PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
PRELIMINARIES **Welcome and meeting preliminaries**	**Agenda Item No. 1.1** **FOR NOTING**

RECOMMENDATIONS

That the RAG **NOTE:**

a. an opening prayer;
b. an acknowledgement of traditional owners;
c. the chairperson's welcome address; and
d. apologies received from members unable to attend.

BACKGROUND

1. No **APOLOGIES** have been received.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
PRELIMINARIES Adoption of agenda	Agenda Item No. 1.2 FOR NOTING

RECOMMENDATIONS

That the RAG **NOTE** and **ADOPT** the Agenda.

BACKGROUND

1. A **draft agenda** (**ATTACHMENT A**) was circulated to members and other participants on 24 September 2018.
2. No changes were requested to the draft agenda.
3. AFMA has suggested adding advice on the Western Line Closure as Agenda Item 8 (Agenda v3)
4. The following three documents were sent along with the draft agenda:

- Milestone Report 1, 30th May 2018 – Harvest Strategies for the Torres Strait Finfish Fishery, AFMA project no. 2016/0824
- Progress Report, 20th June 2018 - Harvest Strategies for the Torres Strait Finfish Fishery, AFMA project no. 2016/0824
- PZJA Torres Strait Finfish Resource Assessment Group Meeting Number 2, 21-22 March 2018 Thursday Island, Final Meeting Record

Protected Zone Joint Authority
Finfish Resource Assessment Group (FFRAG)
Meeting No. 3

DATE:	**Monday 19th and Tuesday 20th November 2018**
VENUE:	**Northern Fisheries Centre, Cairns**
MEETING TIME:	**8:30 am – 5:00 pm Monday 19th November 2018** **8:30 am – 5.00 pm Tuesday 20th November 2018**

DRAFT AGENDA v3

1. **Preliminaries**

   1.1 Opening Prayer / Acknowledgement of Traditional Owners / Welcome / Apologies

   1.2 Adoption of agenda

   1.3 Declaration of interests

   1.4 Actions arising from FFRAG meeting 21-22 March 2018

2. **RAG updates**

   2.1 Industry member updates

   2.2 Management updates

      2.2.1 AFMA

      2.2.2 TSRA

      2.2.3 QDAF

   2.3 Native Title update

3. **Harvest Strategy Project – progress report and work plan**

   CSIRO will provide an overview of the Harvest Strategy project to date and report on action items from FFRAG 2. The RAG is invited to provide advice to the Harvest Strategy Project Team being sought at this item, as well as under agenda items 4b and 5c.

4. **Coral trout**

   a. Presentation of preliminary stock assessment
   b. Advice on harvest strategy reference points and control rules

5. **Spanish mackerel**
    a. Presentation of updated stock assessment
    b. Preliminary Recommended Biological Catch advice based on interim target reference point
    c. Advice on harvest strategy reference points and control rules

6. **Data needs**

    The RAG is invited to review the table of data issues and update the actions and comments to address each issue as necessary.

7. **Rolling Five-Year Research Plan 2019/20 - 2022/23**

    The RAG is invited to consider research priorities for the Torres Strait Finfish Fishery over the next five years in line with the Torres Strait Scientific Advisory Committee's (TSSAC) Five Year Strategic Research Plan.

8. **Western line closure**

    The RAG is invited to provide advice to support removal of the western line closure.

9. **Other business**

10. **Next meeting and meeting close**

Individuals seeking to attend the meeting as an observer must contact the Executive Officer – Andrew Trappett (andrew.trappett@afma.gov.au)

PZJA Torres Strait Finfish Resource Assessment Group	**Meeting 3** **19-20 November 2018**
PRELIMINARIES **Declarations of interests**	**Agenda Item No. 1.3** **FOR ACTION**

RECOMMENDATIONS

That the RAG:

a. **DECLARE** all real or potential conflicts of interest in Torres Strait Finfish Fisheries at the commencement of the meeting;

b. **DETERMINE** whether the member may or may not be present during discussion of or decisions made on the matter which is the subject of the conflict;

c. **ABIDE** by decisions of the RAG regarding the management of conflicts of interest; and

d. **NOTE** that the record of the meeting must record the fact of any disclosure, and the determination of the RAG as to whether the member may or may not be present during discussion of or decisions made on the matter which is the subject of the conflict.

BACKGROUND

1. Consistent with the *Protected Zone Joint Authority (PZJA) Fisheries Management Paper No. 1 (FMP1)*, which guides the operation and administration of PZJA consultative forums, members are asked to declare any real or potential conflicts of interest.
2. RAG members are asked to provide the executive officer with a list of declared interests.
3. FMP1 recognises that members are appointed to provide input based on their knowledge and expertise and as a consequence, may face potential or direct conflicts of interest. Where a member has a material personal interest in a matter being considered, including a direct or indirect financial or economic interest; the interest could conflict with the proper performance of the member's duties. Of greater concern is the specific conflict created where a member is in a position to derive direct benefit from a recommendation if it is implemented.
4. When a member recognises that a real or potential conflict of interest exists, the conflict must be disclosed as soon as possible. Where this relates to an issue on the agenda of a meeting this can normally wait until that meeting, but where the conflict relates to decisions already made, members must be informed immediately. Conflicts of interest should be dealt with at the start of each meeting. If members become aware of a potential conflict of interest during the meeting, they must immediately disclose the conflict of interest.
5. Where it is determined that a direct conflict of interest exists, the forum may allow the member to continue to participate in the discussions relating to the matter but not in any decision making process. They may also determine that, having made their contribution to the discussions, the member should retire from the meeting for the remainder of discussions on that issue. Declarations of interest, and subsequent decisions by the forum, must be recorded accurately in the meeting minutes.
6. Interests declared at the last RAG meeting is provided at **ATTACHMENT A**.

Item 1.3 ATTACHMENT A, FRAG Register of Declared Interests

Name	Organisation	Declaration of interest
David Brewer – RAG Chairperson	Independent chair	Runs a fisheries consultancy which has no Torres Strait interests.
Selina Stoute – AFMA member	AFMA	Nil.
Tom Roberts – QDAF member	QDAF	Nil.
John Ramsay – TSRA member	TSRA	No pecuniary interests. TSRA manages sunset leasing and holds fishery access rights in trust.
Rocky Stephen – industry member	Kos and Abob Fisheries, Ugar	Councillor for Ugar, President of Kos and Abob Fishers Association. Eastern cluster representative on the PZJA Finfish Working Group. Member on PZJA Prawn MAC and Scientific Advisory Committee. Does not hold a TIB fishing licence.
Kenny Bedford – industry member	Erub Fisheries Management Association	TIB licence holder with Spanish mackerel and reef line endorsements. Runs a consultancy business which has delivered the infrastructure audit to TSRA.
Tony Vass – industry member		No financial interests in the Torres Strait. Does not own or operate a licence in Torres Strait.
Michael O'Neill – scientific member	QDAF	Principal scientist for TSSAC recommended project to develop a harvest strategy for the Torres Strait Finfish Fishery. Member of PZJA Finfish Working Group.
Ashley Williams – scientific member	ABARES, JCU	Involved in previous TS research, is an author on the ABARES Fishery Status Reports.
Rik Buckworth – scientific member	Consultant	Independent fisheries scientist with Sea Sense Consultancy, adjunct at Charles Darwin University. No pecuniary interest declared. Hoping to secure future research projects.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
PRELIMINARIES Actions arising and record from RAG Meeting 2, 21-22 March 2018	Agenda Item No. 1.4 FOR NOTING

RECOMMENDATIONS

1. That the RAG **NOTE** the**:**
    a. the progress of actions arising from previous RAG meetings; and
    b. final meeting record of the RAG meeting 2 on 21-22 March 2018.

KEY ISSUES

Meeting record

1. The record from Meeting 2 was circulated for comments on 7 September 2018. The period for comments was closed on 21 September 2018.

2. The final meeting record for the Finfish RAG Meeting 2 of 21-22 March 2018 was circulated to members via email on 24 September 2018 and is provided at **Attachment A.**

3. The meeting record was closed and ratified as a true and accurate record and is posted on the PZJA website for public viewing.

Actions arising

4. Progress against the actions arising from previous RAG Meeting 2 is detailed in **Table 1.**
5. A reminder of any carry over actions from the first RAG meeting (Meeting 1, November 2017) is detailed in **Table 2**.

ATTACHMENTS

Attachment A - Finfish RAG Meeting 2, 21-22 March 2018, FINAL Meeting Record.

Table 1: Progress against action items from RAG Meeting 2

Number	Action	Status
1.	**RAG 2, Action 1, Agenda item 2.1:** AFMA to facilitate a discussion via teleconference between interested RAG members and the QDAF Long Term Monitoring Program (LTMP) to get advice on their methodology for biological data collection and what data may be required. AFMA to report back to the RAG on the outcomes of this discussion.	**In progress** – It is planned for the QDAF LTMP to present directly to the entire RAG at the current meeting (FRAG 3) at Agenda Item 6 – Data Needs.
2.	**RAG 2, Action 2, Agenda item 3.1:** AFMA to circulate the Keith Sainsbury paper "Best Practice Reference Points for Australian Fisheries" for RAG reference.	**Complete -** Emailed to members during FRAG 2 meeting. http://www.afma.gov.au/wp-content/uploads/2010/06/rep_sainsbury_best-practice_jan08_20080228.pdf
3.	**RAG 2, Action 3, Agenda item 3.1:** AFMA, Industry member (Tony Vass) to aid the Harvest Strategy Project Team in investigating whether PNG droughts have impacted mackerel Catch Per Unit Effort levels.	**In progress** – AFMA suggests that the updated mackerel CPUE standardisation (to be presented at FRAG 3) is compared out of session to meteorological data such as Southern Oscillation Index to see whether the poorest years of catch match low rain fall.
4.	**RAG 2, Action 4, Agenda item 3.1**: AFMA and the Harvest Strategy Project Team are to liaise to investigate options for getting extra input from stakeholders on interim performance indicators to aide development of harvest strategy components.	**In progress.** It is planned for the next RAG meeting (FRAG 4 in first quarter 2019) to have a focus on additional information gathering from stakeholders on harvest strategy components.
5.	**RAG 2, Action 5, Agenda item 3.1:** Science member Rik Buckworth to supply the RAG with a short summary of how F-based assessments of biomass are performed.	**Complete –** CSIRO have included a short summary of the tabled discussion on F based assessment in the harvest strategy progress report 20 June 2018, Appendix D pp. 18

Table 2: Progress against action items from RAG Meeting 1, as tabled at RAG 2 in March 2018.

Number	Action	Status
1.	**RAG 1, Action 1, Agenda item 2.2:** Ashley Williams to advise the RAG on how beach price is determined in ABARES Fishery Status Reports. Whether by phone survey direct with Torres Strait buyers or fishers or whether this information is inferred from other sources.	**In progress** - Response supplied OOS to RAG EO, Ashley Williams will provide verbal update at Meeting 2.
2.	**RAG 1, Action 2, Agenda item 3.2:** Harvest strategy project team to provide a short paper advising the RAG on work that would be required to support Management Strategy Evaluation following the Harvest Strategy development.	**Incomplete** – to be prepared for RAG Meeting 3.

Number	Action	Status
3.	**RAG 1, Action 3, Agenda item 5.1:** AFMA to liaise with the harvest strategy project team to investigate the coral trout catch data that underlies a) the apparent decline in biomass from 1980 to 2003 and b) the catch series that underlies the reference period 2001-2005, noting some of these data may be housed by QDAF.	**In progress** – Liaison complete. Coral trout data from AFMA supplied under deed of confidentiality to harvest strategy project team. Data is undergoing characterisation under harvest strategy project and will be reported to RAG.
4.	**RAG 1, Action 4, Agenda item 6**: Harvest Strategy project team to contact Roland Pitcher to enquire as to what Torres Strait habitat mapping data is available.	**In progress** – under harvest strategy project.
5.	**RAG 1, Action 5, Agenda item 6:** AFMA to liaise with the 2007 reef-line sector MSE project team to determine what coral trout catch data series were used in the MSE.	**In progress –** liaison complete. MSE project team is attempting to locate data.
6.	**RAG 1, Action 6, Agenda item 6**: Harvest Strategy project team to advise the RAG and Finfish Working Group on the outcomes of the east coast coral trout assessment in 2018.	**In progress –** east coast Coral Trout assessment due April 2018. To be reported to the RAG at RAG Meeting 3 in August 2018.
7.	**RAG 1, Action 7, Agenda item 6**: Michael O'Neill to provide the Finfish RAG with revised figures e) and f) from Figure 20 of the stock assessment report with the same scale to illustrate how a B60 long term average equilibrium point provides greater catch rates.	**In progress.**

PZJA Torres Strait Finfish Resource Assessment Group

Meeting Number 2

21-22 March 2018
Thursday Island

Final Meeting Record

Note all meeting papers and records are available on the PZJA webpage:

www.pzja.gov.au

Australian Government
Australian Fisheries Management Authority

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Meeting Participants

Table 1. Attendance and declarations of interest – Finfish RAG Members.

Name	Organisation	Declaration of interest
David Brewer	Independent RAG chair	Runs a fisheries consultancy which has no current Torres Strait projects.
Selina Stoute	AFMA	Nil.
Tom Roberts	QDAF	No pecuniary interests.
Andrew Trappett	AFMA, RAG EO	Nil
Rocky Stephen – industry member	Kos and Abob Fisheries, Ugar	Councillor for Ugar, President of Kos and Abob Fishers Association. Eastern cluster representative on the PZJA Finfish Working Group. Sit on Prawn MAC and TS SAC. Does not hold a TIB licence.
Kenny Bedford – industry member	Erub Fisheries Management Association	TIB licence holder with SM and RL endorsement. Runs a consultancy business which has recently delivered the infrastructure audit project to TSRA.
Tony Vass	Industry member	No financial interests in the Torres Strait. Does not own or operate a licence in Torres Strait.
Michael O'Neill	QDAF, Science member	Principal scientist for TSSAC recommended project to develop a harvest strategy for the Torres Strait Finfish Fishery. Member of PZJA Finfish Working Group.
Ashley Williams – scientific member	ABARES, JCU	Involved in previous TS research, is an author on the ABARES Fishery Status Reports.
Rik Buckworth	Consultant,	Independant. Fisheries Scientist with Sea Sense Consultancy, adjunct at Charles Darwin University. No pecuniary interest declared. Hoping to secure future research projects.

Meeting observers and declarations of interests volunteered

Allison Runck	TSRA	No pecuniary interests.
Andy Bodsworth	Consultant	Consultant. On Fishing Feasibility Study Barra Crab study w Andrew Tobin, Snr Manager Northern Fisheries

Yen Loban	TSRA	Chairperson of the Finfish Quota Management Committee. TIB licence holder. TSRA Member.
Charlie Caddie	TSRA	No direct COI, formerly held TIB licence not currently.
Trevor Hutton	CSIRO	CSIRO receives research funding. Principal investigator for TSSAC recommended project to develop a harvest strategy for the Torres Strait Finfish Fishery.
George Leigh	QDAF	No interests. QDAF gets external funding and bids for research contracts.
Jerry Stephens	UQ CARM	TIB Licence holder, Fisheries portfolio member for TSRA
Frank Fauid	TSIRC/ TSRA	FWG central island. PBC Chair. TSRA Member
Andrew Tobin	Consultant	TSRA/FRDC Feasibility Study, HS project team, recently completed AFMA funded SM project with M. O'Neill, no interest in Torres Strait (no quota), retail seafood, no product from Torres Strait.

Actions tabled

Table 1. Action items tabled at the present Finfish RAG meeting (FRAG 2)

FRAG 2, Action 1	AFMA to facilitate a discussion via teleconference between interested RAG members and the QDAF Long Term Monitoring Program to get advice on their methodology for biological data collection and what data may be required. AFMA to report back to the RAG on the outcomes of this discussion.
FRAG 2, Action 2	AFMA to circulate the Keith Sainsbury paper "Best Practice Reference Points for Australian Fisheries" for RAG reference. http://www.afma.gov.au/wp-content/uploads/2010/06/rep_sainsbury_best-practice_jan08_20080228.pdf
FRAG 2. Action 3	AFMA, Industry member (Tony Vass) to aid the Harvest Strategy Project Team in investigating whether PNG droughts have impacted mackerel Catch Per Unit Effort levels.
FRAG 2, Action 4	AFMA and the Harvest Strategy Project Team are to liaise to investigate options for getting extra input from stakeholders on interim performance indicators to aide development of harvest strategy components.
FRAG 2, Action 5	Science member Rik Buckworth to supply the RAG with a short summary of how F-based assessments of biomass are performed.

Agenda Item 1 - Preliminaries

1.1. Welcome and meeting preliminaries

The meeting of the PZJA Torres Strait Finfish Fishery Resource Assessment Group (FRAG) was opened in prayer by Frank Fauid at 8:45 am. FRAG Chairperson, David Brewer, acknowledged the traditional owners of the land on which the meeting was held. It was noted that all FRAG members were in attendance. Mr Maluwap Nona, (Malu Lamar, RNTBC) was an invited participant, but noted as an apology.

1.2 Adoption of agenda

The agenda was adopted as circulated and it was agreed that a discussion on the impacts of Papuan New Guinean droughts on the fishery, would occur under other business.

1.3 Declarations of interests

The RAG noted the requirement to declare all interests, perceived or real. Each member declared their interest in the fishery as documented in Table 1. In line with the AFMA standard for declaring conflicts of interest in Commonwealth MACs and RAGs to best protect the integrity of advice, members with grouped interests (science, industry etc.) were sequentially asked to leave the room to allow the remaining RAG members to:

- freely comment on the declared interests;
- agree if the interests precluded the members from participating in any discussions; and
- agree to any methods to treat the declared interest (e.g. the member provides preliminary input but leaves the room when any advice is formed).

Industry members

Industry members and observers left the room (Rocky Stephen, Kenny Bedford, Tony Vass, Yen Loban, Jerry Stephen). The RAG noted that while industry members did have direct interests in the fishery they also had valuable input and their advice was required. It was noted that members could potentially gain for themselves individually or their community and the RAG would need to manage these interests during relevant discussions. Industry members re-joined the RAG meeting.

Science members

Science members and invited participants left the room (Dave Brewer, Ash Williams, Rik Buckworth, George Leigh, Trevor Hutton, Andy Bodsworth, Andrew Tobin, and Michael O'Neill). The RAG considered their declared interests, noting these interests and the valuable input the members would provide from their wide experience base. The RAG agreed that science members could freely provide advice at all agenda items. RAG noted that science members needed to be mindful and venture their declared interests at agenda items on bidding or providing advice on research contracts.

RAG members queried why certain research institutions such as CSIRO and QDAF received Torres Strait research contracts rather than NSW, Victoria and other Australian science providers. It was noted that anyone can bid for research contracts. The RAG discussed and agreed that generally the successful tenders had highly relevant Torres Strait expertise within their institutions and their personal background in researching. Science members re-joined the RAG meeting.

TSRA members

TSRA members (Charlie Caddy, Allison Runck, Frank Fauid, Jerry Stephen) left the room. The RAG noted that TSRA had in interest in revenue from leasing access to the fishery to the sunset sector on behalf of traditional inhabitants and that this revenue was held in trust. TSRA were noted as being a critical member of the PZJA and also administer funding for valuable research projects in communities such as infrastructure development. The RAG agreed to be mindful of managing how advice on TACs and funding applications from TSRA were handled by the RAG. RAG noted

the need to acknowledge the commercial nature of negotiating lease prices which occurred between TSRA and sunset licence holders noting both parties could be present in RAG or Working Group meetings. The RAG noted the TSRA Finfish Quota Management Committee has its own process and conflict of interest procedures to ensure the integrity of the advice. TSRA staff re-joined the RAG.

1.4 Actions arising

The RAG noted progress against actions arising from the November 2017 RAG Meeting 1 (**Appendix A**).

The RAG noted an update from Ashley Williams on how ABARES calculates and reports on beach prices. It was advised that in the past ABAREs had used direct fisher data obtained from phone surveys. In the last ABARES Fishery Status Reports (reporting on Financial Year 2016/17) no phone interviews were conducted with fishers. Instead during the last reporting cycle Sydney Fish Markets price data were used and beach prices were back calculated using assumptions such as freight cost. RAG noted there is a need to compare Torres Strait beach prices with Queensland East Coast fisheries for target species and other species such as Barramundi Cod. RAG noted that beach prices for Coral Trout on the east coast were very dynamic with prices driven by availability of species with red colouration. It was noted that price does vary throughout the coastal area of Queensland with the more northern ports generally getting lower prices for finfish species.

The RAG noted that, regarding Action Item 5, the 2007 Management Strategy Evaluation report data set has been located as being held by CSIRO. A data request has been submitted to acquire access to these data.

Agenda Item 2 – RAG Business

2.1 Biological data collection to support stock assessment updates

The RAG noted the agenda paper seeking RAG input on a plan of action to address a key data shortfall identified at the November 2017 RAG meeting, the collection of biological data to support stock assessments.

Points discussed on biological data collection:

- RAG noted the previous data collection had occurred from 2000 to 2005 and was detailed in the agenda paper.
- RAG advised that there was a need for the collection of fish frames for the collection of ageing data from both TIB and sunset fishers. These data would aid our understanding of age structure, particularly the ongoing issue for investigation on domed vs. non-domed selectivity of Spanish mackerel.
- To examine the usefulness of these data, sensitivity analyses could be performed on stock assessment runs this year to examine the impacts of including biological data versus running the model without these data.
- It was suggested that the QDAF Long Term Monitoring Program could provide advice on sampling methodology and it was suggested that RAG members could begin discussion though out-of-session teleconferences to better inform what data would likely be required and advice obtained on collection. RAG members advised that any out-of-session fact finding needs to be reported back to the RAG and that a clear process should be mapped out and agreed by the RAG on deciding what data is to be collected and the associated methodology.

RAG 2, Action 1: AFMA to facilitate a discussion via teleconference between interested RAG members and the QDAF Long Term Monitoring Program to get advice on their methodology for biological data collection and what data may be required. AFMA to report back to the RAG on the outcomes of this discussion.

In addition to advice on biological data collection, the RAG provided some additional commentary on other data-needs in the Finfish Fishery as noted below.

Noting the focus for the present meeting was on progressing the harvest strategy, the RAG flagged that future meetings of the group could provide more commentary on shaping the data needs, assessment issues and advice on meeting both short term data gaps and longer term priorities.

The following points on data needs were discussed:

- QDAF will be actioning sensitivity analyses in the updated 2018 Spanish mackerel assessment to examine:
    - whether dome-shaped selectivity is important to the model - if this has an important influence on the model this might highlight the need to acquire biological data to further assess;
    - how unreported catches affect the model (noting an inflated estimate model x1.75 was presented but not accepted in the last assessment update); and
    - unexpected declines in Catch Per Unit Effort for Spanish mackerel.
- Visual dive surveys to assess virgin biomass for coral trout in Torres Strait may not be possible given poor visibility in the Torres Strait compared to Queensland east coast.
- Examining available habitat mapping data for the Torres Strait, and its utility, should be addressed in the short term (e.g. examining the amount of wet reef versus dry reef). At the moment the perimeter of reefs from visual mapping data is used as the proxy.
- Species specific data for coral trout was identified as a key item for investigation (reporting on all four species versus assuming all management applies to the basket of four species). RAG considered that there was likely little or no cost associated with getting individual species catch data from fishers, but this relies on accurate identification of species. A review of the logbook was flagged as a method to improve species ID and reporting accuracy. It was suggested that a program could be run to validate fisher logbooks against species identifications and that this could be run in Cairns during unloads. It was noted this program would likely have associated costs.
- Harvest strategy project team members presentation advised that industry and PZJA forums should be involved in any work on validating available and future fishing data collection. The RAG noted that it could support the Harvest Strategy project team.
- RAG advised that industry member Mr Tony Vass would be well placed to assist with logbook validation based on older logbook data and that he could aid investigation and validation of data ahead of the industry workshop.
- RAG noted previous work had been carried out on researching the connectivity between Bramble Cay and the remainder of the fishery. RAG advised that this was no longer a research priority due to the expense associated with these forms of research. It was advised that a full feedback Management Strategy Evaluation can examine the impacts of various stock structure scenarios e.g. most catches coming from Bramble Cay versus the rest of fishery.
- Members noted that traditional inhabitants have a strong interest in supporting fisheries management and have expressed interest in data collection and were able to assist.

2.2 RAG work plan for 2018 and 2019

The Finfish RAG noted the tabled schedule of upcoming meetings and the main business planned for each meeting. It was noted that the industry workshop was an outcome of previous RAG and Working Group meetings and that the workshop will have a heavy data focus, involve industry with science and management in reviewing the effectiveness of the fishery logbook, characterising and interpreting catch and effort data.

Agenda Item 3 – Harvest Strategy Project

3.1 Harvest Strategy development for Torres Strait Finfish Fisheries

The RAG welcomed the attendance of the Harvest Strategy Project team members (Trevor Hutton, George Leigh, Michael O'Neill and Andrew Tobin) and noted presentations from the team on the

development of a Harvest Strategy for coral trout and Spanish mackerel in the Torres Strait Finfish Fishery.

List of presentations:

- **Attachment A** – Harvest Strategy Development for Torres Strait Finfish Fisheries, presented by Trevor Hutton (CSIRO) and team.
- **Attachment B** – Harvest strategies for Torres Strait finfish: Focus on coral trout, presented by George Leigh, QDAF.
- **Attachment C** – A description of the Torres Strait fisheries for Spanish mackerel and coral trout, presented by Andrew Tobin.

The RAG noted these presentations and provided input to the harvest strategy project team on a number of actions tabled for their input as detailed in the presentations and summarised in **Table 1** below.

RAG noted that the current meeting would have a focus on Spanish mackerel noting that analysis of this stock has been progressed further than coral trout with an agreed assessment in place.

It was noted that the project team were developing the components of the harvest strategy framework and that the adoption of a final harvest strategy will be the responsibility of the PZJA, RAG and Working Group following broader consultation with communities.

The RAG noted upcoming work scheduled on the process of developing the Harvest Strategy. It was noted that the RAG would meet again in the third quarter of 2018 to progress the development of the Strategy framework. Key priorities for the RAG at the present meeting and the next meeting would be providing advice on the adoption of interim reference points which were required to aid the project team in coming up with options for the framework noting that these were only interim and subject to review and testing prior to adoption.

It was noted that the project team would be attending any industry data workshop to be able to get advice from industry on data issues and aid characterisation.

RAG members noted that the project had entered into technically focussed advice at the present stage on components (such as reference points) to meet the objectives with reference being made to the *Commonwealth Harvest Strategy Policy and Guidelines (2007)*[1] and best practice from other fisheries such as Queensland East Coast finfish fisheries and other Torres Strait Harvest Strategies under development (Tropical Rock Lobster and Beche-de-mer). The RAG noted that it is important to consider what the key objectives for the fishery might be for traditional inhabitants in addition to those of the *Finfish Fishery Management Plan 2013*. It was considered that, in parallel to further development of the Strategy, there was merit in conducting a survey or convening an additional workshop to further engage TIB sector fishers and community members in providing input into what the fishery might look like in future, what the aspirations of TIB fishers/communities may be and get input on performance measures that could be considered to meet the objectives.

AFMA advised that they would consider resourcing and meet with the project team following this RAG meeting to assess progress to date and consider additional channels for acquiring stakeholder input.

[1] *http://www.agriculture.gov.au/SiteCollectionDocuments/fisheries/domestic/hsp.pdf*

Table 1. Action items for the Harvest Strategy Project team to acquire advice from the PZJA Finfish RAG Meeting #2.

Action Item	Feedback from RAG
Coral trout actions	
Action 1. Review uncertainties and practical management issues of assessing Coral Trout on the basis of the main target species (*Plectropomus leopardus*) or by splitting into the four species found and fished commercially in the Torres Strait.	RAG considered the two options for management and assessment: a) Species combined into a basket and assessed only on the basis of the primary target species *P. leopardus* (common coral trout) b) Assessed on split species (common, bar-cheeked, blue-spot, passionfruit) RAG advised that a multi-species approach for assessment and management could be adopted with a strong focus on data collection and the percentage break down of species captured. It was suggested that a trigger could be developed for consideration that if more than '*X*' per cent of a one species is caught management could then revert to single species approach focusing on that key species. Further discussions are noted below.
Action 2. As part of (A.1) review the implications for setting aggregated catch limits (for group of species) if Coral Trout is assessed on the basis of single species. Conversely, document potential increased uncertainties (and risks) with non-species specific assessments.	
Action 3. Ascertain what was the rationale for setting the current interim magnitude of Coral Trout catch levels (information is required from WG, RAG and industry).	RAG noted the current TAC is based on average catches from 2001 to 2005 (113.2 t average for TVH and 21.7 t for TIB sector). RAG noted the need for detailed data validation on coral trout (and also Spanish mackerel) and supported an industry meeting being held that could help AFMA and the project team characterise data and fisher behaviour.
Spanish mackerel actions	
Action 4. Adopt a Limit Reference Point for Spanish mackerel.	RAG recommended B20 (20 per cent of virgin biomass) as an interim limit reference point in line with the *Commonwealth Harvest Strategy Policy* and *Guidelines 2007*. RAG suggested a higher level of associated P (e.g. P 0.95) could be adopted to add increased certainty the stock would not breach this point.
Action 5. Adopt performance metrics for Spanish mackerel based on current standard performance measures/metrics used in fisheries.	RAG discussed the use of CPUE as an indicator in detail and provided input to the HS Project Team on a range of likely factors affecting CPUE standardisation as detailed below.
Action 6. Discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points. Explore 'response' rules to each reference point.	RAG noted that a range of harvest control rules would be developed and provided for analysis and discussion as the project progresses.
Action 7. Finalise agreement on different monitoring information that will be collected such as catch-at-age data (with consensus on who, when and by when?).	RAG tabled a range of data needs and perceived value-for-money analyses (for coral trout and Spanish mackerel) (**APPENDIX B**) which would inform development of a sampling program. RAG noted that these could be condensed with the live document tabling research and data needs developed at the Nov 2017 meeting. RAG science members can table business cases for sampling designs (age, length data) to meet data needs as they are analysed and agreed as the project progresses.

Points discussed against tabled items for action (Table 1)

Actions 1 and 2. Strategy to cover assessing either a basket of coral trout species or assess individually split species.

The RAG provided advice on the options of either assessing the stock on the basis of the main coral trout species targeted (common coral trout *Plectropomus leopardus*) or alternatively splitting the assessment of the stock into the four species found and fished commercially in the Torres Strait. The RAG also provided advice to the project team on the implications for setting aggregated catch limits (for a basket of four coral trout species) versus non-species specific assessments.

The following points were noted:

- RAG noted that for a period of five years since leasing began in June 2008 only one sunset sector boat has consistently been fishing for trout fillets rather than fishing for live trout, which had only really begun in the 2017/18 season. Individual species did not matter too much to this boat targeting trouts for fillets as colouration was not an important factor for market for fillets.
- It was advised that live boats will mainly preferentially target *P. leopardus* (common coral trout) due to strong red colouration and will actively avoid portions of the Torres Strait which have higher proportions of the other lower value species (bar-cheeked, blue-spot, passionfruit) for the live trout trade.
- RAG advised that a multi-species approach could be adopted with a strong focus on data collection and the percentage break down of species captured. It was suggested that a trigger could be developed for consideration that if more than '*X*' per cent of a one species is caught management could then revert to single species approach focusing on that key species.
- RAG advised that the east coast coral trout stock is assessed as a basket but is less of an issue as common coral trout are mainly caught with fewer of the other species compared to Torres Strait.
- Both the Catch Disposal Record and Daily Fishing Logbook have the capacity to record multiple trout species (percentage splits for the four Torres Strait species) but this relies on the ability of fishers to identify species. This will require support from management in encouraging fishers with identification material and encouraging accurate reporting.
- It was noted that the analysis of historic coral trout catch data is challenging (fillets versus live boat) and the project team will examine how these data can best be used in the assessment.
- The RAG noted a strong need for:
    a. increased reporting on coral trout catches from the TIB sector;
    b. AFMA to encourage new fishers entering the fishery to complete daily fishing logbooks; and
    c. all fishers are to provide species-split data for coral trout.

Action 3. Coral trout catch data underlying the level of the nominal TAC

RAG noted the current 134.9 t TAC is based on average catches from 2001 to 2005 (113.2 t average for TVH and 21.7 t for TIB sector). RAG noted the need for detailed data validation on coral trout (and also Spanish mackerel) and supported an industry meeting being held that could help to characterise these older data and fisher/fleet behavioural changes over time.

The project team advised that the original data set used for analysis for the 2008 Management Strategy Evaluation work (Evaluation of the eastern Torres Strait reef line fishery, Williams et al. 2007) would be very useful for this purpose. It was advised that the data set had been located (held by CSIRO) and the project team would put in a data request to acquire access. RAG advised that the older island freezer data (part of this data set collected by JCU) would need scrutiny to

check its completeness and usefulness for CPUE analysis given that it may not have associated effort data.

Action 4. Limit reference point for Spanish mackerel

The RAG noted the default *Commonwealth Harvest Strategy Policy* proxy for a limit reference point (BLIM defined as the points below which targeted fishing ceases) is B20 - 20 per cent of virgin biomass - with an associated probability of 90 per cent, meaning that the stock would not drop below B LIM nine times of out ten.

While B20 was noted as the default limit reference point, industry members suggested a higher B LIM such as B25 could have advantages and could be tested as an interim limit reference point. The RAG considered this suggestion but could not support adopting this without a firm justification as to why. RAG considered that instead of moving BLIM to a higher point, it could be kept at B20 but with an added higher level of precaution which would decrease the probability of the stock dipping below the limit.

RAG 2, Action Item 2: AFMA to circulate the Keith Sainsbury paper "Best Practice Reference Points for Australian Fisheries" for RAG reference. http://www.afma.gov.au/wp-content/uploads/2010/06/rep_sainsbury_best-practice_jan08_20080228.pdf

The RAG agreed to an interim BLIM of B20 noting that this would be reviewed and investigation could be carried out on an associated higher level of probability.

