups to discuss progress. The project team is developing two general approaches: pretty-good multi-species yield (PGMSY) and an indicator species approach. The RAG noted that a workshop is likely to be held in early 2021, to inform the project as it progresses. This will include members of the RAG, and from the Department of Agriculture, Water and the Environment (DAWE).

The RAG requested the following <u>action item</u>:

1. Dr Knuckey to provide an update on FRDC project 2018-021 *Development and evaluation of multi-species strategies in the SESSF* at the next SharkRAG meeting.

2.2. CSIRO update

9) Dr Thomson provided an update to the RAG on the progress of the school shark close kin mark recapture project:

a) The project commenced in August 2020. The SIDaC program is on track to meet sampling targets, with improvements in recent times.

b) A pallet of historical samples from a 2010 survey has been located, and these will be examined as the project progresses. It is hoped the samples will include those from larger animals. CSIRO is also undertaking proof of concept work to assess whether a new epigenetics method can be used to assign an age to samples.

c) An industry member queried whether the migration patterns of school shark will affect how the historical samples can be used. Dr Thomson noted this is something they will consider once they examine the samples.

d) The AFMA member noted that the sampling requirements for SIDaC program will be reviewed at a data workshop in early 2021, which will include requirements for school shark. Dr Thomson noted that samples from Western Tasmania, Western South Australia and deeper samples from the automatic longline and trawl fleets would be desirable.

2.3. Industry update

10) There were no further updates provided by industry.

3. RBC Recommendations

3.1. Gummy Shark

11) Dr Thomson presented the report, *Updated stock assessment for Gummy Shark for 2020 using data to 2019 DRAFT*. The report provided an update to the gummy shark Tier 1 assessment. Gummy shark was last assessed in 2016. At the 2018 SESSFRAG data meeting there was concern that there was insufficient new data (poor spatial coverage) to run an updated assessment for gummy shark in 2019. As a result, it was deferred to 2020.

12) The RAG noted that in the intersessional period since the last meeting, Dr Thomson identified additional age data (2016-2019) to be included in the base case model for the gummy shark Tier 1 assessment. Dr Thomson noted that this data was received much later than normal and was missed due to inconsistency in the CAAB codes provided. Previously the RAG agreed on the base case model CAL2019. The addition of the age resulted in an updated base case model referred to in the report as CAL2019c. There were no other changes to the base case model as agreed by the RAG at the last meeting.

13) The RAG discussed the updated base case model (CAL2019c), the recommended biological catch (RBC) calculations and future projections:

a) As shown in Figure 1, the Bass Strait stock is estimated to be slightly under the 48% target so catches are lower at first, until the stock rebuilds to the target. Similarly, Tasmania is above the target (69%) so catches are high initially and reduce as the target is neared. South Australia, which is initially above the target (66%), is complicated by a period of relatively low recruitment around the year 2000 so that catches are high initially, drop in response to lower adult biomass and therefore lower potential pup production, and then increase in response to assumed average recent and future recruitments. The algorithm that calculates annual RBCs is not sophisticated enough to anticipate the drop in pup production when it sets the initial high catch. All stocks remain well above the 20% limit reference point throughout the time series.

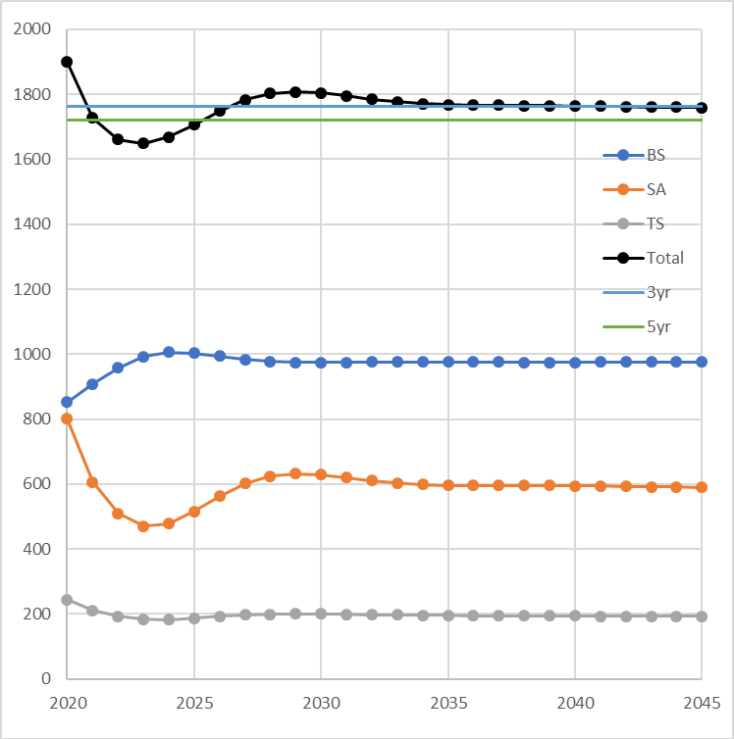


Figure 1: This figure shows the RBC calculations based on the updated base case model (CAL2019c). The annual RBC is calculated separately for each of the three stocks and is then summed across the three (black line). The three year average and five year average RBCs are also shown. Source: Presentation by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Gummy shark assessment update for 2020: Choosing the base case*.

b) An industry member noted that the recruitment spike shown in Figure 2 does not appear to have happened in the past. Dr Thomson noted that this was a function of the rule that calculated the annual RBC. The rule is not able to detect when a value is set that is an over-correction. Therefore it may be more appropriate to use an RBC that has been averaged over a number of years, as opposed to the annual RBC.

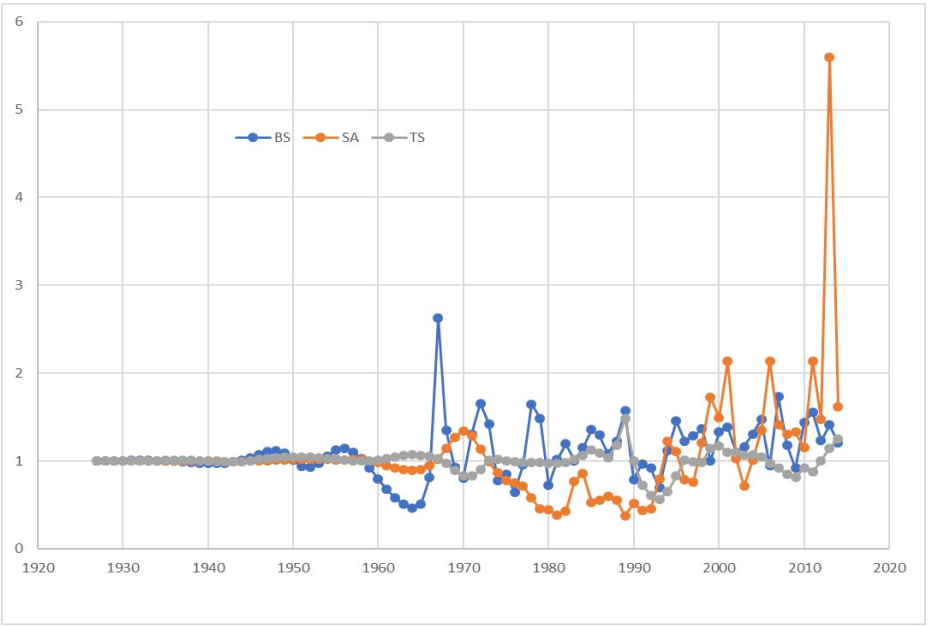


Figure 2: Recruitment deviations. Source: Presentation by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Gummy shark assessment update for 2020: Choosing the base case*.

c) The AFMA member noted that when the assessment was last run in 2016, the stock was well above the target reference point, and as such, the RBCs were set to fish down towards the target over the subsequent three year period. This additional component of the stock has now been taken and so the RBCs have been reduced to fish around the target.

d) The RAG discussed the pup production projections shown in Figure 3. Pup production is used as a proxy for spawning biomass; this is the number of pups, on average, expected to be produced each year by the stock's mature females, noting that larger females produce more pups on average compared to smaller females. Pup depletion is the pup production in any year compared the unfished pup production and is the value used in the harvest control rule. Estimated pup production shows an increasing trend, in recent years, in South Australia and is steady in Bass Strait and Tasmania. The base case model indicates pup depletion is well above the 48% target reference point in South Australia and Tasmania (66% and 69% respectively). For the Bass Strait, the base case model estimates depletion at the target (48%). Pup depletion is above the 20% limit reference point for all stocks and all sensitivity models.

e) Noting that the projections currently extend through to 2060, the RAG agreed the report should be amended to extend the projections through to 2030 only.

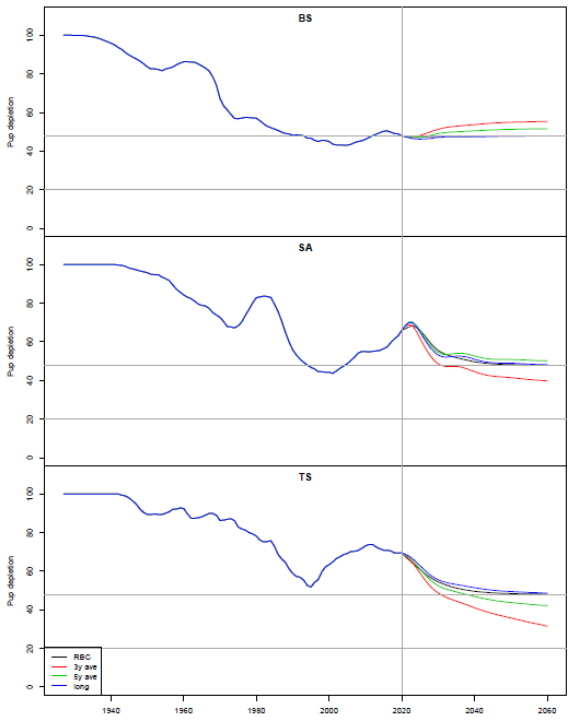


Figure 3: Pup depletion for the three stocks showing future projections using annual RBC (RBC), the average over the most recent three RBCs (3y ave) and the most recent five (5y ave) as well as the long-term RBC (long). A vertical grey line marks the year 2020, and horizontal grey lines mark the 20% and 48% reference points. Source: Report presented by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Updated stock assessment for Gummy Shark for 2020 using data to 2019 DRAFT*.

f) The conservation member asked about changing climate and its impacts on gummy shark recruitment. A scientific member advised the RAG that there is minimal information known

regarding climate impacts on gummy shark. There have been limited studies on how it may impact on gummy shark physiology, however little is known regarding impacts on recruitment.

g) Dr Thomson indicated that the RAG had previously asked whether sampling should occur every second or third year, as opposed to annual sampling. The RAG discussed the practicalities of only running the SIDaC intermittently and it was agreed that such an approach would be difficult to implement. An industry member noted that sampling every year across the footprint of the fishery is important and issues have arisen in the past where this has not occurred. The RAG agreed that with the current assessment and SIDaC program, annual sampling is most appropriate.

14) The RAG further discussed the four RBC options detailed in Table 1:

Table 1: RBC options. Source: Report presented by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Updated stock assessment for Gummy Shark for 2020 using data to 2019 DRAFT*.

