



Australian Government

Australian Fisheries Management Authority

Northern Prawn Fishery Resource Assessment Group (NPRAG)

Meeting minutes

8-9 February 2022

Via teleconference

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Meeting participants

Position	Participant
Chair	Ian Knuckey, Fishwell Consulting
NPRAG members	David Brewer, Scientific member Rik Buckworth, Scientific member Tom Kompas, Economic member Éva Plagányi, Scientific member Phil Robson, Industry member Darci Wallis, AFMA ¹ Bryan van Wyk, Industry member
AFMA Employees	Cate Coddington (Executive officer) Brodie Macdonald Elissa Mastroianni
Invited participant	Annie Jarrett, NPFI ²
Observers	Laura Blamey, CSIRO ³ Ian Butler, ABARES ⁴ Josh Cahill, NPFI Robert Curtotti, ABARES Roy Deng, CSIRO Michael Dylewski, ABARES Gary Fry, CSIRO Trevor Hutton, CSIRO (Day 1) Rob Kenyon, CSIRO Margaret Miller, CSIRO Mark Nelson, Austral Fisheries Sean Pascoe, CSIRO Judy Upston, CSIRO (Agenda items 4 and 11) Tonya van Der Velde, CSIRO
Apologies	
	Ian Boot, Industry member Trevor Hutton, CSIRO (Day 2)

¹ Australian Fisheries Management Authority

² Northern Prawn Fishery Industry

³ Commonwealth Scientific and Industrial Research Organisation

⁴ Australian Bureau of Agricultural and Resource Economics and Sciences

Agenda item 1. Preliminaries

a. Welcome and apologies

1. Ian Knuckey, the Chair, opened the meeting at 1000 AEDT⁵, and:
 - welcomed meeting participants;
 - made an Acknowledgement of Country;
 - reminded participants of their responsibility to keep information confidential;
 - informed participants that the meeting was being recorded and will be used for minute taking purposes, the recording will be deleted after minutes are finalised; and
 - commenced proceedings.
2. The RAG noted that there was a quorum for the meeting as per *Fisheries Administration Paper 12 (FAP12)*.

b. Declarations of interest

3. The RAG discussed potential conflicts of interest and participation under specific agenda items as outlined in FAP12, noting:
 - declarations of interest are at [Attachment A](#)
 - Research interested participants were deemed to have a potential conflict of interest with **Agenda Item 5: 2023-24 Research statement**. These participants left the meeting and their participation in the item was discussed by the remaining participants. The intent of the agenda item is to identify potential scopes to provide to the May meeting, not for making decisions about research items.
 - Industry participants were deemed to have a potential conflict of interest with **Agenda Item 2: Harvest strategy review – byproduct** given the potential impact on Total Allowable Effort for these species. These participants left the meeting and their participation in the item was discussed by the remaining participants.
4. Upon return to the meeting by each group, the Chair outlined the outcomes from deliberations regarding conflicts of interest (**Table 1**) and explained that if any additional conflict of interests arose, that participants have a responsibility to raise them as soon as they are aware.

Table 1. Participation in items where there are declared conflicts of interest

Agenda Item	Potential conflicts of interest	Discussion Participation	Recommendation Participation
2. Harvest Strategy review – byproduct	Industry	Present	Not present
5. 2023-24 Research Statement	CSIRO, independent researchers	Present	Present

c. Adoption of agenda

5. The RAG adopted the agenda as final, outlined at **Attachment B**.

⁵ Australian Eastern Daylight Time

d. Minutes from previous meetings

6. Previously accepted out-of-session, the 23 November 2021 NPRAG minutes were accepted as a true and accurate record of the meeting. The RAG noted that they have been published on the AFMA website on the [NPRAG past meetings](#) webpage.

Agenda item 2. Harvest Strategy review – byproduct

7. The RAG noted the information presented by Darci Wallis about the proposed changes to the byproduct section of the Northern Prawn Fishery (NPF) Harvest Strategy, in particular:
- Scampi – setting an annual 30 tonne limit. Currently there is only a 30 tonne limit for the following year if 30 tonnes was landed in the previous year.
 - It is not anticipated that this limit will impact the operators given that the limit has generally been 30 tonnes each year.
 - There is no sustainability concern with the stock.
 - Squid – reducing the catch trigger limit to 300 tonnes from 500 tonnes, and the review event to 200 tonnes from 300 tonnes – with input requested on what the specifics of a review event would entail.
 - Scallops and cuttlefish – introducing catch and trigger limits for these species because there is none in the harvest strategy.
 - At 180 and 280 t, the acceptable biological catches for scallops and cuttlefish, respectively, are much higher than the current catch levels.
 - Add a precautionary review trigger, well below the current trigger but well above actual catch. If the review trigger were met then it would suggest something has changed that would warrant further analysis of the catch and effort data.
 - A broader review of the NPF Harvest Strategy, including the redleg banana and tiger prawn fishery components, along with a modernisation of the introductory sections is also underway and will be considered by the RAG at the May 2022 meeting.
8. The RAG discussed the proposed changes to the byproduct section of the NPF Harvest Strategy:
- Scampi – setting an annual 30 tonne trigger
 - While it is not expected that the limit will impact industry (given the current catches) or that the limit proposed is unsustainable (under the recent stock assessment), concern was raised about the possibility of restricting the potential future development of this fishery, particularly because there are significant scampi fisheries in adjoining jurisdiction outside the EEZ.
 - It will be important to ensure there is scope in the harvest strategy that enables exploration for, and further development of a fishery for this species.
 - Squid – reducing the catch trigger for squid to 300 tonnes and the review trigger of 200 tonnes:
 - In the past there have been large landings of squid. The current limit of 500 tonnes was implemented when there was a high bycatch, with some catches well over 300 tonnes in the 1990s. The proposed limit of 300 tonnes is from the Milton report⁶. The current 300 tonne trigger has not been reached since it was implemented.