Action 5. Spanish mackerel CPUE as an indicator

The RAG noted that catch per unit effort is traditionally used in assessments and harvest strategies as a powerful indicator (a signal) for how the fishery is performing and also for informing management responses under a harvest strategy. The RAG proposed that CPUE could be used as an indicator during the development of the harvest strategy framework and advised that a number of examinations would need to be performed to increase our understanding.

The RAG noted the apparent downwards trend in standardised catch per unit effort (Nov. 2017 examination of catch data up to 2016) from the last Spanish mackerel stock assessment (Figure 1. below).

It was noted that a number of assumptions underlie such analyses including:

- No fishing power change through time.
- No spatial information.
- No zero catches.
- No "hours fished" before 2003.

The RAG advised that examination of these assumptions is required and that consideration of large changes in the fishery might also need to be taken account of. RAG advised that in recent history (post 2003) the fishery has gone through a period of significant change including the buyout of the TVH sector in 2007 and transition to Sunset sector leasing arrangements since 2008/09, changes to daily fishing logbooks (new logbook in 2003), fluctuations in docket book reporting levels (TIB sector), experienced TIB fishers leaving the fishery and island freezers ceasing operation.

RAG identified that there is a need for consistent daily fishing logbook reporting of the following information to ensure the most accurate data is available to support assessments:

- Identify fishing trips over multiple days
- Target species and gear
- Vessels and skippers
- Locations fished (noting that coral trout data has location of the primary only, no tender fishing location is recorded).

- Time spent searching for fish and time spent fishing.

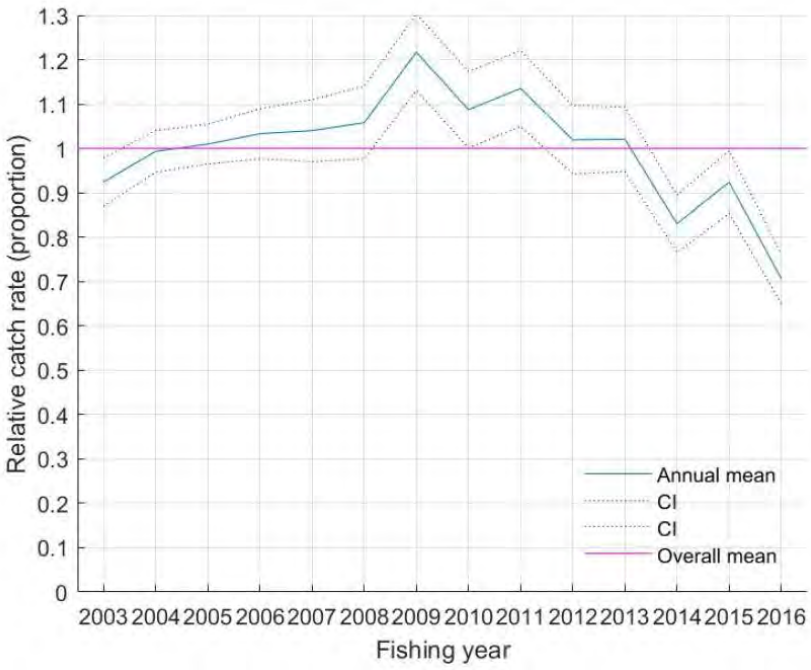

Figure 1. CPUE time series from most recent Spanish mackerel stock assessment.

Other factors were considered to be influencing the utility of CPUE as an indicator for Spanish mackerel including environmental factors, such as droughts in PNG (e.g. 2015/16). An industry member advised that such droughts could be a factor influencing catch rates in the Mackerel sector of the fishery, particularly at Bramble Cay where outflow from the Fly River was known to influence both water turbidity and salinity. AFMA advised that analysis of the historic data set could show which years had poor CPUE and this could be matched against known data from PNG droughts.

RAG 2, Action 3: AFMA, Industry member and Harvest Strategy project team to investigate whether PNG droughts have impacted mackerel CPUE.

RAG encouraged AFMA and the project team to further investigate getting extra input from stakeholders about performance indicators, for example, what is a good number of mackerel per dingy per day for the TIB sector? These data would help inform development of indicators for Spanish mackerel.

RAG 2, Action 4: AFMA and the project team to liaise and investigate options for getting extra input from stakeholders on interim performance indicators to aide development of harvest strategy components.

Action 6. Harvest Control Rules

RAG noted that they were scheduled to discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points.

Noting that work was still ongoing on reference points, the RAG noted that draft harvest control rules and example graphs of stock responses could be presented alongside assessments for consideration at the next harvest strategy meeting.

Action 7. Monitoring data

RAG were asked to provide advice on different monitoring information that will be collected under a harvest strategy such as catch-at-age data. The following points were advised:

- RAG provided some advice on this action item at agenda item 2.1 including identifying that the Queensland Long Term Monitoring Program could be consulted for advice.
- Ideally the fishery would have a consistent monitoring method over time, at scheduled intervals with representative spatial coverage (noting previous ageing data was from Bramble Cay).
- RAG provided a table of data needs (**Appendix B**) for the short term while the strategy was under development together with listed priorities and indicative costing (noting that some of these needs are being addressed through the budgeted Harvest Strategy Project). RAG noted that Table 2 of the prepared agenda paper 2.2 provided some good supporting information for each of the table items in the appendix.
- Priority items for Spanish mackerel were:
    - unexplained CPUE declines and sensitivity analyses to investigate impacts on the assessment model; and
    - data validation (via existing workshops) after logbook validation and analyses.
- Priority items for coral trout were:
    - species specific data (via fishery data)
    - virgin biomass estimate,
    - unexplained CPUE declines, sensitivity analyses
    - data validation (via scheduled workshops).

Other points discussed

- Harvest strategy project team were requested to provide a glossary of terms in their summary updates and final reports.
- The RAG noted that consideration can be given to alternative methods of assessing the biomass of the stock such as F-based approaches. It was noted that scientific member Rik Buckworth could supply the RAG with further information about such approaches.

RAG 2, Action 5: Rik Buckworth to supply the RAG with a short summary of how F-based assessments of biomass are performed.

Agenda Item 5 – Other business

None tabled. It was noted that the PNG droughts issue had been addressed under Spanish mackerel CPUE discussions.

Agenda Item 6 – Date and venue for the next meeting

The RAG noted the schedule of meetings for RAG and Working Group from Agenda Item 2.2 Table 1. It was noted that AFMA would liaise with the project team after the meeting to review progress to date and canvas member availability for the next meeting scheduled to be held in the third quarter of 2018.

List of Attachments

Attachment A – Harvest Strategy Development for Torres Strait Finfish Fisheries, presented by Trevor Hutton (CSIRO) and team.

Attachment B – Harvest strategies for Torres Strait finfish: Focus on coral trout, presented by George Leigh, QDAF.

Attachment C – A description of the Torres Strait fisheries for Spanish mackerel and coral trout, presented by Andrew Tobin.

List of Appendices

Appendix A – Table of action items from RAG Meeting 1 (Agenda Item 1.4)

Appendix B - Table of identified data needs with prioritisation and indicative costings.

List of papers tabled with the RAG at the current meeting :

Fairclough, D.V., Molony, B.W., Crisafulli, B.M., Keay, I.S., Hesp, S.A. and Marriott, R.J. 2014. *Status of demersal finfish stocks on the west coast of Australia*. Fisheries Research Report No. 253. Department of Fisheries, Western Australia. 96pp.

Sainsbury, K. (2008) *Best practice Reference Points for Australian Fisheries (AFMA Report)*. http://www.afma.gov.au/wp-content/uploads/2010/06/rep_sainsbury_best-practice_jan08_20080228.pdf

Stephen J. Newman, Joshua I. Brown, David V. Fairclough, Brent S. Wise, Lynda M. Bellchambers, Brett W. Molony, Rodney C.J. Lenanton, Gary Jackson, Kim A. Smith, Daniel J. Gaughan, Warrick (Rick) J. Fletcher, Rory B. McAuley, Corey B. Wakefield (2018) *A risk assessment and prioritisation approach to the selection of indicator species for the assessment of multi-species, multi-gear, multi-sector fishery resources* – Marine Policy 88, 11-22.

Williams AJ, Begg GA, Little LR, Currey LM, Ballagh AC, Murchie CD (2007). *Evaluation of the eastern Torres Strait reef line fishery*. Fishing and Fisheries Research Centre Technical Report No. 1

Williams, A. J., Little, L. R., and Begg, G. A. (2011) *Balancing indigenous and non-indigenous commercial objectives in a coral reef finfish fishery*. – ICES Journal of Marine Science, 68: 834–847.

Williams, A. J., Newman, S. J., Wakefield, C. B., Bunel, M., Halafihi, T., Kaltavara, J., and Nicol, S. J. (2015) *Evaluating the performance of otolith morphometrics in deriving age compositions and mortality rates for assessment of data-poor tropical fisheries.* – ICES Journal of Marine Science, 72: 2098–2109.

Appendix A

Report on action items from Finfish RAG Meeting 1, November 2017

Number	Action	Status
1.	**RAG 1, Action 1, Agenda item 2.2:** Ashley Williams to advise the RAG on how beach price is determined in ABARES Fishery Status Reports. Whether by phone survey direct with Torres Strait buyers or fishers or whether this information is inferred from other sources.	**Complete** – Advice provided and tabled at Agenda item 1.4 (pp. 5 of this meeting record).
2.	**RAG 1, Action 2, Agenda item 3.2:** Harvest strategy project team to provide a short paper advising the RAG on work that would be required to support Management Strategy Evaluation following the Harvest Strategy development.	**Incomplete** – to be prepared for RAG Meeting 3.
3.	**RAG 1, Action 3, Agenda item 5.1:** AFMA to liaise with the harvest strategy project team to investigate the coral trout catch data that underlies a) the apparent decline in biomass from 1980 to 2003 and b) the catch series that underlies the reference period 2001-2005, noting some of these data may be housed by QDAF.	**In progress** – Liaison complete. Coral trout data from AFMA supplied under deed of confidentiality to harvest strategy project team. Data is undergoing characterisation under harvest strategy project and will be reported to RAG.
4.	**RAG 1, Action 4, Agenda item 6**: Harvest Strategy project team to contact Roland Pitcher to enquire as to what Torres Strait habitat mapping data is available.	**In progress** – under harvest strategy project.
5.	**RAG 1, Action 5, Agenda item 6:** AFMA to liaise with the 2007 reef-line sector MSE project team to determine what coral trout catch data series were used in the MSE.	**In progress –** liaison complete. Catch data was located, held by CSIRO, Harvest Strategy Project team has submitted a data request to acquire these data.
6.	**RAG 1, Action 6, Agenda item 6**: Harvest Strategy project team to advise the RAG and Finfish Working Group on the outcomes of the east coast coral trout assessment in 2018.	**In progress –** QLD east coast Coral Trout assessment due April 2018. To be reported to the RAG at RAG Meeting 3 in August 2018.
7.	**RAG 1, Action 7, Agenda item 6**: Michael O'Neill to provide the Finfish RAG with revised figures e) and f) from Figure 20 of the stock assessment report with the same scale to illustrate how a B60 long term average equilibrium point provides greater catch rates.	**In progress.**

Appendix B

RAG input on monitoring data to support management and harvest strategy development including prioritisation and potential costs
(Areas considered higher priority by the RAG are highlighted in yellow).

Priority (P)	Potential Cost (C)
High priority = 3	<$50 k = 3
Medium priority = 2	$50 - $150 k = 2
Low priority = 1	$>$150 k = 1

Spanish Mackerel				Coral Trout			
	P	**C**			**P**	**C**	
1. Age structure (domed – non-domed selectivity - sunset)	2			1. Species specific data (via fishery data)	3	3	
2. Unexplained CPUE declines, sensitivity analyses (covered?)	3	3		2. Habitat mapping	2	3	
3. Data validation (via existing workshops) after logbook validation and analyses	3	3		3. Virgin biomass estimate	3	1	
4. Ageing data TIB (student)	2	3		4. Ageing (student)			
5. Ageing data TIB (researcher)	2	2		5. Ageing (researcher)			
6. Connectedness between stocks	1	1		6. UVC (Dive survey)		1	
7. Investigation of tagging for fishing mortality data and confirming stock structure.	2	1		7. Unexplained CPUE declines, sensitivity analyses	3		
8. Estimating F (Fishing mortality)	2	2		8. Data validation (via scheduled workshops)	3	3	

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
RAG UPDATES Industry member updates	Agenda Item No. 2.1 FOR DISCUSSION

RECOMMENDATIONS

That the RAG**:**

a. **NOTE** any updates provided by industry members;

b. **DISCUSS** strategic issues, including economic trends, affecting the management and development of Torres Strait fisheries.

BACKGROUND

1. Verbal reports will be provided by industry members under this item.
2. It is important that the Finfish RAG (and also the Finfish Working Group (FWG)) develop common understanding of any relevant matters within adjacent jurisdictions and what issues if any, are having the greatest impact on industry and the management of fisheries. Such understanding will ensure proceedings of the RAG and FWG are focused and may more effectively address each issue.
3. RAG members are asked to provide any updates on trends and opportunities in global markets, processing and value adding. Industry is also asked to contribute advice on economic and market trends where possible. Scientific members are asked to contribute advice on any broader strategic research projects or issues that may be of interest to the Torres Strait industry in future.
4. At the previous meetings of the RAG and FWG, members discussed a range of strategic issues affecting the management and development of Torres Strait fisheries.
5. At the most recent FWG Meeting in March 2018 , the following points were raised:

   The FWG welcomed updates from industry and other stakeholders on activities and strategic issues occurring in the Torres Strait Finfish Fishery and also on issues from other relevant fisheries:

   - It was considered that the outcomes of the TSRA infrastructure initiative would likely increase participation within the Ugar Community in the Torres Strait Finfish Fishery.
   - Ugar community has been engaging with TSRA initiatives such as direct export of seafood product from Torres Strait.
   - Available Sydney Fish Market price data shows strong market prices for Spanish mackerel with a clear spike in prices corresponding with Chinese New Year.
   - Erub Community Freezer is intending to make its recent finfish catch data available to AFMA and the PZJA groups for consideration.
   - The TSRA Finfish Quota Management Committee has seen increased interest from the sunset sector in leasing access to the Torres Strait to catch coral trout.
   - The FWG noted that recent seasons on the Queensland East Coast fishery have seen the Total Allowable Catch almost totally filled with lease prices reaching $6/kg corresponding with peak demand to fill orders for Chinese New Year at the end of the season. It was noted that, based on harvest control rules in place, a likely

200 t increase to the East Coast trout quota in 2018 there may be a decrease in interest from fishers wanting to access the Torres Strait Finfish Fishery reef-line sector. The QDAF member offered to circulate the recent Queensland Finfish Working Group communique for the interest of the FWG. https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable-fisheries-strategy/fishery-working-groups/-coral-reef-fin-fish-fishery-working-group/communiques/communique-6-7-march

- QDAF member advised that consultation is underway on proposed amendments to the *Queensland Fisheries Act* to implement changes including stronger compliance powers and penalties. https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable-fisheries-strategy/changes-to-queenslands-fisheries-legislation

QDAF advised that workshops are being held in Queensland on social and economic indicators for East coast fisheries. These workshops are focused on what data can inform social or economic analyses and how can these data be collected and reported. The FWG noted that the findings from these workshops can help inform the development of Torres Strait harvest strategies.

6. At Finfish RAG meeting 1 in November 2017, the following points were noted:

The RAG noted updates provided by members on strategic issues that may be affecting the adjacent Queensland east coast and the Torres Strait finfish stocks.

Queensland east coast finfish strategic issues

Vessel monitoring systems

- It was noted that the Queensland Vessel Monitoring System project was now in a trial stage with units fitted to both primary vessels in a number of fisheries (as per the Torres Strait) but also to dories – unlike in the Torres Strait. QDAF advised that they are waiting for trial data to come in for review in 2018.

East coast coral trout and reef-line species

- It was advised that the east coast coral trout TAC was nearly entirely now caught (96 per cent of 917 t) and that no over-catch was allowed under management regulations.
- 2017 catch rates appear to have been good despite a 2016 cyclone.
- A theory was reported whereby a cyclone may trigger a drop in water temperature which impacts the coral trout metabolic rates which in turn affects their availability as they will not take baits as readily. It was noted that fish are seen to be present after a cyclone but their availability seems to be affected.
- QDAF advised that east coast coral trout assessment is planned to be updated every five years and was due to be updated in 2018 (stock status and reference points are to be examined).
- It was noted that east coast stock assessment team was reviewing the options for monitoring for coral trout to support the assessment and TAC setting. The project team are comparing the costs and benefits of fishery independent line fishing surveys (to support the age structured assessment model) and are comparing this to port sampling or crew based fishery dependent data. It was noted that Australian Institute of Marine Science survey data (underwater diver abundance surveys) had been powerful and useful data for the east coast coral trout assessment.

East coast red throat emperor

- It was advised that catches of red throat emperor and other reef line species remain low with most fishers focusing on live coral trout with some red throat emperor taken as by-product.

- 2018 will see an updated east coast Red Throat Emperor assessment which will be the first update to the assessment in about a decade.

East coast Spanish mackerel

- It was reported that around 50 per cent of the east coast Spanish mackerel TAC was taken during the last season with this seasons catches appearing to be good (up 31 per cent for the season to date; around 20 per cent of the TAC had normally been filled by this time in previous seasons).
- Finfish RAG will be updated on the outcomes of the east coast Spanish mackerel assessment which is being updated in 2018. It was advised that the new east coast VMS data will likely have a huge benefit in boosting the usefulness of the assessments spatial data (particularly the time spent searching for fish) can be used by assessment scientists for analysis.
- It was noted that the east coast Finfish Harvest Strategy includes decision-rules based on a CPUE model for the commercial sector only and does not apply to recreational sector. Under the Sustainable Fisheries Strategy Queensland will move to have explicit account for catches taken from all sectors under the harvest strategy.

Torres Strait strategic issues for industry

- Kos and Abob Fisheries on Ugar Island are preparing a business plan to guide development of their business over the next few years, especially for when the Ugar freezer is upgraded. The intent of this plan is to ensure that the freezer can run as a viable, commercial business.
- An industry member advised that there is a strong need for TACs to be set at levels that provide enough product to support business.
- Erub Island has seen a spike in finfish catches over the past few weeks before the meeting due to improved weather.
- With good prices and demand for product there is reportedly some interest among the Traditional Inhabitant Boat (TIB) sector in entering the finfish fishery but this would be dependent on infrastructure to support this.
- Both Erub and Mer communities would likely have some recorded data of recent finfish commercial catches.
- More fishers on Mer Island were taking coral trout with good prices being offered from buyers.
- Mer Island women were also engaging in finfish fishing with their partners to boost their household incomes.
- Malu Lamar advised that fishers in the TIB sector need to have a firm understanding of what the TAC is for their sector. The representative advised that the next few seasons would likely result in an increased take from the TIB sector as fishers move across from the beche-de-mer fishery to target finfish. Suggested that young TIB fishers such as Mr Allan Passi from the Mer Community be invited to the Finfish RAG to help increase understanding of fisheries science among the sector and facilitate community understanding.
- TIB sector fishers have an increased understanding of the value of logbooks and good data for management of their fishery.

Meeting observer, TSRA board member Yen Loban, noted that it was of high importance that the TIB sector supplies catch data to AFMA to support decision making and to ensure that the balance is understood between non-traditional inhabitant and TIB sector catches.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
RAG UPDATES AFMA Update	Agenda Item No. 2.2.1 FOR NOTING

RECOMMENDATIONS

That the RAG **NOTE** the updates provided by the AFMA member.

UPDATES

Management arrangements 2018-19 season

1. AFMA has not introduced any significant changes to management arrangements for this fishing season. The structure of permit conditions on sunset permits was changed to allow subheadings to be used along with standard wording for permit conditions across multiple licence types (e.g. area of operation, observer requirements, landing catch).
2. As per measures introduced during last season (2017/18) Vessel Monitoring Systems (VMS or satellite tracking) are mandatory on all fishing boats conducting commercial fishing in the Torres Strait Protected Zone using a primary boat and/or operating with a Carrier Boat License (Class A, B, or C). Vessels operating for freight shipping are exempt from installing VMS. Exemptions may also be provided for carrier vessels that are six (6) meters or less in length.
3. VMS is required on all primary vessels operating under a sunset permit in the Torres Strait Finfish Fishery. It is not mandatory for dories operating individually or in association with a primary vessel to have VMS fitted (although this is the case on the Queensland East Coast).
4. As of 3 October 2018, 148 boats are licenced to fish in the Finfish Fishery under Traditional Inhabitant Boat fishing licences with either a reef line or Spanish mackerel endorsement.
5. Seven vessels have been leased access to the Finfish Fishery under sunset permits as detailed in **Table 1**. The public register of all Torres Strait fishing licences is located here: https://www.afma.gov.au/fisheries-services/concession-holders-conditions
6. Total available commercial catches for 2018/19 season are at **Table 2** noting that these are notional, fishers working under a sunset permit are bound to a strict catch limit enforced via permit conditions.

Table 1. Packages leased to sunset sector permit holders for 2018/19 season.

Package	Mackerel leased (t)	Coral trout leased (t)	Other species leased (t)	Number of tenders licenced.
A	17	0	0	0
B	40	5	3	3
C	1	5	1	6
D	1	25	1	4
E	20	0	0	3
F	5	1	1	3

G	5	12	3	2
Total	**89**	**48**	**9**	**21**

Table 2. Summary of available commercial catch by species group.

Species	**Recommended Biological Catch**	**Total Allowable Commercial Catch**	**Amount available for TIB fishers within RBC.**	**Amount leased to sunset permit holders.**
Spanish mackerel	125 t	115 t (10t deduction from RBC to account for subsistence take)	26 t	89 t
Coral trout	134.9 t	134.9 t	86.9 t	48 t
Other reef-line species	N/A	30 t (PZJA cap on expansion)	N/A does not apply to TIB	9 t

Legislative Amendments

7. Following PZJA and further Ministerial approval, AFMA is continuing to progress draft amendments to the Torres Strait Fisheries Act 1984 and Torres Strait Fisheries Regulations 1985. The amendments will provide immediate improvements to the efficiency and effectiveness of fisheries administration in the Torres Strait.

8. Of particular relevance to the Working Group, the amendment to provide for catch reporting across all licence holders will allow for the implementation of mandatory daily logbook reporting by TIB licence holders. This will provide for improved data on which to base management advice and decisions. A description of the proposed amendments and their status is provided below.

Amendment	**Instrument to be amended**	**Status**
Simplified disclosure of fisheries information	Regulations	Drafting instructions issued to the Office of Parliamentary Counsel (OPC) and legislative drafter assigned
Implementation of Fisheries Infringement Notices	Regulations	Drafting instructions issued to the Office of Parliamentary Counsel (OPC) and legislative drafter assigned
Capacity to require catch reporting across all licence holders	Act, then Regulations	Awaiting policy approval from whole of government consideration, preparation of drafting instructions and assignment of legislative drafter
Capacity to provide electronic licensing and monitoring to licence holders	Act	Awaiting policy approval from whole of government consideration, preparation of drafting instructions and assignment of legislative drafter

Capacity to delegate the powers to grant and vary scientific and development permits	Act	Awaiting policy approval from whole of government consideration, preparation of drafting instructions and assignment of legislative drafter
Capacity to simplify the renewal of fishing licences	Act	Awaiting policy approval from whole of government consideration, preparation of drafting instructions and assignment of legislative drafter
Capacity to delegate powers to contracted service providers	Act	Awaiting policy approval from whole of government consideration, preparation of drafting instructions and assignment of legislative drafter

9. Legislative amendments generally take a number of years, with progress often constrained by the priority of the amendments relative to other amendments being progressed at the time both within AFMA, and more broadly by the Department of Agriculture and Water Resources and other Australian Government agencies. The amendment process generally increases in time and complexity depending on the instrument being amended (e.g. the process to amend Acts may take many years, Regulations 1-2 years and fisheries management instruments within a year). Further details on amendment processes is provided in Attachment 2.2.1a.

10. AFMA will work closely with the TSRA and Queensland Department of Agriculture and Water Resources in progressing the proposed amendments. Opportunities to provide comment on the proposed amendments will also be provided to fishers, their communities and the general public as the amendments are progressed. This will be done so through direct communication with fishers, public notices as well as through the PZJA RAGs, MACs and Working Groups. Further details on when these opportunities will be publicised once determined.

AFMA Compliance Program

11. As of 1 July 2018, AFMA officially took on the role of delivering the commercial domestic compliance program from Queensland Boat and Fishing Patrol within the Torres Strait Protected Zone (TSPZ).

12. Since this time, a number of patrols have taken place in key areas of the fishery and inspections have been undertaken on processing premises and fishing grounds.

13. They key areas of concern for AFMA compliance in the Finfish Fishery include:

    - The quantities and species that are being harvested but are not being landed to a licenced fish receiver, or incorrectly being recorded on Catch Disposal Records.
    - Where the unreported product is moving and by what means? (e.g. by sea or air)

14. The AFMA compliance team has recently recruited a third member to assist with the increase in work load in delivering both domestic and foreign compliance activities.

Australian Bureau of Agricultural and Resource Economics (ABARES) Fishery Status Reports 2018

15. Each year, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) compiles fishery status reports which provide an independent assessment of the biological status of fish stocks and the economic status of fisheries managed, or jointly managed, by the Australian Government (Commonwealth fisheries).

16. The ABARES Fishery Status Reports 2018 were released on 28 September 2018 and summarise the performance of these fisheries in 2017 and over time, against the requirements of fisheries legislation and policy. The reports assess all key commercial species from Australian Government managed fisheries and examines the broader impact of fisheries on the environment, including on non-target species.

17. In summary, the biological status for the key Torres Strait Finfish Fishery species have been assessed for the 2017 period as follows:

Status	2016		2017		Comments
Biological status	**Fishing mortality**	**Biomass**	**Fishing mortality**	**Biomass**	
Coral trout (*Plectropomus* spp., *Variola* spp.)					Management strategy evaluation testing suggests that current catches are well below the level likely to lead to biomass declines. Most recent biomass estimate indicated a biomass above $0.6B_0$.
Spanish mackerel (*Scomberomorus commerson*)					Current fishing mortality rate is below that required to produce MSY. Most recent estimates of biomass are above B_{20}.
Economic status	Estimates of net economic returns are not available. Economic performance in 2016–17 remains uncertain because of varied levels of fishing by different operations, seasonal prices for key species and fishing costs.				

Notes: B_0 Unfished biomass. B_{20} 20% of unfished biomass. **MSY** Maximum sustainable yield.

Fishing mortality	Not subject to overfishing	Subject to overfishing	Uncertain
Biomass	Not overfished	Overfished	Uncertain

18. ABARES fishery status reports can be accessed on the ABARES website at: http://www.agriculture.gov.au/abares/publications/display?url=http://143.188.17.20/anrdl/DAFFService/display.php?fid=pb_fsr18d9abm_20180928.xml

Australian National Audit Office (ANAO) update

19. The ANAO is currently undertaking a performance audit of the coordination arrangements of Australian Government agencies operating in the Torres Strait. The audit will examine whether Australian Government agencies operating in the Torres Strait have appropriate governance arrangements to support the coordination of their activities; and the coordination arrangements are effective in supporting Australian Government activities in the Torres Strait.

20. The audit was open for contribution until 30 September 2018 with a report due to be tabled in January 2019. Australian Government agencies subject to the audit include AFMA, the Department of Agriculture and Water Resources, the Department of Foreign Affairs and Trade, the Department of Home Affairs and the TSRA.

21. Further information on the audit can be accessed on the ANAO website at: https://www.anao.gov.au/work/performance-audit/coordination-arrangements-australian-government-entities-operating-torres-strait

New Assistant Minister

22. On 28 August 2018, Senator the Honorable Richard Colbeck was sworn in as the Assistant Minister for Agriculture and Water Resources. The previous Assistant Minister, Anne Ruston is now the Assistant Minister for International Development and the Pacific. On 28 August 2018, Senator the Hon. Richard Colbeck was sworn in as the Assistant Minister for Agriculture and Water Resources. In his position, Senator Colbeck will serve as the Chair of the Protected Zone Joint Authority. The previous Assistant Minister, Senator the Hon. Anne Ruston is now the Assistant Minister for International Development and the Pacific.

Attachment 2.2.1a

Regulation amendments	Indicative Timeline	Act amendments	Indicative Timeline
Submit proposed amendments to the PZJA then Minister for Agriculture and Fisheries for approval	Completed	Submit proposed amendments to the PZJA then for further whole of government consideration	October-December 2018
Prepare bid for drafting resources	Completed	Prepare bid for drafting resources	October-December 2018
Prepare drafting instructions in consultation with relevant government agencies	Completed	Prepare drafting instructions in consultation with relevant government agencies	October-December 2018
If required, prepare regulation impact statement and conduct public consultation	October-December 2018	If required, prepare regulation impact statement and conduct public consultation	January-April 2019
Amending regulations prepared by Office of Parliamentary Counsel	August-December 2018	Bill prepared by Office of Parliamentary Counsel	January-April 2019
Conduct public consultation on exposure draft of amending regulations	January-March 2019	Conduct public consultation on exposure draft of Bill	May-July 2019
Office of Parliamentary Counsel to prepare any changes to amending regulations identified as a result of public consultation	April 2019	Office of Parliamentary Counsel to prepare any changes to amending regulations identified as a result of public consultation	August 2019
Prepare associated legislation documents (Executive Council minute, explanatory memorandum, explanatory statement, statement of compatibility with human rights etc)	April 2019	Prepare associated legislation documents (explanatory memorandum, statement of compatibility with human rights, second reading speech etc)	August 2019
Submit legislative package to the Minister for Agriculture and Fisheries for approval	May 2019	Submit legislative package to the Minister for Agriculture and Fisheries for approval	September 2019

Regulation amendments	Indicative Timeline	Act amendments	Indicative Timeline
Submit legislative package to Federal Executive Council (ExCo)	June 2019	Give notice to the Clerk of the House, who will arrange for the Bill to be listed on the Notice Paper	TBA
Governor General to make the amending regulations	June 2019	Minister for Agriculture and Fisheries to present Bill to the House of Representatives for debate and agreement	TBA
Register amending regulations on the Federal Register of Legislative Instruments (FRLI), at which point they will come into force	June 2019	Bill presented to the Senate for debate and agreement	TBA
Table regulations in both houses of Parliament for a disallowance period of 15 sitting days	June 2019	Once the Bill has been agreed by both Houses in identical form, present Bill to the Governor-General for royal assent	TBA
Notify stakeholders of making of amending regulations	June 2019	Register Act on the Federal Register of Legislative Instruments (FRLI)	TBA
Implement new provisions of amending regulations	June 2019 onwards	Notify stakeholders of making of the Act	TBA
		Implement new provisions of the Act	TBA

PZJA Torres Strait Finfish Resource Assessment Group	**Meeting 3** **19-20 November 2018**
RAG UPDATES **TSRA Update**	**Agenda Item No. 2.2.2** **FOR NOTING**

RECOMMENDATIONS

1. That the RAG **NOTE** the verbal update provided by the TSRA member.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
RAG UPDATES QDAF Update	Agenda Item No. 2.2.3 FOR NOTING

RECOMMENDATIONS

1. That the Working Group **NOTE** the update provided by the Queensland Department of Fisheries member.

KEY ISSUES

2. The Sustainable Fisheries Strategy (the Strategy) was release in June 2017 and sets out the governments reform agenda for the next 10 years. The Strategy can also be accessed at: https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable-fisheries-strategy/what-is-the-sustainable-fisheries-strategy

3. The establishment of fishery-working groups is a key action under the Strategy to provide operational advice and engage stakeholders from all sectors in the development of the harvest strategies and day to day management of the fisheries. In December 2017, the Sea Cucumber Fishery Working Group was formed to provide advice on the East Coast Sea Cucumber Fishery.

4. The Strategy outlines the following principles for fishing rules in Queensland:

    - Fishing rules adequately control catch to meet fishery-specific targets and cover all sectors (commercial, recreational, charter and traditional).
    - Sustainable catch limits are based on achieving at least maximum sustainable yield (around 40-50% biomass) by 2020. Moving to maximum economic yield (around 60% biomass) by 2027.
    - A consistent approach to management arrangements through harvest strategies with a preference towards quota wherever possible.
    - Latent effort is managed to reduce risk of increased effort over time.
    - Regionally specific management arrangements are put in place (if appropriate).

5. Key achievements in the first 12 months of the Strategy have now been released and include:

    - Sustainable Fisheries Expert Panel established and met 3 times in 2017-18
    - 8 Working Groups formed, which have met a total of 19 times in 2017-18
    - 11 new species monitored
    - Resource reallocation policy published
    - Discussion papers on management reform in the trawl, crab and inshore fisheries
    - Discussion paper on amendments to the Fisheries Act 1994 to allow responsive decisions in line with a harvest strategy, new powers and penalties to address black marketing; and
    - Vessel tracking policy and guidelines released and $3M allocated for rebates.

6. A copy of the achievements under the Strategy in the first 12 months is provided at **Attachment 2.2.3a**.

7. Communiques from the Working Groups are published after each working group meeting and available at https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable-fisheries-strategy/fishery-working-groups

8. The Sea Cucumber Fishery Working Group's 3rd meeting is scheduled for December 2018. Although the fishery is not undergoing reform, a review of ineffective and outdated legislation along with aligning all Queensland's harvest fisheries with other quota-managed fisheries is underway.

9. In collaboration with the working group, a harvest strategy for the East Coast Sea Cucumber Fishery is currently being drafted and is planned to be operationalised at the start of the 2019/2020 quota season.

BACKGROUND

10. The Strategy sets out the government's reform agenda for the next ten years. The Strategy sets out clear targets to be achieved by 2020 and 2027 and a range of actions to deliver on the vision and targets.

11. The Strategy is the outcome of a significant consultation exercise in 2016, during which Fisheries Queensland sought views from everyone in the community about where we are now, where we want to be and how we can get there. More than 11,800 submissions were received. The overwhelming message was that all stakeholders want reform in the way we manage fisheries.