RBC Option	Bass Strait	South Australia	Tasmania	Total
Annual	2020 – 853t 2021 – 909t 2022 – 958t	2020 – 802t 2021 – 606t 2022 – 510t	2020 – 244t 2021 – 212t 2022 – 194t	2020 – 1899t 2021 – 1727t 2022 – 1662t
Three year average	907t	639t	217t	1763t
Five year average	944t	574t	203t	1721t
Long term	976t	588t	192t	1757t

a) The Chair clarified that the advice being sought is with regards to the RBC. A total allowable catch (TAC) will be calculated by taking into account deductions (discount factor (if applicable), catches from other sectors (State commercial and recreational), discards and research catch allowance (if applicable)).

b) The RAG noted that the discard value would be calculated by applying a weighted average to the last 4 years of discard estimates (these estimates are based on a fixed percentage of the total annual landed catches (including state catches)). The AFMA member noted that in future years, it is planned for EM to be used to estimate discards. The RAG discussed that it may be useful to update the ABARES analysis regarding EM and its impacts on the accuracy of logbook recording.

c) The AFMA member noted that the TAC and corresponding deductions will be discussed at SEMAC.

d) All industry members advised that they supported the long term RBC as it offered a more sustainable and consistent option. It was noted that the long term RBC would also provide flexibility should the decision be made in three years not to re-run the assessment.

e) The conservation member advised that they supported the three year average RBC, noting concerns with the uncertainty regarding the impacts of climate change on recruitment.

f) Noting the discussion regarding the unexplained dip in the RBC calculations for South Australia, a scientific member suggested that the long term RBC may be the most appropriate option to take account of this uncertainty. Dr Thomson suggested that any of RBC options that used averages would help to smooth this fluctuation.

g) Dr Thomson noted that any of the RBC options would be a sustainable according to the current base case assessment. This assessment gives similar results under most sensitivity tests, however, she

cautioned that quite different results arise from alternative assumptions regarding density dependence.

h) Another scientific member noted that all RBC options meet the requirements of the Commonwealth Harvest Strategy Policy and SESSF Harvest Strategy. As all the options meet these requirements, the RBC may be informed by industry considerations/preferences.

i) The RAG discussed the implications of increased effort from new entrants (due to recent issues with the South Australian rock lobster fishery) into the fishery. An industry member noted there have been changes to the fleet dynamics since the assessment was last run. The RAG noted that this issue is more suited to SEMAC discussions, and the AFMA member took note to raise these concerns with SEMAC.

j) An industry member expressed their view that any new entrants to the fishery should not be included as an input into the next assessment (e.g. CPUE standardisation), as they are less efficient and likely to skew the trends in the data and mask the performance of the fishery for the next few years. Dr Sporcic advised that vessel effect is incorporated into the CPUE standardisation to take account of individual vessel performance. The AFMA member noted that SESSFRAG will be having a discussion at their March 2021 meeting to consider the impacts of COVID-19 has on the fishery data and assessments, and this issue should also be flagged for discussion at that meeting.

15) Regarding future work for the gummy shark assessment, Dr Thomson presented a number of priorities. The RAG agreed this should be discussed at the next meeting.

16) Regarding the RBC for gummy shark, the RAG recommended that any of the four RBC options presented in Table 1 are appropriate for a multi-year RBC, on the basis that they meet harvest strategy requirements. Furthermore, none of the four RBC options pose a risk of breaching the 20% limit reference point. In making this recommendation the RAG noted any of the four RBC options is unlikely to increase school shark catches. The RAG further noted that this RBC recommendation is based on the current structure of the fishery. If there is substantial change in the dynamics of the fishery (e.g. gear or location), the RAG recommends that the RBC be revisited.

The RAG requested the following <u>action items</u>:

2. Dr Thomson to restrict projections to 2030, noting the long term RBC will still be calculated on the 50 year projection, this will be noted in the updated report.
3. AFMA to consider how new entrants to the fishery can be accounted for in the gummy shark assessment.
4. Dr Thomson to prioritise and cost the future work she proposes regarding the gummy shark assessment and provide this to the next meeting of SharkRAG.

17) The RAG agreed to consider the updated gummy shark species summary at **Attachment D** out of session.

3.2. Sawshark

18) Dr Sporcic presented the report, *Draft Tier 4 Sawshark assessment in Australia's Gillnet Hook and Trap Sector of the SESSF (data to 2019)*. The report produced a Recommended Biological Catch (RBC), an update from the previous 2017 assessment.

19) Dr Sporcic highlighted the following key points:

a) The RBC for Sawshark is calculated to be 653.4 t, an increase of 135 t from the previous estimate (2017). This increase is mostly attributable to the inclusion of annual discard estimates within the reference period (2002-08), which was not included in the previous Tier 4 assessment.

20) The RAG discussed the following key points:

a) As shown in Figure 67 (Sporcic (2020). Title: Draft CPUE Standardizations for shark species in the SESSF (data to 2019) , the standardised trawl CPUE which is used in a Tier 4 assessment has been increasing towards the long-term average and is above the target reference point (see Figure 4 below; blue line).

b) The trend seen across years in Figure 4 was consistent with previous years and that the TAC is not typically fully caught.

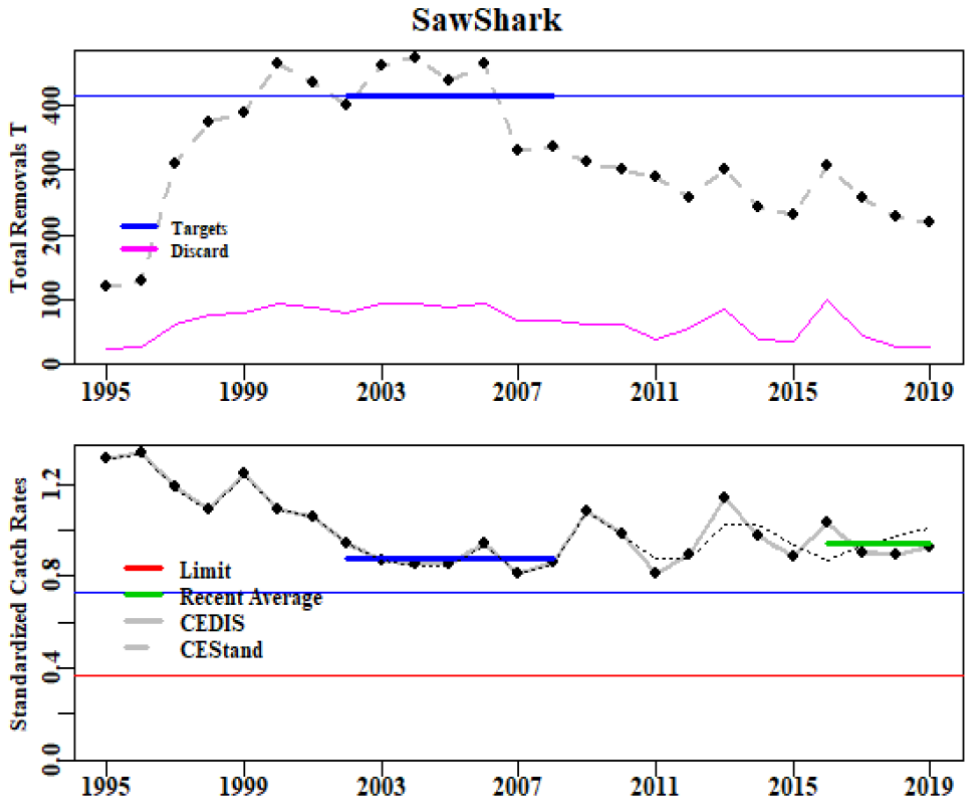


Figure 4: Sawshark Discard. Top plot is the total removals with the fine line illustrating the target catch. Bottom plot represents the standardized catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate. The thin black dotted line is the unmodified standardized CPUE before the inclusion of discards. Source: Report presented by Dr Sporcic to SharkRAG on 3-4 December 2020 titled, *Draft Tier 4 Sawshark assessment in Australia's Gillnet Hook and Trap Sector of the SESSF (data to 2019)*.

c) The Chair reminded the RAG that as this is a Tier 4 assessment, a discount factor of 15% is applied when converting the RBC to a TAC. The AFMA member noted that as explained for gummy shark, there will be deductions applied to the RBC and that this will be considered by SEMAC. The MAC will also discuss whether the change limiting rule is to be applied which is required when a TAC increases by more than 50% from one year to another.

d) The conservation member asked about the confidence intervals for the standardised catch rates and Dr Sporcic noted that the assessment is considered to be relatively "noisy". The RAG requested that Dr Sporcic provide the plot of the confidence intervals out of session.

e) A scientific member asked why sawshark catch has decreased in recent years. It was noted that effort in the trawl sector has decreased in recent years.

f) The Chair noted the uncertainty in Tier 4 assessments which uses CPUE as an indicator of abundance. Furthermore, as this assessment is used for two species, the Southern Sawshark and Common Sawshark, the RAG noted that there is no recent information regarding species composition. This creates uncertainty as to whether the CPUE reflects abundance for both species. An industry member commented that the species of sawshark caught is highly dependent on which area is being fished. The member noted there has been higher sawshark abundance on the East coast than in previous years. It was also noted that there is only one option to record sawshark in electronic logbooks. The RAG noted this uncertainty within the assessment. A scientific member commented that EM reviews are not separating Southern Sawshark from Common Sawshark and efforts should be made to do that. The scientific members agreed that species specific data is important and it was suggested that collecting life history characteristics would also be helpful. The conservation member supported working towards collecting species specific data.

21) Regarding the RBC for sawshark, the RAG recommended a multi-year RBC of 653.4t.

The RAG requested the following <u>action items</u>:

5. AFMA to add to the data workshop agenda to explore ways to differentiate between Common Sawshark and Southern Sawshark in logbooks and EM.
6. Dr Sporcic to circulate the graph regarding standardised catch rate confidence intervals to the RAG out of session.

22) The RAG agreed to consider the updated saw shark species summary at **Attachment E** out of session. The RAG also noted that the most recent data for elephantfish and school shark had been considered at the SESSFRAG data meeting in August 2020. Updated species summaries are provided at **Attachments F and G** for consideration.

4. Research Priorities

23) The AFMA member introduced the agenda item noting its purpose was to seek the advice of the RAG regarding research priorities to be included in a draft Southern and Eastern Scalefish and Shark Fishery (SESSF) Annual Research Statement 2022-23 (the draft 2022-23 Research Statement).

24) The AFMA member noted four SESSF related projects were included in the recent AFMA call for research for 2021-22:

a) Non-extractive survey methodology for establishing Eastern Gemfish index of abundance;

b) Further investigation of factors (length/depth relationship) that influence length frequencies for all species and ISMP port sampling;

c) Analysis of Blue Grenadier acoustic survey data collected by industry in 2019 for inclusion in the 2021 Tier 1 stock assessment; and

d) Pink Ling Tier 1 Stock Assessment 2021.