⁶ Milton DA, Fry GC, Kuhnert P, Tonks M, Zhou S & Zhu M. (2010) *Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn Fishery*. Fisheries Research and Development Corporation Final report 2006/0008. Available at: https://fish.gov.au/Archived-Reports/2014/Documents/Milton_et_al_2010_Assessing_data_poor_resources_2006_008.pdf

- Squid are important byproduct species that add revenue to the fishery and can assist to counteract poor tiger prawn seasons. With climate change impacts, cephalopods are generally becoming more important and could continue to develop as part of the NPF.
- The proposed changes could limit the future prospective fishery for squid.
- Stock recruitment is highly variable and can be impacted by environmental conditions and the availability of food.
- Will need to ensure that spawning aggregations are protected and that fishing the stock will not impact the recruitment for the next year.
- There is limited information about squid in this fishery and a need for more information about the stock to be able to provide advice on an appropriate trigger.
- Consideration of the expert advice provided as part of the recent ERA process should be considered.
- Scallops and cuttlefish – setting a precautionary review trigger and catch limit.
 - Both species are caught during fishing operations, but it is primarily cuttlefish that are landed as there is not currently a cost-effective market for NPF scallops.
 - There is not much data from fishery operations about either species. Additional data and analyses would assist in the provision of advice, particularly the proportion of landed versus total catch. Observer data may be able to provide further information about these proportions.
 - Based on the ERA, there was little concern about the scallop resource. It was noted that there is a range of different cuttlefish species that inhabit a wide array of habitats.
- While the harvest strategy is to be reviewed every five years⁷, reviews can be undertaken earlier if needed.

Recommendation

9. NPRAG discussed each species group but delayed consideration of the proposed changes to the byproduct section of the NPF harvest strategy until the next meeting. Further work is required to ensure there are no unnecessary restrictions that could prevent future sustainable development of those species. Regarding:
- Scampi – the triggers and total catch limits of scampi will need to be reconsidered once industry is consulted on the proposed triggers and limits. Updates for scampi should also consider catch per unit effort (CPUE) alongside size structure of catch.
 - Scallops and Cuttlefish – while an annual catch trigger of between 50-100 for these species seems reasonable and is under the scientifically derived acceptable biological catch (ABC), these triggers should be considered at the May meeting with further information from the observer program about proportions of landed to total catch of cuttlefish.
 - Squid – need to ensure that the life history of squid is considered in the development of harvest control rules, particularly as it is strongly affected by environmental factors and has a highly variable recruitment. This species is potentially an important byproduct species for the fishery with the potential impacts of climate change. Reconsider at the October/November meeting, with an update to be provided at the May meeting.

Action Item 1: AFMA and NPFI

NPFI and AFMA to consult with industry regarding the trigger and catch limit proposed for scampi to provide back to the RAG. A paper to be provide to NPRAG in May 2022 that includes industry feedback and any other relevant information.

⁷ A requirement under the [Commonwealth Fisheries Harvest Strategy Policy 2018](#)

Action Item 2: AFMA

AFMA to provide NPRAG with information about the landed weight / total catch weight ratio for cuttlefish from available observer data. A paper to be provided to NPRAG in May 2022.

Action Item 3: AFMA, CSIRO and NPF

AFMA, CSIRO and NPF to develop a proposal to review the information on squid to support updating the NPF harvest strategy. Need to ensure that the protection of spawning aggregations and the experience from other squid fisheries (including pre-season surveys) are considered. An update to be provided to the NPRAG in May 2022, with further consideration to occur at the October/November 2022 if required.

Agenda item 3. Industry Update - 2021 tiger prawn season

10. The RAG noted the industry update on the 2021 tiger prawn season:

- Catches of tiger prawns in the Gulf of Carpentaria were the lowest in a while, with the larger size-class of prawns making up a lower proportion of the catch, but no changes in the volumes of the other size classes.
- Overall, it has been a financially improved year due to:
 - the contribution of squid as a byproduct,
 - a better outcome in Joseph Bonaparte Gulf due to first season closure, and
 - stronger prawn prices, which were the best in 20 years due to a strong retail presence in Asia, the domestic restaurant market improving and the lower catches.
- Costs have increased substantially, particularly for fleet maintenance – as such it will be important to maintain strong prices.

11. The RAG discussed the industry update with relation to the export market and challenges accessing foreign markets:

- Prices were strong, at the height of the season prices were over \$40 for the larger size grades – U/6-8 (pieces to the pound).
- The season was very different to normal, with the domestic market increasing in importance.
- The lower volume of product resulted in strong demand and had a positive impact on the price. While there were some logistical issues, for example freight costs, needing to move product quickly and freight from the motherships during the season to meet demand, shipping container availability and restrictions on restaurants in Asia – the retail market in Asia was strong.
- There was no overflow of stock so the prices were not impacted.

Agenda item 4. Stock assessment project – redleg banana prawns

12. The RAG noted the information presented by Éva Plagányi on the progress made to date on the redleg banana prawn stock assessment revision project (AFMA Project 2019/0843):

- The project is nearing completion with the draft final report circulated, although the following items are needed to finalise project:
 - aligning the stock assessment with the harvest strategy;
 - developing a voluntary trigger to guide fishers when to cease fishing towards the end of the fishing season. The analysis of average nominal CPUE could inform the voluntary reference level. The analysis suggested that a monthly average of 500kg / day is appropriate and is approximately 67% of the CPUE that corresponds on average to the target level; and
 - determining minimum data requirements (assessment and fishing power and developing a definition for data sufficient years to be able to conduct an assessment).