12. In June 2017, the Queensland Government approved $20.883 million over 3 years to support implementation. This will deliver a boost to compliance (including 20 more frontline compliance officers), more monitoring, better engagement and communication and more responsive decision-making.

13. These reforms also tick off a number of commitments under the Reef 2050 Long Term Sustainability Plan, highlighting the government's commitment to the Great Barrier Reef.

Queensland Sustainable Fisheries Strategy

2017–2027

Progress report

Year 1

Queensland Government

Key achievements in first 12 months

Sustainable Fisheries Expert Panel established and met **3** times in 2017–18

8 working groups, which met **19** times in 2017–18

More than **620** regional face-to-face meetings

17% growth in Facebook followers in 2017–18*

* as at 19 June 2018

Recreational and commercial fishing apps under development

11 new species monitored

Innovation project using cameras, sensors and image recognition

Ecological risk assessment (ERA) guideline published and ERAs started

Resource reallocation policy published

Harvest strategy guideline published and work commenced on drafting harvest strategies

Discussion papers on regulatory changes released for trawl, crab and inshore fisheries

Discussion paper released on amendments to the *Fisheries Act 1994* with changes to allow responsive decisions using pre-agreed rules in harvest strategies

20 new compliance officers recruited, including **16** in the Great Barrier Reef

Gladstone Queensland Boating and Fisheries Patrol office reopened and new boat is now operational

New powers and penalties proposed under the Act for black-marketing – more than **90%** support from consultation

Final vessel tracking policy and guidelines released and **$3m** allocated for rebates

$5.78m spent in 2017–18 as part of the **$20.8m** additional funding over **3** years

All actions on track

11 already delivered

33 actions

In June 2017, the Queensland Government released the Sustainable Fisheries Strategy 2017–2027, paving the way for Queensland to have a world-class fisheries management system. These reforms will ensure healthy fish stocks that will support thousands of Queensland jobs. The strategy outlines 33 actions to be delivered across 10 reform areas and sets targets to be achieved by 2020 and 2027.

Progress report

Reform area	Delivery on track	Comment
1. Improved monitoring and research	On track	Good progress on new monitoring, including reef species, scallop, juvenile snapper, blue swimmer crab and eastern king prawn. New social and economic indicators to be rolled out in 2018–19.
2. Sustainable catch limits	On track	Catch limits will be set out in harvest strategies.
3. Improved engagement	Minor issues	Significant efforts have been made including traditional and novel methods of engagement. Further work is needed to build relationships and communicate the reform process and objectives of the strategy.
4. Impacts on non-target species	On track	Good progress on finalising guidelines for ecological risk assessments, with technical work underway.
5. Resource allocation	On track	Existing catch shares to be explicit in harvest strategies. Reallocation policy released to deal with requests for closures/net free areas.
6. Harvest strategies	On track	Guideline released and drafting of harvest strategies underway.
7. Fishing access and rules	On track	Discussion papers on reforms to key fisheries released. Regulatory changes expected in 2019.
8. Responsive decisions	On track	New process proposed under amendments to the *Fisheries Act 1994* to allow responsive decisions using pre-agreed harvest strategies.
9. Compliance	On track	Excellent progress with 20 new Queensland Boating and Fisheries Patrol officers recruited and Gladstone office reopened. Vessel tracking on track to be on all net, crab and line boats by 1 January 2019. Cross-decking will continue with other enforcement organisations (e.g. police, maritime safety and marine parks). Cultural liaison officers identified.
10. Resourcing	On track	Good progress rolling out new funding.

Overall comments

Overall progress has been good in the first 12 months. There has been particularly strong effort in compliance, engagement and rolling out new monitoring. One-third of all the actions in the strategy have been delivered in the first 12 months. All of the actions due to be delivered in 2017–18 were complete. As with any major reform program, there are challenges in communicating with stakeholders, understanding the change process and dealing with uncertainty. A strong focus has been put on better engagement, but relationships need to be further built between government, commercial fishers, recreational fishers and other community groups as the reform process progresses.

Areas for focus in next 12 months

The next 12 months will focus on reviewing fishing rules, amending legislation and developing harvest strategies. This will culminate in an amended Act and new Regulation proposed to commence in July 2019. There will be a continued focus on improved engagement and collecting better data to underpin decisions and the roll out of new technologies.

Delivery on track key

- Completed or delivered
- On track
- Minor issues
- Major issues
- Not yet commenced

Measuring progress against targets

To measure our performance over time, targets have been set for both 2020 and 2027. This progress report sets the baseline for these targets that we can measure against in future years. This will help track our performance and ensure we are achieving the outcomes identified.

2020 targets

Target	Baseline 2017–18
Sustainable catch limits based on maximum sustainable yield (around 40–50% biomass)	23 stock assessments for species or species complex that enables a biomass or on maximum sustainable yield calculation. 8 catch based quotas currently, but not explicitly set using biomass targets.
Harvest strategies for all fisheries	0 harvest strategies in place
Maintained export approvals	100% export approvals in place
Improved stakeholder satisfaction with engagement	The overall satisfaction with Fisheries Queensland's engagement: 56/100
Increased satisfaction of recreational fishers	Overall satisfaction of recreational fishers in Queensland: 61/100
Better data for fish stocks	15 species undefined; 57 species not assessed; 4 species with negligible data

2027 targets

Target	Baseline 2017–18
Sustainable catch limits based on maximum economic yield (around 60% biomass)	23 stock assessments for species or species complex that enables a biomass or on maximum sustainable yield calculation 8 catch based quotas currently, but not explicitly set using biomass targets.
No overfished stocks in Queensland fisheries	2 overfished stocks (scallop and snapper)
Increased certainty for commercial operators	No data yet (to be collected in 2018)
Reduced volume of fisheries regulation	933 pages of regulation (733 pages of Fisheries Regulation and 200 pages in the trawl management plan)
Improved trends of compliance rates*	91% compliance rate
Responsive and consultative approach to fisheries management	The overall satisfaction with Fisheries Queensland's engagement: 56/100 Other measures to be developed

*The QBFP has moved to an intelligence-based approach to compliance, which may result in lower compliance rates due to targeting non-compliance rather than random on-water inspections.

Major milestones and reporting timeline

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
RAG UPDATES Native Title Update	Agenda Item No. 2.3 FOR NOTING

RECOMMENDATION

1. That the RAG **NOTE** any updates on Native Title matters from members, including representatives of Malu Lamar (Torres Strait Islanders) Corporation RNTBC (Malu Lamar).

BACKGROUND

2. On 7 August 2013 the High Court of Australia confirmed coexisting Native Title rights, including commercial fishing, in the claimed area (covering most of the Torres Strait Protected Zone). This decision gives judicial authority for Traditional Owners to access and take the resources of the sea for all purposes. Native Title rights in relation to commercial fishing must be exercisable in accordance with the *Torres Strait Fisheries Act 1984*.

3. Traditional Owners and Native Title representative bodies have an important role in managing Torres Strait fisheries. It is important therefore that the RAG keep informed on any relevant Native Title issues arising.

4. AFMA has extended an invitation to Malu Lamar to attend this meeting as an observer and is investigating longer term arrangements for representation in consultation with PZJA agencies.

PZJA Torres Strait Finfish Resource Assessment Group	**Meeting 3** **19-20 November 2018**
HARVEST STRATEGY **Harvest Strategy Project – Progress and Work Plan**	**Agenda Item No. 3** **FOR DISCUSSION and ADVICE**

RECOMMENDATIONS

1. That the RAG **DISCUSS** and provide **ADVICE** on the progress report and work plan for the harvest strategy project: "*Harvest Strategies for the Torres Strait Finfish Fishery";*

2. That the RAG **NOTE** Dr Trevor Hutton, Principal Investigator for the project will be attending the RAG to provide a progress report and seek RAG input to inform development on a number of components of the harvest strategy;

3. That the RAG **NOTE** detailed discussions on stock assessments and harvest strategy control rules for coral trout and Spanish mackerel will be considered under agenda items 4b and 5 respectively.

BACKGROUND

4. Dr Trevor Hutton, CSIRO Research Scientist, is the Principal Investigator for the project and will be attending the meeting provide an overview of progress to date including formal milestone and progress reports submitted to AFMA in May and June 2018.

5. RAG advice on progress to date and the proposed work plan is being sought.

6. A copy of the harvest strategy project proposal is provided at **Attachment A**.

Project objectives (as specified in the project proposal, Attachment A)

7. The project will develop and ratify a clear and concise draft harvest strategy for the Torres Strait finfish fishery. It will include clear guidance for sustainable fishing, the data requirements that underpins management strategies, options for flexibility to suit market and community needs, targets and limits and guidance for situations where these targets and/or limits are reached, and data requirements for potential fishery expansion.

8. The project will:

   a) Collate and analyse available coral trout and Spanish mackerel fishery data to estimate variability and assess whether there is sufficient information to develop time-series indicators of stock status. This includes linkage to the Finfish Monitoring Project (data links and sampling methodology).

   b) Summarise and assess utility of updated stock assessments and reference points for coral trout and Spanish mackerel.

   c) Present results and HS guidelines (including Harvest Control Rules) to the Finfish working group, with fishery managers and representative stakeholders to develop and evaluate key elements of the draft HS. It is the responsibility of the FWG to take the recommended draft HS and formally adopt it as the HS[1].

[1] While the FWG need to endorse the draft HS, the PZJA will need to have the final clearance prior to release for public comment.

Progress

9. The Harvest Strategy project comprises four distinct tasks.

   a) **Task 1** – Data collation and quality assessment (this task collates data and provides early consideration of harvest strategy options).

   b) **Task 2** - Assessment minor revision (Spanish M) and assessment development (Coral trout)

   c) **Task 3** - Harvest Control Rule (HCR) specification – for all components of a Harvest Strategy, these being:
      - Indicators (full set of chosen indicators outlined) (here included in Task 1);
      - Current Monitoring and future monitoring (here included in Task 1, but future monitoring relevant to all Tasks);
      - Reference Points (for both stocks: Spanish mackerel and coral trout – the target and limit reference points will be defined and agreed to as part of Task 2, and this task);
      - Method of status evaluation (assessment and empirical). For each stock the actual method depends on data and is a cost/risk analysis that should be informed by resources available (AFMA to advise);
      - Decision rules.

   d) **Task 4** - Summation of formal links with other Projects – Finfish Monitoring Project

10. Progress has been made against tasks 1-3 with stock assessments to be considered at this meeting together with further development of harvest control rules for Spanish mackerel and coral trout. A copy of first project milestone report (30 May 2018) and progress report (20 June 2018) is provided at **Attachment B** and **C** respectively.

11. Advice provided by the RAG at its last meeting is summarised in **Attachment D**.

12. At its March 2018 meeting the RAG also noted that consideration should be given to alternative methods of assessing the stock biomass such as fishing mortality based (F-Based) approaches. Further discussion on the merits of this approach is expected.

Work plan

13. Subject to RAG advice (including the need for any additional work) an updated work plan to support the finalisation of a draft harvest strategy is provided in **Table 1**. Note this updates the RAG work plan considered at the last meeting.

14. In line with Commonwealth Harvest Strategy Policy, proposed harvest strategies should be subject to a management strategy evaluation to examine likely performance. The RAG requested the harvest strategy project team to provide advice on the likely requirements for an MSE (Action item 2, RAG meting #1, Nov 17). Preliminary advice is at page 11 of the HS progress report (**Attachment C).** The RAG should consider the need for an MSE when advising on research priorities for the Fishery under Agenda Item 7. A suggested work plan for RAG and FWG support for an MSE project is at **Table 2.**

Table 1. Work plan for RAG and Working Group to support the finalisation of a draft harvest strategy

Date	Meeting	Harvest Strategy	Other key business
19-20 November 2018*	RAG 3	RAG to consider preliminary assessments for coral trout and updated Spanish mackerel assessment together with possible harvest control rules. RAG advice is sought on out of session work with stakeholders ahead of the next meeting e.g. surveying views on HS components.	Preliminary RBC for Spanish mackerel. Review of data needs. Review Strategic Research plan
Early 2019** (Note: RAG views are sought on the merits of a combined RAG/FWG/Industry Workshop or series of meetings in early 2019 – suggestions are sought on timings for each of these parts of a combined meeting/series of meetings i.e. industry first, RAG then FWG?)	RAG 4	RAG to consider any further updates performed, finalise stock assessments and advice on harvest control rule options.	Final RBC advice for Spanish mackerel. Subject to progress on stock assessment, provide RBC advice based on possible harvest strategy options. Advice on logbook changes to meet data needs.
	Stakeholder Harvest Strategy workshop	Seek stakeholder input on harvest strategy options, including harvest strategy objectives, reference points and controls.	
	Working Group	Consider RAG advice on harvest strategy options.	TAC advice for 2019-20 season for Spanish mackerel and potentially coral trout.
July 2019***	Industry data meeting	Focus on data needs raised through assessments and HS development. Industry to provide advice to mgmt. and scientists on characterising fishing gear setup, uniformity of effort, spatial data, large size classed fish (dome shaped selectivity). Discuss logbook review.	
July 2019 ****	Joint WG and RAG	Finalise draft harvest strategy.	

* RAG 3 was previously scheduled for August 2018.
** RAG 4 was previously scheduled for October 2018.
*** Previously scheduled for July 2018. AFMA understands July is the best time for operators being pre-mackerel peak catches.
**** Previously scheduled for June 2019.

Table 2. Additional work plan for Management Strategy Evaluation post CSIRO led HS development project.

Steps below subject to funding approval for Management Strategy Evaluation.
Management Strategy Evaluation (likely 6 month project during 2019/20 season)
RAG to consider outcomes of MSE and recommend any changes to the draft harvest strategy.
Working Group to consider RAG advice on any proposed changes to the draft harvest strategy
PZJA to agree for draft harvest Strategy to be released for public comment (3 months for OOS decision)
Public comment (likely 6 weeks).
RAG and Working Group to meet to consider outcomes of public consultation and finalise advice on a draft harvest strategy.
PZJA agree Harvest Strategy (3 months for OOS decision) to come into effect for the 2020/21 season beginning 1 July 2020.

Agenda Item 3 - List of attachments

Attachment A – Harvest Strategy Proposal (Funding Application) – Harvest Strategies for the Torres Strait Finfish Fishery, CSIRO, December 2016.

Attachment B – Milestone Report 1, 30th May 2018, Harvest Strategies for the Torres Strait Finfish Fishery, AFMA Project No. 2016/0824, Trevor Hutton (CSIRO), Michael O'Neill (QDAF), George Leigh (QDAF), Andrew Tobin (Tobin Fishtales Ltd.), Eva Plagyani (CSIRO), Matt Holden (UQ) and Roy Deng (CSIRO).

Attachment C – Progress Report, 20th June 2018, Harvest Strategies for the Torres Strait Finfish Fishery, AFMA Project No. 2016/0824, Trevor Hutton (CSIRO) et al.

Attachment D - Summary of advice from Finfish RAG to Harvest Strategy project team at FRAG 2 meeting, March 2018.

Agenda Item 3 Attachment D - Summary of advice from Finfish RAG to Harvest Strategy project team at FRAG 2 meeting, March 2018.

Table 1. Action items for the Harvest Strategy Project team to acquire advice from the PZJA Finfish RAG Meeting #2.

Action Item	Feedback from RAG
Coral trout actions	
Action 1. Review uncertainties and practical management issues of assessing Coral Trout on the basis of the main target species (*Plectropomus leopardus*) or by splitting into the four species found and fished commercially in the Torres Strait.	RAG considered the two options for management and assessment: a) Species combined into a basket and assessed only on the basis of the primary target species *P. leopardus* (common coral trout) b) Assessed on split species (common, bar-cheeked, blue-spot, passionfruit)
Action 2. As part of (A.1) review the implications for setting aggregated catch limits (for group of species) if Coral Trout is assessed on the basis of single species. Conversely, document potential increased uncertainties (and risks) with non-species specific assessments.	RAG advised that a multi-species approach for assessment and management could be adopted with a strong focus on data collection and the percentage break down of species captured. It was suggested that a trigger could be developed for consideration that if more than '*X'* per cent of a one species is caught management could then revert to single species approach focusing on that key species. Further discussions are noted below.
Action 3. Ascertain what was the rationale for setting the current interim magnitude of Coral Trout catch levels (information is required from WG, RAG and industry).	RAG noted the current TAC is based on average catches from 2001 to 2005 (113.2 t average for TVH and 21.7 t for TIB sector). RAG noted the need for detailed data validation on coral trout (and also Spanish mackerel) and supported an industry meeting being held that could help AFMA and the project team characterise data and fisher behaviour.
Spanish mackerel actions	
Action 4. Adopt a Limit Reference Point for Spanish mackerel.	RAG recommended B20 (20 per cent of virgin biomass) as an interim limit reference point in line with the *Commonwealth Harvest Strategy Policy* and *Guidelines 2007*. RAG suggested a higher level of associated P (e.g. P 0.95) could be adopted to add increased certainty the stock would not breach this point.
Action 5. Adopt performance metrics for Spanish mackerel based on current standard performance measures/metrics used in fisheries.	RAG discussed the use of CPUE as an indicator in detail and provided input to the HS Project Team on a range of likely factors affecting CPUE standardisation as detailed below.
Action 6. Discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points. Explore 'response' rules to each reference point.	RAG noted that a range of harvest control rules would be developed and provided for analysis and discussion as the project progresses.
Action 7. Finalise agreement on different monitoring information that will be collected such as catch-at-age data (with consensus on who, when and by when?).	RAG tabled a range of data needs and perceived value-for-money analyses (for coral trout and Spanish mackerel) (**APPENDIX B**) which would inform development of a sampling program. RAG noted that these could be condensed with the live document tabling research and data needs developed at the Nov 2017 meeting. RAG science members can table business cases for sampling designs (age, length data) to meet data needs as they are analysed and agreed as the project progresses.

RAG 2 - Points discussed against tabled items for action (Table 1 above)

Actions 1 and 2. Strategy to cover assessing either a basket of coral trout species or assess individually split species.

The RAG provided advice on the options of either assessing the stock on the basis of the main coral trout species targeted (common coral trout *Plectropomus leopardus*) or alternatively splitting the assessment of the stock into the four species found and fished commercially in the Torres Strait. The RAG also provided advice to the project team on the implications for setting aggregated catch limits (for a basket of four coral trout species) versus non-species specific assessments.

The following points were noted:

- RAG noted that for a period of five years since leasing began in June 2008 only one sunset sector boat has consistently been fishing for trout fillets rather than fishing for live trout, which had only really begun in the 2017/18 season. Individual species did not matter too much to this boat targeting trouts for fillets as colouration was not an important factor for market for fillets.
- It was advised that live boats will mainly preferentially target *P. leopardus* (common coral trout) due to strong red colouration and will actively avoid portions of the Torres Strait which have higher proportions of the other lower value species (bar-cheeked, blue-spot, passionfruit) for the live trout trade.
- RAG advised that a multi-species approach could be adopted with a strong focus on data collection and the percentage break down of species captured. It was suggested that a trigger could be developed for consideration that if more than '*X'* per cent of a one species is caught management could then revert to single species approach focusing on that key species.
- RAG advised that the east coast coral trout stock is assessed as a basket but is less of an issue as common coral trout are mainly caught with fewer of the other species compared to Torres Strait.
- Both the Catch Disposal Record and Daily Fishing Logbook have the capacity to record multiple trout species (percentage splits for the four Torres Strait species) but this relies on the ability of fishers to identify species. This will require support from management in encouraging fishers with identification material and encouraging accurate reporting.
- It was noted that the analysis of historic coral trout catch data is challenging (fillets versus live boat) and the project team will examine how these data can best be used in the assessment.
- The RAG noted a strong need for:
    a. increased reporting on coral trout catches from the TIB sector;
    b. AFMA to encourage new fishers entering the fishery to complete daily fishing logbooks; and
    c. all fishers are to provide species-split data for coral trout.

Action 3. Coral trout catch data underlying the level of the nominal TAC

RAG noted the current 134.9 t TAC is based on average catches from 2001 to 2005 (113.2 t average for TVH and 21.7 t for TIB sector). RAG noted the need for detailed data validation on coral trout (and also Spanish mackerel) and supported an industry meeting being held that could help to characterise these older data and fisher/fleet behavioural changes over time.

The project team advised that the original data set used for analysis for the 2008 Management Strategy Evaluation work (Evaluation of the eastern Torres Strait reef line fishery, Williams et al.

2007) would be very useful for this purpose. It was advised that the data set had been located (held by CSIRO) and the project team would put in a data request to acquire access. RAG advised that the older island freezer data (part of this data set collected by JCU) would need scrutiny to check its completeness and usefulness for CPUE analysis given that it may not have associated effort data.

Action 4. Limit reference point for Spanish mackerel

The RAG noted the default *Commonwealth Harvest Strategy Policy* proxy for a limit reference point (BLIM defined as the points below which targeted fishing ceases) is B20 - 20 per cent of virgin biomass - with an associated probability of 90 per cent, meaning that the stock would not drop below B LIM nine times of out ten.

While B20 was noted as the default limit reference point, industry members suggested a higher B LIM such as B25 could have advantages and could be tested as an interim limit reference point. The RAG considered this suggestion but could not support adopting this without a firm justification as to why. RAG considered that instead of moving BLIM to a higher point, it could be kept at B20 but with an added higher level of precaution which would decrease the probability of the stock dipping below the limit.

RAG 2, Action Item 2: AFMA to circulate the Keith Sainsbury paper "Best Practice Reference Points for Australian Fisheries" for RAG reference. http://www.afma.gov.au/wp-content/uploads/2010/06/rep_sainsbury_best-practice_jan08_20080228.pdf

The RAG agreed to an interim BLIM of B20 noting that this would be reviewed and investigation could be carried out on an associated higher level of probability.

Action 5. Spanish mackerel CPUE as an indicator

The RAG noted that catch per unit effort is traditionally used in assessments and harvest strategies as a powerful indicator (a signal) for how the fishery is performing and also for informing management responses under a harvest strategy. The RAG proposed that CPUE could be used as an indicator during the development of the harvest strategy framework and advised that a number of examinations would need to be performed to increase our understanding.

The RAG noted the apparent downwards trend in standardised catch per unit effort (Nov. 2017 examination of catch data up to 2016) from the last Spanish mackerel stock assessment (Figure 1. below).

It was noted that a number of assumptions underlie such analyses including:

- No fishing power change through time.
- No spatial information.
- No zero catches.
- No "hours fished" before 2003.

The RAG advised that examination of these assumptions is required and that consideration of large changes in the fishery might also need to be taken account of. RAG advised that in recent history (post 2003) the fishery has gone through a period of significant change including the buyout of the TVH sector in 2007 and transition to Sunset sector leasing arrangements since 2008/09, changes to daily fishing logbooks (new logbook in 2003), fluctuations in docket book reporting levels (TIB sector), experienced TIB fishers leaving the fishery and island freezers ceasing operation.

RAG identified that there is a need for consistent daily fishing logbook reporting of the following information to ensure the most accurate data is available to support assessments:

- Identify fishing trips over multiple days
- Target species and gear
- Vessels and skippers

- Locations fished (noting that coral trout data has location of the primary only, no tender fishing location is recorded).
- Time spent searching for fish and time spent fishing.

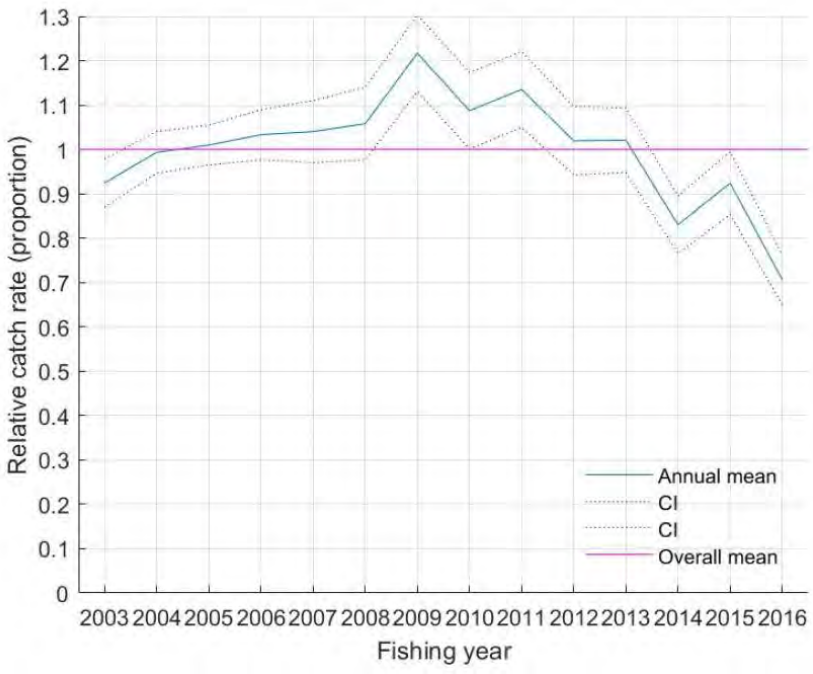

Figure 1. CPUE time series from most recent Spanish mackerel stock assessment.

Other factors were considered to be influencing the utility of CPUE as an indicator for Spanish mackerel including environmental factors, such as droughts in PNG (e.g. 2015/16). An industry member advised that such droughts could be a factor influencing catch rates in the Mackerel sector of the fishery, particularly at Bramble Cay where outflow from the Fly River was known to influence both water turbidity and salinity. AFMA advised that analysis of the historic data set could show which years had poor CPUE and this could be matched against known data from PNG droughts.

RAG 2, Action 3: AFMA, Industry member and Harvest Strategy project team to investigate whether PNG droughts have impacted mackerel CPUE.

RAG encouraged AFMA and the project team to further investigate getting extra input from stakeholders about performance indicators, for example, what is a good number of mackerel per dingy per day for the TIB sector? These data would help inform development of indicators for Spanish mackerel.

RAG 2, Action 4: AFMA and the project team to liaise and investigate options for getting extra input from stakeholders on interim performance indicators to aide development of harvest strategy components.

Action 6. Harvest Control Rules

RAG noted that they were scheduled to discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points.

Noting that work was still ongoing on reference points, the RAG noted that draft harvest control rules and example graphs of stock responses could be presented alongside assessments for consideration at the next harvest strategy meeting.

Action 7. Monitoring data

RAG were asked to provide advice on different monitoring information that will be collected under a harvest strategy such as catch-at-age data. The following points were advised:

- RAG provided some advice on this action item at agenda item 2.1 including identifying that the Queensland Long Term Monitoring Program could be consulted for advice.
- Ideally the fishery would have a consistent monitoring method over time, at scheduled intervals with representative spatial coverage (noting previous ageing data was from Bramble Cay).
- RAG provided a table of data needs (**Appendix B**) for the short term while the strategy was under development together with listed priorities and indicative costing (noting that some of these needs are being addressed through the budgeted Harvest Strategy Project). RAG noted that Table 2 of the prepared agenda paper 2.2 provided some good supporting information for each of the table items in the appendix.
- Priority items for Spanish mackerel were:
    - unexplained CPUE declines and sensitivity analyses to investigate impacts on the assessment model; and
    - data validation (via existing workshops) after logbook validation and analyses.
- Priority items for coral trout were:
    - species specific data (via fishery data)
    - virgin biomass estimate,
    - unexplained CPUE declines, sensitivity analyses
    - data validation (via scheduled workshops).

Other points discussed

- Harvest strategy project team were requested to provide a glossary of terms in their summary updates and final reports.
- The RAG noted that consideration can be given to alternative methods of assessing the biomass of the stock such as F-based approaches. It was noted that scientific member Rik Buckworth could supply the RAG with further information about such approaches.

RAG 2, Action 5: Rik Buckworth to supply the RAG with a short summary of how F-based assessments of biomass are performed.

Australian Fisheries Management Authority
FUNDING APPLICATION

The Australian Fisheries Management Authority provides funding for strategic research projects in Torres Strait Fisheries guided by advice from the Torres Strait Scientific Advisory Committee.

ADMINISTRATIVE SUMMARY

Project Details

Project Title: Harvest Strategies for the Torres Strait FinFish Fishery

Planned Start Date: 01/02/2017
Planned End Date: 31/08/2018

Project Applicant
Organisation: CSIRO Oceans and Atmosphere
Large Organisation (more than 20 people) – Yes.

Address: CSIRO Oceans and Atmosphere. CSIRO Head Office, GPO Box 1700, Canberra, Australian Capital Territory, 2600.

Project Budget Summary[1]

BUDGET[2]	TOTAL PROJECT COSTS					CONTRIBUTIONS			
Year	Salary	Travel	Operating	Capital	TOTAL	AFMA Contribution	Applicant Contribution	Applicant In kind	Other In kind
2016/2017	7540	1000	30073		38613	32580	6033		61500
2017/2018	27956	8000	110606		146562	123662	22900		218940
2018/2019	8754	3000	41246		53000	44719	8281		82570
	44250	12000	181925		238175	200961	37214		363010

External Review

Do you agree to any information being sent to external reviewers – Yes.

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[1] Please list budget exclusive of GST
[2] Please list budget exclusive of GST

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PROJECT DESCRIPTION

Project Challenge

From: 2015 TSSAC operational plan
C. Finfish
1) Efficacy of management arrangements
1a) Investigating improvement of efficient, long term monitoring for all sectors of the fishery
1b) Developing efficient harvest strategies for the fishery

Project Species

Species Group	FinFish (Spanish mackerel and Coral trout)
Species	*Scomberomorus commerson* & *Plectropomus leopardus*

Background

Research is required to deliver harvest strategy (HS) options as described in the project outline established by the PZJA consultative forums, TSSAC 2016 research call and the TSSAC operational plan. Since 2008 the Torres Strait Finfish Fishery has been reserved for Traditional Inhabitants, on whose behalf the Torres Strait Regional Authority (TSRA) leases out fishing licences to non-Traditional Inhabitants. The leasing process is based on consideration of estimates of sustainable total allowable catches (TAC) for coral trout and Spanish mackerel, with the aim to generate revenue for the benefit of Torres Strait (TS) communities.

A HS framework for the finfish fishery is sought to guide future TAC decisions, support leasing arrangements and expansion of the fishery using new stock status indicators; and to achieve ecological, economic and social management objectives consistent with the Torres Strait Fisheries Act 1984, TSFFF management plan 2013, the Commonwealth Fisheries Harvest Strategy Policy and Guidelines and Torres Strait FinFish Action Plan. HS options will also assist and guide future investment on finfish research and data collection to ensure the shared interests of Torres Strait Islanders, AFMA, TSRA and DAF are balanced in developing sustainable and economic fishing opportunities.

Current management of the fishery involves TACs based on historical catch which have remained unchanged since 2008. A clear contrast between under-utilisation of coral trout and over-subscription to Spanish mackerel exists. Lack of data and rules to set effective allowable harvests may impede the returns to islanders and put the fishery at risk, unless there is a clear set of harvest control rules (within a harvest strategy framework) agreed to by the custodians of the resource. This has been the subject of some discussion at management forums (e.g. FFWG) and community meetings for some time. A new harvest strategy process will provide the platform for an agreed and transparent strategy for managing, monitoring and information gathering into the foreseeable future.

Consultation

The need for the project has been highlighted through management forums such as the Finfish Working Group (FFWG) which includes TS Islander representatives. The proposed project has a significant consultation component that will take place during FFWG meetings that will include key stakeholders and experts. At these future FFWG meetings, stakeholder feedback will be recorded by the project team as part of the work-plan to merge any new additional considerations with those documented within the Torres Strait FinFish Action Plan (FRDC project 2014-240; Bodsworth et al 2016).

This level of engagement was inferred re: TSSAC letter 1st September 2016 and phone conversation with AFMA, stating clear focus be given to the development of harvest strategy information and procedures (i.e. two stages). Significant community consultation will also take place subsequent to this project, by AFMA, and this project will also be able to use significant islander consultation opportunities during the current Torres Strait Finfish Monitoring project [CSIRO].

For this project, the lead researches have already sort support from key staff in AFMA and the TSRA. Furthermore they have sought the approval of Traditional owners (Kenny Bedford).

The TSSAC supported the pre-proposal from each of the groups that submitted (DAF, CSIRO and Tobin Fish Tales Ltd). This resulted in a combine full proposal ‘version 1’ being reviewed by TSSAC in July–August 2016. The TSSAC response questioned the proposed stakeholder need analysis and workshop. All parties have consulted to revise the proposal appropriate.

Need

The Torres Strait finfish fishery consists of a mix of commercial, traditional and recreational sectors. The commercial allocation is held by Torres Strait Islanders and is fished by islander owner-operators and non-islander lease-fishing operators. The leased allocation provides income and market certainty to communities; the islander operators provides important local employment and income opportunities, and local food security and health benefits. The strategy for overseeing each sector and their joint fishing impact is relatively ad hoc, with a Total Allowable Catch (a separate TAC for Spanish mackerel and coral trout) the primary point of reference for capping fishing pressure at a level which meets sustainability targets,. Under the current management approach there is considerable risk of under or overfishing in some situations and no process of formalising harvest control rules to control fishing pressure.

A major impediment to defensible and robust management decisions is the development of a clear understanding of management arrangements including the potential mechanisms for fishery expansion and potential co-management, the knowledge underpinning current management strategies and fishery risk. Much of the rationale for current management arrangements are immersed in consultative meeting minutes, scientific reports or in various stages of ratification through a complex administrative framework. The development of a HS document that is ratified by management agencies and Islanders will guide and demonstrate sustainable fishing, in a clear consultative fashion for future development of the fishery. Adding some additional urgency is the fact that the current strategic assessment for the fishery includes a commitment for the development of "*harvest strategies to include meaningful performance indicators, performance measures and responses*".