25) The AFMA member noted that a number of research proposals previously submitted for FRDC funding in 2020-21 and 2021-22 were not considered by ComRAC and will either need to be resubmitted to FRDC for consideration in February 2020, or included in the draft 2022-23 Research Statement. These include:

a) Investigate options for use of dynamic reference points for SESSF species;

b) Research to support the Upper-Slope Dogfish Management Strategy;

c) Application of Close-Kin assessments for key species in the SESSF;

d) School shark and gummy shark post release survival; and

e) Close-kin sampling of school shark pupping grounds to understand stock structure.

26) The AFMA member also advised the RAG that the development of the draft 2022-23 Research Statement will take into account the previous research statement and revisit any of the priorities that may not have been funded. Furthermore it is an opportunity to identify any new projects that should be put forward to the ARC or FRDC for funding.

27) The RAG discussion and prioritisation of research projects to be included in the draft 2022-23 Research Statement is provided in Table 2.

28) A scientific member noted that there are a number of projects proposing the use of the close kin method and suggested it would be prudent to wait for the outcomes of the independent expert peer review of the close kin assessment for school shark before finalising these for inclusion in the 2022-23 Research Statement. The AFMA member noted that there is an 18 month lead time for the projects that are being proposed for inclusion in the draft 2022-23 Research Statement. The RAG agreed that the review may have results that are informative for future close kin work for other species, and priorities identified in the draft 2022-23 Research Statement relating to close kin should be revisited once the outcomes of this review are known.

29) The conservation member noted their interest in utilising AFMA collected data to support research regarding conservation risks for endemic shark and ray species in the SESSF. The AFMA member explained that there is an ERM framework for responding to species that are categorised as at risk through the ERA process.

Table 2: Advice provided by the RAG on research priorities to be included in the draft 2022-23 Research Statement.

Funding source	Title	Objectives and component tasks	Total cost (approx. only)	Priority/ ranking	Feasibility	SharkRAG 9 Comments and Priority Advice
FRDC (2020-21)	School shark and gummy shark post release survival	Investigation of the post-release survival rates of gummy shark (focus on tertiary stress response) and school shark (focus on immediate and post-release mortality), and the application of survivability to discard estimates for these species.	Medium	High	High	**The RAG noted mixed views on the priority for this project.** • The RAG agreed that gummy shark should not be included in the scope for this project, as gummy shark discards are limited. • Members gave this project varying priority. • It was noted that currently all school shark discards are considered to be mortalities in the assessment.
FRDC (2021-22)	Close kin sampling of school shark pupping grounds to understand stock structure.	Identify nursery areas for school shark in South Australia for potential future conservation areas. Including locations, connectivity to get better understanding of stock structure. Noting that the stock assessment review should be completed first, as it may be found that broader sampling may be needed (or inversely there are enough samples).	Medium	High (pending results of independent expert peer review of close kin assessment for school shark)	Medium	**High priority, pending results of independent expert peer review of close kin assessment for school shark.** • A scientific member explained to the RAG that the most valuable pupping ground for school shark (located in Tasmania) is potentially vulnerable to a few local environmental impacts. • Another scientific member noted that it is very important that there is a clear pathway to using the research for management. The conservation member suggested that identifying nursery areas could form part of species recovery plans, following the close kin project. • An industry member noted that there is an area North of Devonport, where there is an abundance of small school sharks. The AFMA

Funding source	Title	Objectives and component tasks	Total cost (approx. only)	Priority/ ranking	Feasibility	SharkRAG 9 Comments and Priority Advice
						member agreed to raise this with Dr Thomson and whether this should be captured in the sampling design for school shark.
FRDC	Developing a Close-Kin Harvest Strategy	Investigate development of a close-kin harvest strategy. To be informed by the multi-species harvest strategy project (MSHSP).	TBC	High (subject to advice from MSHSP and pending results of independent expert peer review of close kin assessment for school shark)	High	**High Priority – pending results of independent expert peer review of close kin assessment for school shark and confirmation of whether this is already captured under "Application of Close-Kin assessments for key species in the SESSF" which is proposed for FRDC funding in 2020-21.** • The AFMA member agreed to clarify the scope of the original FRDC project proposal to determine if there have been changes made since the original scope was proposed, including whether the current project proposal looks to examine a key issue with the current close kin assessment for school shark concerning the lack of an index of abundance relative to unfished biomass.
AFMA	Obtaining discard data and fish lengths using electronic monitoring	Investigate implementation issues, cost and solutions to adopt electronic monitoring to collect length frequency information for key commercial species on hook and gillnet vessels to support Tier 1 assessments.	Low	Medium	High	**Medium Priority – project to be refined at data workshop in early 2021.** • The RAG noted the priorities and/or the project scope may be revised at a data workshop scheduled for early 2021. • The RAG discussed the potential to use electronic logbooks to collect this data and noted that whilst the reliability is not currently known, the EM program has potentially improved reporting. The RAG

Funding source	Title	Objectives and component tasks	Total cost (approx. only)	Priority/ ranking	Feasibility	SharkRAG 9 Comments and Priority Advice
						expressed interest in an updated analysis comparing logbook versus EM discard data. • A scientific member noted that there may be common bias in logbooks and EM therefore there is merit in also considering the use of AFMA Observers.
AFMA	Improving CPUE standardisations for sharks	Improve standardisations: - Clarify relationship between CPUE and net length - Effects of Australian Sea Lion and other closures on CPUE - Account for changing dynamics of fleet with new entrants.	Low	High	High	**High Priority** • Industry members noted that from their perspective this project was the highest priority of those discussed at the RAG. • The conservation member noted that they believed this project is a medium priority. • The RAG agreed the scope should be specify species e.g. Clarify relationship between CPUE and net length, relates to gummy shark.
	Environmental drivers for stock abundance	Examine environmental, and other factors (e.g. seismic testing) on stock abundance.				**Priority pending confirmation of work already undertaken or broader projects planned in this space.** • The RAG requested that AFMA summarise the current background work being undertaken in regards to this project, before determining the research priority.

The RAG requested the following action items:

7. AFMA to raise with Dr Thomson as to whether the area North of Devonport, where industry has observed an abundance of small school shark, should be captured in the sampling design for school shark.
8. AFMA to clarify the current scope of the "Developing a Close-Kin Harvest Strategy" project to determine if there have been changes made since the original scope was proposed, including whether the current project scope looks to examine a key issue with the current close kin assessment for school shark concerning the lack of an index of abundance relative to unfished biomass
9. AFMA to discuss with ABARES regarding project to update the 2018 analysis comparing logbook and EM records of discards.
10. AFMA to produce a summary of previous, current, and planned work that relates to the "Environmental drivers for stock abundance" project.
11. AFMA to make a summary of all the data and reports produced through the EM program e.g. catch comparisons - in preparation for the data workshop in early 2021.
12. AFMA to include the SIDaC program in the draft 2022-23 Research Statement as a project underway or completed.

5. Metier and targeting analysis

30) The AFMA member introduced the agenda item , providing the background of the project and implications for RBC and TAC setting processes, noting that the next RAG meeting will include review of the School Shark Rebuilding Strategy.

31) Dr Burch provided a presentation titled, *Metiers, Companion Species and Targeting Analyses*. The purpose of the presentation was to provide an update to the RAG regarding the metier and targeting analysis on school shark being undertaken by CSIRO. This analysis was requested by AFMA to support the School Shark Rebuilding Strategy review to be undertaken in early 2021. The RAG was asked to review the progress thus far and provide advice on how to improve the analysis.

32) Dr Burch highlighted the following key points and results:

a) The objectives of the analysis are to:

i. Quantify the likely unavoidable school shark bycatch;

ii. Identify non-bycatch catches of school shark;

iii. Explore ways to reduce non-bycatch catches of school shark.

b) The project consists of:

i. The companion species analysis (Metier approach) – used to identify which species are caught together and seek to quantify the impacts on rebuilding species of modifying TACs for companion species;

ii. The targeting analysis – used to identify characteristics associated with individual rebuilding species catches to inform management on avoidance.

c) Dr Burch highlighted the analysis used:

i. Logbook data between 2014 and 2019;

ii. Fish price from ABARES fisheries reports to estimate contribution of each species to the value of the shot;

iii. Separate clustering analyses for 5 gear types/regions.

33) Dr Burch highlighted the following key conclusions:

a) The hook sector takes around 4 times as much school shark per tonne of gummy shark than the gillnet sector;

b) Trawl catch of school shark is 15% of the total and is likely to remain stable baring large increases to Blue Grenadier and Western Pink Ling catches.

c) There was no evidence of spatial or temporal changes in school shark catches;

d) Regarding future work, Dr Burch will be checking the results for individual vessels and asked the RAG if there were key aspect they would recommend looking at.

34) The RAG discussion focussed on the following points:

a) The RAG discussed the incorporation of area into the analysis. Dr Burch noted that south east trawl areas had been incorporated however shark areas were not included. Industry members suggested that area should be a more significant consideration than gear type as it has larger impact on school shark catch. Dr Burch acknowledged that area and gear type were confounded in this analysis and that more school were caught in SA than in Bass Strait. The RAG supported future analysis including known shark areas. A scientific member suggested that the results should also be summarised by vessel catch of school shark as a percentage of gummy shark; this was supported by the RAG.

6. School Shark Updates

6.1. Rebuilding Strategy Review

35) The AFMA member provided an update to the RAG on the progress of the review of the School Shark Rebuilding Strategy.

36) The AFMA member noted the following key points:

a) School shark is subject to a rebuilding strategy with the initial objective to rebuild the stock to above 20% of unfished biomass levels within three generation times (66 years). The Strategy is required to be “reviewed by AFMA, with input from SharkRAG and SEMAC, when the results of the fishery independent measure of abundance using close kin genetics techniques are available and in any case after five years”. The Strategy was last reviewed in 2015.

b) In line with these requirements, AFMA has commenced a review of the Strategy. A subgroup of SEMAC has convened to discuss how to assess the performance of the Strategy. The analysis by Dr Burch will support these discussions. A discussion paper is currently being developed. The discussion paper will be progressed through SharkRAG, SESSFRAG and SEMAC. The review will encompass the results of the independent expert peer review of the close kin assessment for school shark and recent changes to the Commonwealth Harvest Strategy Policy.

c) It was noted that the next SharkRAG would be meeting would be more focussed on this issue.

6.2. Independent Review of Close Kin Mark Recapture

37) The AFMA member provided an update to the RAG on the status of the independent expert peer review of the close kin assessment for school shark.

38) The AFMA member noted the following key points:

a) The Southern Shark Industry Alliance (SSIA) commissioned a review of the assessment in 2019. In January 2020, SharkRAG members supported the engagement of a third party to review the results of the CKMR assessment for school shark. A draft terms of reference for the review was considered by SharkRAG in May 2020 and was finalised out of session. SharkRAG agreed that a panel of reviewers was likely to be required to perform the review, as there are several distinct areas of expertise required for a comprehensive review to be completed. SharkRAG members were asked to provide nominations for potential reviewers. Experts ranged from shark biologists to close kin and statistical analysis experts. The AFMA member provided an overview of the selected panel members.

b) The Expert Panel's report will be presented to SharkRAG and SEMAC in early 2021. A meeting of SharkRAG will be convened for this purpose.

39) The RAG discussion focussed on the following points:

a) The conservation member asked for clarification regarding the disclosure of the FRDC reports. The AFMA member confirmed that the panel had been provided with a package of documents, including the FRDC reports which were provided in confidence. AFMA is following up with the FRDC regarding the release of the FRDC reports to the RAG for their consideration.