- A paper was published in *Conservation Biology*⁸ on the management strategy evaluation (MSE) to test the robustness of harvest control rules for environmental variability. Considerations of the MSE results informed the decision for the permanent first season closure in the Joseph Bonaparte Gulf.
- To consider the minimum data requirements and data sufficient years, data analysis and simulations were applied to the period 2007 to 2010 (the previous period that the first season was also closed). Based on the analyses, the data-sufficient number of boat days to achieve an error of less than or equal to 10 percent is in the range of 60-80 days on average.
 - There is a trade-off between the need to ensure that the assessment is run frequently enough to detect stock status accurately (and is not below B_{lim} ⁹) and the need to ensure that the assessment (and fishing power) is sufficiently accurate to provide confidence in the outcome.
 - The closure of the first season is a precautionary measure that helps to add additional protection for redleg banana prawn stocks.
 - A cross-check was undertaken on 2015 data when there were 79 total fishing days. The model performed reasonably when a retrospective assessment was undertaken, suggesting that fewer than 100 boat days could still yield a reliable assessment.

13. The RAG thanked CSIRO for the work undertaken on the redleg banana prawn assessment and industry's input, particularly given the importance for Marine Stewardship Council (MSC) certification. The RAG discussed the update:

- Development of a full bio-economic model for redleg banana prawn is not considered feasible for a number of reasons:
 - it is only a small component of a much larger fishery, so a large investment into the assessment is not warranted;
 - there is a high level of environmental influence and uncertainty in the fishery
 - obtaining reliable cost data for the redleg banana prawn fishery is problematic, and
 - there is no dedicated time-series of fishing power to use.
- The closure of the first season in the Joseph Bonaparte Gulf seems to have had a positive impact on prawn size – Bryan van Wyk reported that the prawn size U/15 had increased to 45 per cent of the catch from 20 per cent in the previous season for Austral Fisheries. However, whether this increase is across the fishery needs to be confirmed as the data for the whole fishery is not currently available.
- The minimum data requirements for fishing power. A higher number of fishing days leads to increased accuracy in the assessment.
 - While the lower 60 fishing days delivers a reasonably accurate assessment and could be better than not having an assessment, there is a level of uncertainty that could lead to an outcome that is not necessarily precautionary.
 - From a stock assessment perspective, a higher number of minimum fishing days (e.g. 80) provides a more accurate assessment, but there would be more years when an assessment is not undertaken.
 - The midpoint of 70 fishing days provides a reasonable compromise. Additionally, there is a historical precedent as this aligns with the minimum number of days for the fishing power assessment.

⁸ Blamey LK, Plagányi ÉE, Hutton T, Deng RA, Upston J, & Jarrett A. Redesigning harvest strategies for sustainable fishery management in the face of extreme environmental variability. *Conservation Biology*. 2021; 1–17. <https://doi.org/10.1111/cobi.13864>

⁹ Biomass limit

- The new first season closure will likely have some impact on the assessment. Reconsideration of some of the assessment options will be better informed following a few more years of data under the new management arrangements.

Recommendation

14. NPRAG agreed that a suitable minimum threshold to run a redleg banana prawn assessment was 70 fishing days. This threshold should be reviewed in 3 years (2025) to enable the consideration of the impacts of the first-season closure on the data availability and assessment (when updated data will be available).

Action Item 4: NPMI

Industry to provide feedback to CSIRO on the approach of using a voluntary trigger rate to help operators decide when to stop fishing for redleg banana prawns; currently proposed as 0.5 tonnes (500kg) per day.

Agenda item 5. 2023-24 Research Statement

15. The RAG noted the information presented by Darci Wallis:

- Research scopes for potential projects for funding in the 2023/24 financial year will be developed and provided to NPRAG for consideration in May 2022.
- While there were no NPF-specific scopes progressed for the 2022-23 financial year due to the extension of the species-split project (update at **Agenda Item 11**), four AFMA-wide scopes that are relevant to the NPF were developed and progressed by the AFMA Research Committee.
- The current Wildlife Trade Operation approval under the *Environment Protection and Biodiversity Conservation Act 1999* (expires on 6 January 2024) has conditions relating to sea snake research, monitoring and identification (alongside sawfish) that need to be met. It is important to ensure that the available sea snake research adequately meets this condition.

16. The RAG discussed potential research needs for the NPF:

Sea snakes

- There had been a six-fold increase¹⁰ in the number of reported interactions with sea snakes. This can be attributed, as least in part, to improved reporting:
 - Crew-member observers (CMOs) are collecting more robust information with improved species identification.
 - NPMI has undertaken a lot of education to ensure that skippers are reporting their catch accurately, there has been an increase in the number of vessels reporting sawfish (to 90%) providing proof that reporting is increasing.
- The Ecological Risk Assessment (ERA) undertaken recently (see **Agenda Item 8**) did not assign sea snakes as at potentially high-risk following a residual assessment.
- There has not been any specific gear trials undertaken analysing sea snake escapement. Sea snake behaviour is different to other species in that they actively seek to escape. There is some

¹⁰ Subsequent to the meeting, the six-fold increase in sea snake interactions was found to be due to a reporting error in the NPF database. Once rectified, the number of reported sea snake interactions was on par with the previous year with no significant increase.

evidence of snake egress from turtle excluder devices (5-10 per cent) and square mesh sections.

- Research work undertaken by CSIRO during the 2000's found that survival rates of sea snakes is about 50 per cent ([survival rates of sea snakes caught by demersal trawlers in northern and eastern Australia](#)). Trawling practices have not changed substantially since.
- It may be possible to analyse the underwater footage of sea snakes from the *assessing the impacts of trawl gear on sawfishes in the Northern Prawn Fishery research* project (Fisheries Research and Development Corporation (FRDC) [2019-112](#)) to help inform sea snake survival rates.
- MSC certification reassessment is due in 2023.