Planned Outcomes

This research will provide a sound basis for the development of the Harvest Strategy (HS) for this locally important fishery for Torres Strait Islanders. This fishery has the potential to provide significant long-term livelihood benefits for local communities in the Torres Strait. The HS design, stock status indicators and assessment tools will provide the framework to improve monitoring, management and sustainable use of Torres Strait finfish resources. For the PZJA, AFMA, TSRA, DAF and community stakeholders, these outputs will contribute to stock status reporting (ABARES, Fishery status reports) and the evaluation of TAC. These will help identify revenue potential for Islanders through marketing of sustainably fished resources and understanding of the sustainable number of licences and TAC to lease. The project will also help sustain profitable levels of harvests for lessees, including taking into account need for more certainty as per lease agreements. The resulting outcomes will be measured through a) uptake and management use of a HS procedure, b) simple cost effective reporting on stock status, and c) feedback from the PZJA, managers, stakeholders and project extensions to inform government leaders, Islanders and fishers.

Objectives

1. Collate and analyse available coral trout and Spanish mackerel fishery data to estimate variability and assess whether there is sufficient information to develop time-series indicators of stock status (Task 1, Figure 1). This includes linkage to the Finfish Monitoring Project (Task 4, Figure 1) (data links and sampling methodology).
2. Summarise and assess utility of updated stock assessments and reference points for coral trout and Spanish mackerel (Task 2, Figure 1).
3. Present results and HS guidelines (including Harvest Control Rules – Task 3) to the Finfish working group, with fishery managers and representative stakeholders to develop and evaluate key elements of the draft HS. It is the responsibility of the FFWG to take the recommended draft HS and formally adopt it as the HS.

The project will develop and ratify a clear and concise draft harvest strategy for the Torres Strait finfish fishery. It will include clear guidance for sustainable fishing, the data requirements that underpins management strategies, options for flexibility to suit market and community needs, targets and limits and guidance for situations where these targets and/or limits are reached, and data requirements for potential fishery expansion.

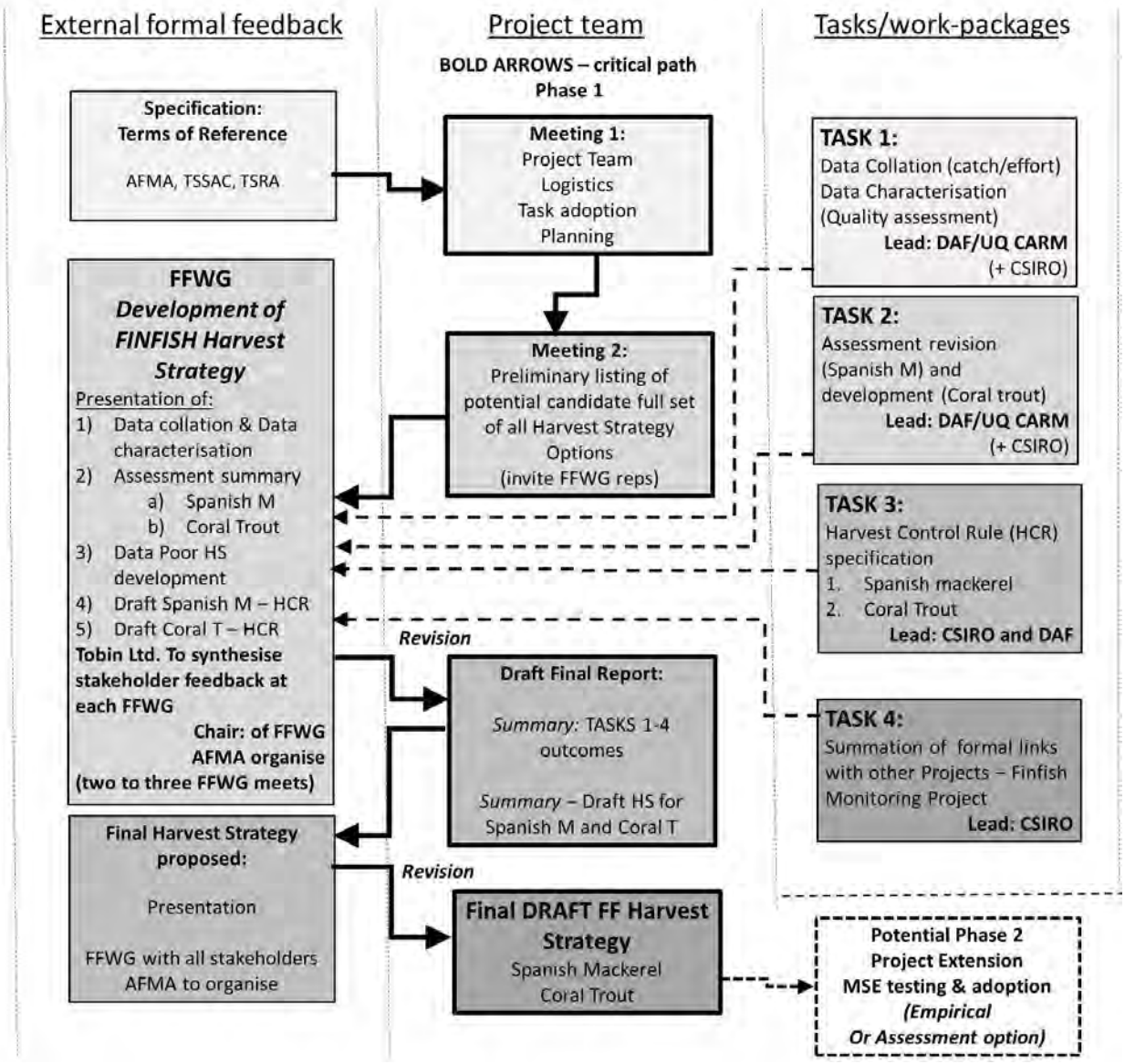

Figure 1. Proposed Process for project team meetings and deliverables, and tasks for the project (HCR – harvest control rule).

Methods

Phase 1

Tasks 1 will assess fish abundance indicators and empirical reference points (e.g. target and limit catch rates) that are achievable and are not based on unusually benign times in the past history of the fisheries. Task 1 aims to ensure a solid foundation for AFMA, TSRA, Fisheries Queensland, Torres Strait Islanders, fishery stakeholders and TSSAC to benefit from harvest strategies outcomes. Engagement processes on task outputs and their meaning will be determined through project meetings and presentations with the FFWG (see plan diagram, Figure 1).

Task 1 – Data collation and quality assessment:

This task collates data and provides early consideration of harvest strategy options.

Collate and review existing raw data for coral trout and Spanish mackerel and identify useful data (taking into account confidentiality constraints, following the guide for fisheries researchers working in the Torres Strait). Identify critical data gaps and indicate how they might be addressed. Analyse past research and logbook data sets to establish whether these data have sufficient information to develop critical indicators of fishery

performance and status. This will build on current Spanish mackerel analyses (O'Neill and Tobin, report draft with AFMA, email dated 21/11/2016) and coral trout analyses (Leigh et al 2014). Statistical analyses to be employed will be generalised linear models, generalised linear mixed models and GIS mapping.

For Spanish mackerel, the existing data and standardised catch rates from the updated assessment in 2015 (O'Neill and Tobin) will be used. This will be built on to calculate statistical powers of detection (e.g. confidence in detecting a 10%, 20% etc. significant change in catch rates) for quantifying HS precision at different spatial levels of fishing. In addition, the results will inform on HS control rule triggers and/or appropriate transformations to mitigate variances. Monitoring sample sizes for fish age frequencies will be calculated to demonstrate effective samples sizes and precision. This will provide options on increasing the tiered level of analyses and on the monitoring of fish ages frequencies. These analyses are in line with those conducted for HS for tropical snappers across northern Australia (FRDC Project No. 2009/037, O'Neill et al 2011).

For Torres Strait coral trout, no analyses or results are available. Therefore, the catch rate and stock analyses need to be developed to establish indicators and reference points for the HS. This will utilise existing methods applied to the Queensland fishery. Data variances and statistical powers will be reported, with reference points scaled as appropriate based on analysis trends and signals. Alignment with stock model predictions will be explored. Application of this data source will depend on the amount of information.

Data synthesis will also include historical information relevant to weather conditions, legislative and policy arrangements, fishery characteristics, stakeholders, their life histories, stock status, key threats and relevant available data. This will provide the context for the development of appropriate abundance indicators and reference points.

Recently AFMA have highlighted the management need to review data for other important quota fish species (e.g. Lethrinidae, Lutjanidae and Serranidae). For these "other species", no harvest strategy design will be conducted in this project; see project phase 2 options.

Task 2 - Assessment minor revision (Spanish M) and assessment development (Coral trout)

The recent Spanish mackerel assessment for TS was presented at the FFWG in 2016 (Brisbane 10th November). This model is adequate given the limitations in data in terms of providing a baseline assessment for Spanish mackerel. Review of the assessment during the FFWG meeting (10th Nov 2016) provided a series of recommendations for future consideration (e.g. run sensitivity test assuming catchability on older age classes decreases). Given the current progress made with the Spanish mackerel assessment, no new assessment work will be conducted for Spanish mackerel, except to adjust model settings (analyses) to estimate (target and limit) reference points as required for judging empirical indicators in the HS.

The Queensland coral trout model will be expanded for Torres Strait data in order to calculate reference points. Modification of the current assessment for Qld coral trout (spatial coral trout model - Leigh et al 2014) will be considered and adapted to Torres Strait reefs and data as appropriate. Catch rates are subject to significant effects of social learning (fish quickly learn not to take the bait when they are fished, which reduces catchability), environment (tropical cyclones and other low pressure systems) and fisher skill. The environmental effects of cyclones may be less of a problem in Torres Strait than in the Great Barrier Reef, as cyclones are less common, but analyses will need to confirm the significance of such effects and the implications for abundance indicators. The variances and extent that abundance indicators are affected by environmental variables rather than fishing will be assessed before being used as input into a harvest strategy.

Both models are annual age-structured population models which can define management reference points (target and limit) for fish harvest, catch rates, age-length and mortality in order to guide empirical or model-based harvest-strategy options. Furthermore, this task will review past research and assessments for the species to complete the knowledge base for the Torres Strait.

Performance indicator: identify empirical fish abundance indicators and procedures to mitigate variance in harvest strategies; establish analysis tools for simple and cost effective operation; identify target and limit reference points.

Both task 1 and 2 will be conducted by Dr Michael O'Neill (DAF) and Dr George Leigh (DAF) (in collaboration with UQ (CARM)) and Dr Trevor Hutton (CSIRO) who have many years of direct experience with the stocks in this fishery in terms of data, empirical-based techniques for stock status reporting, standardisation of fisheries indicators, formal stock assessments and the provision of recommend fisheries management advice, in addition to extensive skills and experience in local stakeholder engagement.

Task 3 - Harvest Control Rule (HCR) specification

The completion of a Harvest Strategy Framework for a fishery/stock; in this case Spanish mackerel and coral

trout relies on a complete set of components of the framework being specified, these being:

I. Indicators (full set of chosen indicators outlined) (here included in Task 1)
II. Current Monitoring and future monitoring (here included in Task 1, but future monitoring relevant to all Tasks)
III. Reference Points (for both stocks: Spanish mackerel and coral trout – the target and limit reference points will be defined and agreed to as part of Task 2, and this task)
IV. Method of status evaluation (assessment and empirical). For each stock the actual method depends on data and is a cost/risk analysis that should be informed by resources available (AFMA to advise)
V. Decision rules (THIS TASK)

The specification of a set of Harvest Control Rules (HCRs) would form the core element of the HS for each stock and the fishery. These HCRs are very much predicated on the outcomes of the previous project tasks, especially the uncertainty associated with data, the uncertainty of the assessments in estimating stock status and/or empirical techniques for estimating stock status, and a cost/risk analysis that should be informed by resources available (AFMA to advise). Given the fact that at least three separate factors (one of which is clearly independent of the project) are going to inform the exact final specification of each HCR, these HCRs can only be developed with a process (this being driven within a series of FFWG meetings where all parties commit to informing the process). Overall, the project will draw upon the National Guidelines to Develop Fishery Harvest Strategies (Sloan et al. 2014) – define operational objectives, empirical indicators, reference points, risk levels, data collection, process for HS analyses and rules that control fishing harvest and intensity. It will have a close link to the proposed separate TRL HS project to ensure consistency of HS framework and terminology.

The presentations to the FFWG will be made by the lead researchers (Hutton, O'Neill and Tobin). Further additional presentations will be made at FFWG meetings by other members of the project team such as Dr Eva Plaganyi (CSIRO, example of empirical HS development in the TSRL fishery). Given that stakeholder involvement and buy-in is dependent on stakeholder engagement and inclusion at the FFWG (planning thereof is dependent on management agencies); the plan is to monitor (and summarise) on-going stakeholder feedback during the FFWG meetings to later inform agencies whether all stakeholder needs have been addressed during the FFWG meetings (or in Action Items)(to be led by Andrew Tobin Ltd).

This task will be led by Dr Trevor Hutton (CSIRO), Dr Michael O'Neill (DAF), Dr George Leigh (DAF), Dr Andrew Tobin and Eva Plaganyi (CSIRO). Trevor Hutton (CSIRO) is separately currently part of a national project to review the Commonwealth Harvest Strategy Guidelines.

Performance indicators: develop draft HS options and HCRs for Spanish mackerel and coral trout. Note: The project team (and project) cannot 'create' a FINAL HS (and set of HCRs for each stock); only a DRAFT of each. The FINAL HS and accompanying HCRs are "created" when the DRAFT of each are endorsed by the Working Group and RAG, and authorities which are responsible for managing the fishery; with stakeholder support. The project team with facilitate this process as much as possible by presenting options to the Working Group.

Task 4 - Summation of formal links with other Projects – Finfish Monitoring Project

The project will also utilise data and proposed indicators from the current Finfish Monitoring Project (CSIRO).Further detail can be provided as the project progresses as linkages are highly dependent on progress made in this separate project which is out of the scope of this project team's influence.

Method references:

O'Neill and Tobin, In press, Torres Strait Spanish mackerel, Stock assessment II, 2015.

O'Neill, M. F., and Leigh, G. M. 2016a. Stout Whiting Fishery. Queensland Total Allowable Catch for 2016. p. 68. https://www.daf.qld.gov.au/fisheries/monitoring-our-fisheries/data-reports/sustainability-reporting/stock-assessment-reports/stout-whiting-fishery-summary

O'Neill, M. F., Leigh, G. M., Martin, J. M., Newman, S. J., Chambers, M., Dichmont, C. M., and Buckworth, R. C. 2011. Sustaining productivity of tropical red snappers using new monitoring and reference points. The State of Queensland, Department of Employment, Economic Development and Innovation. FRDC Project No. 2009/037 106 pp.

Leigh, G. M., Campbell, A. B., Lunow, C. P., and O'Neill, M. F. 2014. Stock assessment of the Queensland east coast common coral trout (*Plectropomus leopardus*) fishery. Fisheries Resource Assessment Report, Department of Agriculture, Fisheries and Forestry, Queensland Government. https://www.daf.qld.gov.au/fisheries/monitoring-our-fisheries/data-reports/sustainability-reporting/stock-assessment-reports.

Sloan, S. R., Smith, A.D.M., Gardner, C., Crosthwaite, K., Triantafillos, L., Jeffries, B. and Kimber, N. 2014. National Guidelines to Develop Fishery Harvest Strategies. FRDC Report – Project 2010/061. Primary Industries and Regions, South Australia, Adelaide.

Phase 2

The Phase 2 project component (Figure 1) is noted here for management strategy evaluation (simulation testing), adoption of a harvest strategy (HS) design, and assessing potential for any extra fishery monitoring. Phase 2 has not been costed in this proposal and represents an optional project extension. Costings and work details for Phase 2 will be provided separately if requested by AFMA and TSSAC, and are dependent on the successful outputs from Phase 1.

Phase 2 will:

- Undertake simulation modelling of the Torres Strait coral trout and Spanish mackerel fishery sectors to test candidate HS's (e.g. rules to set annual TAC's) to gauge their effectiveness prior to implementing procedures in real-world management.
- Test a risk-based range of assessment options reflecting increases in stock assessment information (i.e., a 'tiered' harvest strategy).
- Build simulations onto the fish stock models from task 1 and consider data components from the recent CSIRO-DAF ELFSim model (Little et al 2015).
- Produce statistics measuring the HS's biological, fishery and management performance.

Performance indicators: identify a robust HS for uptake into fishery management.

Risk Analysis

Threat: Key staff (M.O., A.T., G.L., K.B., T.H.) not being available to complete the project. It is highly unlikely that more than one of the listed would not be available. There are opportunities for substitution of tasks.
Contingency: This is a short term (1.5 year) project that should mitigate this risk. Also, there are other staff within CSIRO with similar skills to the Key staff who will have an allocation within the project and who could complete the project (e.g. Eva Plaganyi).

Performance Indicators

1. In principal agreement from the FFWG and TSSAC on a draft harvest strategy for the Torres Strait finfish fishery; that protects it from overexploitation while promoting its appropriate development.
2. Input and agreement from the relevant Torres Strait communities at the FFWG.
3. Draft Harvest Strategy put forward to the PZJA; including proposed harvest control rules (HCRs) for Spanish mackerel and coral trout.

Related Projects

This research project will build on the outcomes and recommendations from previous and current research and management activities on the Torres Strait finfish, including: Spanish mackerel and coral trout assessments. The investigators on this project are senior scientists experienced in finfish research, statistics, harvest strategy design, management and stock assessment nationally. They have numerous years of fisheries research experience and involvement in achieving favourable outcomes from previous Torres Strait, FRDC and government funded projects. The project will link and draw knowledge from a number of past and present research studies, such as O'Neill and Tobin (current Spanish mackerel stock assessment); O'Neill and Leigh 2015; Little et al 2015; Sloan et al 2014; Leigh et al 2014; Campbell et al 2012; O'Neill et al 2011; O'Neill 2010; and Begg et al 2006. The project will also maintain in parallel a formal link with the Torres Strait Tropical Rock Lobster HS project.

Outputs and Extensions

This research will provide a sound basis for the development of this important fishery for Torres Strait Islanders. This fishery has the potential to provide significant livelihood benefits for local communities in Torres Strait. The project will produce a formal harvest strategy, suitable for consideration by the relevant management and islander stakeholders.

Intellectual Property

Code	Description
1	Published, widely disseminated and promoted, and/or training and extension provided. Relates mainly to outputs that will be available in the public domain.
2	Published, widely disseminated and promoted, and/or training and extension provided. Related products and/or services developed. Relates mainly to outputs that will largely be available in the public domain, but components may be commercialised or intellectual property protected.
3	Published, widely disseminated and promoted, and/or training and extension provided. Related products and/or services developed. Relates mainly to outputs that may have significant components that are commercialised or intellectual property protected.

Code 1 applies. Open disclosure will be encouraged as much as possible.
Some components of the project will contain intellectual property that may require protection e.g. individual inputs into the stakeholder consultation.

Flow Of Benefits

Fishery (including aquaculture) Managed by:	Commercial(%)	Recreational(%)	Traditional(%)
ACT			
AFMA			75%
NSW			
NT			
QLD			25%
SA			
TAS			
VIC			
WA			

The AFMA benefit also recognises the TSRA role in fishery management.

Data Management

I have searched for existing data. (Refer to guidelines on how to search the Australian Spatial Data Directory and Oceans Portal) [Yes / No]

Provide a brief description of the resulting data from the project and how this data will be stored for future protection and access.

Data management should include a description of the data to be produced by the research and show details on the following aspects:

Data security or privacy issues, applying to the data.
Nominated data custodian, clearly identifying the party responsible for this data and the database/repository system that .the data will be stored in. AFMA may require researchers to provide copies of data and or metadata to them.

All data supplied by AFMA or other organisations will be in a single secure MS Access database that will be stored in the 'Stock Assessment Security Group' directory on the DAF server behind a firewall. The AFMA form 'deed of confidentiality' will be signed to cover the authority/access for the PI and co-investigators to analyse the data. When the project is complete, a copy of the database will be made available to AFMA under the 'deed' agreement, to allow future updates and enable the HS assessment tools to be utilised. Description of project data will be stored on the Repository with clearly stated access and use conditions. Clear and accurate records will be kept to allow verification, replication and review of the research work.

This project will produce consolidated information from the Torres Strait Islander communities. This will be maintained in a secure location in CSIRO and DAF. Public record information will be reported to the FFWG for recording in meeting proceedings.

BUDGET

Milestone List

Identify the key milestones against which progress of the project will be measured. All tangible outputs for the project should be listed as milestones together with the dates by which their achievement is anticipated, and the criteria for verifying that the milestones have been achieved. All milestones must be costed.
To facilitate project management please base milestone dates on the completion of significant reportable activities rather than traditional calendar dates such as end of the month, financial or calendar year.

Due Date	Details	Justification	Salary	Travel	Operating	Capital	Total
30/09/2017	FinFish Working Group presentation •Outline of Data collation •Summary of assessments	Salary, travel and operating for draft harvest strategy and consultation with experts and stakeholders	13978	4000	44000		**61978**
30/03/2018	Progress report prepared to a standard reasonably agreed by AFMA and the PI •Outline of Data collation •Summary of assessments •Draft Harvest Control Rule for each stock	Salary, travel and operating for draft harvest strategy and consultation with FFWG (request stakeholder representatives attend)	13978	4000	44000		**61978**
31/08/2018	Final Report prepared to a standard reasonably agreed by AFMA and the PI	Salaries, travel and operating related to production of Final Draft Harvest Strategy. Presentation to AFMA.	8754	3000	34140		**45894**

Cash Contributions

Contributor Name	Contributor Contact Details	Amount

Schedule of Payments

The schedule of payments is automatically generated. If there is a cash contribution associated with the project please specify the breakdown between the milestones.

Due Date	Details	Milestone cost
01/03/2017	Initial payment for project staff time in conducting data collation and characterisation, initial project team planning meetings.	32580
30/09/2017	FinFish Working Group presentation • Outline of Data collation • Summary of assessments	61831

30/03/2018	Progress report prepared to a standard reasonably agreed by AFMA and the PI •Outline of Data collation •Summary of assessments •Draft Harvest Control Rule for each stock	61831
31/08/2018	Final report prepared to a standard reasonably agreed by AFMA and the PI	44719

Special Budget Considerations

Include information that may impact on the project budget. This could include revenue from the sale of publications or other items (e.g. fish sales or capital items) or details of potential co-funding arrangements.

Contribution by Applicant

Provide estimates of contributions (cash and in kind) made to the project to cover staff, facilities, vessels, and administrative support costs. Ensure any cash contributions from the applicant are captured here.

Year	Salaries	Travel	Operating	Capital	Total	Justification
2016/17					6033	Addresses strategic goals of CSIRO Oceans and Atmosphere Flagship
2017/18					22900	Addresses strategic goals of CSIRO Oceans and Atmosphere Flagship
2018/19					8281	Addresses strategic goals of CSIRO Oceans and Atmosphere Flagship

Contribution by Other

Provide estimates of contributions (cash and in kind) made to the project from other government and private investors to cover staff, facilities, vessels and administrative support costs. Ensure any cash contributions from other sources (not applicant or AFMA) are captured here.

Year	Name of Contributor	Salaries	Travel	Operating	Capital	Total	Justification
2016/17	DAF					22350	
	University of Queensland					39150	
2017/18	DAF					71030	
	University of Queensland					147910	
2018/19	DAF					39060	
	University of Queensland					43510	

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Harvest Strategies for the Torres Strait Finfish fishery

AFMA project no. 2016/0824

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Milestone Report 1, 30th May 2018

CSIRO Oceans and Atmosphere

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1 Introduction

The Torres Strait Finfish Fishery (TSFF) is an important fishery, particularly for Traditional Inhabitants of the Torres Strait. The fishery is comprised of the Torres Strait Spanish Mackerel Fishery, the Torres Strait Reef Line Fishery and the Torres Strait Barramundi Fishery. The word 'finfish' is generally used as a collective term to describe these fisheries. This project focusses on Spanish mackerel and Coral trout (common coral trout). The finfish fishery has recently become a 100% indigenous fishery and meeting the strategic objectives of protecting the livelihoods of traditional inhabitants by managing stocks in a sustainable manner is a priority for indigenous inhabitants. For many of the Torres Strait fisheries the previous fractured approach to operating and managing the fishery has created problems for effective development and planning, managing effort and monitoring the catch, all of which impact the returns to islanders. In the case of the Finfish fishery there are aspirations by the indigenous sector to increase the size of their commercial catch. The development of a new harvest strategy agreement/document will provide the platform for a transparent protocol, agreed on by stakeholders, for monitoring, information gathering, assessment and management into the foreseeable future.

Much of the rationale for current management arrangements are immersed in consultative meeting minutes, scientific reports, or in various stages of ratification through a complex administrative framework. The development of a harvest strategy document that is ratified by management agencies and Islanders will guide and demonstrate sustainable fishing, in a clear consultative fashion for future development of the fishery. Adding some additional urgency is the fact the current strategic assessment for the fishery includes a commitment for the development of "harvest strategies to include meaningful performance indicators, performance measures and responses". Australia's Commonwealth Harvest Strategy Policy defines harvest strategies as "*a framework that specifies the pre-determined management actions in a fishery necessary to achieve the agreed ecological, economic and/or social management objectives*." A key principle is that fishery managers, fishers and key stakeholders utilise pre-agreed (and preferably pre-tested) rules as to how to adjust management recommendations given updates of data and/or model outputs (http://www.agriculture.gov.au/fisheries/domestic/harvest_strategy_policy).

1.1 Background and context

This project was developed and implemented within a specific context. Key aspects to note are:

- The development of harvest strategies are process-based involving extensive and continuous consultation (within the existing stakeholder forums lead by AFMA).
- The fisheries already have extensive management arrangements which would be included in any changes to management arrangements after adoption of harvest strategies.
- Funding was not provided for management strategy evaluation (MSE).
- The project was initiated after combining contributions from CSIRO, QDAF (and UQ) as well as Tobin Fishtales (Ltd), thus the project has contributions from a diverse range of expertise.
- RAG/WG membership has changed and alternative forums for stakeholder feedback are now in place since inception of the project.

1.2 Project Objectives

The project will develop a draft harvest strategy for the Torres Strait Finfish fishery as per the design criteria in the Commonwealth Fisheries Harvest Strategy Policy and Guidelines. It will be focused on collating past management and research for both Spanish mackerel and Coral Trout in Torres Strait. The development with integrate the existing measures already in place such as the first order harvest strategy approaches such as global fishery TACs, size limits and any closures. It will include guidance for future sustainable fishing, the data requirements that underpin higher order management strategies, including indicators, reference points and decision rules, including data requirements for potential fishery expansion. Any harvest strategy development will need to be pragmatic given the limitations in terms of fishery operational characteristics, socio-economics and governance issues.

The objectives of the harvest strategy project are specifically to:

1. Collate and analyses available data to estimate variability and assess whether there is sufficient information to develop indicators of stock status over time.

2. Summarise updated stock assessments and reference points for Coral trout and Spanish mackerel.

3. Present Guidelines to working group; and with stakeholders and managers develop and evaluate a draft harvest strategy. The final adoption of final harvest strategy is Working Group/RAG responsibility.

2 Introductory concepts on Harvest Strategies

2.1 Rationale for introducing Harvest Strategies

The aim was to present at the RAG/WG meeting the most elementary explanation possible of Harvest Strategies and the key aspects of introducing harvest strategies within the Finfish fisheries. Proving the rationale, and background was critical for stakeholder engagement. Given the context of the AFMA co-management framework and the opportunity to workshop potential options and decisions for interim arrangements it was essential to provide key explanations of the main concepts. Below is a summary of the material presented. Feedback from the stakeholders present will be presented in more detail in next progress report.

The rationale for introducing the key components of a harvest strategy within a fishery as provided by the policy guidelines (see DAFF 2007, Sloan et al. 2014,) is to create management framework that is *transparent* and *clear*. A harvest strategy is defined as a formal framework that sets out the management actions to achieve objectives (such as managing a fishery sustainably). To be effective harvest strategies at the very least must specify: (a) the processes for monitoring and assessing the biological and economic conditions in a fishery and (b) the decision rules for controlling the harvest according the latter conditions (DAFF 2007). Social aspects are also considered and becoming ever increasingly incorporated via inclusion of higher level strategic objectives, as within these fisheries, the Torres Strait Protected Zone Joint Authority clearly articulate Objective 1: To acknowledge and protect the traditional way of life and livelihood of Traditional Inhabitants, including their rights in relation to traditional fishing for finfish.

Stakeholder feedback: "Harvest strategy for Finfish must begin with clear statement that finfish is 100% owned by traditional inhabitants"

In order to meet the criterion of transparency the development of harvest strategies becomes process orientated with full inclusion of stakeholders. The co-management fora (e.g. Resource Assessment Group/ Working Groups) established provide the forum for agreement at each step. The overall objective is provide a formal structure to the management of the fisheries such that established and agreed to protocols and decision rules are in place. There is not necessarily a need to continually re-address the same issues over and over again, providing for more cost-effective arrangements.

There will always be the option if circumstances permit for some issues to be re-addressed under changing conditions in a fishery; thus the framework does promote the concept of adaptive management to a degree. This is especially the case, in this situation where the research resources for full-feedback management strategy evaluation (MSE) are not available at this stage, thus the most constructive progress can be made by choosing interim arrangements which can be trialled and later evaluated. In many fisheries where formal evaluation has not been possible especially in the case of data-poor fisheries (e.g. Dowling *et al.* 2008, 2015a,b), choosing proxy values which define some of the target and limit reference points is standard practice until more data can be collected (and/or further more in-depth analyses undertaken).

Background material

Apart from the national and state guidelines on harvest strategy development the objective was to provide stakeholders with comparison material. In other words refer to other fisheries they are familiar with as most of the concepts are the same. The two key fisheries referred to are the *Torres Strait Rock Lobster Fishery* and the *Torres Strait beche de mer Fishery*. The progress with implementing harvest strategies within these fisheries where all the components thereof have been formally adopted are at various stages of development (see Plagányi et al. 2016, as an example). While comparisons are useful there are also some key differences across the fisheries. For example, available data (fisheries independent surveys), number of species targeted and species identification. The full set of references to these case studies will be provided in future progress reports.

We also referred stakeholders to the publically available Harvest Strategy documents of the Northern Prawn Fishery (NPF) and the Southern and Eastern Scalefish and Shark Fishery. This was done to highlight some of the higher level generalisations about the development of harvest strategies pointing to cases where despite many years of research effort some finer details and recent initiatives in updating harvest control rules are still in being undertaken in an adaptive framework due to changing circumstances with the stocks. The relevant example here is the recent suggested updates to the Red-legged banana prawn harvest control rule to account for low catches within the NPF fishery.

Clarifying Strategic versus Operational Objectives

Further clarification on objectives can be provided as the development stages for the formulation of components for the harvest strategy progress. However at the onset of the meeting where basic elements of harvest strategies were introduced in order to communicate key concepts to stakeholders the project team focussed on a sub-set of the existing established objectives with the TS Finfish fisheries.

The DAFF (2007) Commonwealth Fisheries Harvest Strategy: Policy and Guidelines highlight **minimum standard operational objectives (TEXT Box 1)**. We focus at this stage only on these for two important reasons:

1) They provide the elementary core objectives that meet the criteria for fishing the stocks as biologically sustainable levels while also meeting other objectives
2) They stipulate these objectives such that they are bound by two fundamental components of harvest strategies, the **target reference point** (TRP) and the **limit reference point** (LRP).

We see no utility in progressing the development of harvest strategies unless the stakeholders providing feedback clearly understand the underlying rationale behind the TRP and the LRP. Especially as the co-management fora have been established to obtain the endorsement from the stakeholders on the inclusion of all the key components of the harvest strategies for the Spanish mackerel and Coral trout stocks.

Text Box 1. Example for illustrative purposes:

The minimum standard *operational objectives* of the Harvest Strategy are to

a) maintain the stock at (on average), or return to, a target reference biomass point $B_{TARG.}$
b) maintain stocks above the limit reference biomass point (B_{LIM}), at least 90 per cent of the time.
c) implement rebuilding strategies, if the stock moves below B_{LIM} in repeated years

The overall strategic objectives as outlined in the Finfish Fishery Management plan is provided in Appendix A. Various formal processes are in place to meet these higher level objectives. For example, the committee established and in place to allocate quota in order to directly and indirectly meet these higher level strategic objectives (Appendix A) is the Finfish Quota Management Committee (FQMC).

2.2 Elementary explanation of Target Reference Point

The need for a target reference point for fish stocks was explained to the stakeholders by using biomass as an indicator. Although biomass or changes in biomass like all indicators can be problematic to estimate (via stock assessments and/or absolute abundance surveys) it does provide a clear basis for understanding the effect of fishing on a biological population. Less fish means lower biomass, and lower biomass can impact on recruitment. These relationships were highlighted to remind stakeholders of the risks to stocks. As per Figure 1, panel A, a biomass fluctuating over time at some high level relative to unfished biomass will be reflecting a healthy stock and meet sustainability criteria. More importantly for efficacy and economic and

social goals a higher biomass does mostly mean high catch rates (and as noted before less chance that fishing combined with environmental factors results in fluctuations in stocks that can potentially reduce biomass to lower levels and impact on future recruitment).

Purely for illustration the schematic of equilibrium yield against biomass was introduced to the stakeholders (Figure 1 (panel B)). As an example, biomass at 60% of unfished biomass (here termed B60) was presented as an amount which still provides higher yields than at very low biomass levels (or at unfished levels). The exact number here is not critical; it could be B55. The aim of the exercise was to communicate that without a detailed bio-economic assessment, that one could assume some basic assumptions about fishing costs versus harvest rates and as a generalisation assume that profit (the difference between yield as revenue and costs) would be maximum when biomass was high. Here schematically represented as being higher than that at B50. Given the functional form of a quadratic yield curve with symmetry maximum sustainable yield, referred to as MSY (Figure 1, panel B) is estimated to be a 50% of unfished biomass (hence B50). Note that for the equilibrium model the estimated MSY is not where profit is maximised. The point at which profit is maximised is generally referred to as the point at which maximum economic yield is obtained, referred to as MEY. Figure 1 (panel C), infers that that the TRP of B60 can be achieved over time by setting harvest rates lower when below the target and setting harvest rates higher when above the TRP, if biomass is estimated and the fishery adopts a harvest strategy that incorporates harvest rates that respond to changes in biomass.