6.3. Scheduling of Next School Shark Assessment

40) The AFMA member introduced the agenda item regarding the scheduling of the next school shark assessment and sought advice on an approach for setting an RBC until the assessment can be re-run with close kin data.

41) The AFMA member noted the following key points:

a) At its meeting in May 2020, SharkRAG noted that an assessment in 2021 is not possible given there needs to be three years of close kin data prior to re-running the assessment. It was also noted that the pending contract for the ongoing close kin work for school shark provided for the assessment to be re-run in 2024.

b) At the May 2020 meeting, concerns were raised regarding the ability to set incidental TACs in lieu of an assessment. The RAG suggested this item be placed on the agenda for further discussion at the next SharkRAG and SEMAC meetings.

42) Dr Thomson provided an update on the SIDAC program and noted the following:

a) The previous assessment covered the fishing season up to 2021 however a decision regarding RBC calculation for 2022 and beyond is required.

b) Using the new close kin assessment with its existing parameters, the assessment projections can be re-run with the annual catches and discards since the assessment was last run.

43) The RAG advised that as the results of the independent expert peer review of the close kin assessment for school shark has yet to be finalised, the RAG is not able to provide a recommendation on this matter until the outcomes of this process are known.

7. Automatic Longline Bass Strait Trial

44) Dr Knuckey provided an update regarding FRDC project 2019-129 Potential transition of shark gillnet boats to longline fishing in Bass Strait - ecological, cross-sectoral, and economic implications.

45) Dr Knuckey highlighted the following key points:

a) The objectives of the project are to:

i. Conduct a trial using automatic longlines to target gummy shark in SESSF waters in Eastern and Western Bass Strait;

ii. Collect comprehensive information on longline catch rates and catch composition of all target, bycatch, byproduct and TEP species. Collect length frequency distributions on major target and byproduct species;

iii. Describe potential resource sharing and gear interaction implications for SESSF and other Commonwealth and State fisheries;

iv. Undertake an economic analysis of viability of gillnet boats converting to longlines to target Gummy Shark in Bass Strait; and

v. Present the results of the longline trials to relevant AFMA RAGs and MACs, VFA, DPIPWE and other stakeholders.

b) The project involves the trial of automatic longlines as an alternative to using gillnets to target gummy shark in Bass Strait. A commissioned boat (the FV Candice K), operating under a Scientific Permit issued by AFMA, conducted a number of trips from May to June and November 2020 across four main areas: Lakes Entrance, North of Flinders Island, South West of Flinders Island and East of King Island.

c) Two observers were deployed during the trial. There were zero seabird interactions, tori lines and Brickle curtains were used. There were two TEP interactions: a Great White Shark and an Australian Fur Seal. Dr Knuckey noted that the decision was made to retain draughtboard sharks to minimise interference with the trial, hence a significant part of the retained catch during the trial was Draughtboard shark.

d) Dr Knuckey noted that the results of the trial will be presented to SEMAC, VFA and DPIPWE with the final report to complete in late January 2021. The data from the trial will be made available to CSIRO for the stock assessment.

46) The RAG discussion focussed on the following points:

a) The AFMA member noted that the trial was under the same strict constraints regarding automatic longline dehooking and bycatch that other permit holders are.

b) The RAG discussed the methods that could be used to compare the trial to the performance of typical gear types. The AFMA member indicated that the use of EM catch comparison reports could be used as a starting point. The RAG noted that the accuracy of identifying Draughtboard sharks by EM reviews would need to be reliable.

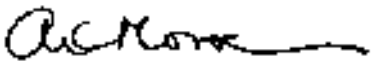
c) An industry member stated that this trial would of benefit for industry to know that there is potential to fish there and that the economics of the trial may be higher in reality if targeting was allowed.

8. Other Business

47) The Chair invited RAG members and participants to discuss any further business. The RAG noted no further items to discuss. The RAG expressed interest in returning in-person meetings at the earliest convenience.

9. Dates for next meeting

48) The Executive Officer noted the next meeting will be held February 2021. The Chair closed the meeting at 2:45pm.

Signed (Chairperson): 

Alexander Morison

Date: 17 Feb 2021

Attachment A – SharkRAG 9 Agenda

DAY 1 – 03 December 2020 0930 – 1530

Agenda item	Purpose	Paper / presentation	Schedule	Time (AEDT)
Acknowledgement of country		Chair	9:30-9:35	5 mins
Preliminaries				
1.1. Welcome and apologies	For information	Chair	9:35-9:40	5 mins
1.2. Adoption of agenda	For action	Chair	9:40-9:45	5 mins
1.3. Declarations of interest	For action	Chair	9:45-10:15	30 mins
1.4. Adoption of Meeting Minutes	For discussion	AFMA	10:15-10:25	10 mins
1.5. Status of action items	For information	AFMA	10:25-10:45	20 mins
2. Updates From Members	For information			
2.1. AFMA Update		AFMA	10:45-11:05	20 mins
2.2. CSIRO Update		CSIRO	11:05-11:15	10 mins
2.3. Industry Update		Industry Members	11:15-11:35	20 mins
BREAK			11:35-11:50	15 mins
3. RBC Recommendations				
3.1. Gummy Shark 3.1.1. Updated base case model 3.1.2. RBC / MYTAC	For advice	CSIRO	11:50-13:50	2 hrs
3.2. Saw shark 3.2.1. Tier 4 Assessment report 3.2.2. RBC / MYTAC	For advice	CSIRO	13:50-14:50	1hr
Recommendations (If required)			14:50-15:30	40 min

DAY 2 - 04 December 2020 0930 – 1430

Agenda item	Purpose	Paper / presentation	Schedule	Time (AEDT)
4. Research Priorities	For advice	AFMA	9:30-10:30	1 hr
5. Metier and targeting analysis	For advice	CSIRO	10:30-12:00	1.5 hr
BREAK			12:00-12:30	30 min
6. School Shark Updates				
6.1. Rebuilding Strategy Review	For information	AFMA	12:30-12:50	20 mins
6.2. Independent Review of Close Kin Mark Recapture	For information	AFMA	12:50-13:10	20 mins
6.3. Scheduling of Next School Shark Assessment	For advice	AFMA	13:10-13:40	30 mins
7. Automatic Longline Bass Strait Trial	For information	Dr Knuckey	13:40-14:10	30 mins
8. Other Business	For discussion	Chair	14:10-14:25	15 mins
9. Dates for next meeting	For information	AFMA	14:25-14:30	5 mins

Attachment B – Declarations of Interest

Member	Position	Interest declared
Alexander (Sandy) Morison	Chair	Director of Morison Aquatic Sciences. Chair of SharkRAG. Contracted by government departments, non-government agencies and companies for a range of fishery related matters including research and for MSC assessments of AFMA managed and other Australian and international fisheries. No pecuniary or other interest in the SESSF.
Robin Thomson	Scientific Member	CSIRO, Assessment scientist. Acquiring funding for research purposes.
Charlie Huveneers	Scientific Member	Associate Professor and research scientist. Potential interest in funding for research. No pecuniary interest or otherwise.
Ian Knuckey	Scientific Member	Director Fishwell Consulting Pty Ltd. Involved in SESSF and GAB Fishery Independent Survey (FIS). Range of research interests in relation to South East fisheries including the GHAT, GABTF, SESSF and auto-longline sector. This includes the project on using EM data for estimating discards and collecting length information. Principal Investigator of FRDC Project 2019-129 “Potential Transition of Shark Gillnet Boats to Longline Fishing in Bass Strait - Ecological, Cross-Sectoral, and Economic Implications” Agent for Olfish Electronic Logbooks NPF RAG Chair, Scientific member on NORMAC. Provides research advice to various industry associations: SETFIA, GABIA and SSIA.
Leigh Castle	Industry Member	Tasmanian shark hook, scalefish hook and tuna minor line fisher. Owns SESSF quota and vessel statutory fishing rights. Has a declared interest in shark hook interests and RBC recommendations.
Kyri Toumazos	Industry Member	South Australia/Bass Strait shark fisher, boats fishing with hooks and gillnets. SESSF quota holder. Southern Rock Lobster Board CEO. Declared interests in RBCs.
Jamie Papas	Industry Member	Gillnet fisher and SFR holder. Board Director San Remo Fishermen’s Co/Op

Julian Morison	Economics Member	Director, Kuti Co Pty Ltd – SA Pipi quota holder Director, BDO Advisory (SA) Pty Ltd - current contracts with SA & Qld state governments collecting fisheries economic data Member, SA Snapper Management Advisory Committee (PIRSA) Economics member, Scallop Fishery Resource Assessment Group (AFMA) Member, Economics Working Group (AFMA) Member, Human Dimensions Research subprogram (FRDC) Principal & co-investigator on several FRDC research projects
Craig Harris	Industry Member	Gillnet fisher and SFR holder.
Leonardo Guida	Conservation Member	Conservation member and lead shark conservation campaigner for the Australian Marine Conservation Society. No pecuniary interest or otherwise.
Natalie Couchman	AFMA Member	AFMA member. No interest pecuniary or otherwise.
Lou Cathro	Executive Officer	AFMA EO. No interest pecuniary or otherwise.
Ross Bromley	Invited Participant	Principal of Girella Fisheries Services Engaged by Southern Shark Industry Alliance as project manager for Shark Industry Data Collection project (SIDaC) and Blue Eye Trevalla co-management Engaged to provide advice on various SESSF MSC accreditation projects Project manager of Western Orange Roughy Data Collection project (WORDaC) Provide advice to various fisheries on EPBC Act accreditation.
James Woodhams	Invited Participant	ABARES Senior Scientist. No interest pecuniary or otherwise. Any potential future interest in funding for research will be declared as appropriate.
Miriana Sporcic	Invited Participant	Employed by CSIRO, Assessment scientist. Acquiring funding for research purposes
Paul Burch	Invited Participant	Employed by CSIRO, Research Scientist. Acquiring funding for research purposes

Fiona Hill	Observer	No interest pecuniary or otherwise
Natalie Manahan	Observer	Employee of Atlantis Fisheries Consulting Group