Other research

- The [NPF Strategic Research Plan 2019-23](#) is due to be updated in 2023.
- Understanding spatial assessment models and environmental changes could have different influences spatially on stock assessments. For example, the work undertaken on the *Models of Intermediate Complexity for Ecosystem assessments* (MICE) project (**Agenda Item 9**)¹¹ could be used as a model to include climate change and other environmental factors for stock assessments. There are also other projects being undertaken that could provide an integrated understanding, for example species-split and the integrated monitoring projects.
- The impacts of climate change could be considered. These include direct impacts on prawn stocks and secondary impacts on trade and on export markets.
- It may be possible to access some of the \$5 million that has been recently allocated to a new threatened and migratory species bycatch mitigation initiative under the [Ocean Sustainability and Climate Change](#) leadership package.
- Work could be undertaken to ensure that the MEY target and catch triggers are calibrated with price elasticity as well¹². It was noted that CSIRO have already started price elasticity work for banana prawns and the tiger prawn market is mostly export, so not relevant.
- The RAG discussed the potential to improve the tiger prawn assessment model during Agenda Item 7: *Tiger prawn assessment – update on progress*.

Recommendation

17. NPRAG recommended a background paper summarising information about sea snakes to be presented to the RAG for consideration.
18. NPRAG identified the following scopes be developed for the May 2022 meeting:
 - climate change – direct impacts on prawn stocks and secondary impacts trade and export markets
 - tiger prawn assessment improvements
 - Detailed analysis of environmental variables that could affect tiger prawn population dynamics
 - price elasticity – bananas / tigers. (Note: CSIRO have started price elasticity work for banana prawns, and the tiger prawn market is mostly export, so not relevant).

¹¹ Éva Plagányi declared a conflict of interest in this item.

¹² The project was suggested at the beginning of the second day of the meeting

Action Item 5: AFMA

AFMA to work with the relevant parties to develop research scopes for consideration by NPRAG at the May meeting.

Agenda item 6. MSC Conditions

19. The RAG noted that the third MSC surveillance audit had been completed. The audit found that progress is being made against the requirements of certification and the status of the conditions remains on target. Annie Jarrett thanked all those, including CSIRO, who were involved in contributing to the 3rd MSC surveillance audit. The RAG noted that the fourth surveillance audit and full re-assessment is due in November 2022.

Day 1 finished 1400 AEDT

Day 2 started 1000 AEDT

Agenda item 7. Tiger prawn assessment – update on progress

Progress with the 2022 stock assessment

20. The RAG noted the update provided by Roy Deng on the progress of the tiger prawn assessment:

- Preparation for the assessment is on track, with additional work required on catch and effort data, fishing power estimates, fishery independent surveys and economic inputs. While the weekly CPUE, annual recruitment and spawning surveys indices of four species (grooved and brown tiger prawns and blue and red endeavour prawns) have been available, only those of the two tiger prawn species will be included in the size model. Annual CPUE will be used in two endeavour prawn production model (blue endeavour in the base case, and both species for the four-species sensitivity test).

Base case and sensitivity tests

21. The RAG discussed the base case model to be used for the 2022 stock assessment and the eight sensitivity tests, which have been developed over the last decade (outlined in **Table 2**):

- The use of the low effort threshold of 2777 fishing days in the base case scenario was established in 2008 based on the 2007 level of nominal effort¹³. It is not representative of the actual effort in the fishery and overestimates the effort in the brown tiger components. However, to determine whether this should be altered in the base case requires careful consideration (including the rationale of the original decision).
- The most recent inclusion as a sensitivity test of red Endeavour prawns is crucial due to the requirements under the MSC conditions.

¹³ In 2008, there was agreement to take an 8% increase in effort due to the reduction in boat numbers since 2006 and that this should apply to half the tiger prawn effort (assuming that effort was split 50/50 to brown and grooved tiger prawns). The 2007 level of nominal effort was 5142 days, when divided by 2 and increased by 8% gives the minimum effort constraint of 2777 days for brown tiger prawns; if it had been based on the last stock assessment at the time it would have been 1280.

- The low threshold sensitivity of 1000 fishing days is important as it dealt with the issue of model convergence.

Table 2. Base case and sensitivity scenarios. [Note: the base case row is green, differences in the parameters for the sensitivity scenarios to the base case are highlighted in orange].

Scenario	Variables								
	Model	Fishing power	Weekly pattern	Max. effort change	Recruitment survey selectivity function	Ignoring last survey LF ¹⁴ data	Low effort threshold	Effort allocation algorithm	No. of species
Base case	SSB ¹⁵	Low	Last 2 year average	N/A	Gamma	Yes	2777	Yes	3
DDD ¹⁶	DDD	Low	Last 2 year average	N/A	N/A	N/A	2777	Yes	3
Mid-High Fishing Power	SSB	Mid-high	Last 2 year average	N/A	Gamma	Yes	2777	Yes	3
Fixed effort pattern	SSB	Low	NPRAG 2013 specified season	N/A	Gamma	Yes	2777	No	3
Estimate season	SSB	Low	estimated	N/A	Gamma	Yes	2777	No	3
Constraining effort change (year-on-year)	SSB	Low	Last 2 year average	15%	Gamma	Yes	2777	Yes	3
Low effort threshold	SSB	Low	Last 2 year average	N/A	Gamma	Yes	1000	Yes	3
Base Case plus red endeavour	SSBB ¹⁷	Low	Last 2 year average	N/A	Gamma	Yes	2777	Yes	4
No effort threshold	SSB	Low	Last 2 year average	N/A	Gamma	Yes	No effort threshold	Yes	3

2021 inter-assessment report

22. The RAG noted that CSIRO updated the 2020 assessment to include 2021 catch and effort data and recruitment survey indices – as per the NPRAG recommendation from the 12-13 May 2021 meeting – and that the report¹⁸ is available for uploading on the AFMA website subject to final approval.