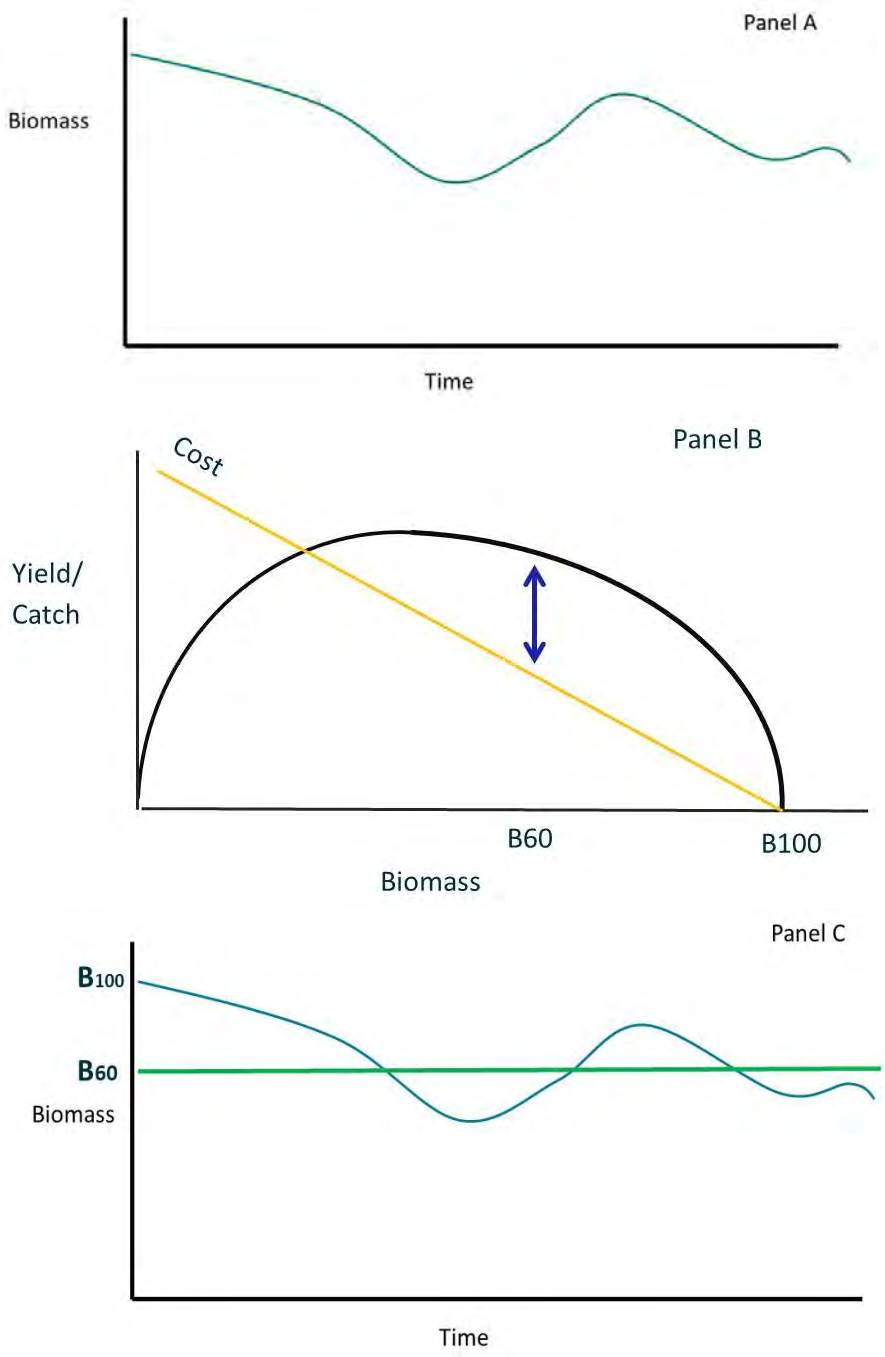

Figure 1. An illustration of the origin of an example *target reference point*. In this case B60 is chosen purely to communicate the rationale for choosing targets that will meet specific biological, social and economic objectives. Changes in fish stock biomass is presented here as the indicator in order to evaluate the concept of the *target reference point* (TRP) with Panel A providing the context of a stock varying over time; slighting lower than unfished biomass (at time = 0). Panel B provides an indication, by using the equilibrium yield versus biomass relationship with fishing cost included, of where profit (difference yield as revenue and cost) is maximised (e.g. B60). Panel C illustrates that the TRP of B60 can be achieved over time by setting harvest rates lower when below the target and setting them higher when above the TRP.

2.3 Elementary explanation of Limit Reference Point

Similarly, to the TRP the rationale for the choice of a *limit reference point* for fish stocks was explained to the stakeholders by using biomass as an indicator. Fish stocks that are impacted by fishing such that over time (Figure 2, panel A) biomass has reduced to low levels relative to a time when biomass was at the highest level - are at risk. Fishing at levels which reduce biomass such that future recruitment is potentially compromised does place the overall stock at risk. When biomass is low, catch rates tend to be low.

The implications for low catch rates are not only economic. To maintain livelihoods of traditional inhabitants a certain level of catch rate which suits their needs is essential. When stocks are depleted to levels where catch rates are very low, the impact can have social consequences as people are forced to seek other sources of food. Using B20 as an example (Figure 2, panel B) which is where biomass is 20% of unfished biomass; the yield can be lower than that as MSY (the peak of the quadratic function as illustrated in graph). The blue arrow pointing to the origin has been placed there to illustrate as was explained to stakeholders that when biomass of fish stocks are fished to low levels (e.g. less than B20); there is a risk that either due to overfishing (or environmental drivers) the stock can be further reduced to levels which place the stock at risk. Thus of primary concern is the fact that lower biomass (of adult stock) generally leads to lower future recruitment. Many factors impact on this relationship and fish tend to be highly fecund, yet the general rule does tend to hold, that is less adults could lead to less juveniles. The stakeholders were well aware of this generalisation given what we know about resources which are exploited.

The secondary consequences of fishing biomass to lower levels such as B20, is that the cost curve here intersects the yield curve (which if equal to revenue) represents the bionomic equilibrium. This is the point, at which given the latter assumptions that are valid in many small-scale fisheries, that revenue is the same as the cost of fishing, thus profit approximates zer0 (as catch rates are low – given low biomass levels). The exact level of biomass that this occurs (e.g. B15 or B30) can only be computed with data on the biology of the stocks and comprehensive economic data on the fishing vessels. This exact estimate would also be sensitive to real time price changes, fuels costs and exchange rates when fish products are exported. The value of B20, for illustrative purposes suits the aim of explaining the concept.

In this situation, as mentioned, profit approximates zero and although maintaining some positive profit may not be a critical objective in a fishery where commercial fishers are less important than subsistence fishers, the direct impacts on all who fish are the same: catch rates are low such that anyone targeting the fish are spending the same or more dollars on fuel and time catching them than they are worth (or need to

be spending, if catch rates are left to recover). Thus when fish stocks are depleted over time (Figure 2, panel c), to levels where they fall below levels such as B20 (this lower *bound*), it is critical to put in place management actions that reduce harvest levels to zero in order to let the stock recover.

When the stock is above B20 for example, the harvest rate should be set at a level where the stock is less impacted than under high fishing pressure such that it can grow in size in order then it approaches the TRP (as explained above).

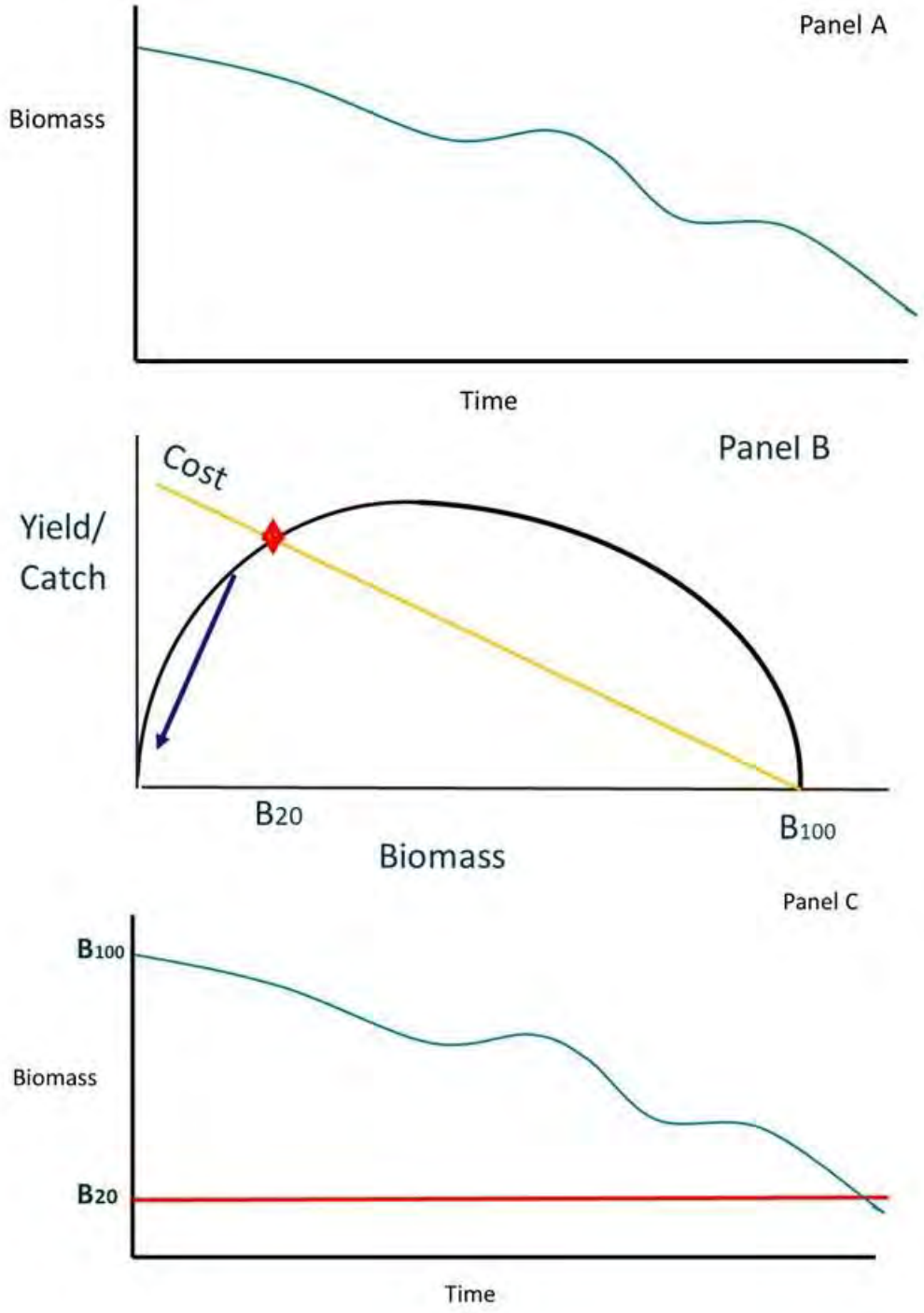

Figure 2. An illustration of the origin of an example *limit reference point.* Panel A provides the context of a stock varying over time where it is much lower than unfished biomass (at time = 0). Panel B provides an indication, by using the equilibrium yield versus biomass relationship with fishing cost included, of where profit (difference yield as revenue and cost) is zero (here at B20); with the primary concern as shown by blue arrow that the stock could be further reduced to even lower levels impacting on recruitment. Given these risks when the biomass of a stock does fall below this limit (here for example B20) the suitable management action would be to reduce harvest to zero in order that it recovers to above that level.

2.4 Establishing the basis for Harvest Control Rules

The two preceding sections provided the rationale for implementing *target reference points* and *limit reference points* and provided some indication of the responses (or actions) potentially required if an indicator such as fish stock biomass fell below or above each of these points. The purpose of explaining these underlying concepts by going back to first principles was seen as important given the terminology is borrowed historically from other research fields and can be subject to mis-interpretation especially in terms of how it implies some prescriptive external control. Rather the actual meaning is more empowering and is a: decision response. Without a full review of literature concepts such as control rules have their historical basis in subjects such as optimal control theory; and words such as "control' and 'rule" engender negative connotations when in fact they are merely a set of decision responses. The implied language is one where it assumes one *is in control of the system if one makes a decision* and the *formal decision response gets called a rule*. Thus, harvest control rules (HCRs) can in fact be re-termed harvest decision responses.

The detailed harvest control rules are chosen beforehand by those responsible for providing inputs into the management of a fishery, they are not imposed. By using the terms *harvest control rules* people are sticking with the terminology in order to be consistent with state, national and international usage. Given the elementary explanations of TRP and LRP as per the above text sections, Figure 3 illustrates by way of a graph of biomass over time and the TRP and LRP, and a text box – the most suitable responses when biomass fluctuates at various levels. These responses are in fact basic but critically important rules to follow if the underlying guidelines for managing fisheries by harvest strategies are to be met.

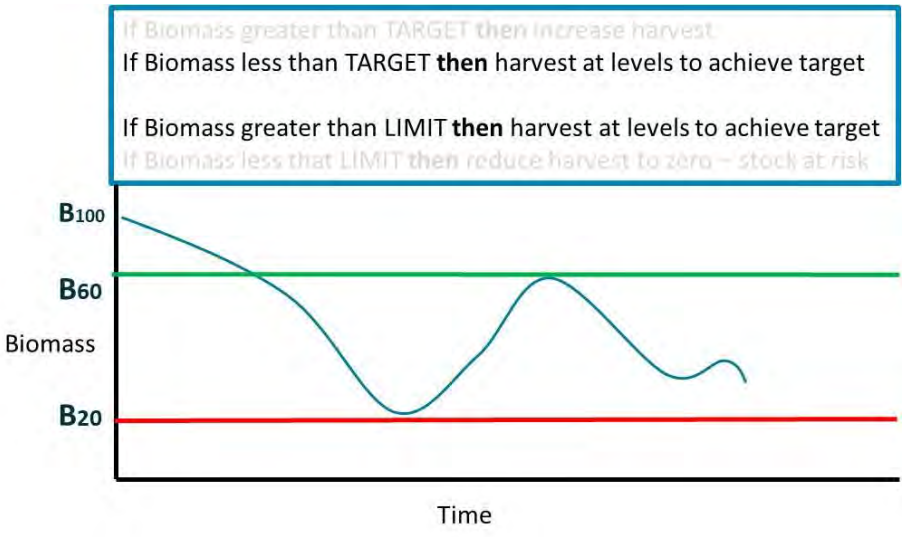

Figure 3. An example of typical decision response/actions, that is harvest control rules (in text box) when biomass is fluctuating between the target (B60) and limit (B20) reference points. B60 and B20 chosen purely for illustrative purposes in this case.

Brief explanation of origin of proxies used for TRP and LRP in certain circumstances

In adopting target and limit reference points in harvest strategies many fisheries have had to resort to choosing proxies for key indicators when data is poor and/or formal evaluation using MSE has not been undertaken. Stakeholder groups are often provided values for these indicators without any explanation of their origin. The team provided some background explanation for the origin of some of the more commonly used proxies. Referring to Figure 4, the maximum sustainable yield for some species of fish can be obtained when biomass is less than 0.5B(unfished). Here for illustration at the level of 40% of unfished biomass (B40).

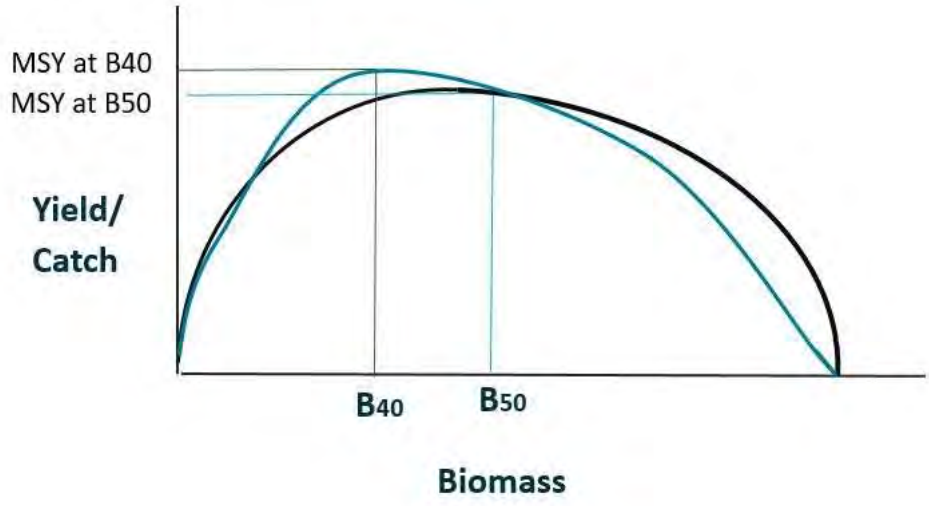

Figure 4. The classic equilibrium yield versus biomass relationship for fish stock, with the symmetrical quadratic function shown as well as one where the peak of yield is less than half of unfished biomass (where biomass is maximum).

Taking into account that maximum yield can in some circumstance be estimated to be at B40 (Figure 4), then the following algebraic mathematical relationships apply:

i) Assuming that it would be high risk to reduce a stock below half (0.5) of its maximum yield (here B40) then one obtains the value of B20 for the limit (that is 0.5x 40% of B = 20% of B, that is B20)

ii) Assuming that biomass at maximum economic yield (MEY, the target) is obtained at 1.2 of maximum sustainable yield (MSY), then if MSY in this case is B40, one obtains the value of B48 for the target (that is 1.2x 40% of B = 48% of B, that is B48)

The more conservative target of B60 (again a proxy for MEY) is obtained via the following assumption, that is, if MSY is 0.5B, then 1.2 X 50% of B = 60% of B, that is B60.

Invariably without MSE testing, interim limit and target reference points could potentially be chosen that are a mix of the assumptions of the above, as there is no formal risk assessment process that is as robust as MSE for evaluating the impacts of all the sources of uncertainty. ABARES has in effect adopted B20 as limit reference point for Torres Strait Finfish Fishery as per reporting (Marton et al. 2017). The most recent review by ABARES which references the most up-to-date assessment at the time of publication refers to the biomass of the Spanish mackerel stock being above B20 (Marton et al. 2017).

Harvest Control Rule – an example provided to initiate discussion

Under conditions where data are not limited and extensive research resources exist for evaluating harvest control rules - the ideal situation in terms of methodology is to conduct management strategy evaluation (MSE). This is done to test the adoption of certain indicators, performance metrics, TRPs, LRPs and response rules when various indicators fall below or above (that is, *trigger*) the reference points. The full set of uncertainties pertinent to fisheries stock assessment and management can be evaluated to a degree. In this case, the funding for full feed-back MSE was not provided at the onset, thus evaluations will not involve full-feedback MSE. Options exist to adopt interim arrangements and by applying the existing management arrangements adopt a qualitative/quantitative framework for some initial preliminary risk-based runs of potential future harvest levels to ascertain given the current assessment models and assumptions where the current estimates of biomass are relative to the interim adopted reference points. This is the only option given the limitations; however the approach can still be informative and allow the stakeholders to get an indication of potential management responses. Uncertainty can be re-introduced within deterministic model simulations of alternative levels of harvest in order to get some indication of risk (although we acknowledge it is *ad hoc* and not best practice). MSE sets the standard. How a stock responds to potential alternative harvest rates, and how this is simulated requires the specification of some more detail around the exact response at various levels of biomass (if this is used as a key indicator of resource status). Here we provide one example. Again only for illustrative purposes as various options are available. Setting the exact rules for how harvest rates can be set at various levels of biomass (and the biomass levels at TRP and LRP) can be as indicated in Figure 5. The figure and associated text was presented to the stakeholders in order to link the previously presented concepts (rationale for TRP and LRP) and how one could relate the choice of harvest rate to changes in estimated biomass to account for these reference points.

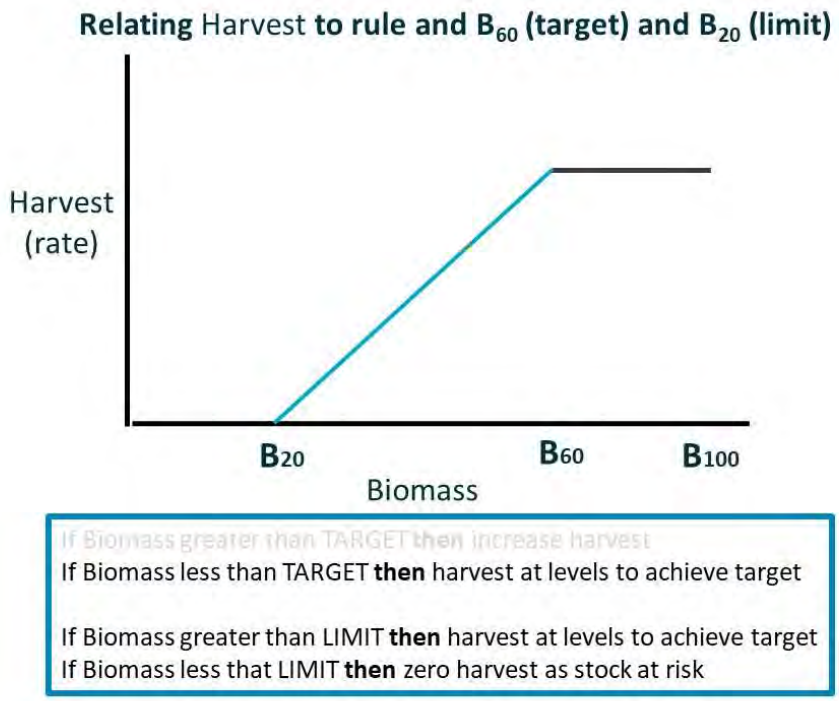

Figure 5. An example of typical decision response/actions here specifying the harvest rate at various levels of biomass. The exact shape of the functional form here is dependent on various factors (see text). As an example, the 'hockey-stick' relationship is shown here whereby harvest is reduced when a stock is below the TRP (B60), and set at zero if below the LPR (B20).

2.5 Key components of harvest strategies and process of development

The formal framework for harvest strategies as outlined by DAFF (2007) has a set of key components:

(1) Indicators (data from the fishery; Docket books & Logbooks)

(2) Monitoring (agreed protocols to obtain data; Population surveys, Size/age monitoring)

(3) Reference points (targets and limits; Stock biomass, Fishing mortality)

(4) Method of assessment (Stock assessment, Catch per Unit of Effort (CPUE) standardisation)

(5) Decision rules (agreed rules for setting catch levels; also called Harvest Control Rules)

For stakeholders this categorisation of key components can at times be daunting as it is merely a list. No background is provided as to the formal linkages of these components. Most importantly many of the components can already be established within a fishery and the management policy. There is not necessarily a need to re-create what is already in place, but rather incorporate existing procedures if suitable. The management of both Spanish mackerel and Coral Trout in the Torres Strait has a set of established arrangements in place, be they licencing arrangements, size limits on individual species, catch restrictions on each fishery when they interact with each other, seasonal closures and no take species.

Figure 6 presents the key components as per (1-5 above) but with purposeful minimal detail in order to communicate the main concepts. Here biomass and catch are listed as Indicators when in fact there are others. Biomass was the example Indicator as per all the preceding sections explaining the background and rationale for the target and limit reference points. This conceptual diagram (Figure 5) was explained to the stakeholders and feedback sort on any aspect that was not clear.

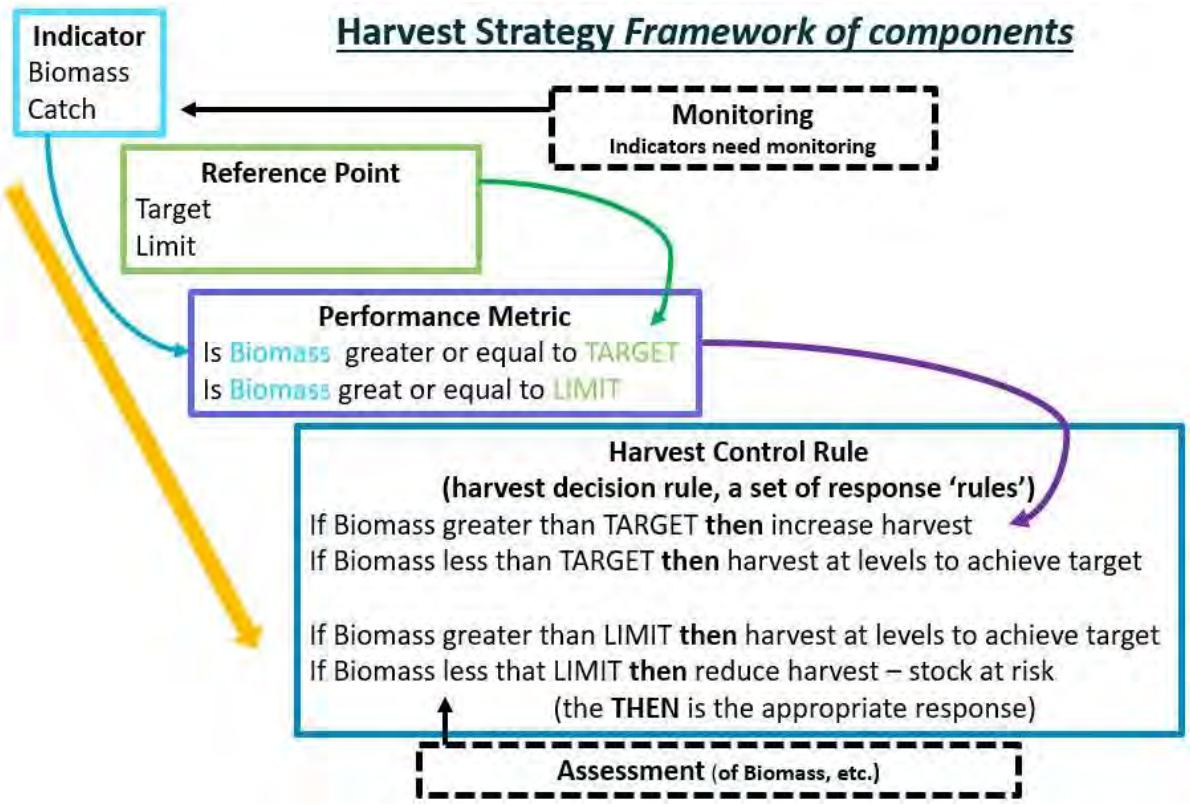

Figure 6. Key components of a harvest strategy. Biomass here is chosen as the example indicator with an indication potential decision response rules embedded within a Harvest Control Rule if and when biomass triggers particular performance metrics depending on status relative to some target or limit reference point.

The development of a harvest strategy proceeds in a series of steps, based on Dowling et al. (2015) which is relevant to data poor species or stocks where more data and information is available. The key steps are:

1. *Compile and review information*
2. *Identify possible indicators e.g. biomass indices from surveys, changes in catch composition, CPUE for species*
3. *Identify reference points for key indicators*
4. *Select an appropriate harvest strategy and decision rules*
5. *If possible, formally evaluate whether the harvest strategy options are likely to achieve the management objectives*
6. *Implementation*

2.6 Indicators and performance metrics

Indicators can be directly derived from logbooks or surveys. In addition than can be estimated using numerical approaches. Thus changes in biomass can be estimated from surveys or changes can be indirectly estimated via assessment models. Indicators such catch, catch per unit of effort (CPUE), abundance indices of numbers of individual fish or biomass can be directly derived. Economic indicators of average boat profit can be directly obtained from economic surveys on the cost breakdown for vessels. Whereas estimates of biomass and fishing mortality can be estimated using various assessment techniques. To provide the stakeholders with some comparative information an example set of Indicators from three other Commonwealth fisheries was presented (Appendix B). The highlight of the comparison with the Finfish stocks, that being Spanish mackerel and Coral trout is that fisheries independent surveys of abundance exist for many other stocks which is not the case for these two species. There are no fisheries independent surveys of changes in stock abundance for Spanish mackerel and coral trout in the Torres Straits. This places a greater emphasis on obtaining reliable fishery dependent data for these stocks.

Further comparisons were made with the performance metrics applied in other fisheries (Appendix C). Again the same three example Commonwealth fisheries were presented (TS Rock Lobster, Northern Prawn fishery Tiger prawn stocks and Blue grenadier [Southern and Eastern Scalefish and Shark Fishery]). Here the exact comparison between the actual values chosen for the TRP and LRP in each fishery is not the important set of factors to consider as the biology, economics and social aspects of each fishery differ. The main point conferred to the stakeholders was that establishing and monitoring additional performance metrics which consider changes in effort, catch, CPUE or average annual variation (AAV) in catch were being used in other fisheries. Stakeholders were encouraged to consider which of these may apply to Spanish mackerel and/or Coral trout in the future for reporting.

A preliminary assessment of the availability of key indicators (Table 1), potential performance metrics (Table 2) overall harvest strategy components (Table 3) for Spanish mackerel and Coral trout was also presented to the stakeholders. In terms of definitions the first two performance metrics (TRP and LRP) are termed STATUS RELATED metrics whereas metrics such as future predicted catch, average annual variation (AAV) in catch, or profit are defined as UTILIZATION RELATED metrics. Priorities under the key objectives are such that meeting agreed to set bounds on STATUS RELATED metrics obtain priority over UTILIZATION RELATED metrics, especially in case of the lower limit reference point (LRP). In other words if a stock falls below the LRP there is no need to trade-off against the UTLIZATION metrics and objectives the harvest rate needs to be constrained. In summary, a number of options exist and interim arrangements are in place which can be incorporated with a draft harvest strategy. The main components which are place which put both stocks at risk (Table 3) are the constant catch interim decision rules.

Table 1. Availability of data for typical indicators (direct and indirect) used to monitor changes in stock productivity, status or exploitation rate for the two main species considered. CT – refers to Coral trout.

Indicator	Coral trout	Spanish mackerel	Challenges/Issues
Catch	YES	YES	Data quality Species identification (catch not recorded by species for 'Coral Trout').
CPUE	(yes), Processing and require standardisation	YES Standardisation procedure currently in place	Data quality Species identification (catch not recorded by species for 'Coral Trout').
Survey Indices	NO	NO	
Estimated biomass	Work in progress Previous estimates for group as a whole	YES, Based on current assessment	Await outcomes of preliminary stock assessment for CT
Estimated fishing mortality	Work in progress	YES, Based on current assessment	Await outcomes of preliminary stock assessment for CT
Others: Profit	NO	No	No economic data collated Future work if analysis requested

Table 2. Potential performance metrics that could be applied to Finfish stocks within a harvest strategy. CT – refers to Coral trout; SM refers to Spanish mackerel.

Performance Metric	Example: set value	Typical sub-rule	Rationale/additional aspects to note
Target Reference Point **Is Biomass<TRP**	60% of B(unfished) B60	Current Biomass must be = B60, of if not the lower catches to achieve it…. by a set time Note: if Current biomass > B60 then catches are too low (increase catch)	It is what you want to achieve – aspire too Represents an amount above BMSY in many cases to obtain higher catch rates (lower costs) and achieve greater economic benefits
Limit Reference Point **Is Biomass >LRP**	20% of B(unfished) B20	Current biomass > B20	The most critically important Performance Metric.
Catch (predicted future catch)	SITUATIONAL Depends on stocks 134 tonnes (CT) 125 tonnes (SM)	Catch at levels which sustain fishery	However, catch in future must vary around some amount which still meets Reference Point rules Over-ridden by above two rules
Average annual variation in catch (AAV) Catch variability	Depends on how much variability is acceptable 10%; 15%, 30%?	Catch variability must be <15% (over set time period)	Set the harvest rate (and take into account environmental variability) such that catch year on year is not too variable

Table 3. Preliminary assessment for Coral trout and Spanish mackerel as to which components of a harvest strategy some interim items are already part in place and/or considered or applied in the current situation.

Component	Coral trout (CT)	Spanish mackerel (SM)
Indicators	Catch, CPUE Work in progress (est. biomass, F) NO SURVEYS	Catch, CPUE Est biomass, F NO SURVEYS
Reference Points	No target reference point (TRP) Proxy B_{20} used by ABARES	Interim target reference point B60 (preferred) Proxy B_{20} used by ABARES
Performance Metrics	Example: is Biomass < TRP is Biomass > LRP At this stage not able to produce until assessment complete	Yes – are able to dynamically estimate Bcurrent versus TRP, (LRP) And project catch under future scenarios And project catch variability
Decision rules (interim)	"Constant catch" Interim The TAC (134.5 tonnes) is based on the average catches 2001-2005.	"Constant catch" Interim The RBC is based on median harvest of two stock analyses to achieve B_{60}
Monitoring	Catch Effort (not species specific) Data quality issues	Catch Effort Spatial, and WIND, Lunar By sector and Fish length-at-age (planning)
Assessment	Work in progress	Yes

3 Spanish mackerel

3.1 Overall progress

The project component has made steady progress against objectives. The project is on track to meet scheduled milestones. Project methodologies and the stock model are developed. Updates to project data are continuous according to availability from AFMA. Analyses are in accord with new data. Final project outputs will use the latest data to inform fishery stakeholders and management on harvest strategy options.

The project has undertaken analyses of the fishery data collated at the start of the project. Improved data inputs of standardised catch rates will define new population modelling outputs. Simplifications and improvements to the modelling allow for calculation of more reference points based on the current exploitable population size of Spanish mackerel. Potential reference points have been provided by AFMA and the Queensland Sustainable Fisheries Strategy (SFS) initiative. Thus Total Allowable Catch (TAC) harvest and Total Allowable Effort (TAE) effort measures (standardised boat days) will be calculated for: a) equilibrium B_{MSY} and F_{MSY}, b) equilibrium $B_{60\%}$ and $F_{60\%}$, and c) B_{2018} for $F_{60\%}$ and F_{MSY}. Simple model projections of fishing effort will show what is required to meet biomass targets under certain periods and how example harvest strategies may perform.

Key summary points:

- Stock model and reference point structures developed.
- 2017–2018 data update – still to be actioned. When actioned, data inputs will then encompass all fishing years and allow stock assessment estimates for the complete 2018 fishing-year (to the end of June 2018). Catch rate analyses are being refined, as more data are available.
- Presentation of results and frameworks to AFMA industry members and managers in March 2018.