Attachment C – Status of Action Items

- Complete/Redundant
- Underway
- Yet to start
- Need SharkRAG advice

	Meeting & agenda item reference	No.	Description	Responsibility	Timeframe	Status
	SharkRAG 2 2016	1	For the next gummy shark assessment, the assessment scientist to investigate estimating selectivity separately for the three regional stocks and allowing it to be flexible in form. This may allow the differing availability function to be removed from the assessment.	CSIRO Assessment Scientist	In time for the next stock assessment.	Estimations of selectivity for each separate region would require length frequency data for each fleet in each region, or 'mirroring' of selectivity patterns between some regions when insufficient data is available for separate estimation. SharkRAG advice is sought on the continued need for this action, noting advice on feasibility.
	SharkRAG 2 2016	3	The School Shark Rebuilding Strategy to be updated to reflect research showing there is some genetic connectivity between Australian and New Zealand school shark stocks.	AFMA	2019	AFMA is undertaking a review of the *School Shark (Galeorhinus galeus) Stock Rebuilding Strategy* in 2020-21. This will include updating information concerning latest research relevant to the species.
	SharkRAG 1 2018	3	AFMA to investigate removing elephant fish as a quota species in the SESSF.	AFMA	TBC	A new harvest strategy is in the process of being developed for the SESSF to take into account the 2018 *Commonwealth Harvest Strategy Policy*. This item will be considered as part of that process.
	SharkRAG 2 2018	1	Dr Thomson to liaise with Dr Braccini to investigate the availability of further vertebrate samples taken during surveys	Dr Thomson/ Dr Braccini/FAS	TBC	Samples may be with Dr Thomson (in samples supplied from AFMA). Additional funding required to sort through samples.
	SharkRAG 3 2018	17	Dr Thomson to liaise with Dr Koopman to get the EM data analysis code for incorporating into	Dr Thomson	Before SESSFRAG February 2019	CSIRO have obtained the data analysis code. This now needs to be incorporated into the discard process which is part of the SESSF contract between CSIRO

			the existing discard estimation process.			and AFMA. Funding is being sought to support this work going forward.
	SharkRAG 3 2018	18	AFMA to develop proposal to do cross comparisons between EM retained length and industry collected lengths for verification and cost.	Mr Macdonald	Next SESSFRAG Meeting	Proposal has been developed for funding and is currently included in the SESSF Annual Research Statement for 2021-22. There is very limited overlap between observers and EM data so the feasibility of project should be considered. The scope could be revised to look at available data sources and collection techniques (EM and industry). Estimated cost, priority/ranking and feasibility to be discussed at the meeting of SharkRAG in February 2021.
	SharkRAG 3 2018	19	AFMA to provide the TAC recommendations paper and TAC calculation spreadsheet to RAG members and invited participants for information each year.	SharkRAG Executive Officer	December each year	The SESSF TAC recommendations paper is sent in late December each year. AFMA EO's will distribute this to RAG members and invited participants.
	SharkRAG 4 2018	21	Refer the question of conducting biennial collection of biological data for stock assessment to SESSFRAG February 2019 data meeting.	SESSFRAG	February 2019	Considered at SESSFRAG Chairs' meeting in February 2019. For the next gummy shark stock assessment, CSIRO to undertake data exclusion to investigate the effect of biennial sampling to determine the impact of biennial data collection by removing every second year of length and age data. Dr Punt is completing significant investigations in this space. CSIRO will provide an update when available.
	SharkRAG 4 2018	29	Mr Macdonald to investigate the RAG suggestion that high risk species identified through ERA should go to expert reference groups (e.g. AAD, Commonwealth Marine Mammal Working Group, IUCN shark reference group etc.) for consideration.	Mr Macdonald	SharkRAG 5	To be discussed with managers / senior managers in the SESSF.

	SharkRAG Teleconference 2020	3	AFMA and CSIRO to prepare a summary table of assumptions that went into the original close-kin assessment model.	AFMA/CSIRO	2021	Pending finalization of independent expert peer review of the close kin assessment for school shark.
	SESSFRAG Data 2019	13	Seek advice from SharkRAG to update the SIDaC data collection plan to include : • the collection of total and partial lengths of school and gummy shark particularly any school sharks larger than 160cm total length (100cm partial length). Gummy shark over 160 TL and 100cm PAR are also important; • Collection of gummy and school shark samples from automatic longline vessels.	SharkRAG	SharkRAG Meeting	• Dual length measurements for large school and gummy sharks were collected alongside a recent trial of automatic longline gear in the Bass Strait (FRDC project 2019-129). Further data collection has commenced under the SIDaC Program. • To be considered at a shark data workshop proposed for February 2021, prior to SharkRAG.
	SESSFRAG Data 2019	14	AFMA to confer with Ian Knuckey and Robin Thomson to determine the sampling regime for discard lengths to support future discard estimates and, if further advice is needed, seek SharkRAG advice.	AFMA	Prior to the November 2019 SharkRAG meeting	To be considered at a shark data workshop proposed for February 2021, prior to SharkRAG.
	SESSFRAG Data 2019	15	SERAG and SharkRAG to consider the data for the remaining rebuilding species that were not discussed during the SESSFRAG data meeting.	SharkRAG	November 2019 SharkRAG meeting	To be discussed at the meeting of SharkRAG in February 2021.
	SharkRAG 7 September 2020	1	Dr Thomson to highlight the rationale for not including recreational catch data in the final report of the 2020 gummy shark	Dr Thomson	December 2020	Dr Thomson to include in draft gummy shark assessment report to be provided under agenda item 3.1.

			stock assessment			
	SharkRAG 7 September 2020	2	AFMA to incorporate recreational state catches of Commonwealth shark species into data sharing arrangements with State Agencies.	AFMA	Next data sharing meeting with State jurisdictions	AFMA to discuss with respective state agencies at next OCS meetings.
	SharkRAG 7 September 2020	3	AFMA to formally request recreational catch from State agencies on an annual basis.	AFMA	Next data sharing meeting with State jurisdictions	AFMA to discuss with respective state agencies at next OCS meetings.
	SharkRAG 7 September 2020	4	Dr Althaus to incorporate elephantfish into the recreational catch report	CSIRO	Prior to finalization of gummy shark assessment	Dr Althaus to provide an update out of session.
	SharkRAG 7 September 2020	5	Dr Althaus to finalise the recreational catch report with the most recent available data from State agencies.	CSIRO	Prior to finalization of gummy shark assessment	Dr Althaus to provide an update out of session.
	SharkRAG 7 September 2020	6	Dr Sporcic to investigate a CPUE series which combines the manual longline and automatic longline fleets	Dr Sporcic	Before the next gummy shark stock assessment (2023)	Dr Sporcic to investigate prior to the 2023 gummy shark assessment.
	SharkRAG 7 September 2020	7	AFMA and CSIRO to discuss additional analysis to determine the relationship between net length and CPUE before the next meeting of SharkRAG	AFMA/CSIRO	Prior to October 2020 intersessional meeting of SharkRAG	To be considered under agenda item 3.1.
	SharkRAG 7	9	Dr Thomson to split the trawl CPUE series into two series (1996 – 2005;	Dr Thomson	Prior to November	To be considered under agenda item 3.1.

	September 2020		2008 – 2019) in the upcoming base model for gummy shark		2020 meeting of SharkRAG	
	SharkRAG 7 September 2020	11	Dr Thomson to plot expected CPUE for a range of values of the effort saturation parameter to illustrate its effect	Dr Thomson	To present at SharkRAG November 2020 meeting	To be considered under agenda item 3.1.
	SharkRAG 7 September 2020	12	SharkRAG to determine the weighting of each method to be included in the gummy shark assessment at the next meeting of SharkRAG	SharkRAG	November 2020	To be considered under agenda item 3.1.
	SharkRAG 7 September 2020	13	AFMA to modify the contract with fish aging services to allow shark vertebrae to be sectioned on an annual basis	AFMA / FAS	December 2020	AFMA will discuss alterations to the contract with fish aging services.
	SharkRAG 8 November 2020	1	Dr Sporcic to check if the 2009 pdiscard estimate for sawshark is from trawl only or multiple methods	Dr Sporcic	December 2020	SharkRAG to be updated at SharkRAG 9, December 2020
	SharkRAG 8 November 2020	2	Dr Sporcic to check if it is possible to get discard data for trawl vessels only	AFMA	December 2020	SharkRAG to be updated at SharkRAG 9, December 2020
	SharkRAG 8 November 2020	3	Dr Sporcic to include the justification for the reference period in the final Tier 4 assessment report for sawshark	Dr Sporcic	2021	
	SharkRAG 8 November 2020	4	Dr Sporcic to use the old State catch values in the upcoming Tier 4 Assessment unless the issues concerning the NSW State catch data	Dr Sporcic	2021	

			are resolved			
	SharkRAG 8 November 2020	5	CSIRO to check with NSW concerning the double count issues and report to SharkRAG	CSIRO	2021	SharkRAG to be updated at SharkRAG 9, December 2020
	SharkRAG 8 November 2020	6	AFMA to examine justification for low sawshark TACs in 2009 and 2010	AFMA	SharkRAG 10	AFMA to provide an update to SharkRAG at a meeting in 2021
	SharkRAG 8 November 2020	7	Inclusion of all shots that capture gummy shark in the CPUE series be investigated for the next gummy shark Tier 1 Assessment	CSIRO Stock Assessment Scientist	Prior to the next gummy shark Stock assessment	
	SharkRAG 8 November 2020	8	the next stock assessment should have a gear saturation factor that also considers the effects of longline effort	CSIRO Stock Assessment Scientist	Prior to the next gummy shark Stock assessment	
	SharkRAG 8 November 2020	9	CSIRO to investigate why significant changes to pup depletion are occurring in the models where density dependence is affected by 0-2 and 0-4 year olds	CSIRO Stock Assessment Scientist	Prior to the next gummy shark Stock assessment	
	SharkRAG 8 November 2020	10	SharkRAG to discuss the method of data weighting in the gummy shark Tier 1 model be examined for the next gummy shark assessment in 2023	SharkRAG	Prior to the next gummy shark Stock assessment	
	SharkRAG 8 November 2020	11	Dr Thomson to include a Danish Seine fleet in the next gummy shark assessment in 2023	CSIRO Stock Assessment Scientist	Prior to the next gummy shark Stock assessment	

		12	Dr Thomson to produce confidence intervals around the following projections for the next meeting of SharkRAG • long term RBC • annual RBCs • 5 year average over recent RBCs • 3 year average over recent RBCs	CSIRO Stock Assessment Scientist	December 2020	To be presented at SharkRAG 9
	SharkRAG 8 November 2020	13	SharkRAG to discuss future work to be completed before the next gummy shark assessment	SharkRAG	December 2020	Agenda Item for SharkRAG 9
	SharkRAG9 December 2020	1	Dr Knuckey to provide an update on FRDC project 2018-021 Development and evaluation of multi-species strategies in the SESSF at the next SharkRAG meeting.	Dr Knuckey	March 2020	Agenda item for March 2021 SharkRAG meeting
	SharkRAG9 December 2020	2	Dr Thomson to restrict projections to 2030, noting the long term RBC will still be calculated on the 50 year projection, this will be noted in the updated report.	Dr Thomson	To be included in the updated report	
	SharkRAG9 December 2020	3	AFMA to consider how new entrants to the fishery can be accounted for in the gummy shark assessment.	AFMA	2021	

	SharkRAG9 December 2020	4	Dr Thomson to prioritise and cost the future work she proposes regarding the gummy shark assessment and provide this to the next meeting of SharkRAG.	Dr Thomson	SharkRAG March 2021	Dr Thomson to provide at the March 2021 meeting
	SharkRAG9 December 2020	5	AFMA to add to the data workshop agenda to explore ways to differentiate between Common Sawshark and Southern Sawshark in logbooks and EM.	AFMA	SharkRAG March 2021	Agenda item for March 2021 SharkRAG meeting
	SharkRAG9 December 2020	6	Dr Sporcic to circulate the graph regarding standardised catch rate confidence intervals to the RAG out of session.	Dr Sporcic	December 2020	Graph included in the stardardized CPUE report that was circulated to SharkRAG
	SharkRAG9 December 2020	7	AFMA to raise with Dr Thomson as to whether the area North of Devonport, where industry has observed an abundance of small school shark, should be captured in the sampling design for school shark.	AFMA and Dr Thomson	2021	
	SharkRAG9 December 2020	8	AFMA to clarify the current scope of the “Developing a Close-Kin Harvest Strategy” project to determine if there have been changes made since the original scope was proposed, including whether the current project scope looks to examine a key issue with the current close kin assessment for school shark concerning the lack of an index of abundance relative to unfished biomass	AFMA	2021	