¹⁴ Length frequency

¹⁵SSB – “Size model” for two tiger prawn species and “Bayesian hierarchical production” model for blue endeavour prawn.

¹⁶ DDD – “Delay difference model” for all three species

¹⁷ SSBB – “Size model” for two tiger prawn species and “Bayesian hierarchical production” model for two endeavour prawn species.

¹⁸ Deng, R.A., Hutton, T., Punt, A., Upston, J., Miller, M., Moeseneder, C., and Pascoe, S. 2021. *Status of the Northern Prawn Fishery Tiger Prawn Fishery at the end of 2019 with estimated TAEs for 2020 and 2021*. Report to the Australian Fisheries Management Authority, September 2021. CSIRO.

Catch variability

23. The RAG noted and discussed the update provided by Roy Deng about the variability of tiger prawn catches. Tiger prawn catches have varied between 800 and 2500 tonnes since 2003, the catch in 2021 was at the lower end at about 900 tonnes. Catch variability has been attributed to a range of factors, including water temperature, winds, rainfall etcetera as well as the fleet reduction in 2006/07.

- Prawns are a short-lived species and there is need to consider broad scale and regional or localised effects.
- Climatic short-term variability, decadal variability and underlying climate trends
- The current model doesn't enable regional consideration and would need spatial disaggregation.
- Environmental drivers are likely to be impacting recruitment, growth, mortality and the sex ratio. In the current model growth and mortality parameters are time invariant.

Model development to include banana prawns

24. The RAG noted the update provided by Sean Pascoe on an internal CSIRO-funded experimental process to include banana prawns in the NPF bio-economic model; a paper has been published in *Fisheries Research*¹⁹:

- The current model has not been updated for over a decade and there are several issues that need redress:
 - effort is consistently overestimated on brown tiger prawns;
 - there is now an overlap with the tiger and banana prawn seasons given the stock recovery, which may affect the level of effort on tigers – particularly brown tiger prawns;
 - there is an ongoing assumption about allocating fixed costs that is largely ad hoc and could affect the results; and
 - a whole-of-fishery model is needed to assess environmental impacts, for example the potential impact of reduced river flow rates on the fishery.
- The main changes superimposed on the model were:
 - banana prawn effort was included from the first day of the seasons, with a period where both tiger and banana prawns can be caught;
 - a banana prawn effort model was developed, which was a good fit to the data; and
 - some price flexibility work was undertaken to analyse the impact of changes in landings of banana prawns on the price received and included in the model.
- Key outputs from the updated model (**Figure 1**) include:
 - the effort on brown tiger prawns was lower than the effort estimated in the current models, unless the banana prawn biomass was very low;
 - effort on grooved tiger prawns in the updated model was generally higher than currently estimated; and
 - banana prawns were found to be the key driver of profit in the fishery.
- The updated model is still experimental and in the developmental phase. It is not currently a sensitivity at this stage.

¹⁹ Hutton, T., S. Pascoe, R. A. Deng, A. E. Punt, and S. Zhou. 2022. Effects of re-specifying the Northern Prawn Fishery bio-economic model to include banana prawns. *Fisheries Research* 247:106190 Brisbane. 102 p. Available at: www.sciencedirect.com/science/article/abs/pii/S0165783621003180?dgcid=rss_sd_all

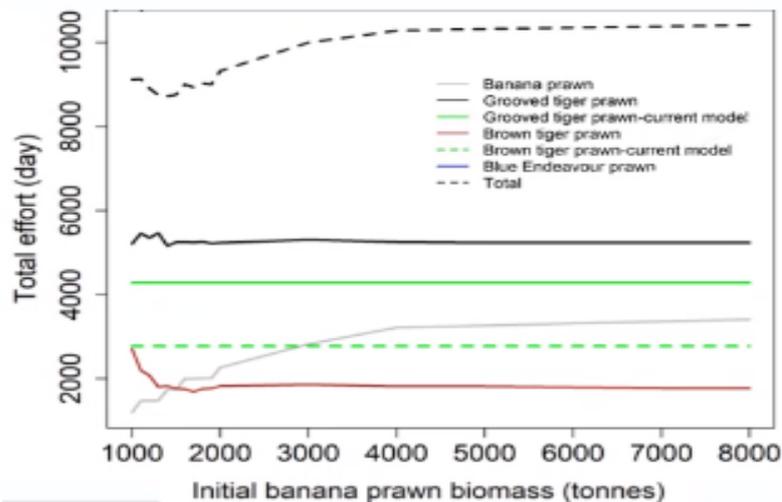


Figure 1: Comparison of effort model output between the current and the experimental models

25. The RAG noted that the results of the study align with fishery industry experience, that fishing effort is lower for tiger prawns when there is a good banana prawn season.

Strategic planning to investigate environmental and climate influences on tiger prawns

26. In considering the overarching issue of climate change, the RAG noted the initiatives being undertaken, or considered by CSIRO that could improve the tiger prawn stock assessment model in the NPF:

- all available environmental and physical data for the Gulf of Carpentaria has been collated, including historical cyclone index (appropriate for input to models);
- downscaled regional climate projections for the region and southern oscillation index (SOI) projections have been sourced (and may be useful for common and redleg banana prawn projections);
- preliminary investigations on the influence of environmental variables on tiger prawns has been done (further in-depth analyses and modelling are needed);
- the types and timing of data available, and how these could help with hypothesis testing is being scoped;
- the MICE model is well-suited as a tool for modelling and projecting climate change impacts;
- demand modelling for common banana prawns has progressed that may provide useful insight for the NPF;
- a new strategic project focussed on the resilience of supply chains has commenced and may provide useful insights for the NPF; and
- there is a dearth of data on the inshore juvenile tiger prawn population inhabiting littoral seagrass communities. This needs investigating to understand possible impacts on the juvenile phase.