3.2 Project data and analyses

The Spanish mackerel stock model (annual age-structured estimates) will use information from various sources to predict the spawning stock biomass and other indicators and reference points. The key time-series data inputs are 1) annual harvests by fishing sector 1940…2018, 2) standardised annual catch rates of Spanish mackerel 1989…2018 (generated from TVH AFMA logbooks) and 3) fish age-length composition

data 2000…2002 (no new age data are available). The data are stored on the secure DAF server for stock assessment. Updates on data will occur throughout the project as required for the population model – new update is actioned for July 2018. AFMA maintains most of the data, such as logbook records. Some abiotic and remote sensing environmental data will be collated by Andrew Trappet (to be actioned by AFMA) to add to project descriptions of fishery trends.

3.3 Standardised catch rates

An updated generalised linear model estimated catch rates for the 2003–2016 fishing years. The analysis of variance table is below. The model analysed the number of Spanish mackerel harvested per boat operation day (nfish2). Predictions from the regression model are standardised numbers of fish. They were standardised for difference between fishing boats, seasons (time of year: c12, cs2, c6 and cs6), number of tender boats, hours fished, lunar phases and wind strengths and directions. Interestingly predicted catch rates declined from 24 fish in 2015 to 18 fish 2016 (tabled below). A data update will be actioned in July 2018 to verify more current catch rates. There has been a steady decline in catch rates since 2009 (Figure 7). This is of interest after annual harvests had declined (Figure 8).

Wald tests for dropping terms

Term	Wald statistic	d.f.	F statistic	F pr.
fishyear	173.4	13	13.34	<0.001
boat	2332.5	20	116.63	<0.001
c12	5.0	1	4.96	0.026
cs12	135.6	1	135.62	<0.001
c6	118.8	1	118.78	<0.001
cs6	32.2	1	32.25	<0.001
tendersn	244.3	1	244.34	<0.001
hours2	51.9	1	51.87	<0.001
lunar	62.9	1	62.92	<0.001
lunar_adv	273.2	1	273.19	<0.001
windns	4.6	1	4.59	0.032
windnsQ	5.0	1	5.02	0.025
windew	7.5	1	7.51	0.006
windewQ	23.3	1	23.25	<0.001

Residual d.f. 7991

Predictions from regression model

These predictions are estimated mean values, formed on the scale of the response variable, adjusted with respect to some factors as specified below.

The predictions have been formed only for those combinations of factor levels for which means can be estimated without involving aliased parameters.

The predictions are based on fixed values of some variates:

Variate	Fixed value	Source of value
c12	-0.01290	Mean of variate

cs12	-0.3414	Mean of variate
c6	-0.3178	Mean of variate
cs6	-0.04797	Mean of variate
tendersn	1.905	Mean of variate
hours2	13.37	Mean of variate
lunar	0.4869	Mean of variate
lunar_adv	0.4784	Mean of variate
windns	-10.03	Mean of variate
windnsQ	145.9	Mean of variate
windew	13.93	Mean of variate
windewQ	287.8	Mean of variate

The predictions have been standardized by averaging over the levels of some factors:

Factor	Weighting policy	Status of weights
boat	Marginal weights	Constant over levels of other factors

The standard errors are appropriate for interpretation of the predictions as summaries of the data rather than as forecasts of new observations.

Response variate: nfish2

fishyear	Prediction	s.e.
2003	23.75	0.7010
2004	25.51	0.6040
2005	25.92	0.5783
2006	26.54	0.7243
2007	26.71	0.8953
2008	27.16	1.0459
2009	31.26	1.1082
2010	27.92	1.1062
2011	29.14	1.0982
2012	26.18	0.9901
2013	26.21	0.9307
2014	21.32	0.8314
2015	23.73	0.9052
2016	18.14	0.7202

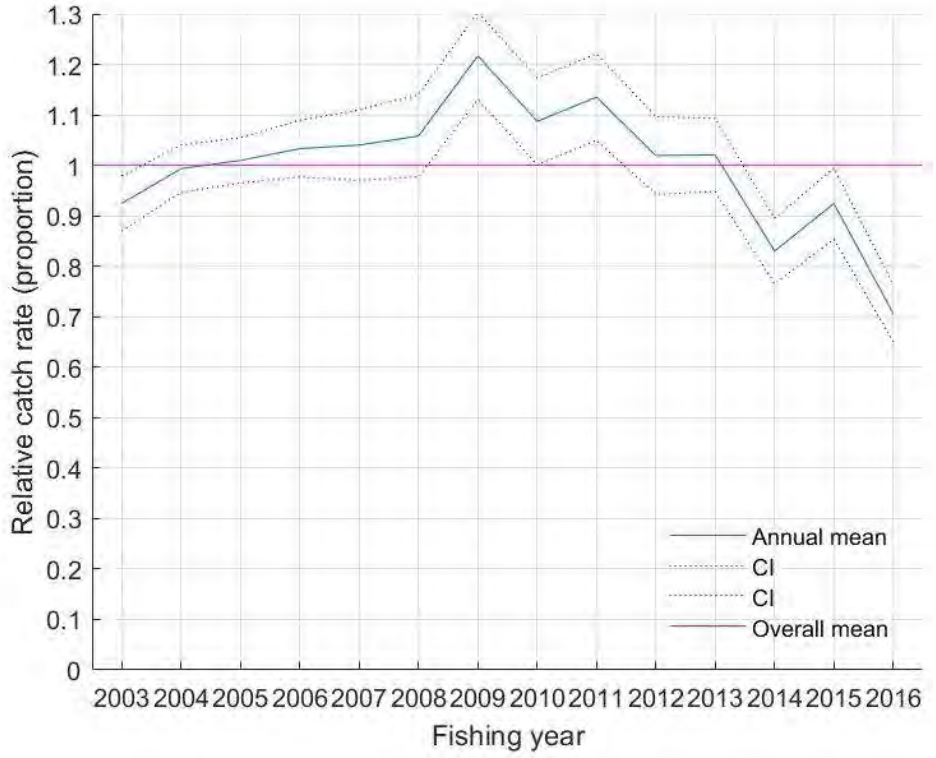

Figure 7. Standardised catch rates of Spanish mackerel. Catch rates were normalised to the 2003–2016 mean.

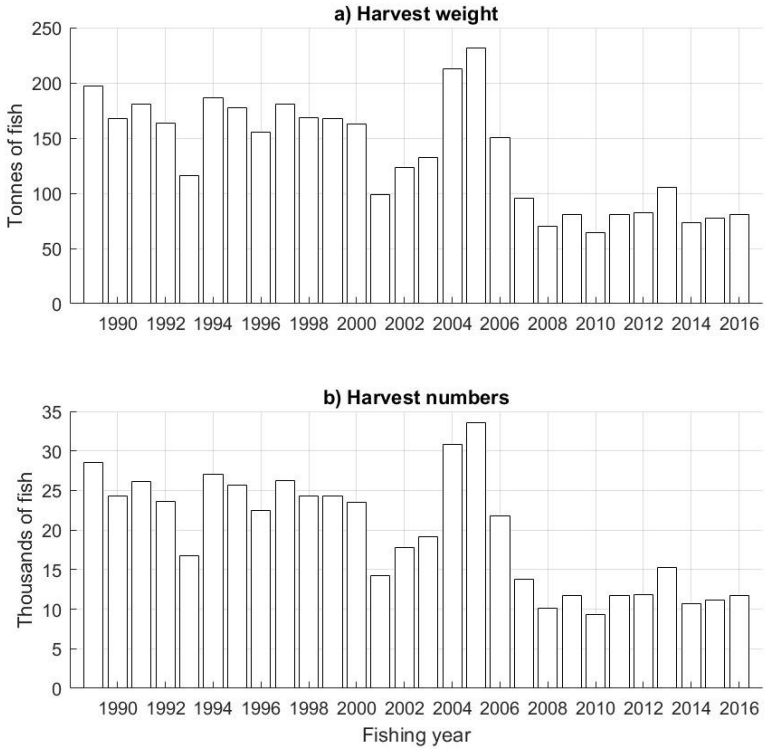

Figure 8. Harvests of Spanish mackerel by fishing year.

3.4 Stock model

The stock assessment model reviewed by the Torres Strait Finfish Scientific Technical Working Group advised that the Torres Strait Finfish Working Group consider a recommended biological catch of 125 t of Spanish mackerel for the 2017–18 fishing season (AFMA 2016). This recommendation used a precautionary approach to account for uncertainties in data and a preference to maintain the stock at reference point levels above B_{40} and closer to B_{60}.

The assessment will refit the same model to updated data and consider model scenarios:

- Levels of harvest by sector
- Standardised catch rate (hyperstability, indicator vessels)
- Vulnerability of fish – logistic or domed
- Natural mortality

The analysis outputs will advise on the best management model for the data and assumptions. Spawning biomass reference points for $S_{LIMIT=20\%}$, $S_{MSY\approx40\%}$ and $S_{TARGET=60\%}$ shall be clarified for setting recommended biological harvest, commercial harvest quotas and sectoral allocations. Spawning biomass is referred to where possible. The logic is that management needs to ensure sustainability of the stock and that is achieved by keeping the spawning biomass from falling low ($<B_{msy} \sim B_{40}$) where future recruitment might be compromised. General indicators of biomass, e.g. total-biomass and sometimes exploitable-biomass tell us about the short-term health of the fishery as opposed to the fish stock.

An example template for the reference points and a harvest control rule was discussed at the March 2018 TS FinFish Resource Assessment Group meeting. The simple calculations consider the distributions of current exploitable biomass and sustainable fishing (harvest) rates to estimate distributions Spanish mackerel yields (Y – Recommended Biological harvest) (example using the stock assessment for 2014,(Figure 9). The distributions can form median estimates and confidence intervals.

The formula for Figure 9 follows the similar methodology as in the Australian Government's – Commonwealth Harvest Strategy Policy. The concept uses a rule to reduce fishing pressure when stock biomass declines below B_{MSY} (Figure 10). The concepts in Figure 9 and Figure 10 can be transposed to represent a Recommended Biological Harvest conditional on the current state of the fish biomass (Figure 11). These theoretical examples are hypothetical at this time. Further review by the management working groups will advise on their practicality and changes required.

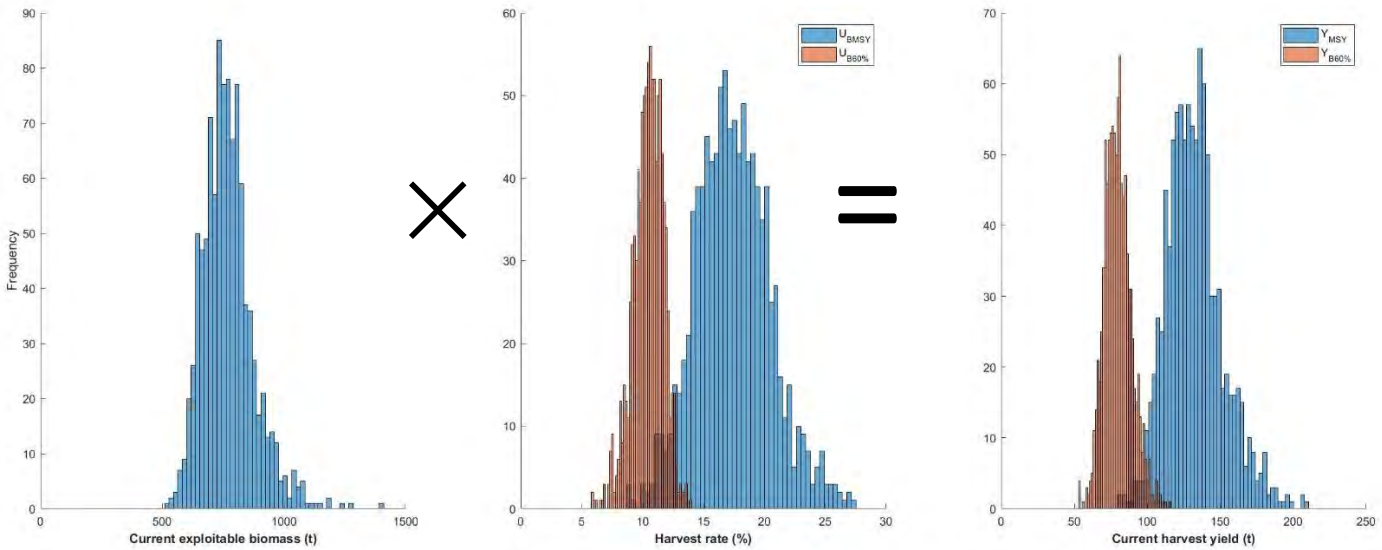

Figure 9. Example calculation of Spanish mackerel yield tonnes for 2014.

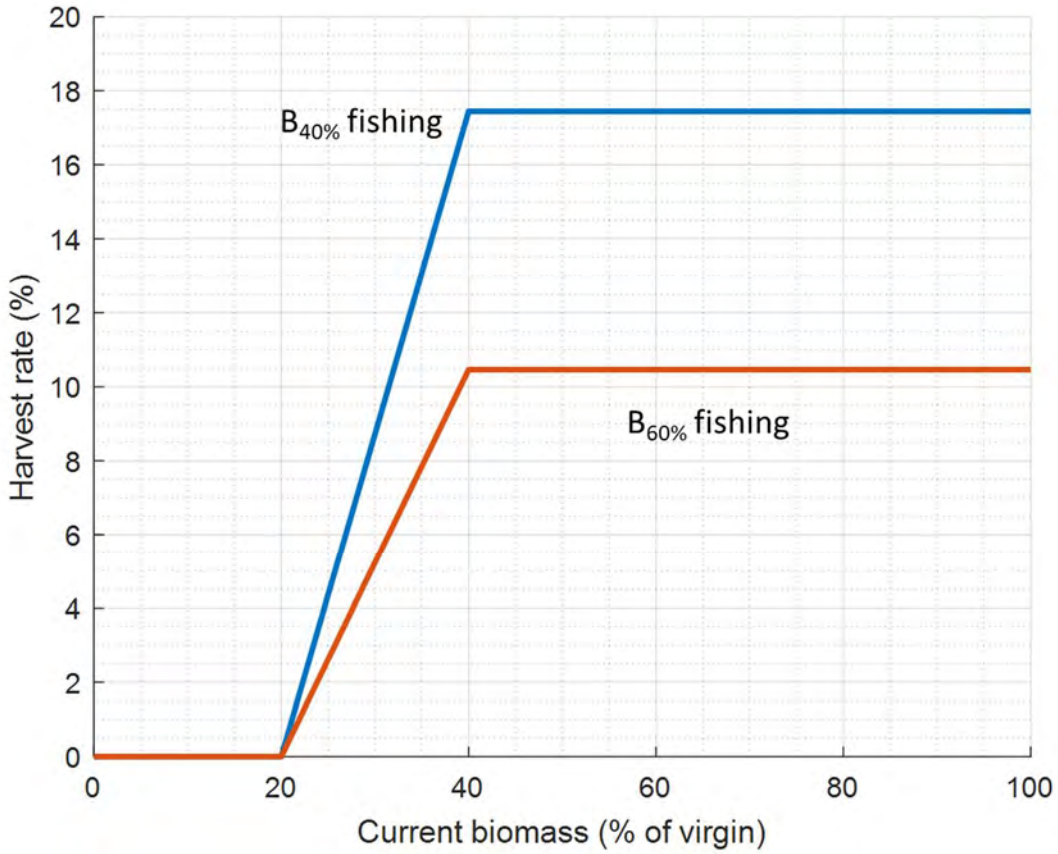

Figure 10. Example hockey stick control rule for reducing fishing pressure (harvest rates) when fish biomass falls below 40% ≈ B_{MSY}. Two fishing strategies are illustrated: 1) fishing for maximum sustainable yield (B_{40} fishing) and 2) fishing for better profit ~ maximum economic yield (B_{60} fishing).

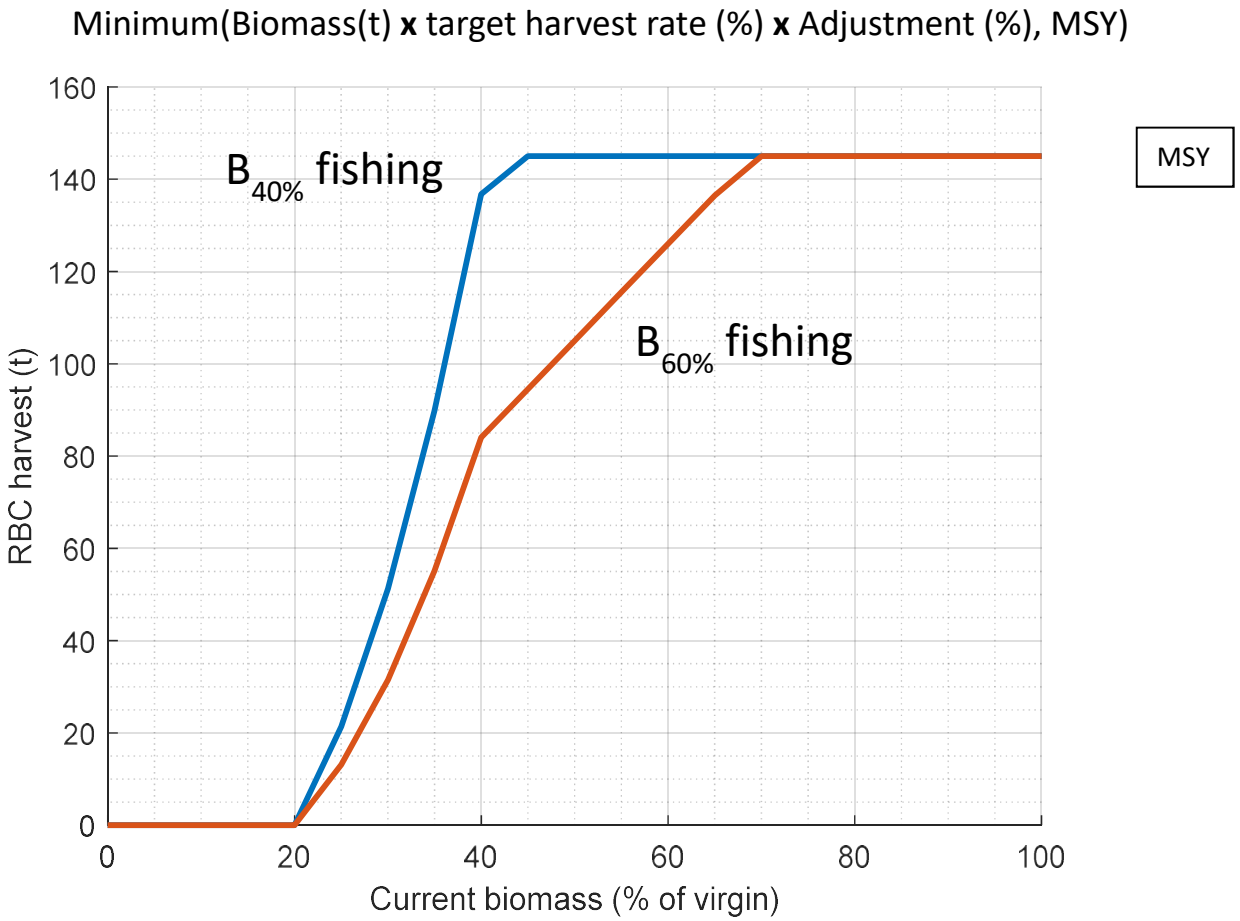

Figure 11. Example hockey stick control rule for reducing the recommended biological harvest (RBC) when fish biomass falls. Two management strategies are illustrated: 1) fishing for maximum sustainable yield (B_{40} fishing) and 2) fishing for greater profit at an proxy estimate of maximum economic yield (B_{60} fishing).

4 Work in progress/next steps

A number of key challenges have been identified, many associated with evaluating alternative management options and uncertainty. A request was made to summarise future options for management strategy evaluation for each stock (Coral trout and Spanish mackerel). MSE frameworks are key examples of formal risk assessment methods, given their focus on the identification and modelling of uncertainties as well as in balancing different representations of resource dynamics (Sainsbury et al. 2000). They involve modelling each step of the formal adaptive-management approach and evaluating the consequences of a range of management strategies, especially in the face of uncertainty. This includes consideration of the implications, for both the resource and its stakeholders, of alternative combinations of monitoring data, analytical procedures, and decision rules. By identifying and evaluating trade-offs in performance across a range of management objectives, MSE provides advice on whether different management measures can be reconciled and whether they are robust to inherent uncertainties in all inputs and assumptions used. Plagányi et al. (2013) provide an example of using a MSE to integrate across biological and climate uncertainties, and test the performance and risks (biological, multispecies, economic) of alternative management strategies applied to the Torres Strait *bêche-de-mer* (sea cucumber) fishery. Lessons learnt from these modelling exercises will be used in developing appropriate harvest strategies for implementation, and where necessary the modelling framework can be modified and used to test additional strategies.

The following will be presented in the next report (Progress Report – 20th June 2018):

- Feedback on the key Action Items from meeting held to workshop components for harvest strategy development (and during project team presentations – Appendix E), and
- Overview of existing management arrangements for each stock and summary of data projects ongoing (e.g. Murphy et al. 2016), previous assessment and modelling work (brief summary which will be expanded for next Milestone report), and
- Summary of progress with Coral trout data collation, CPUE analysis, collation of mapping data and planned methodology with stock assessment.

5 Acknowledgements

Funding for this project has been provided by AFMA and CSIRO Oceans and Atmosphere. We thank all the stakeholders, the TSRA and AFMA who have provided input via the RAG/WG meetings. We are grateful to Jerzy Filar (UQ) for supporting UQ's participation in the project.

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Appendix A - Strategic objectives

Finfish Fishery Management Plan objectives

Objective 1: To acknowledge and protect the traditional way of life and livelihood of Traditional Inhabitants, including their rights in relation to traditional fishing for finfish.

Objective 2: Harvest levels are at, or below levels that maintain biologically viable stocks of target and non-target species.

Objective 3: To provide for the use and conservation of Torres Strait Finfish resources in a way that minimises impact on the marine environment.

Objective 4: To optimise economic viability of the fishery.

Objective 5: To provide for optimal utilisation, cooperative management, and for catch sharing to occur with PNG.

Appendix B - Indicators

Examples provided from other fisheries: Indicators

Indicator	TS – Rock Lobster	NPF (Tiger prawns)	South East Fishery (Blue grenadier)
Catch	YES	YES	YES
CPUE	YES Standardisation procedure currently in place	YES Fishing power analysis	YES
Survey Indices	YES (2 series before)	Yes (2 series, 1 in alternative years)	Survey Index
Estimated biomass	YES, Based on current assessment	YES, Based on current assessment	YES, Based on current assessment
Estimated fishing mortality	YES, Based on current assessment	n/a	YES, Based on current assessment

Appendix C - Performance metrics

Examples provided from other fisheries: Performance metrics

Components	TS – Rock Lobster	NPF (Tiger prawns)	South East Fishery (Blue grenadier)
TRP	B65	B59 100% Bmey	B48 (Multi-species fishery) Defaults to proxy
LRP	B32 'Conservative'	B27.7 (approx.) 0.5 Bmsy (5 years sliding)	B20 (Multi-species fishery) Defaults to proxy
Catch/effort	yes	yes	yes
AAV Catch Catch variability	For MSE	For MSE	(for MSE if relevant)
Other	(profit/supply chain)	Profit (NPV calculated as part of optimisation)	unknown

Notes: in these examples typically: TRP > Bmsy, (in region of B60); LRP ~ 0.5Bmsy or > approx. B20 and above. All numbers are *'illustrative'* – as some Harvest Strategies are in development . For NPF, value is average of grooved and brown tiger prawns (0.5, 0.6, B_{MSY}, 0.65, 0.54, B_{MEY}). NPV – net present value.

Appendix D - List of Meeting sessions and Action items

First session: Focus on Coral Trout

Meeting Action 1: Review uncertainties and practical management issues of assessing Coral Trout on the basis of main species (*Plectropomus leopardus*).

Meeting Action 2: As part of (A.1) review the implications for setting aggregated catch limits (for group of species) if Coral Trout is assessed on the basis of single species. Conversely, document potential increased uncertainties (and risks) with non-species specific assessments.

Meeting Action 3: Ascertain what was rationale for setting the current interim magnitude of Coral Trout catch levels. Where did the numbers come from? (we need information from WG and RAG).

Second session: Focus on Spanish mackerel

Meeting Action 4: Adopt a Limit Reference Point for Spanish mackerel.

Meeting Action 5: Adopt performance metrics for Spanish mackerel based on current standard performance measures/metrics used in fisheries.

Meeting Action 6: Discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points. Explore 'response' rules to each reference point.

Meeting Action 7: Finalise agreement on different monitoring information that will be collected such as catch-at-age data (with consensus on who, when and by when?).

Third session: Key challenges, risks and uncertainties

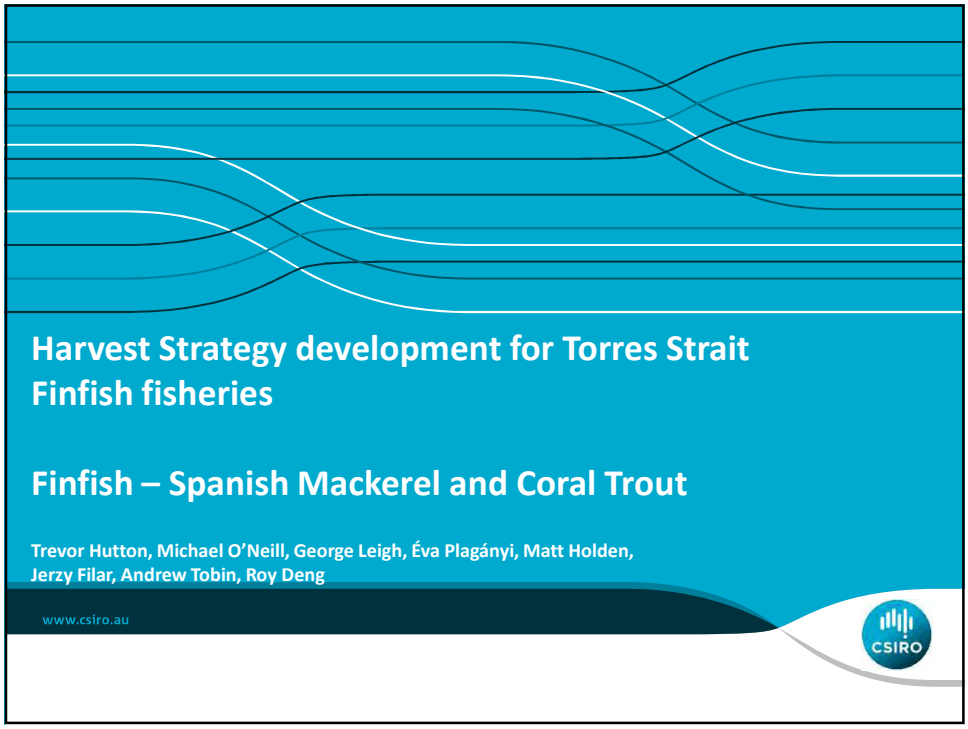
Meeting Action 8: Review potential use of additional indicators (e.g. profit).

Meeting Action 9: Review potential use of additional performance metrics.

Fourth session: Wrap up/key points raised not considered before meeting

Meeting Action 10: Clearly document new points raised.

Appendix E - Presentations provided during meeting



Meeting agenda

Overview - Trevor

Focus on Coral Trout - Andrew Tobin and George Leigh

Focus on Spanish mackerel - Andrew Tobin and Michael O'Neill

Meeting action items

Broken day into session to workshop through detail and items

Harvest Strategy

It is a formal framework that sets out the management actions to achieve objectives

To be effective harvest strategies must contain:

- processes for monitoring and assessing the biological and economic conditions in a fishery
- decision rules for controlling the harvest according to the conditions

Reference: ***Commonwealth Fisheries HS: Policy and Guidelines***

Harvest Strategy

Why use this framework?

So management is clear and transparent

Because as a process it is inclusive (agreement sort at each step)

Once some structure in place it is cost-effective

Although adaptive (changing circumstances may mean folk have to re-address some aspect)

The Reference material we referred to:

Harvest Strategy Policy document and Guidelines (2007)

Other fisheries harvest strategies (various stages of development)

Torres Strait Rock Lobster, TS beche der mer, Northern Prawn Fishery, SESSF (Southern and Eastern Scalefish and Shark Fishery)

Various key international published papers – Dowling *et al* (2008, 2014, 2015, 2016) – Guidelines on developing harvest strategies, empirical, case studies.

Broader process

It is a formal framework to achieve sustainability, social and economic objectives (probably too broad a definition)

Indirectly/directly achieve the strategic Objectives via a series of *operational objectives* (tactical "short" term)

Management Plan deals with higher level strategic Objectives

Finfish Quota Management Committee (FQMC) process is there to meet key strategic Objectives

Outline of overview presentation

First part of presentation: highlight minimum standard *operational objectives* for sustainability strategic Objective

Explain rationale behind reference points

Explain all the components of Harvest Strategies and how they formally link into a framework:

(e.g. what are typical harvest control rules)

Rest of meeting: detailed presentation of species and workshopping the 'development of harvest strategies'.

Torres Strait PZJA Protected Zone Joint Authority

Queensland Government

Finfish Fishery Management Plan objectives

Objective 1: To acknowledge and protect the traditional way of life and livelihood of Traditional Inhabitants, including their rights in relation to traditional fishing for finfish.

Objective 2: Harvest levels are at, or below levels that maintain biologically viable stocks of target and non-target species.

Objective 3: To provide for the use and conservation of Torres Strait Finfish resources in a way that minimises impact on the marine environment.

Objective 4: To optimise economic viability of the fishery.

Objective 5: To provide for optimal utilisation, cooperative management, and for catch sharing to occur with PNG.

Operational objectives in Harvest Strategy that would meet strategic Objective 2 (and 4,..)

The *operational objectives* of the Harvest Strategy are to:

a) maintain the stock at (on average), or return to, a target reference biomass point $B_{TARG.}$

b) maintain stocks above the limit reference biomass point (B_{LIM}), at least 90 per cent of the time.

c) implement rebuilding strategies, if the stock moves below B_{LIM} in repeated years.

Strategic Objectives and operational objectives

Strategic Objective	Operational Objectives/ strategies/ performance criteria/ checking outcomes
To acknowledge and protect the traditional way of life and livelihood of Traditional Inhabitants, including their rights in relation to traditional fishing for finfish (Number 1)	**Various strategies and performance criteria in Management Plan and outcomes being monitored and broader community processes**
Harvest levels are at, or below levels that maintain biologically viable stocks of target and non-target species (Number 2)	a) maintain the stock at (on average), or return to, a target reference biomass point B_{TARG}. b) maintain stocks above the limit reference biomass point (B_{LIM}), at least 90 per cent of the time. c) implement rebuilding strategies, if the stock moves below B_{LIM} in repeated years.
To optimise economic viability of the fishery (Number 4)	**Various strategies and performance criteria in Management Plan and outcomes being monitored and broader community processes (the FQMC)**

Range of tools for managing stocks where some are apart from limiting harvest of target species

Licences (if a form of effort control on one sector – can be for economic, harvest, conservation …. Objectives)

Size limits *(part of limiting harvest)*

Catch restrictions on each fishery when interacting with other

Gear restrictions (part of limiting harvest) – but also conservation Objective

Seasonal closures *(part of limiting harvest)*

No take species (conservation Objective)

Operational objectives in Harvest Strategy that would meet strategic Objective 2 (and 4,..)

The *operational objectives* of the Harvest Strategy are to:

a) maintain the stock at (on average), or return to, a target reference biomass point $B_{TARG.}$

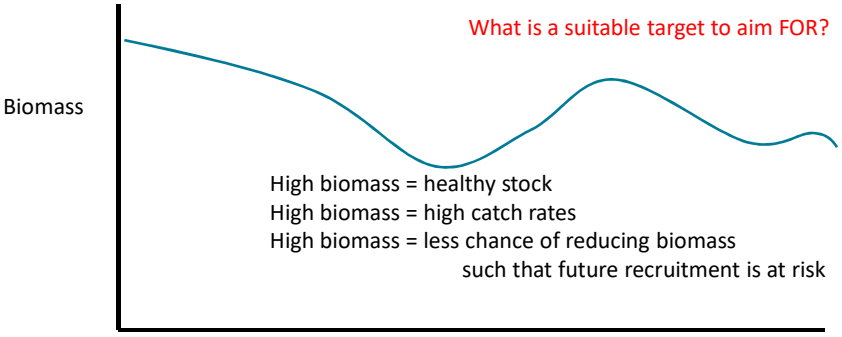
b) maintain stocks above the limit reference biomass point (B_{LIM}), at least 90 per cent of the time.

c) implement rebuilding strategies, if the stock moves below B_{LIM} in repeated years.

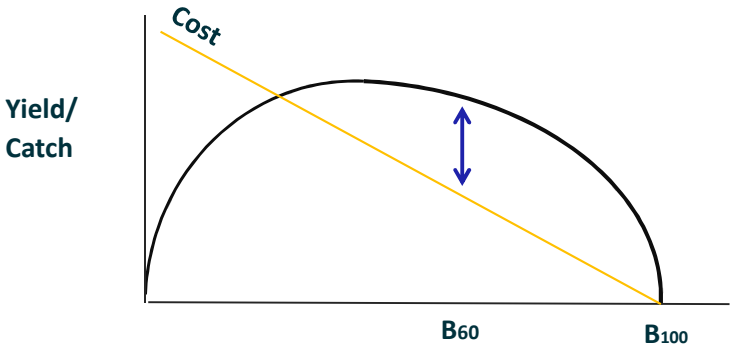
Origin of concepts

Where does Target Reference Point come from?

What is rationale behind it?