	SharkRAG9 December 2020	9	AFMA to discuss with ABARES regarding project to update the 2018 analysis comparing logbook and EM records of discards.	AFMA	2021	
	SharkRAG9 December 2020	10	AFMA to produce a summary of previous, current, and planned work that relates to the “Environmental drivers for stock abundance” project.	AFMA	2021	
	SharkRAG9 December 2020	11	AFMA to make a summary of all the data and reports produced through the EM program e.g. catch comparisons - in preparation for the data workshop in early 2021.	AFMA	2021	
	SharkRAG9 December 2020	12	AFMA to include the SIDaC program in the draft 2022-23 Research Statement as a project underway or completed.	AFMA	Before the 2022-23 draft Research Statement is due	

Attachment D – Gummy shark species summary

Gummy Shark

Mustelus antarcticus

Fisheries Research & Development Corporation (2012)

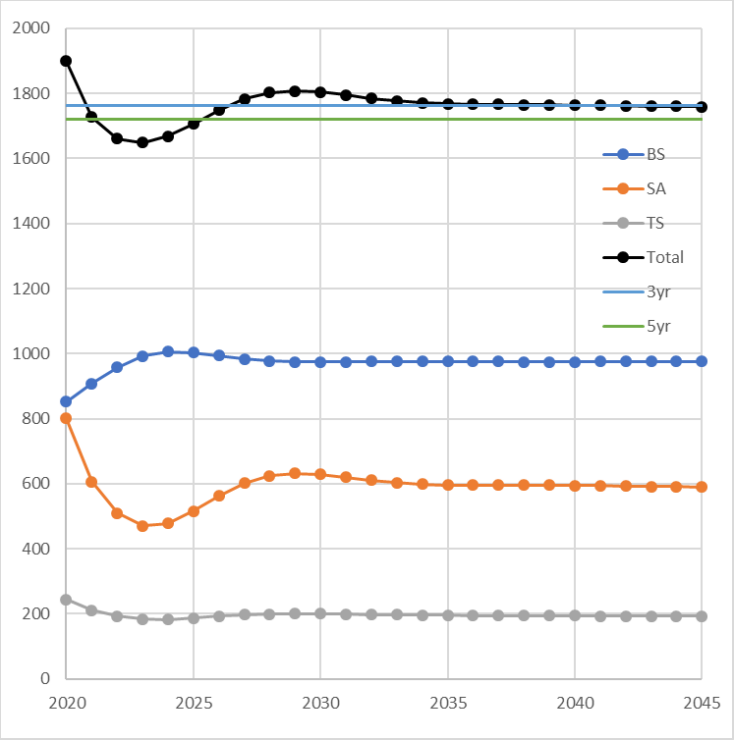
Species Summary					
Common Names	Gummy Shark				
Stock assessment	Tier 1 Species - last assessed by SharkRAG in December 2020.				
Stock Structure	Gummy shark is endemic to southern Australia. It is considered a single genetic stock across the SESSF extending from Bunbury in WA to Jervis Bay in NSW. The single genetic stock is assessed as three separate sub-stocks within broad regions on the continental shelf of Bass Strait, Tasmania and SA.				
Bass Strait **Stock status against reference points (%SB)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	48	48	20
	1	2016	59		
	1	2013	>48		
Tas **Stock status against reference points (%B_0)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	69	48	20
	1	2016	83		
	1	2013	>48		
SA **Stock status against reference points (%B_0)**	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2020	66	48	20
	1	2016	69		
	1	2013	>48		
Stock trend and other Indicators See CPUE Report (Attachment C)**Error! Bookmark not defined.**	Pup production is used as a proxy for spawning biomass; this is the number of pups, on average, expected to be produced each year by the stock's mature females. Pup depletion is the pup production in any year compared the unfished pup production and is the value used in the harvest control rule. Estimated pup production shows an increasing trend, in recent years, in SA and is steady in Bass Strait and Tasmania. The base case model (CAL2019c) indicates pup depletion is well above the 48% target reference point in SA and Tasmania (66% and 69% respectively). For the Bass Strait, the base case model estimates depletion at the target (48%). Pup depletion is above the 20% limit reference point for all stocks and all sensitivity models.				

<table>
<tr><td>See Data Summary</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Multi-Year TAC</td><td colspan="2">Year of MYTAC (2020-21)</td><td colspan="2">Have breakout rules been triggered?</td></tr>
<tr><td colspan="2">4th of 3-year</td><td colspan="2">Yes
SESSFRAG (August 2020) recommended continuing the current MYTAC and update the assessment in 2020.</td></tr>
<tr><td rowspan="5">Catch and TAC (t)</td><td>SESSF Fishing Year</td><td>Agreed TAC</td><td>TAC after unders/overs</td><td>Catch</td></tr>
<tr><td>2020-21</td><td>1017</td><td>1119</td><td>-</td></tr>
<tr><td>2019-20</td><td>1785</td><td>1897</td><td>1779</td></tr>
<tr><td>2018-19</td><td>1763</td><td>1871</td><td>1682</td></tr>
<tr><td>2017-18</td><td>1774</td><td>1916</td><td>1745</td></tr>
<tr><td rowspan="4">Economics
(Primary)
Gillnet, Hook and Trap</td><td>Financial Year</td><td>Species GVP ($m)</td><td>Fishery GVP ($m)</td><td>% Fishery GVP</td></tr>
<tr><td>2018-19</td><td>20.94</td><td>23.66</td><td>88.50</td></tr>
<tr><td>2017-18</td><td>17.13</td><td>19.51</td><td>87.80</td></tr>
<tr><td>2016-17</td><td>17.93</td><td>20.23</td><td>88.63</td></tr>
<tr><td>ABARES Status (2020 report)</td><td colspan="2">Biomass: Not overfished</td><td colspan="2">Fishing Mortality: Not subject to overfishing</td></tr>
<tr><td colspan="5">Assessment Summary</td></tr>
<tr><td>Key model technical assumptions/ parameters</td><td colspan="4">Base case model (CAL2019c):
- Age-Structured Integrated Analysis model
- three sub-stocks – Bass Strait, SA and Tasmania. WA and NSW are not included. Sub-stock boundaries are somewhat arbitrary;
- 7 fleets - trawl, shallow line, deep line and gillnets (6, 6.5, 7, 8 inch mesh sizes). Selectivity estimated for all but gillnets.

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

Parameters
- Density dependence shared - M (0-30y) by 1+ biomass;</td></tr>
</table>

	- Gear saturation per sub-stock; - Unfished biomass (B_0) per sub-stock; - Natural mortality (M) shared; - Pup survival deviation / recruitment per sub-stock per year; - Gear selectivity per sub-stock.
Significant changes to data inputs	In addition to the inclusion of new data for 2016-2020, SharkRAG (September 2020) recommended the following changes for the base case model: - use a gillnet CPUE series based on net length; - use three trawl CPUE series, one for each sub-stock; the trawl series for Bass Strait should be split before 2005, and after 2008; - include age data, where length data are also available, as conditional-length-at-age rather than as age compositions - not include Danish Seine data; - the best way to represent uncertainty with the model is via a series of sensitivities as per the last stock assessment. A sensitivity of effort saturation for gillnets should be investigated.
Data and RAG comments	SharkRAG (November 2020) recommended for the next assessment in 2023: - review the use of the effort (gear) saturation parameter; - CSIRO to investigate why estimated pup depletion is very different in the models where density dependence is affected by 0-2 and 0-4 year olds; - SharkRAG to discuss the method of data weighting in the model; - Danish Seine fleet to be included in the next assessment. SharkRAG will discuss a future work plan for the next assessment in 2023, at their next meeting (tentatively scheduled for early 2023).
Stock assessment information and RAG comments	SharkRAG (December 2020) discussed the RBC calculations shown in Figure 1. The Bass Strait sub-stock is estimated to be slightly under the 48% target so catches are lower at first, until the sub-stock rebuilds to the target. Similarly, Tasmania is above the target (69%) so catches are high initially and reduce as the target is neared. SA, which is initially above the target (66%), is complicated by a period of relatively low recruitment around the year 2000 so that catches are high initially, drop in response to lower adult biomass and therefore lower potential pup production, and then increase in response to assumed average recent and future recruitments. The algorithm that calculates annual RBCs is not sophisticated enough to anticipate the drop in pup production when it sets the initial high catch. All sub-stocks remain well above the 20% limit reference point throughout the time series.

	 **Figure 1: This figure shows the RBC calculations based on the base case model (CAL2019c). The annual RBC is calculated separately for each of the three sub-stocks and is then summed across the three (black line). The three year average and five year average RBCs are also shown. Source: Presentation by Dr Thomson to SharkRAG on 3-4 December 2020 titled, *Gummy shark assessment update for 2020: Choosing the base case*.**
Projected Biomass	SharkRAG (December 2020) discussed the pup production projections shown in Figure 2. Estimated pup production shows an increasing trend, in recent years, in SA and is steady in Bass Strait and Tasmania. The base case model indicates pup depletion is well above the 48% target reference point in SA and Tasmania (66% and 69% respectively). For the Bass Strait, the base case model estimates depletion at the target (48%). Pup depletion is above the 20% limit reference point for all stocks and all sensitivity models.

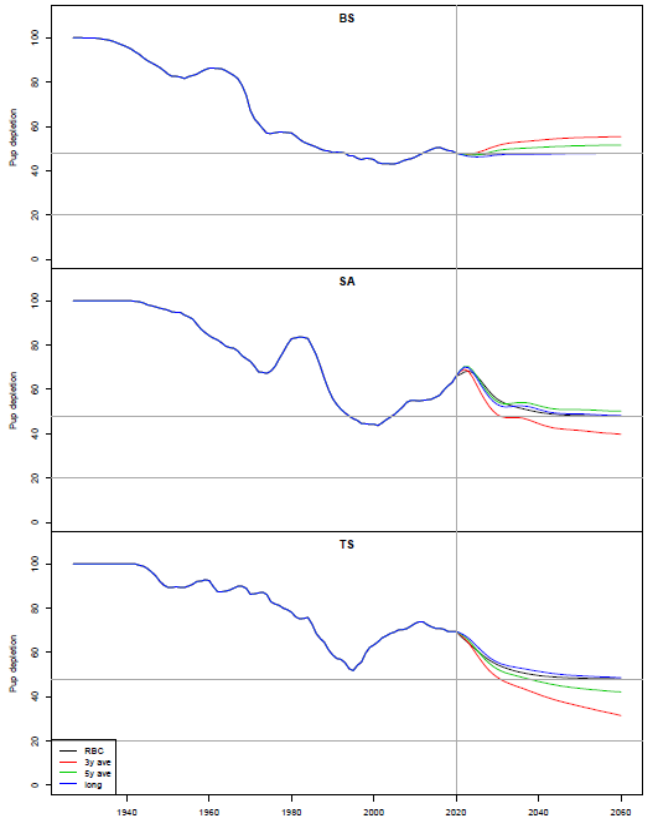


Figure 1: Pup depletion for the three sub-stocks showing future projections using annual RBC (RBC), the average over the most recent three RBCs (3y ave) and the most recent five (5y ave) as well as the long-term RBC (long). A vertical grey line marks the year 2020, and horizontal grey lines mark the 20% and 48% reference points (Thomson 2020).