27. The RAG discussed the potential improvement to, and possibly the fundamental change of, the NPF stock assessment model:

- While the current model was well ahead of its time when it was developed in 2007 (and implemented in 2010), computational ability has moved on.
- The current model should be used for the tiger prawn assessment this year to provide TAEs for the upcoming years; it will not be possible to fundamentally change the assessment this year.

- To ensure that there will be a strategic approach developed for the next decade, it will be important to consider the approach undertaken to undertake NPF stock assessments overall and not just the model.
- Developing a strategic approach will need to be undertaken in parallel with the current stock assessment process with the starting point to make the most of the data that exists.
 - Strategic planning will be important to enable future improvements for fundamental change. It may be possible to garner further ideas from a broader array of specialists from outside the fishery.
 - Appropriate funding will be important.
 - The five-year strategic research plan is due for renewal in 2023.
- Regional recruitment indices are displaying real signals that suggest there are regional impacts with much spatial variation that is significant for regions. However, it is unclear exactly what the impacts are, particularly for inshore regions (tiger prawn nurseries).
- Three additional items of work were raised that could contribute to the process:
 - A well-developed climate change model for 140 countries²⁰, which tracks changes in income and might be relevant to the demand cycle for tiger prawns (Tom Kompas).
 - Austral Fisheries have been undertaking an analysis of their database (last 20 years) to investigate whether any patterns emerge for small regions (paddocks). Consideration has been given to different sizes and grades of catch, while they have not undertaken a species split, the assumption has been made that grooved tiger prawns are in deep water and brown tiger prawns are in shallow water (Bryan van Wyk).
 - CSIRO have progressed demand modelling for common banana prawn, which may provide a helpful input into socio-economic climate modelling for the NPF (Sean Pascoe).

Recommendation

28. NPRAG to consider the tiger prawn assessment and decide whether a change in base case parameters (specifically relating to minimum effort) is required in future assessments and which sensitivities are needed; this will be done in an agenda item prior to considering the results of the assessment. In the meantime, CSIRO to run all the sensitivity models.

Action Item 6: CSIRO and AFMA

CSIRO and AFMA to summarise the sensitivity tests used for the tiger prawn assessment, including the basis for their use, and their purpose to ground-truth the tests. This will enable informed decisions to be made about the tests that are reasonable to use. A paper to be presented at the May meeting.

Action Item 7: AFMA, CSIRO, NPFI and Ian Knuckey

As a 2023/24 research priority for the fishery, workshops will be held to ensure that the approach to the tiger prawn assessment remains appropriate and is future-proofed by considering the latest information and initiatives. These workshops will inform the new 5-year strategic research plan. Participants to include: AFMA, CSIRO, NPFI and Ian Knuckey.

²⁰ Kompas, T., Pham, V. H., & Che, T. N. (2018). The effects of climate change on GDP by country and the global economic gains from complying with the Paris Climate Accord. *Earth's Future*, 6, 1153–1173.
<https://doi.org/10.1029/2018EF000922>

Agenda item 8. ERA finalisation

29. The RAG noted the information presented by Darci Wallis on the final draft ERA reports for the white banana prawn and tiger prawn sub-fisheries, in particular:

- The draft reports have been considered a number of times by NPRAG since the initial draft provided in 2019 (the process commenced in 2017).
- Expert advice was sought in 2021 on squid, cuttlefish, crustaceans and sea snake species, their reports indicated that, under current NPF management arrangements and trawl effort in the fishery there is unlikely to be a high-risk to these species. This advice was accepted by NPRAG.
- CSIRO have incorporated all relevant comments into the updated reports.
- Four sawfish species were identified as potentially high-risk.
- The reports will be provided to NORMAC for finalisation.

30. The RAG expressed their appreciation for the work undertaken by CSIRO (Miriana Sporcic) and discussed the final draft ERA reports:

- AFMA is looking to automate the ERA process,
- The ERA for the redleg banana prawn sub-fishery is scheduled to be undertaken in 2022 as a trial.
- While species that are classified as at medium-risk are not considered a priority for management, a fishery can consider specific management for those species if required.
- It would be worth considering the priorities for the CMO Program and scientific observer work based on updated ERA results to ensure that needs are targeted.
- The RAG will be considering an ERA trigger process at the next meeting in May 2022, which will inform when an ERA needs to be updated.

Recommendation

31. NPRAG endorsed the final draft Ecological Risk Assessment (ERA) reports for the white banana prawn and the tiger prawn sub-fisheries and thanked Miriana Sporcic for the work undertaken on the reports.

Action Item 8: NPFI and CSIRO

NPFI (Josh Cahill) and CSIRO (Gary Fry) to consider readjusting priorities for the CMO program to ensure that the program it is targeting fishery needs, particularly given the recent ERA results.

Agenda item 9. MICE project update

32. The RAG noted the information presented by Éva Plagányi on a summary of the findings / final results of the project [*ecological modelling of the impacts of water development in the Gulf of Carpentaria \(GoC\) with particular reference to impacts on the Northern Prawn Fishery*](#) (FRDC 2018-079):

- A full set of water resource development (WRD) scenarios has been run. A key finding factsheet will be publically available towards the end of February 2022, with the final report due for submission to FRDC on 15 March 2022.
- A MICE model was developed to undertake quantitative estimates of the impact of alternative flow regimes on the relative abundance of key fishery and other marine species in the Gulf of Carpentaria, as well as impacts on total fishery catches and value. The model has been

rigorously tested and reviewed by a large team, comprising of internal CSIRO reviewers and external partners.