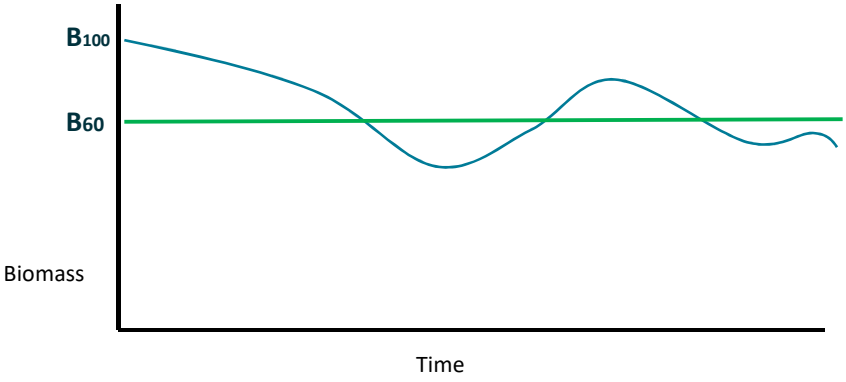


Target Reference Point - schematic



Origin of concepts

Example where B_{60} shown ….

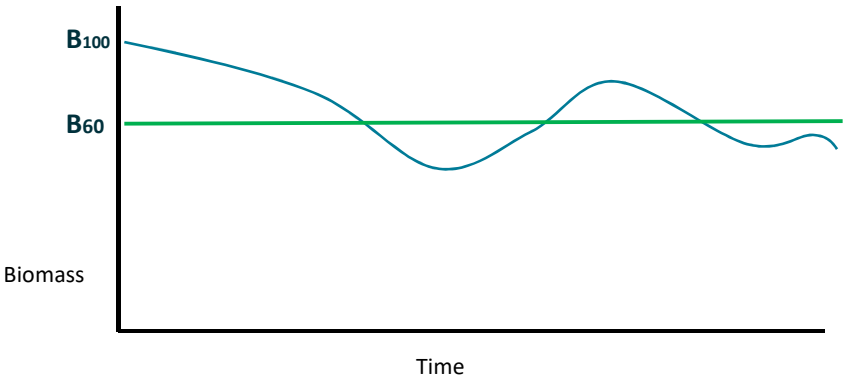


How would you respond

In order to meet *operational objective* of being at or around Target

If you below it reduce harvest (catches) so biomass increases

If above can increase catch

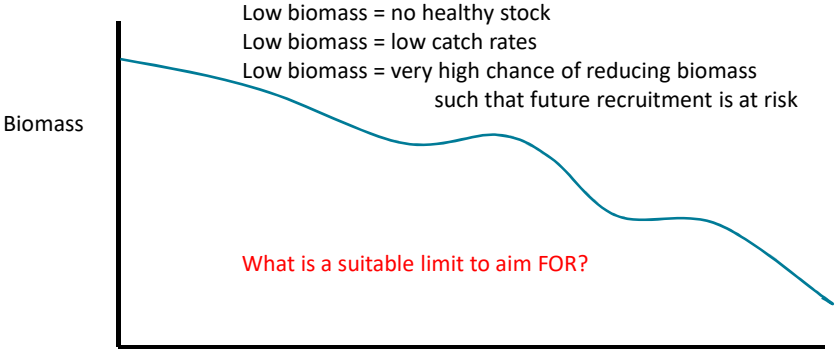


Origin of concepts

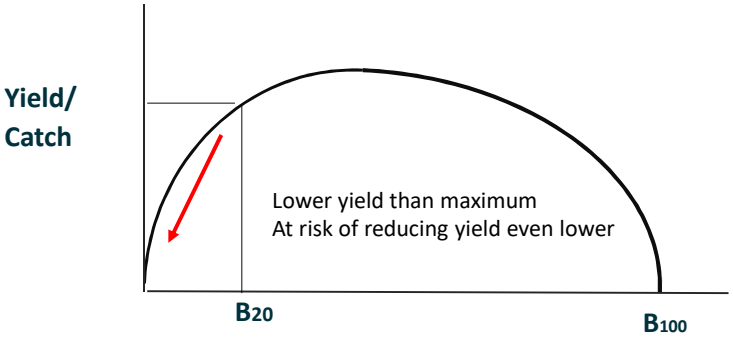
Where does Limit Reference Point come from?

What is rationale behind it?

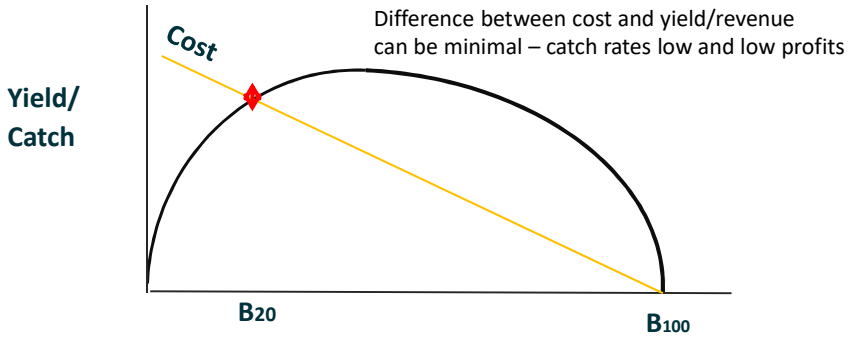
Low biomass = no healthy stock
Low biomass = low catch rates
Low biomass = very high chance of reducing biomass such that future recruitment is at risk



Limit Reference Point - schematic

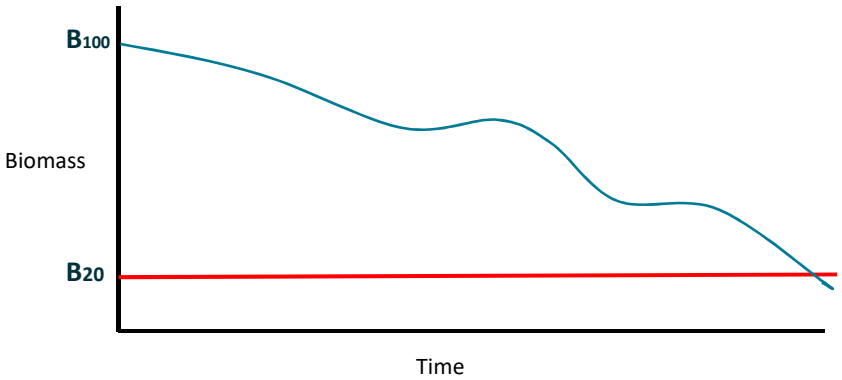


Limit Reference Point - schematic



Origin of concepts

Example where B_{20} shown ….

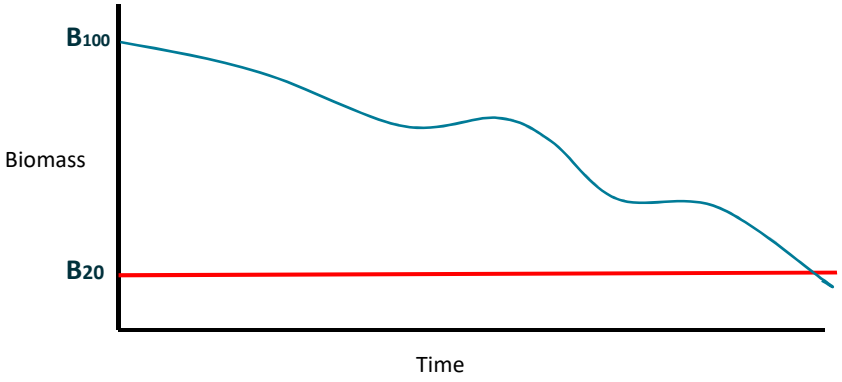


How would you respond

In order to meet *operational objective* of: must be ABOVE limit

If you below it no harvest (that is no catches) so biomass increases

If above can increase catch but at levels that rebuild biomass towards Target



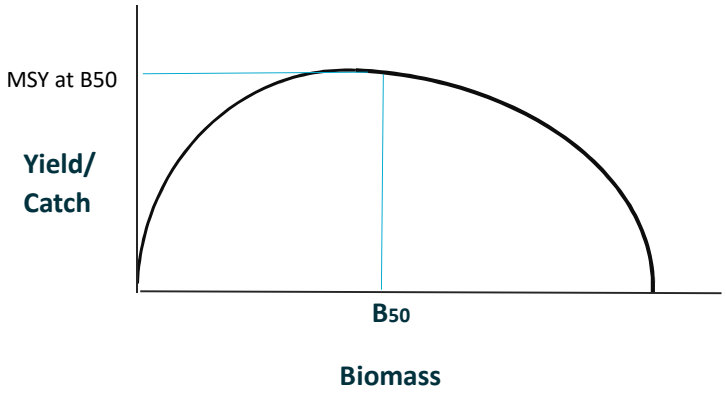
B(20) – already "used" by ABARES – as it is standard practice to proxies

TABLE 16.1 Status of the Torres Strait Finfish Fishery

Status	2015		2016		Comments
Biological status	Fishing mortality	Biomass	Fishing mortality	Biomass	
Coral trout (*Plectropomus* spp., *Variola* spp.)					Management strategy evaluation testing suggests that current catches are well below the level likely to lead to biomass declines. Most recent biomass estimate indicated a biomass above $0.6B_0$.
Spanish mackerel (*Scomberomorus commerson*)					Current fishing mortality rate is below that required to produce MSY. Most recent estimates of biomass are above B_{20}.

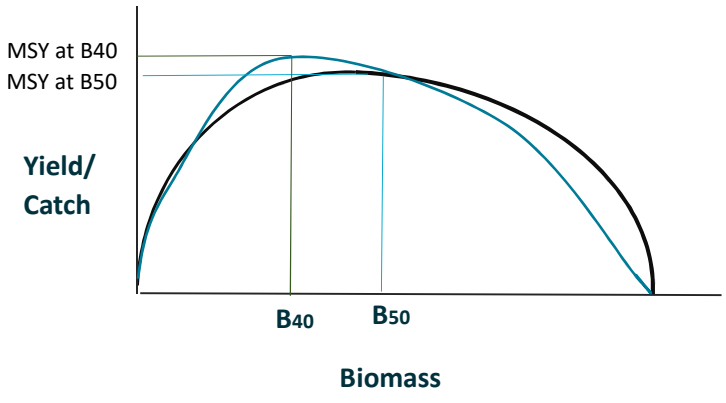
Origin of other proxies

Classic equilibrium based on many fish stocks



Origin of other proxies

Classic equilibrium based on a range of fish stocks



Proxies

Bmsy is 40% or more of B (that is B40)

Blim is 0.5Bmsy thus Blim = B20

Btarg is 1.2Bmsy thus Btarg is B48 (based in additional assumption that Bmey is 1.2 Bmsy)

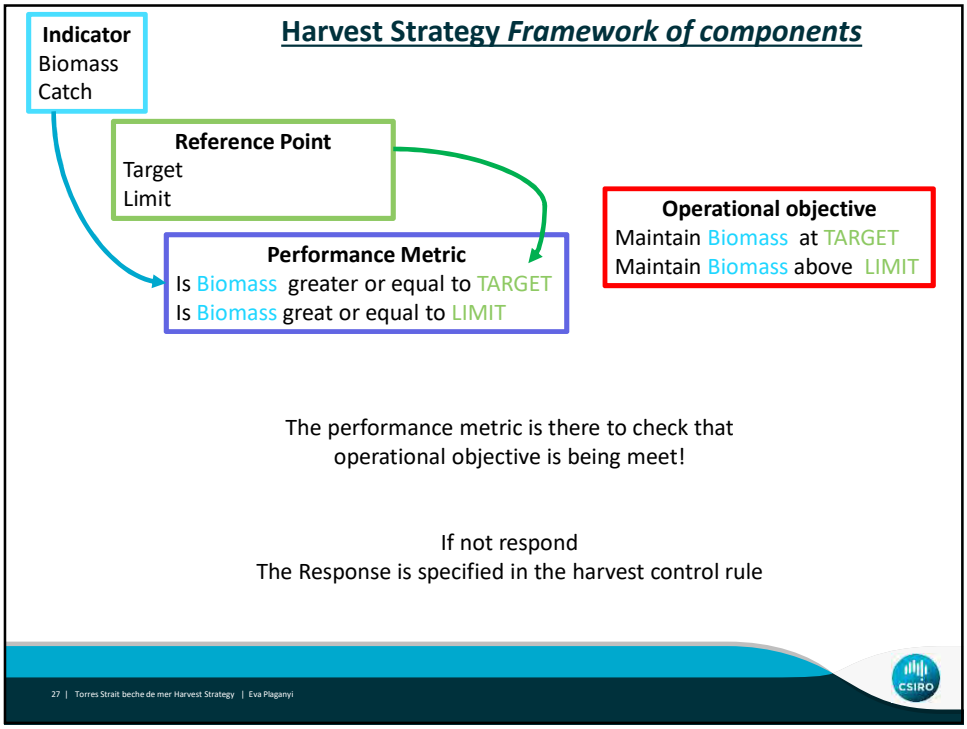
However Bmsy can be as higher than B40, more in region of classic assumption of B50.

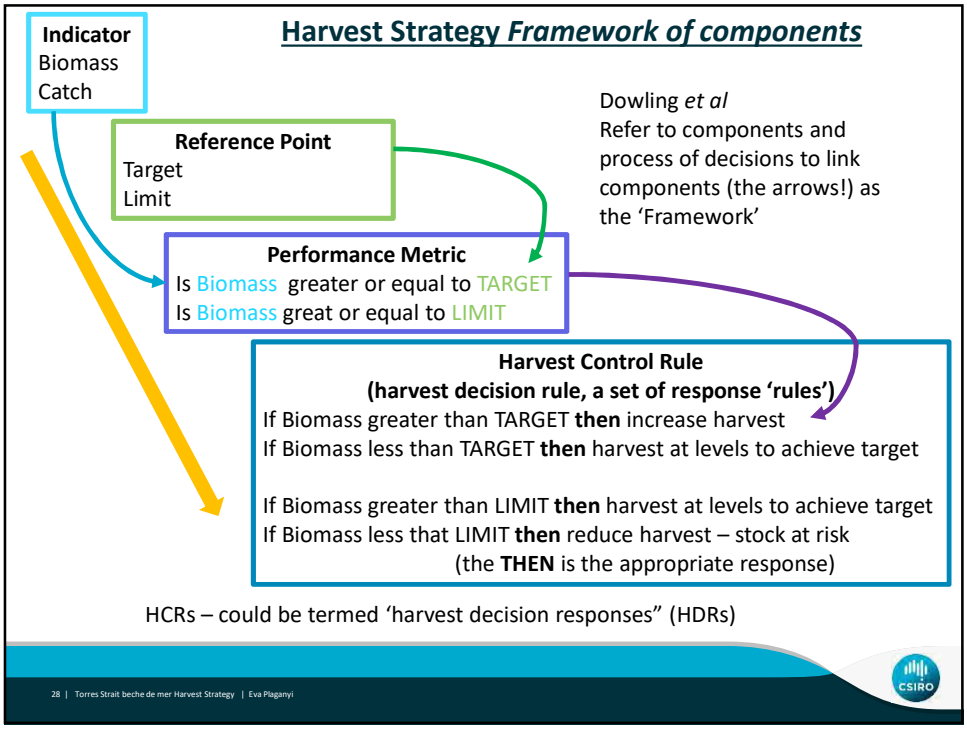
In this case Btarg is 1.2(Bmsy) thus B60

Can also 'shift' these higher to be more precautionary (tiers)
Or due to assumption that in many fisheries Bmey could be as high as 1.5 Bmsy)(1.5 X 0.40 = 0.60)

Harvest Strategy – Key Components

- *Indicators* *e.g. Biomass* ✓
- *Reference points* *Target & Limit* ✓
- *Performance METRICS*
- *Decision rules*
- *Monitoring*
- *Assessment*


Harvest Strategy *Framework of components*
Indicator
Biomass
Catch
Reference Point
Target
Limit
Performance Metric
Is Biomass greater or equal to TARGET
Is Biomass great or equal to LIMIT
Operational objective
Maintain Biomass at TARGET
Maintain Biomass above LIMIT
The performance metric is there to check that operational objective is being meet!
If not respond
The Response is specified in the harvest control rule
27 | Torres Strait beche de mer Harvest Strategy | Eva Plaganyi
CSIRO


Harvest Strategy *Framework of components*
Indicator
Biomass
Catch
Reference Point
Target
Limit
Performance Metric
Is Biomass greater or equal to TARGET
Is Biomass great or equal to LIMIT
Dowling *et al*
Refer to components and process of decisions to link components (the arrows!) as the 'Framework'
Harvest Control Rule
(harvest decision rule, a set of response 'rules')
If Biomass greater than TARGET **then** increase harvest
If Biomass less than TARGET **then** harvest at levels to achieve target
If Biomass greater than LIMIT **then** harvest at levels to achieve target
If Biomass less that LIMIT **then** reduce harvest – stock at risk
(the **THEN** is the appropriate response)
HCRs – could be termed 'harvest decision responses" (HDRs)
28 | Torres Strait beche de mer Harvest Strategy | Eva Plaganyi
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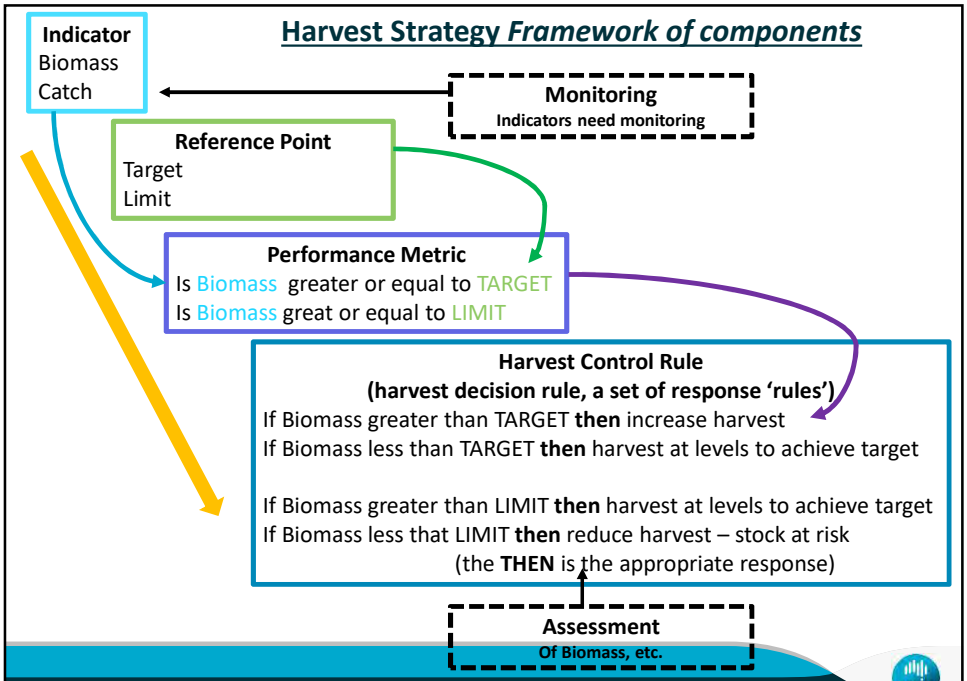
Harvest Strategy – Key Components

- *Indicators* *e.g. Biomass* ✓
- *Reference points* *Target & Limit* ✓
- *Performance METRICS* *is indicator </> reference point* ✓
- *Decision rules (HCR)* *response to meet operational objective* ✓
- *Monitoring*
- *Assessment*

Harvest Strategy *Framework of components*



The Process of developing a HS (the steps…)

Species to be considered

Data available (take account of existing monitoring)

Take account of existing and past assessments if any (and existing management processes in place, where overlap with other strategic Objectives)

Develop limits and targets (consistent with policy)

Develop initial options for Harvest Control Rules (HCRs)

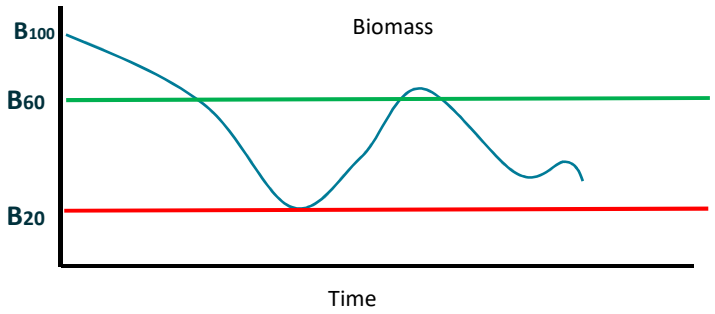
Develop full Harvest Strategy including monitoring, assessment and final HCRs

Evaluate (Qualitative/Quantitative)

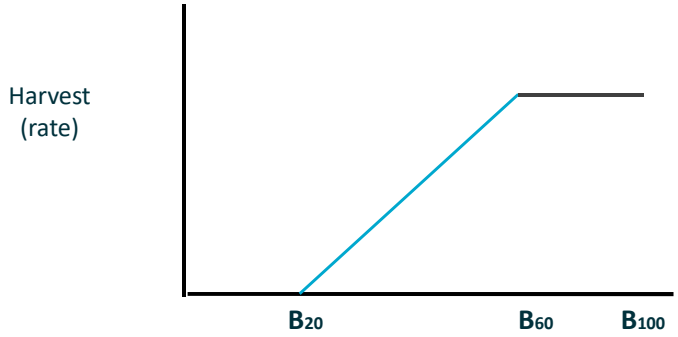
Harvest Control rules - detail

If Biomass greater than TARGET **then** increase harvest
If Biomass less than TARGET **then** harvest at levels to achieve target

If Biomass greater than LIMIT **then** harvest at levels to achieve target
If Biomass less that LIMIT **then** reduce harvest – stock at risk



Relating Harvest to rule and B_{60} (target) and B_{20} (limit)

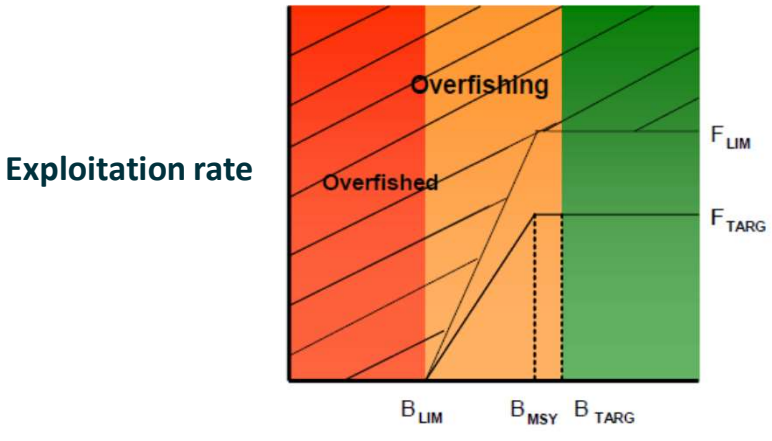


If Biomass greater than TARGET **then** increase harvest
If Biomass less than TARGET **then** harvest at levels to achieve target

If Biomass greater than LIMIT **then** harvest at levels to achieve target
If Biomass less that LIMIT **then** zero harvest as stock at risk

33 |

Harvest Control Rule – "Hockey stick'
Just explained the origin



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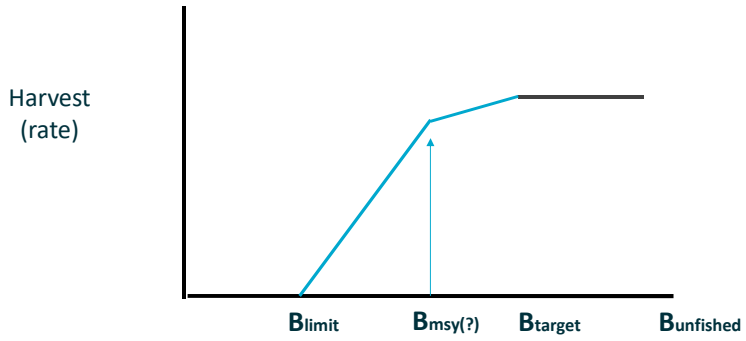
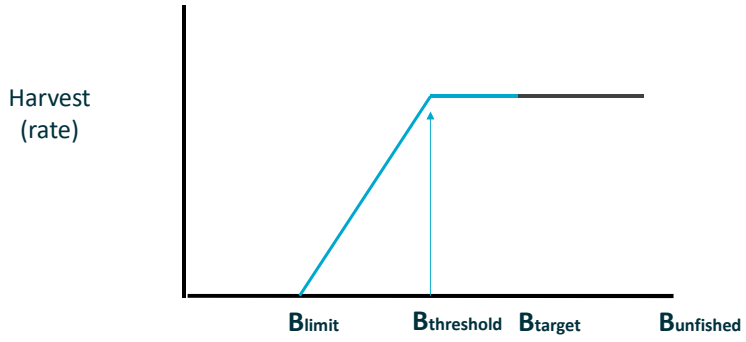
Other options for functional form of HCR



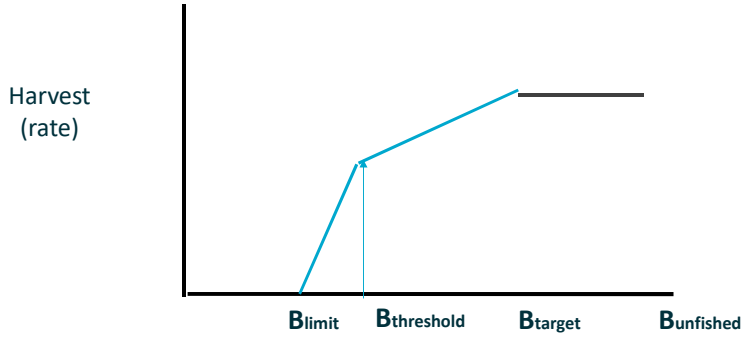
35 |

Other options for functional form of HCR



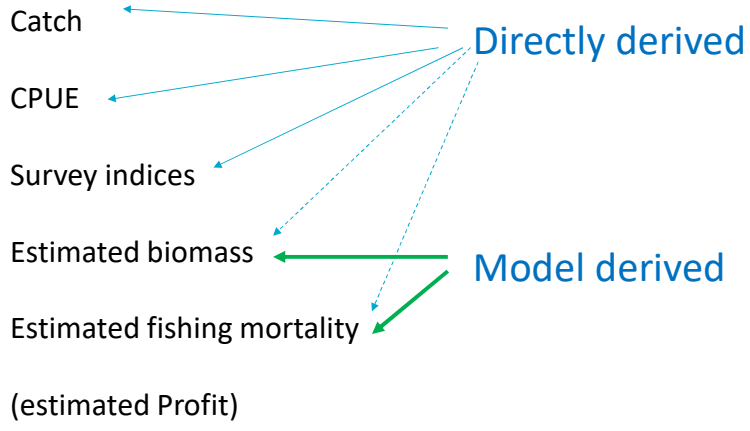
36 |

Other options for functional form of HCR



Evaluating the detail in each fishery

Types of Indicator



Types of Indicator

Indicator	Coral trout	Spanish mackerel	Challenges/Issues
Catch	YES	YES	Data quality Species identification (catch not recorded by species for 'Coral Trout').
CPUE	(yes), Processing and require standardisation	YES Standardisation procedure currently in place	Data quality Species identification (catch not recorded by species for 'Coral Trout').
Survey Indices	NO	NO	
Estimated biomass	Work in progress Previous estimates for group as a whole	YES, Based on current assessment	Await outcomes of preliminary stock assessment for CT
Estimated fishing mortality	Work in progress	YES, Based on current assessment	Await outcomes of preliminary stock assessment for CT
Others: Profit	NO	No	No economic data collated Future work if analysis requested

Types of performance metric – Status related or Utilization related

Performance Metric	Example: set value	Typical sub-rule	Rationale/additional aspects to note
Target Reference Point Is Biomass<TRP	60% of B(unfished) B60	Current Biomass must be = B60, of if not the lower catches to achieve it…. by a set time Note: if Current biomass > B60 then catches are too low (increase catch)	It is what you want to achieve – aspire too Represents an amount above BMSY in many cases to obtain higher catch rates (lower costs) and achieve greater economic benefits
Limit Reference Point Is Biomass >LRP	20% of B(unfished) B20	Current biomass > B20	The most critically important Performance Metric.
Catch (predicted future catch)	SITUATIONAL Depends on stocks 134 tonnes (CT) 125 tonnes (SM)	Catch at levels which sustain fishery	However, catch in future must vary around some amount which still meets Reference Point rules Over-ridden by above two rules
Average annual variation in catch (AAV) Catch variability	Depends on how much variability is acceptable 10%; 15%, 30%?	Catch variability must be <15% (over set time period)	Set the harvest rate (and take into account environmental variability) such that catch year on year is not too variable

Types of Indicator – Examples from Other Fisheries

Indicator	TS – Rock Lobster	NPF (Tiger prawns)	South East Fishery (Blue G)
Catch	YES	YES	YES
CPUE	YES Standardisation procedure currently in place	YES Fishing power analysis	YES
Survey Indices	YES, (2 series before)	Yes (2 series, 1 alternative years)	Survey Index
Estimated biomass	YES, Based on current assessment	YES, Based on current assessment	YES, Based on current assessment
Estimated fishing mortality	YES, Based on current assessment	n/a	YES, Based on current assessment

Performance Metrics: Examples from Other Fisheries

Components	TS – Rock Lobster	NPF (Tiger prawns)	South East Fishery (Blue Grenadier)
TRP	B65	B59 100% Bmey	B48 (Multi-species fishery) Default to proxy
LRP	B32 'Conservative'	B27.7 (approx.) 0.5 Bmsy (5 years sliding)	B20 (Multi-species fishery) Default to proxy
Catch/effort	yes	yes	yes
AAV Catch Catch variability	For MSE	For MSE	(if MSE if relevant)
Other	(profit/supply chain)	Profit	unknown

The message – TRP > Bmsy, (~B60); LRP ~ 0.5Bmsy or > (~B20 and above)
Note: Some numbers are 'illustrative' – as some HSs are in development
For NPF, average of grooved and brown tiger prawns (0.5, 0.6, B_{MSY}, 0.65, 0.54, B_{MEY})

Framework and the fisheries (CT and SM)

Component	Coral trout (CT)	Spanish mackerel (SM)
Indicators	Catch, CPUE Work in progress (est. biomass, F) NO SURVEYS	Catch, CPUE Est biomass, F NO SURVEYS
Reference Points	No target reference point (TRP) Proxy B_{20} used by ABARES	Interim target reference point B60 (preferred) Proxy B_{20} used by ABARES
Performance Metrics	Example: is Biomass < TRP is Biomass > LRP At this stage not able to produce until assessment complete	Yes – are able to dynamically estimate Bcurrent versus TRP, (LRP) And project catch under future scenarios And project catch variability
Decision rules (interim)	"Constant catch" Interim The TAC (134.5 tonnes) is based on the average catches 2001-2005.	"Constant catch" Interim The RBC is based on median harvest of two stock analyses to achieve B_{60}
Monitoring	Catch Effort (not species specific) Data quality issues	Catch Effort Spatial, and WIND, Lunar By sector and Fish length-at-age (planning)
Assessment	Work in progress	Yes

Risk-cost-catch framework

LIMITED DATA (data poor)

High risk MEANS need for precautionary management = lower fishery catches

MORE DATA

Low risk MEANS less need for precautionary management = higher fishery catches

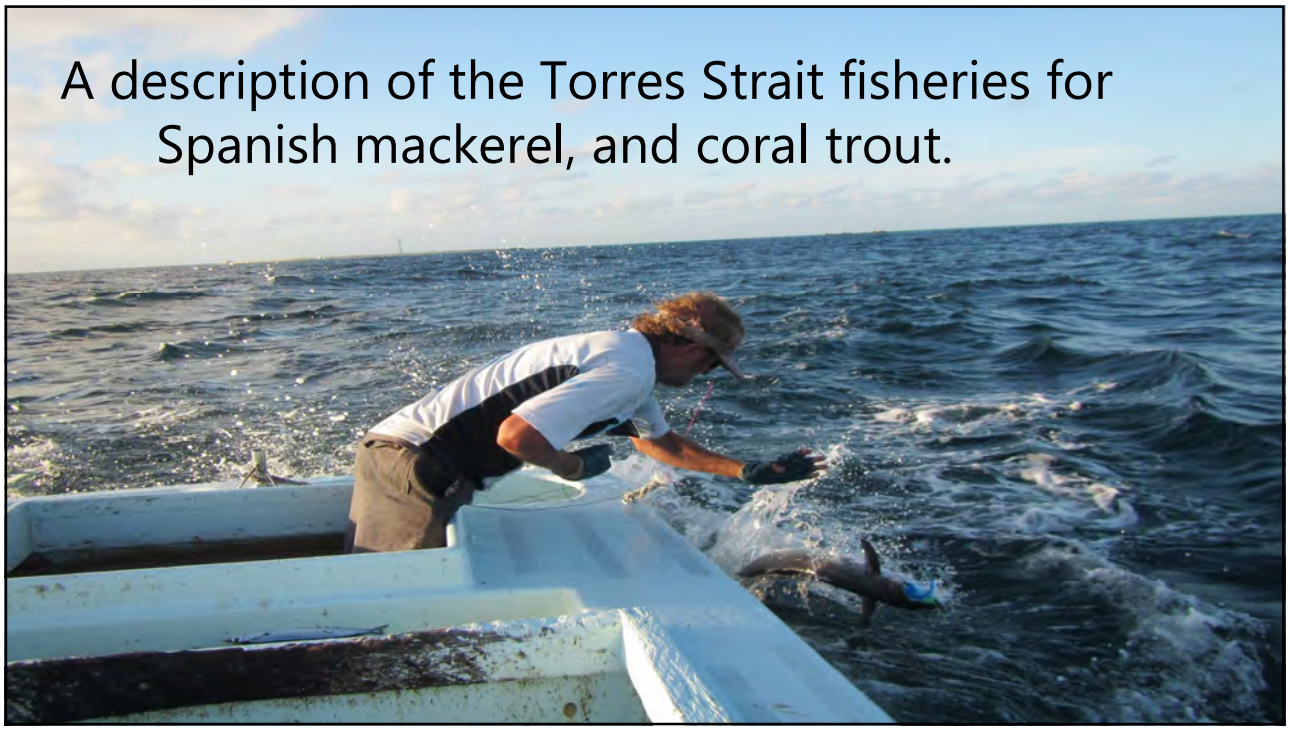
Uncertainty and Risk

Tiered-based analysis

Four tiers:

1. Robust quantitative assessment
2. Preliminary quantitative stock assessment
3. Basic assess/analysis (estimate F from catch curves)
4. Catch/effort only

Relationship between data and how complex assessment is (can be)
But then also specifies (by implication of risk trade-off) greater precaution for less data tiers



Spanish mackerel

A historical perspective

- An extensive history of fishing – TVH, TIB, Charter, Recreational
- The 2007 buyout of TVH fishers and handing of access rights to Torres Strait people
- Since 2008, the lease of access (quota) by TVH fishers has been strong, while TIB fish effort & catch has remained relatively low
- A recent stock assessment advised a lowering of TAC (125 t)
- Access to the resource is shared with PNG, though no PNG activity occurs at this time.