Species Specific Research

GHAT CPUE calculation methodology

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

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

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

GHAT CPUE calculation methodology

RAG Recommendations

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

RBC Option	Bass Strait	SA	Tasmania	Total

<table>
<tr><td>Annual</td><td>2020 – 853 t
2021 – 909 t
2022 – 958 t</td><td>2020 – 802 t
2021 – 606 t
2022 – 510 t</td><td>2020 – 244 t
2021 – 212 t
2022 – 194 t</td><td>2020 – 1,899 t
2021 – 1,727 t
2022 – 1,662 t</td></tr>
<tr><td>Three year average</td><td>907 t</td><td>639 t</td><td>217 t</td><td>1,763 t</td></tr>
<tr><td>Five year average</td><td>944 t</td><td>574 t</td><td>203 t</td><td>1,721 t</td></tr>
<tr><td>Long term</td><td>976 t</td><td>588 t</td><td>192 t</td><td>1,757 t</td></tr>
<tr><td rowspan="4">Recommended Biological Catch (t)</td><td>Year</td><td>RBC (t)</td><td colspan="2">Is a MYTAC Recommended?</td></tr>
<tr><td>2023</td><td>Annual – 1,662 t
3-year – 1,763 t
5-year – 1,721 t
Long term -1,757t</td><td colspan="2" rowspan="3">Yes
3-Year MYTAC using one of the options provided above.
SharkRAG (December 2020) recommended if there is substantial change in the dynamics of the fishery (e.g. gear or location), the RBC be revisited.</td></tr>
<tr><td>2022</td><td>Annual – 1,727 t
3-year – 1,763 t
5-year – 1,721 t
Long term - 1,757t</td></tr>
<tr><td>2021</td><td>Annual – 1,899 t
3-year – 1,763 t
5-year – 1,721 t
Long term -1,757t</td></tr>
<tr><td>Discount Factor (t)</td><td>N/A</td><td colspan="3">Discount factors are not applied to Tier 1 assessments.</td></tr>
<tr><td>State Catch (t)</td><td>132.2 t</td><td colspan="3">The 2016-2019 weighted average of state catches is to be deducted from the RBC. Previously the State allocations agreed under the shark memorandum of understanding with SA, and Victoria have been deducted from the RBC. However, SharkRAG (2018) recommended deducting the weighted average State catch from the RBC, as is the case for other SESSF species. There is no allocation for Tasmania, rather, catch is limited by Tasmania through bycatch trip limits.</td></tr>
<tr><td>Discards (t)</td><td>95 t</td><td colspan="3">Weighted average of discards are to be deducted from the RBC, as there is no model estimate produced. This is calculated by applying a weighted average to the last 4 years of annual discard estimates (annual discard estimate = 4.786% of annual total landed catches (including State</td></tr>
</table>

		catches)). The weights are 8,4,2,1 with the most recent year receiving the highest weighting.
Recreational Catch (t)	N/A	Estimates of recreational catches are available but are considered uncertain and not deducted from the RBC.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		Annual – 1,672 t 3-year – 1,536 t 5-year – 1,494 t Long term – 1,530 t

MAC Recommendations

Commercial fishers' interests	To be updated – SEMAC 42
Species specific management (target, companion and bycatch)	To be updated – SEMAC 42.
MAC advice and any dissenting views	To be updated – SEMAC 42

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

AFMA Advice

To be updated – SEMAC 42

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & Undercatch (%)	Determined amount (t)	Change in TAC (t)
1,775				

Attachment E – Sawshark species summary

Sawshark

Pristiophorus spp.

CSIRO national Fish Collection (2009)

Species Summary					
Common names	Common sawshark (*Pristiophorus cirratus*), southern sawshark (*P. nudipinnis*), eastern sawshark (*P.* spp)				
Stock assessment	Tier 4 Species - last assessed by SharkRAG in 2020.				
Stock Structure	Sawshark (comprising of *P. cirratus*, *P. nudipinnis*, *P.* spp and *Pristiophoridae*) are currently assessed as a single stock. Three endemic species of sawsharks occur off southern Australia, but their distributions have not been described precisely. Common sawshark (*P. cirratus*) is reported to range from Jurien Bay in WA to Eden in NSW, including Tasmania, to depths of 310 m. Southern sawshark (*P. nudipinnis*) is reported to range from the western region of the GAB to eastern Gippsland in Victoria, including Tasmania, to depths of 70 m. The eastern sawshark (P. sp. A) is reported to range from approximately Lakes Entrance in Victoria to Coffs Harbour in NSW at depths of 100–630 m (Last and Stevens 1994). Little is known of stock structure or movement rates. For assessment purposes, all sawsharks south of the Victoria–NSW border are assumed to be common sawshark and southern sawshark, whereas those north of this border are assumed to be eastern sawshark.				
Stock status against reference points (C_{lim}/C_{targ})	**Tier**	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	4	2020	0.9476	0.7293	0.3646
	4	2017	0.9443	0.7236	0.3618
	4	2013	1.0050	0.8740	0.3497
Stock trend and other Indicators See CPUE Report (Attachment C)**Error! Bookmark not defined.** See Data Summary	Total catches in 2019-20 are similar to the previous fishing year. Trawl CPUE is increasing towards the long-term average and has been used for the Tier 4 assessment. The assessment also includes discard estimates and State catches. The depth distribution of effort has remained stable throughout the time series. The length frequency distribution has remained stable throughout the time series.				
Multi-Year TAC	**Year of MYTAC (2020-21)**		**Have breakout rules been triggered?**		
	3rd of 3-year		Yes SESSFRAG (August 2020) recommended updating the Tier 4 assessment in 2020.		

Catch and TAC (t)	**SESSF Fishing Year**	**Agreed TAC**	**TAC after unders/overs**	**Catch**
	2020-21	432	471	-
	2019-20	430	470	189
	2018-19	430	472	179
	2017-18	442	482	205
Economics (Secondary) Gillnet, Hook and Trap	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	0.60	23.66	2.54
	2017-18	0.41	19.51	2.10
	2016-17	0.52	20.23	2.57
ABARES Status (2020 report)	**Biomass: Not overfished**		**Fishing Mortality: Not subject to overfishing**	

Assessment Summary

Key model technical assumptions/ parameters	The Tier 4 assessment uses the standardised trawl CPUE series as a key input (Sporcic 2020). Landings data between 1995 and 2001 was sourced solely from GABTS logbook data. Since 2002, data has been sourced from CDRs. It was noted the reference period (2002 – 2008) for the 2020 assessment will use CDR data. The Tier 4 assessment assumes there is a linear relationship between catch rates and exploitable biomass, and that the character of the estimated catch rates has not changed significantly since the reference period to the end of the most recent year.
Significant changes to data inputs	In addition to the inclusion of new data for 2016-2020, SharkRAG (November 2020) recommended, consistent with the approach adopted by SERAG for other Tier 4 assessments, the following changes to data inputs to the assessment: - an updated catch series incorporated part of a revised NSW annual catch. There are issues of (i) double reporting of Commonwealth catch and NSW catch and (ii) misreporting of Commonwealth catch as NSW catch before about 1998 which needs to be resolved. However, revised NSW annual catch post 1998 are not subject to the above (double and misreporting) issues and was therefore used in this assessment (i.e. in the reference period 2002-08); - Pdiscard values were estimated for years where no data exists, inclusive of the reference period (2002-2008). These pdiscard values were estimated by calculating the average value for years where data exists. The average pdiscard value did not include values which were forward filled from previous years (i.e. 2010, 2015 and 2019).
Data and RAG comments	SESSFRAG (August 2020) noted there is a lack of availability of port or length data, however there is some data from trawlers and Danish seine, and gillnet boats in 2017 and 2018.
Stock assessment information and RAG comments	SharkRAG (December 2020) noted, that as shown in Figure 3, the standardised trawl CPUE which is used in a Tier 4 assessment has been increasing towards the

long-term average and is above the target reference point (CPUE report, Sporcic, 2020).

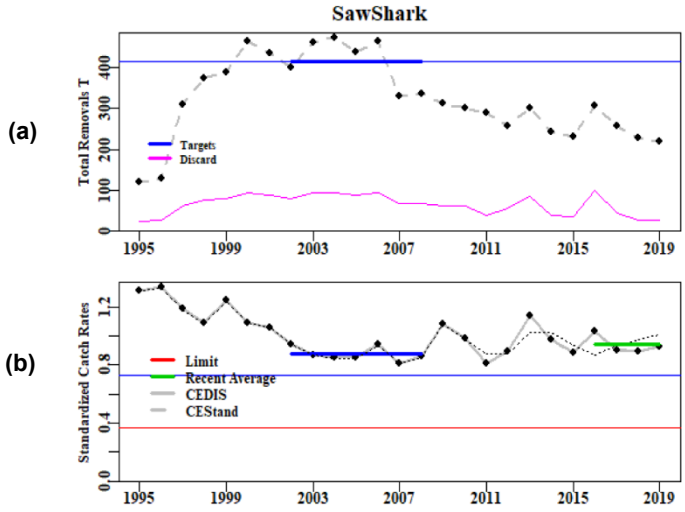


Figure 3: (a) total removals with the fine line illustrating the target catch, (b) standardized catch rates with the upper fine line representing the target catch rate and the lower line the limit catch rate. Thickened lines represents the reference period for catches, catch rates, and the recent average catch rate. The thin black dotted line is the unmodified standardized CPUE before the inclusion of discards. Source: Report presented by Dr Sporcic to SharkRAG on 3-4 December 2020 titled, *Draft Tier 4 Sawshark assessment in Australia's Gillnet Hook and Trap Sector of the SESSF (data to 2019).*

The RBC for sawshark was calculated to be 653.4 t, an increase of 135 t from the previous RBC (2017). This increase was mostly attributable to the inclusion of annual discard estimates within the reference period (2002-08), which was not included in the previous Tier 4 assessment.

Noting that the assessment covers two species, the RAG requested that AFMA monitor species composition over the coming seasons to be able to respond to any potential changes which would have implications for the assessment. AFMA will be considering how to approach this task at data workshop in early 2021, including using the use of logbooks and EM to differentiate between Common Sawshark and Southern Sawshark.