- The model tested the impacts of various river flows under 19 different WRD scenarios on fishery species (including banana prawns), threatened species (*Pristis pristis*) and key habitat forming species (including seagrass and mangroves). The key scenarios are considered plausible.
- There is a spatial component to the model with eight regions. Currently the project is focussed on regions that incorporate the Mitchell, Flinders and Gilbert rivers (Regions 2 to 6). It is intended that the model will be applied to updated flow development scenarios for the Roper River (Region 7) as a next step.
- The model, which incorporated a significant timeframe of historical data (for example there was 50 years of data available for prawn species), provided a rigorous basis for predicting impacts.
- The model predicted that different WRD scenarios impact river flows to differing levels, e.g. changing flows in a wet year to resemble those in an intermediate year or from an intermediate to a dry year. The greater the reduction of flow correspondingly leads to a greater impact on catch.
- System connectivity is important. There is a river portfolio effect, different rivers can exacerbate or can mitigate changes to regional biomass and catch..
- There were also economic impact assessments undertaken of the main WRD scenarios, with declining profit and NPV found with declining river flow. Impacts on small regions were found to still have significant impacts on profits. An economic risk assessment is still being developed.
- Under an ecological risk assessment, reduced flows were found to have a mild to severe risk for banana prawns depending on the WRD scenario. However, largemouth sawfish were predicted to show the greatest sensitivity to WRDs with risks ranked as intolerable across the WRDs.
- MICE predicted major to severe risks to mangrove habitats under some scenarios.
- For common banana prawns, the Flinders River catchment emerged as the most sensitive to WRDs.

Action Item 9: CSIRO

CSIRO (Éva Plagányi) to provide an extract from the *economic risk assessment applied to common banana prawn model report* to NPRAG for comment.

Agenda item 10. Integrated monitoring program – pre-season survey update

33. The RAG noted that preparations for the Integrated Monitoring Program pre-season survey, which starts on 18 February 2022 is on track. The scientific permit, to be granted under the *Fisheries Management Act 1991*, is expected to be granted by 16 February 2022.

Agenda item 11. Species split project update

34. Judy Upston expressed appreciation for people, particularly industry, who collected samples and data for the species split project– *updated NPF species distribution data, models and sampling schemes – towards regular ongoing monitoring* (AFMA project 2019/0805), and updated the RAG on the status of the project:
- Coverage of samples for the tiger prawn fishing seasons in both 2019 and 2020 were excellent with sampling proportional to commercial catch distribution. However, sampling in the 2020

banana prawn season did not achieve the needed outcomes due to COVID constraints. As such an additional sampling was is needed to be undertaken in the 2022 banana prawn season.

- Processing of samples for all species is proceeding well. Ensuring that a representative sample is being collected across the species with the catches separated between grooved and brown tiger prawns separated and into red and blue endeavour prawns is critical.

35. The RAG discussed:

- The importance of providing feedback on the project to those in industry who have collected samples and data to retain project engagement and broader industry support in general. The RAG noted that the focus for the project between February and April is to ensure collection of the number of samples that are needed.

Action Item 10: NPFI / CSIRO / AFMA

NPFI (Annie Jarrett) / AFMA (Darci Wallis) / CSIRO (Judy Upston) to consider information about the project that can be provided to industry. NPFI to provide the information to industry.

Agenda item 12. Next meeting

36. The RAG noted the next meeting is scheduled in May 2022, in Brisbane – travel restrictions dependent.

Agenda item 13. Other Business

37. No other business was raised.

Close of meeting: 1250 AEDT

Attachment A – Register of interest

Name	Declared interests
Chair	
Ian Knuckey	<p>Director – Fishwell Consulting Pty Ltd Director – Olrac Australia – a company associated with electronic logbooks. Scientific member – NORMAC Member – North Marine Parks Advisory Committee Chair – Tropical Rock Lobster RAG Chair – Victorian Rock Lobster RAG Scientific member – SESSF shark RAG Scientific member – GABRAG Works with Indigenous communities in capacity building activities Chair – South Australia’s Gulf of St Vincent prawn fishery’s research committee Scientific member – South Australia’s Gulf of St Vincent prawn fishery’s management advisory committee Current consultancy with NT Fisheries designing a snapper species survey Various research interests in other Commonwealth and State fisheries. No direct pecuniary interests in the NPF</p>
Members	
David Brewer	<p>Scientific member – NPRAG Director – Upwelling P/L (David Brewer Consulting) Scientific member – Torres Strait Fin Fish Working Group Chair – Torres Strait Fin Fish RAG Current consultancy work with the Quandamooka Yoolooburrabee Aboriginal Corporation/FRDC (Moreton Bay), Newcrest mining (Lihir I gold mine PNG) and MRAG (MSC certification assessment). Research provider. Has in the past and may in future seek and receive funding for research in the fishery.</p>
Ian Boot	<p>Industry member – NPRAG Managing Director of Austfish, a company that operates NPF vessels. Has a commercial interest in the fishery. NPF broodstock permit holder. Participates in scampi fishing.</p>
Rik Buckworth	<p>Scientific member – NPRAG Scientific Member – Torres Strait Finfish RAG Director – Aquatic Remote Biopsy Pty Ltd Director – Sea Sense Australia Pty Ltd Adjunct Professor – Charles Darwin University Appointed as a CSIRO Fellow in 2020 Current consultancy contract with NPF to review Red Endeavour Prawns Chair of the NT Aquarium Fishery Management Advisory Committee Various consultancy work with NT Fisheries Current consultancy contract with AFMA and QDAF for a project in the Torres Strait Researcher involved particularly in stock assessment research in NPF. Has in the past and may in future seek and receive funding for research in the fishery.</p>
Tom Kompas	<p>Economic member – NPRAG Employed by University of Melbourne. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.</p>
Éva Plagányi	<p>Scientific member – NPRAG Employee of CSIRO. Research provider involved particularly in stock assessment research in NPF. Also currently receiving FRDC funding related to development of a GoC ecosystem model. Has in the past and may in future seek and receive funding for research in the fishery. Scientific member of TRLRAG and TS HCRAAG.</p>