Species Specific Research

GHAT CPUE calculation methodology

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

RAG Recommendations

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

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Biological Catch (t)	2023	653.4	Yes 3-Year MYTAC using the RBC of 653.4 t from the 2020 Tier 4 assessment.
	2022	653.4	
	2021	653.4	

Discount Factor (t)	98 t	SharkRAG (December 2020) recommended applying the default Tier 4 discount factor of 15 per cent.
State Catch (t)	11.7 t	2016-2019 weighted average.
Discards (t)	34.4 t	2016-2019 weighted average.
Recreational Catch (t)	N/A	Recreational catch estimates are uncertain. Recreational catch is not included in the assessment and not deducted from the RBC.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		509 t

MAC Recommendations

Commercial fishers' interests	To be updated – SEMAC 42
Species specific management (target, companion and bycatch)	To be updated – SEMAC 42
MAC advice and any dissenting views	To be updated – SEMAC 42

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

AFMA Advice

To be updated – SEMAC 42

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & Undercatch (%)	Determined amount (t)	Change in TAC (t)
430				

Attachment F – Elephant fish species summary

Elephant fish

Callorhinchus milii

Ken Graham DPI Fisheries (1984)

Species Summary					
Common Names	Ghost Shark, Elephant Shark, Whitefish, Plownose Chimaera				
Stock assessment	Last considered by SERAG in 2020 using a weight of evidence approach.				
Stock Structure	Little is known about stock structure from an assessment and management perspective. Their biology suggests some potential for regional management of stocks. However it is currently assessed as a single stock.				
Stock status against reference points (C_{lim}/C_{targ})	Tier	**Year**	**$CPUE_{Recent}$**	**$CPUE_{Target}$**	**$CPUE_{Limit}$**
	Weight of evidence approach	2020	$F<F_{MSY}$	N/A	N/A
	4	2018	0.8656	0.844	0.422
	4	2015	1.0257	0.9750	0.3901
Stock trend and other Indicators See CPUE Report (Attachment C)**Error! Bookmark not defined.** See Data Summary	Following the advice from the SESSFRAG Technical Working Group (TWG), SESSFRAG (August 2019) recommended assessing elephant fish as a 'weight of evidence approach' recognising issues with the Tier 4 assessment due to high discard rates. This method sets a TAC based on the existing TAC, subject to sustainability concerns of SharkRAG and consideration of whether the TAC is restricting catches of that species or any other species. The SESSFRAG TWG recommended this method be used as an interim approach pending the outcomes of the multi-species harvest strategy project. SharkRAG (January 2020) suggested utilising recreational catch data as a potential source of information when considering future TACs.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	1st of 3-year			No	
Catch and TAC (t)	**SESSF Fishing Year**		**Agreed TAC**	**TAC after unders/overs**	**Catch**
	2020-21		114	123	-
	2019-20		114	124	47
	2018-19		114	125	51
	2017-18		114	122	46

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

Assessment Summary

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

Species Specific Research

No species specific research priorities have been identified.

RAG Recommendations

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

	Year	RBC (t)	Is a MYTAC Recommended?
Recommended Total Allowable Catch (t)	2022	N/A	Yes. Three-year MYTAC using annual TAC of 114t.
	2021	N/A	
	2020	N/A	
Discount Factor (t)	N/A	A discount factor is not applied as the TAC is set based on a weight of evidence approach.	
State Catch (t)	N/A	State catches are estimated to be 2.4 t. These are considered as part of the weight of evidence approach, but are not deducted from the TAC.	
Discards (t)	N/A	Discards are considered to be high, 120.9 t. These are considered as part of the weight of evidence approach, but are not deducted from the TAC.	
Recreational Catch (t)	N/A	The only estimates of recreational catch are 45 t for Victoria in 2008. These are considered as part of the weight of evidence approach, but are not deducted from the TAC.	
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.	
Provisional TAC under the Harvest Strategy		114 t	

MAC Recommendations

Commercial fishers' interests	To be updated – SEMAC 42
Species specific management (target, companion and bycatch)	To be updated – SEMAC 42
MAC advice and any dissenting views	To be updated – SEMAC 42

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

AFMA Advice

To be updated – SEMAC 42

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & Undercatch (%)	Determined amount (t)	Change in TAC (t)
114				

Attachment G – School shark species summary

School shark

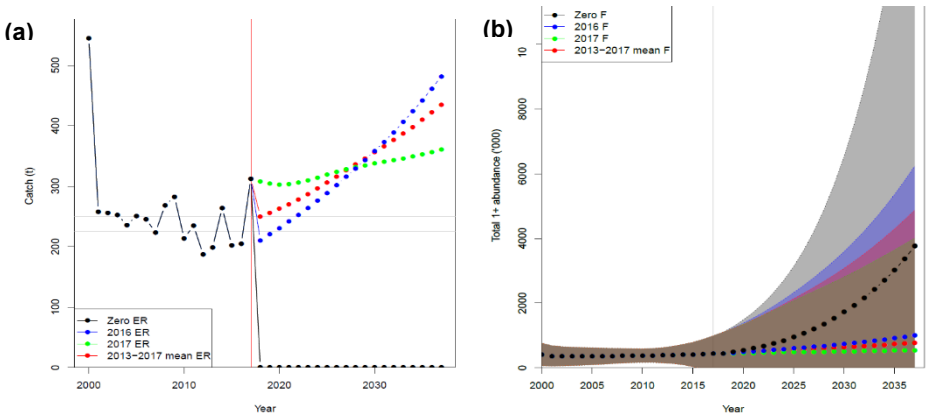
Galeorhinus galeus

Fisheries Research & Development Corporation (2012)

Species Summary					
Common names	School shark				
Stock assessment	Tier 1 Species - last assessed by SharkRAG in 2018 (close kin mark recapture (CKMR) assessment model). Review of Rebuilding Strategy underway by SharkRAG and SEMAC in 2020-21.				
Stock Structure	Tagging and genetic data shows some evidence for one well mixed stock. However, earlier data suggests there could be an east/west divide in stocks. This is supported by research documenting a collapse in the eastern part of the fishery around Tasmania and Bass Strait. After this collapse a fishery subsequently established in the west suggesting a reproductively isolated stock.				
Stock status against reference points ($\%B_0$)	**Tier**	**Year**	**Biomass**	**Target**	**Limit**
	1	2018	Unknown	48	20
	1	2016	<20		
	1	2012	<20		
Stock trend and other Indicators See CPUE Report (Attachment C)**Error! Bookmark not defined.** See Data Summary	The CKMR assessment model provides an estimate of current absolute abundance with trend back to 2000. It does not provide an estimate of depletion from B_0. The CKMR model indicates that the stock had recovered slightly during the period from 2000 to 2017. Gillnet CPUE is not considered a reliable index of abundance as school shark are actively avoided by gillnet fishers. Although representing only a small proportion of total catch, the trawl CPUE shows an increasing trend since 2003. In 2016, SharkRAG noted that this is a positive sign suggesting that the school shark is rebuilding. This is consistent with advice from industry that school shark, particularly juveniles, are in relatively high abundance.				
Multi-Year TAC	**Year of MYTAC (2020-21)**			**Have breakout rules been triggered?**	
	N/A – Rebuilding species			No	
Catch and TAC (t)	**SESSF Fishing Year**		**Agreed TAC**	**TAC after unders/overs**	**Catch**
	2020-21		195	195	-
	2019-20		189	189	184
	2018-19		215	215	196

	2017-18	215	215	206
Economics (Secondary) Gillnet, Hook and Trap	**Financial Year**	**Species GVP ($m)**	**Fishery GVP ($m)**	**% Fishery GVP**
	2018-19	2.04	23.66	8.62
	2017-18	1.87	19.51	9.58
	2016-17	1.70	20.23	8.40
ABARES Status (2020 report)	**Biomass: Overfished**		**Fishing Mortality: Uncertain**	

Assessment Summary	
Key model technical assumptions/ parameters	The CKMR assessment model assumes that there is one well mixed stock.
Significant changes to data inputs	The Shark Industry Data Collection (SIDaC) program continues to collect close kin samples as a key input to the CKMR assessment.
Data and RAG comments	The CKMR assessment model considers only one region, one population, starts in 2000 and does not allow (or need to take account of) movement between regions because there is only one region.
Stock assessment information and RAG comments	Assessments (since 1991) have consistently estimated the school shark population to be below the limit reference point of 20 per cent of unfished levels. In October 2018, SharkRAG accepted the CKMR assessment model noting high confidence in the absolute estimate of abundance produced by the model, but accepting lower confidence in the estimates of trend. SharkRAG recommended setting an incidental catch TAC based on projections using the average fishery mortality rates over the last five years (2013-17 mean F, red line in figures below). This rate, taking into account increasing stock size due to rebuilding, gives total fishing mortality estimates of 256 t in 2019-20, 263 t in 2020-21 and 270 t in 2021-22. This level of fishing mortality provides for consistent recovery, whereas projections using the 2017 fishing mortality rate (green line in figures below) would lead to an initial reduction (first two years) in stock size before recovery due to the effect of age class inputs in the model. The CKMR assessment model considers only one region, one population, starts in 2000 and does not allow (or need to take account of) movement between regions (because there is only one region). The base case model shows a population that is relatively small compared with that estimated by the previous stock assessment model. However the model is inconsistent with the catches taken during the 1990s which brings into question whether or not the stock from which the CKMR sample was taken is different from the stock that sustained catches prior to 2000. That is, the stock being assessed may have been a different and smaller stock than the stock that was historically fished. Any future consideration of B0 and associated reference points will need to take this into account. SSIA commissioned a review of the CKMR assessment in 2019. In 202, FRDC also conducted a peer review process for the CKMR assessment report as part of its normal project review process. The outcomes of the FRDC peer review process have yet to be released. In January 2020, SharkRAG members supported the engagement of a third party to review the results of the CKMR assessment for school shark. A draft terms of reference for the review was considered by SharkRAG in May 2020 and were finalised out of session.

	Four experts were selected to form an Expert Panel to undertake the review: one chair and three panel members. The Expert Panel's report will be presented to SharkRAG and SEMAC in early 2021. A meeting of SharkRAG will be convened for this purpose.
Projected Biomass	The CKMR model provides an estimate of current absolute abundance with trend back to 2000. It does not provide an estimate of depletion from B_0. The CKMR model indicates that the stock had recovered slightly during the period from 2000 to 2017.  **Figure 4: (a) Projected catch (t) using different constant exploitation rate scenarios. (b) Projected abundance estimates based on different constant fishing mortality rate scenarios.**

Species Specific Research

Continued Close Kin Mark Recapture sampling and analysis for school shark

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

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

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

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

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

RAG Recommendations

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

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

State Catch (t)	32.3t	2016-2019 weighted average. SharkRAG (October 2018) noted the importance of ensuring that State catches do not exceed the agreed levels allocated through the Memorandum of Understanding with Victoria, SA and Tasmania.
Discards (t)	43.5t	Uses 2014 ISMP discard estimate of 15.1% (estimate not available from ISMP for later years due the introduction of e-monitoring in the GHAT sector).
Recreational Catch (t)	N/A	Recreational catch estimates are uncertain. Recreational catch is not included in the assessment and is not deducted from the RBC.
Research Catch Allowance (t)	N/A	There has been no specific research catch allocated.
Provisional TAC under the Harvest Strategy		194 t – incidental bycatch TAC

MAC Recommendations

Commercial fishers' interests	To be updated – SEMAC 42
Species specific management (target, companion and bycatch)	To be updated – SEMAC 42
MAC advice and any dissenting views	To be updated – SEMAC 42

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

AFMA Advice

To be updated – SEMAC 42

2020-21 agreed TAC (t)	2021-22 recommended TAC (t)	Overcatch & Undercatch (%)	Determined amount (t)	Change in TAC (t)
195				