Name	Declared interests
Phil Robson	Industry member – NPRAG Employee of A Raptis and Sons, responsible for managing NPF vessels & an NT demersal fish trawler. Has provided charter for scientific surveys in NPF in the past and may in future.
Darci Wallis	AFMA member – NPRAG Employed by AFMA, Manager of Northern Prawn Fisheries. No interest, pecuniary or otherwise.
Bryan van Wyk	Industry member – NPRAG Employed by Austral Fisheries, a company with SFR holdings in the fishery.
Executive Officer	
Cate Coddington	AFMA employee No interest, pecuniary or otherwise.
Invited participant	
Annie Jarrett	CEO – NPFI MSC – Asia Pacific director Commonwealth Fisheries Association Director Chair – Australian Council of Prawn Fisheries (ACPF) Member of the FRDC selection panel. No pecuniary interests Represents the interests of industry.
AFMA employees	
Brodie Macdonald	Employed by AFMA, A/g Senior Manager – Northern Fisheries. No interest, pecuniary or otherwise
Elissa Mastroianni	Employed by AFMA No interest, pecuniary or otherwise.
Observers	
Laura Blamey	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.
Ian Butler	Employed by ABARES. Economics research provider. No current pecuniary interest in fishery. Potential to seek and receive funding for research in the fishery in future.
Josh Cahill	Employed by NPFI. Executive Officer – Abalone Victoria Central Zone Executive Officer – Abalone Council Victoria Commercial sea urchin diver in the Victoria Central Zone Fishery Projects Manager – NPFI Undertakes contracting work with other fisheries – Commonwealth and state jurisdictions.
Robert Curtotti	Employed by ABARES. Economics research provider. No current pecuniary interest in fishery. Potential to seek and receive funding for research in the fishery in future.
Roy Deng	Employed by CSIRO. Research provider. Member of a research body providing scientific advisory services to the fishery management. May in future seek and receive funding for research in the fishery.
Michael Dylewski	Employed by ABARES. Economics research provider. No current pecuniary interest in fishery.
Gary Fry	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.

Name	Declared interests
Trevor Hutton	Employed by CSIRO. Research provider involved particularly in stock assessment research in NPF. Has in the past and may in future seek and receive funding for research in the fishery.
Rob Kenyon	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.
Margaret Miller	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.
Mark Nelson	Employed by Austral Fisheries - Operations
Sean Pascoe	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.
Judy Upston	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.
Tonya Van Der Velde	Employed by CSIRO. Research provider. Has in the past and may in future seek and receive funding for research in the fishery.

Attachment B – Final meeting agenda

Agenda Item	Purpose	Lead presenter
1. Preliminaries		
a. Welcome and apologies	For action – to open the NPRAG meeting with an Acknowledgement of Country	Chair
b. Declarations of interest	For action – to consider the declared conflicts of interest and decide on how these conflicts of interest will be managed	Chair
c. Adoption of agenda	For adoption – to discuss any changes to the draft agenda and adopt a final agenda	Chair
d. Minutes from previous meetings	For information – to note the final minutes of the November 2021 NPRAG Meeting	Chair
2. Harvest Strategy review - byproduct	For advice – to seek advice from NPRAG on the proposed changes to the byproduct section of the NPF Harvest Strategy	Darci Wallis
3. Industry Update - 2021 tiger prawn season	For information – to provide an update to NPRAG on the 2021 Tiger Prawn season from industry and NPFI	Annie Jarrett
4. Stock assessment project – redleg prawns	For discussion – to note the circulation of the draft final report and presentation to be given at the RAG by Éva Plagányi regarding the stock assessment project (AFMA Project 2019/0843) on redleg banana prawns and for NPRAG to provide discussion around these results	Éva Plagányi
5. 2023-24 Research Statement	For advice – to seek advice from NPRAG on research priorities for funding in the 2023-24 financial year to be included in the Northern Prawn Fishery (NPF) Annual Research Statement 2023-24.	Darci Wallis
6. MSC Conditions	For information – to note the brief update from NPFI on progression with the current MSC conditions	Annie Jarrett
7. Tiger prawn assessment – update on progress	For recommendation – to provide NPRAG with an update by CSIRO on the progress on the 2022 Tiger Prawn assessment; and for NPRAG to consider the sensitivity tests for use in the tiger prawn stock assessment.	Roy Deng
8. ERA finalisation	For recommendation – to endorse the final draft Ecological Risk Assessment (ERA) reports for the white banana prawn and the tiger prawn sub-fisheries	Darci Wallis
9. MICE project update	For discussion – to note the update provided by Éva Plagányi regarding the final results from the FRDC MICE GoC water extraction project (FRDC 2018-079)	Éva Plagányi
10. Integrated monitoring program – pre-season survey update	For information – to update NPRAG on the status of the research project NPF Integrated Monitoring Program (IMP) 2021-24	Rob Kenyon
11. Species split project update	For information – to note the verbal update from CSIRO on the species split project	Judy Upston
12. Next meeting	For information – to note that the next meeting will be held in May 2022, in Brisbane if possible.	Ian Knuckey
13. Other business		