Spanish mackerel

TVH Fishing

- Interest in accessing quota by TVH is unlikely to drop
- Catches on the Queensland east coast are limited
- Management changes on the Queensland east coast are likely, that may further limit effort and catch
- Competition to lease quota may increase

Spanish mackerel

TIB Fishing

- Historically (pre-2008) TIB fishers took 7% of the TS catch.
- Aspirations to build commercial fishing businesses are strong in some communities
- Infrastructure to process and market catch is limited
- Recent effort and catch data is sporadic with no discernable trends

Spanish mackerel

Management strengths

- Some critical aggregation sites are very lightly impacted

- The biology of Spanish mackerel could allow for rapid replenishment

Spanish mackerel

Management challenges

- Spanish mackerel may be “at risk” from fishing due to their predictable aggregating behavior.
- As TIB activity grows, how do you manage TVH displacement.

Coral trout

Coral trout

A historical perspective

- An extensive history of fishing – TVH, TIB, Charter, Recreational
- The 2007 buyout of TVH fishers and handing of access rights to Torres Strait people
- Since 2008, the lease of access (quota) by TVH fishers has been poor, while TIB fish effort & catch has remained relatively low
- A recent change in permitting "live" fishing, and quota shortages for the Queensland east coast fishery, has seen TVH interest build.
- No formal stock assessment, the current TACC set based on historical catch stability (?).

Coral trout

TVH Fishing

- Interest in accessing quota will be influenced by the Queensland east coast fishery and market economics
- Live trout from TS are worth less because the market prefers red fish
- Quota access may not be limited on the east coast in some years meaning lease interest may be volatile

Coral trout

TIB Fishing

- Historically (pre-2008) TIB fishers took 16% of the TS catch.
- Aspirations to build commercial fishing businesses are strong in some communities
- Infrastructure to process and market catch is limited in some areas
- Effort and catch is sporadic with no increasing trends

Coral trout

Management strengths

- The biology of coral trout is robust to fishing mortality.
- Some spatial management limits TVH activities (10 nm exclusion Erub, Ugar, Mer, Masig)
- VMS (?)
- Robust data from the TVH fleet.
- Improved data collection from TIB

Coral trout

Management challenges

- Spatial distribution of catch may be restricted because of the fish.
- Volatile TACC and quota values on the Queensland east coast fishery may mean unpredictable changes in TVH interest in the TS.

Transition from TVH to TIB challenges

<u>Displacement or removal of TVH</u>

- Successful TVH businesses that are not easy to move "somewhere else".
- Can the HS be useful tool to plan for and manage this transition?

Scomberomorus commerson

Harvest strategies for TS FinFish

Spanish mackerel

RAG meeting March 2018

Queensland Government

Key elements of a harvest strategy

- Operational **objectives** ✓
- **Indicators** of fishery performance ✓
- **Reference points** for indicators ✓×
- Program to collect **data** (Table 2 RAG notes) ✓×
- **Method** to analyse data - stock assessment ✓
- **Rules** to use results and set levels of fishing ✓×
- Keep **simple**

Data - stock area

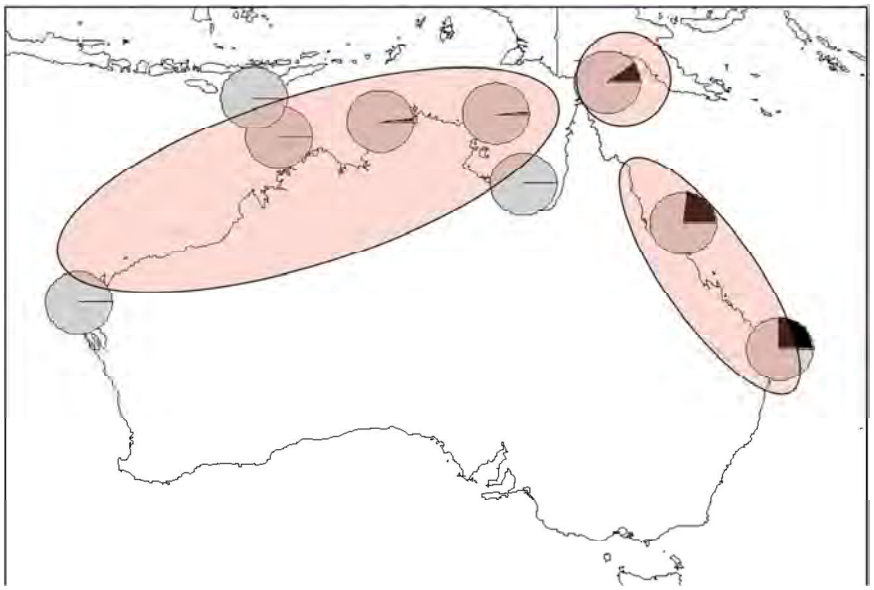
Buckworth et al 2007; Ovenden and Street 2007.

Torres Strait Spanish mackerel are regarded as a discrete population for management.

The TS population is a mixture of surrounding populations.

Management of stocks adjacent to the TS may impact on the viability of the TS population.

Stock area



Samples (fish)

n = 32 Sept 1998

n = 40 Oct 1999

From Bramble Cay and Ashmore Reef

Data - biology

- Oldest fish (longevity) from the:
  - Torres Strait = 12 years
  - East Gulf of Carpentaria = 15 years
  - Queensland east coast = 26 years
- Age maturity 2 to 4 years
- Fish can grow to:
  - 160-180 cm total length
  - weigh 20 to 30 kg
- Female fecundity about 75000 eggs per kg
- Natural mortality? 18% : 25% : 32% per year

Data - harvests and catch rates

Data

- AFMA logbooks
  - SM02 1989-2003
  - tsf01-torres-strait-finfish-logbook.
- AFMA docket book records
- Winds and lunar phases

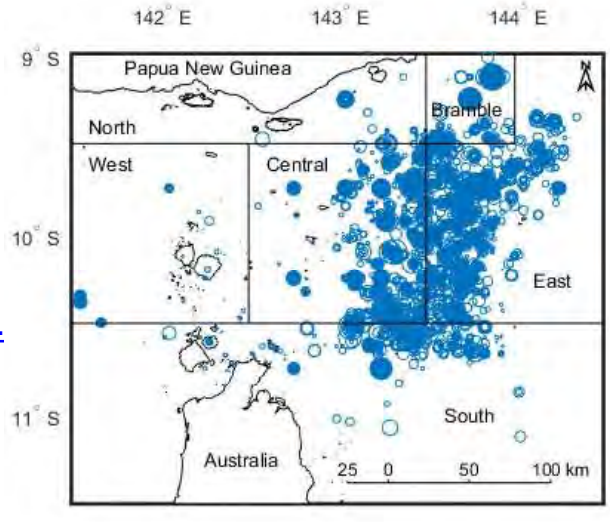
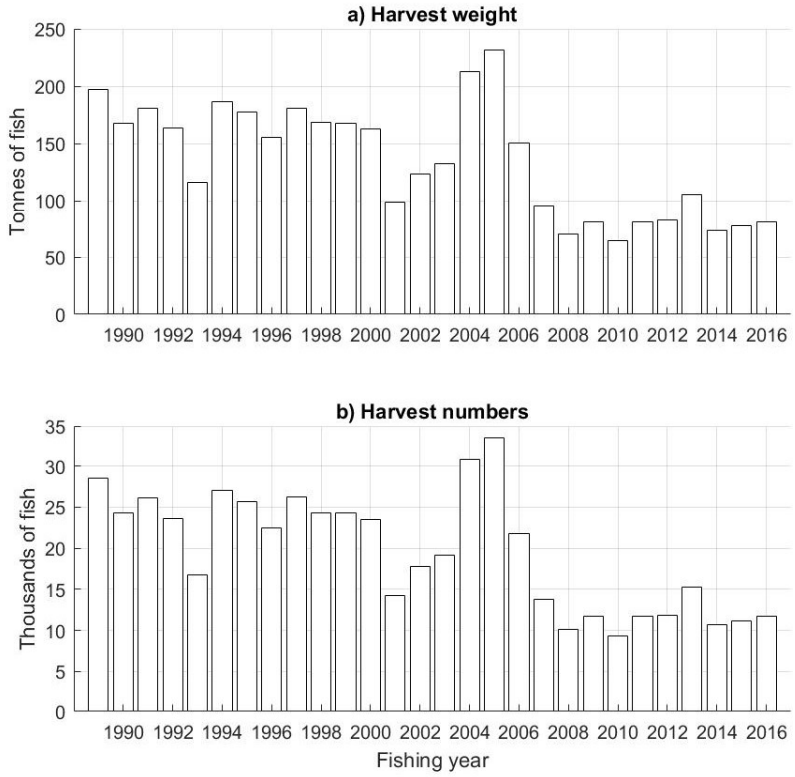
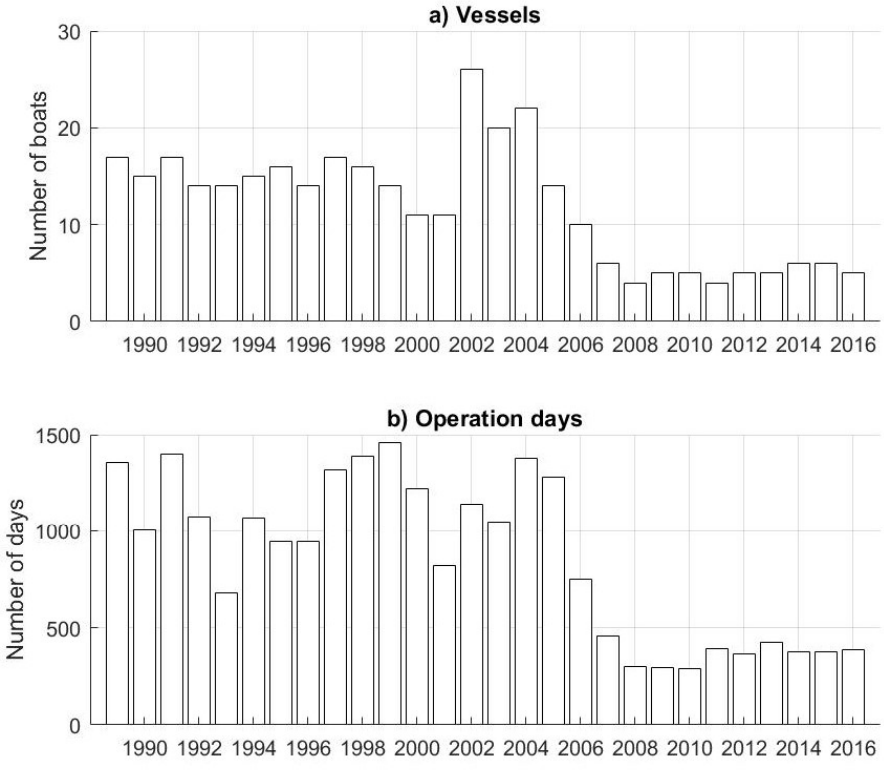


Figure 5 p 10. Map of the Torres Strait and regional stratifications with blue circles indicating the numbers of Spanish mackerel harvested per vessel day 1989–2015.

Data - estimated harvest from logbook



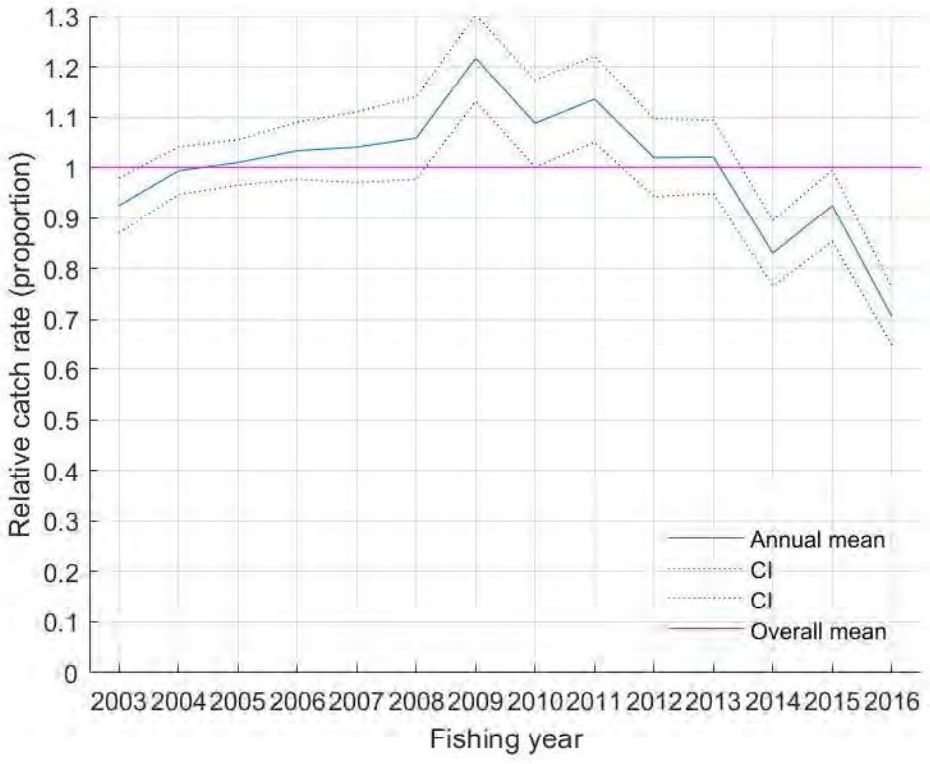
Data - nominal effort from logbook



Data need ! – total annual harvests

- Commercial harvest (TIB)
- Islander subsistence harvest
- Leased commercial harvest (TVH)
- Charter
- Recreational
- Papua New Guinea

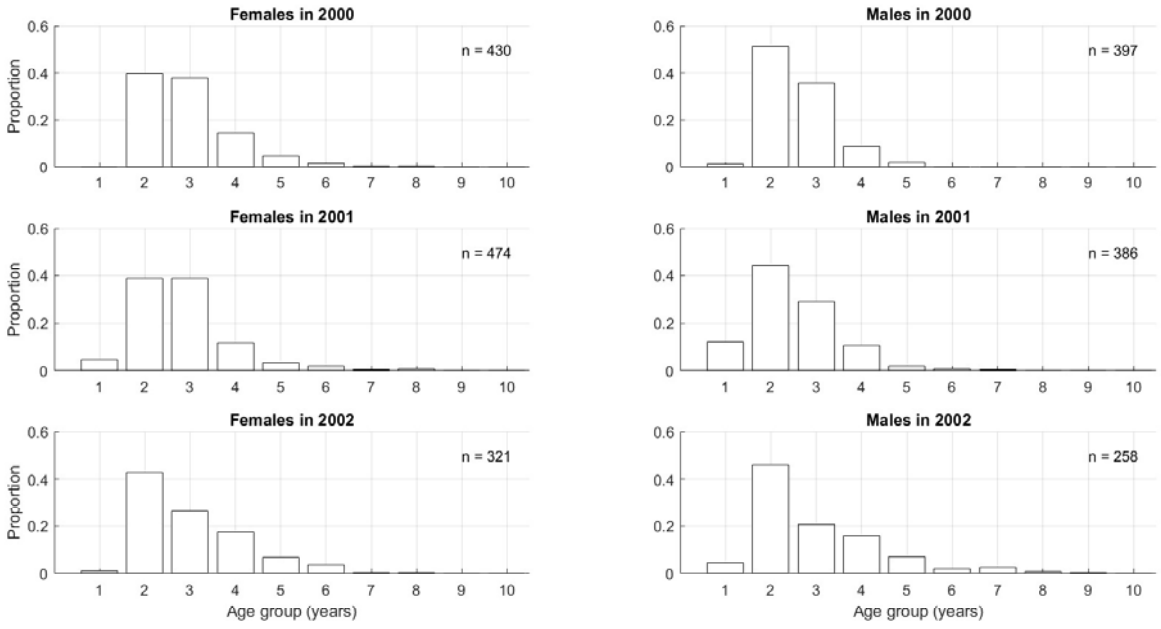
Data - standardised catch rate



Data need ! – fishing effort

- Consistent daily logbook recording:
  - Identify fishing trips over multiple days
  - Target species and gear
  - Vessels and skippers
  - Locations fished
  - Search and fishing time

Data – fish ages



Data need ! – fish ages

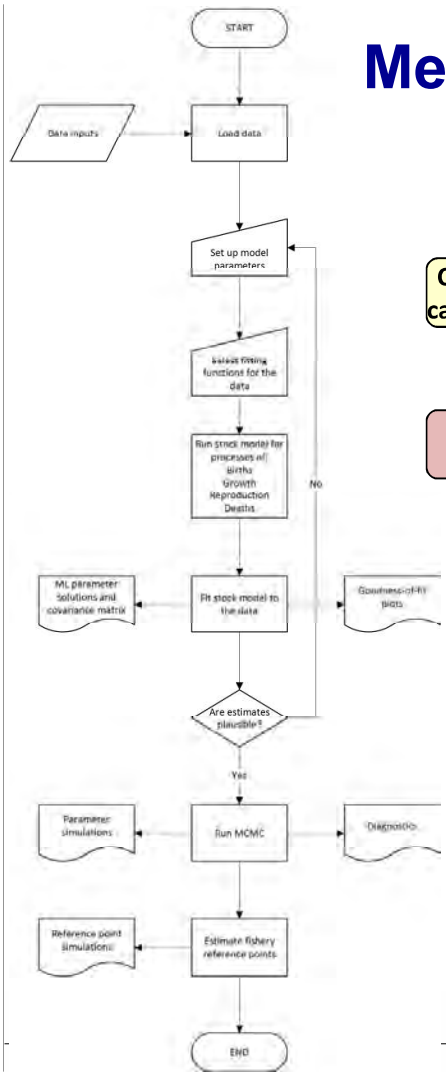
- Consistent monitoring method
- Increased spatial coverage

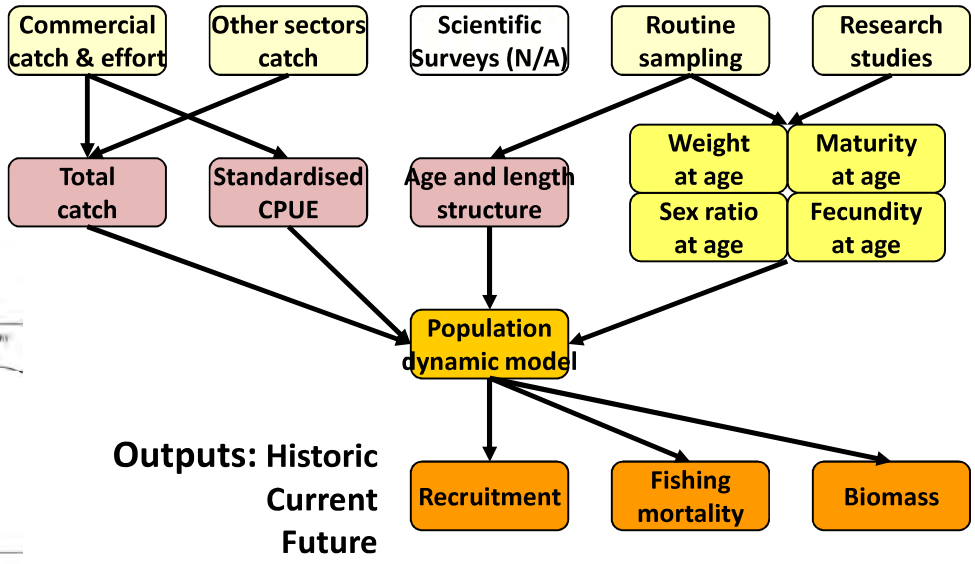
Method – standardised catch rates

- Generalised linear models (GLM) for standardised catch rates
  - Over dispersed Poisson
- Standardised catch rates (numbers) of Spanish mackerel per vessel operation day

  ~ annual average catch rates adjusted to a constant vessel operation, fishing season, number of tenders, lunar cycle, wind strength*direction and **logbook type**.
- Assumptions:
  - No fishing power change through time.
  - No spatial information.
  - No zero catches.
  - No “hours fished” before 2003.

Method – Age structured stock model





Method – stock model

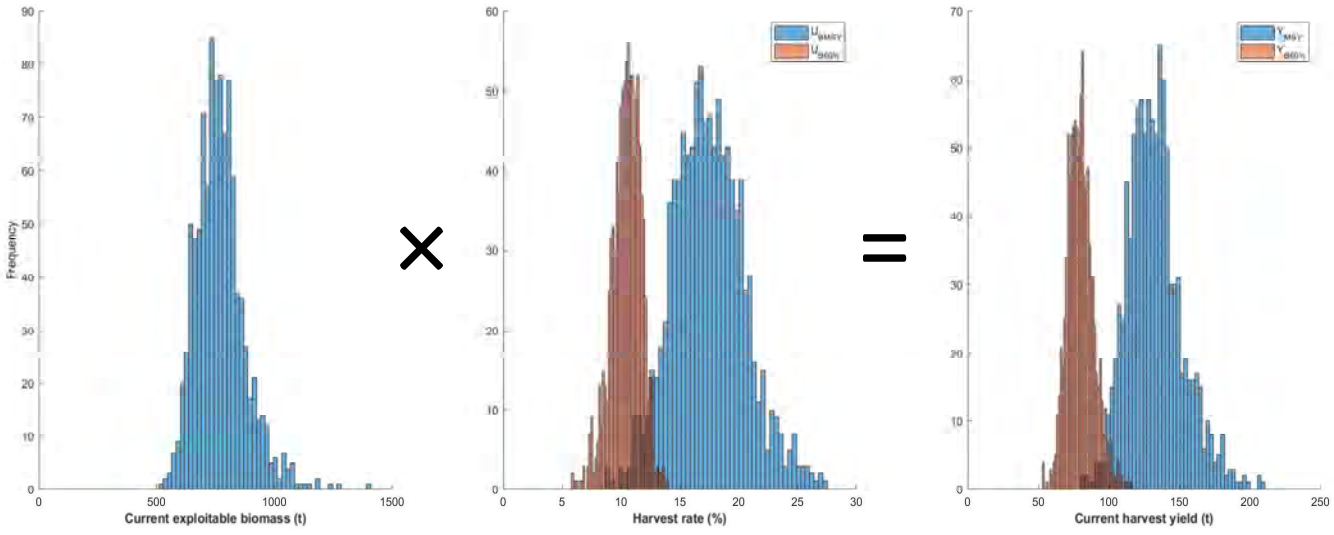
- To run in a Harvest Strategy, the FFRAG will need to choose the best set of inputs (data and assumptions) for the model.

- Sensitivities
  - Levels of harvest by sector
  - Standardised catch rate (hyperstability, indicator vessels)
  - Vulnerability of fish – logistic or domed
  - Natural mortality
  - Others to note?

Indicators – stock assessment

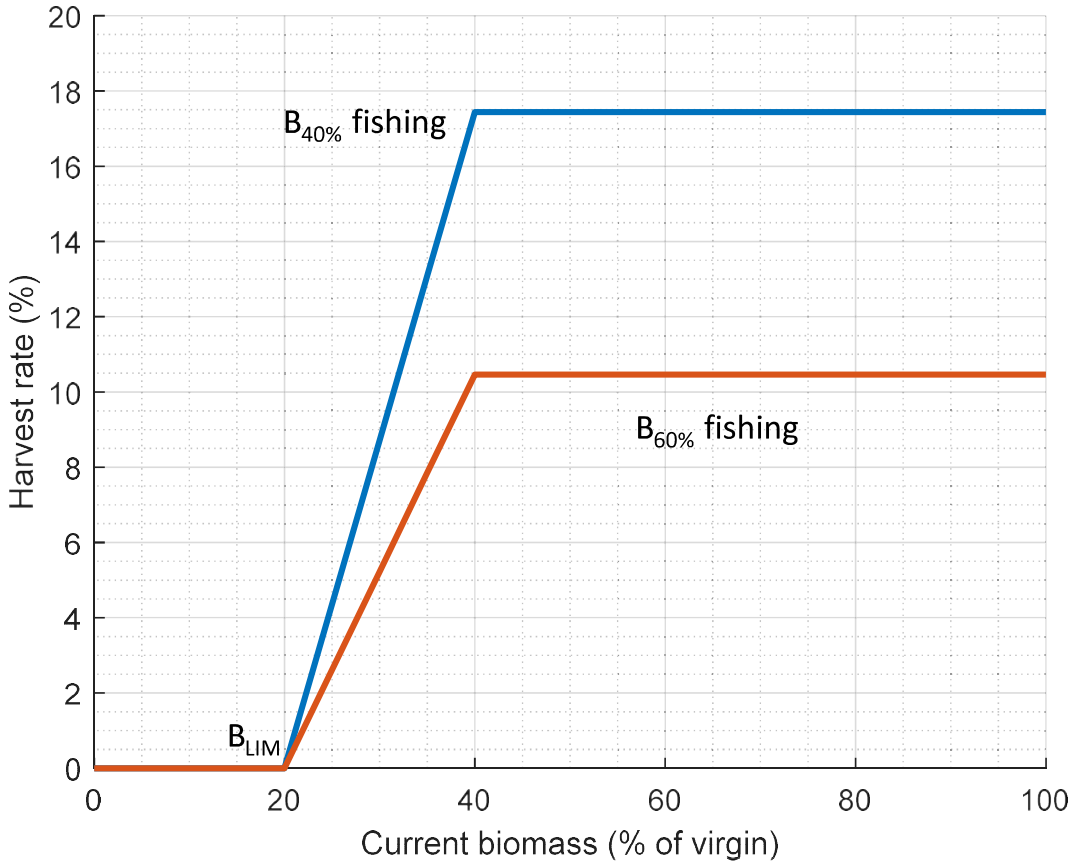
Indicators	Reference points	Methods to calculate Recommended Biological Catch (RBC)
Fishing pressure $F_{current} / F_{MSY}$ ✓		Equilibrium? Use current biomass?
Exploitable biomass $B_{current} / B_{MSY}$ $B_{current} / B_{100\%}$ ✓	$B_{100\%}$ (unfished level) $B_{60\%}$ (target) $B_{40\%} \approx B_{MSY}$ (trigger) $B_{20\%}$ (limit)	
Spawning egg production $S_{current} / S_{MSY}$ $S_{current} / S_{100\%}$ ✓		
Recruitment $R_{current} / R_{MSY}$ ✓ $R_{current} / R_{100\%}$		

Rules – example RBC analysis 1



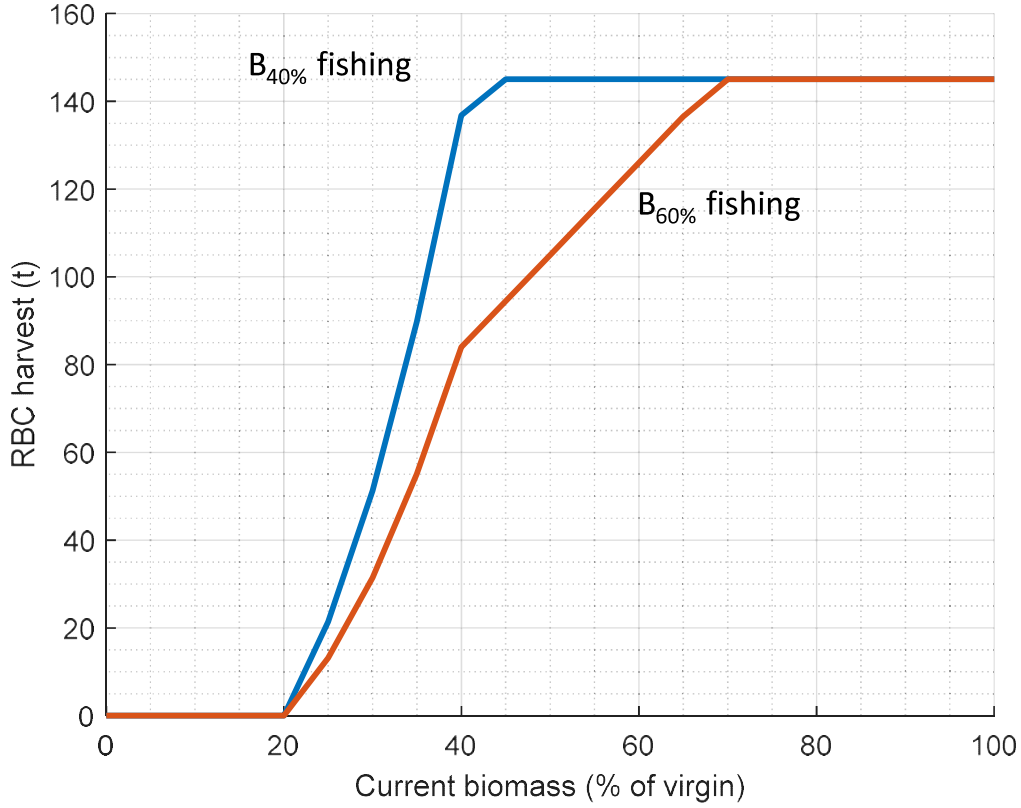
2014

Rules – example RBC analysis 1



Rules – example RBC analysis 1

Minimum(Biomass(t) **x** target harvest rate (%) **x** Adjustment (%), MSY)



Discussion, questions and actions

- Action items – HS components to address

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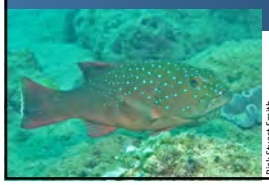
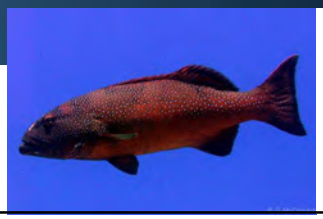
Harvest strategies for Torres Strait finfish

Focus on coral trout

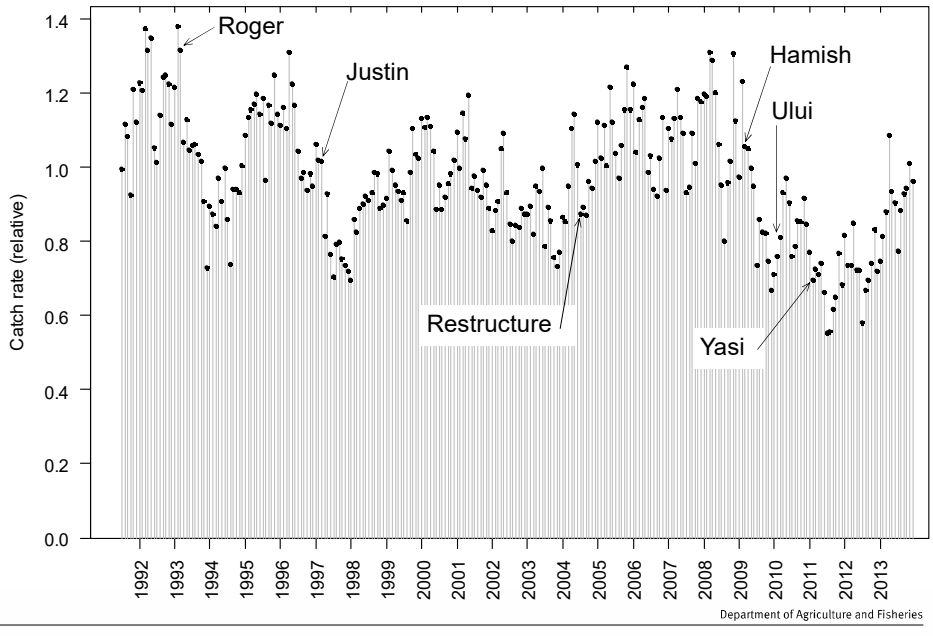
RAG meeting March 2018





Queensland Government

GBR catch rates: Catch per unit effort (CPUE)



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Use of catch rates

- Measure of abundance
- Easy to calculate from commercial logbook data
- Susceptible to factors unrelated to abundance
  - E.g., tropical cyclones and other weather systems

Biological data collection: fish length

(Fish pictures are of tailor)

Sexing: Female fish

Sexing: Male fish

Dissection: Accessing the otoliths

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Extracting the otoliths

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The most important part: cataloguing!

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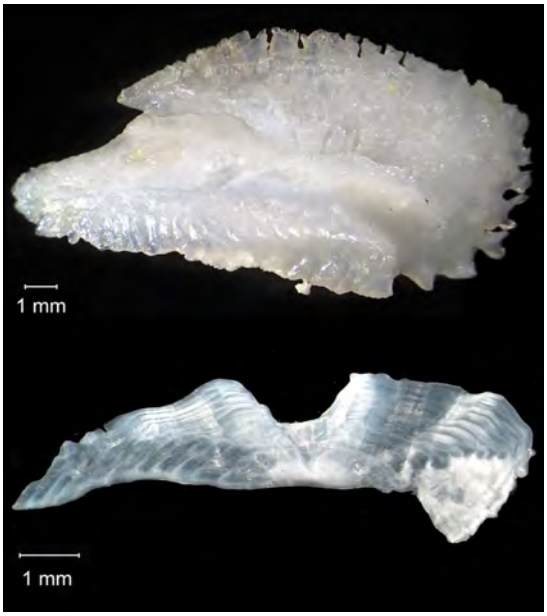
Otolith to be read in the lab



FWC Fish & Wildlife Research Institute

Annual rings show the age.

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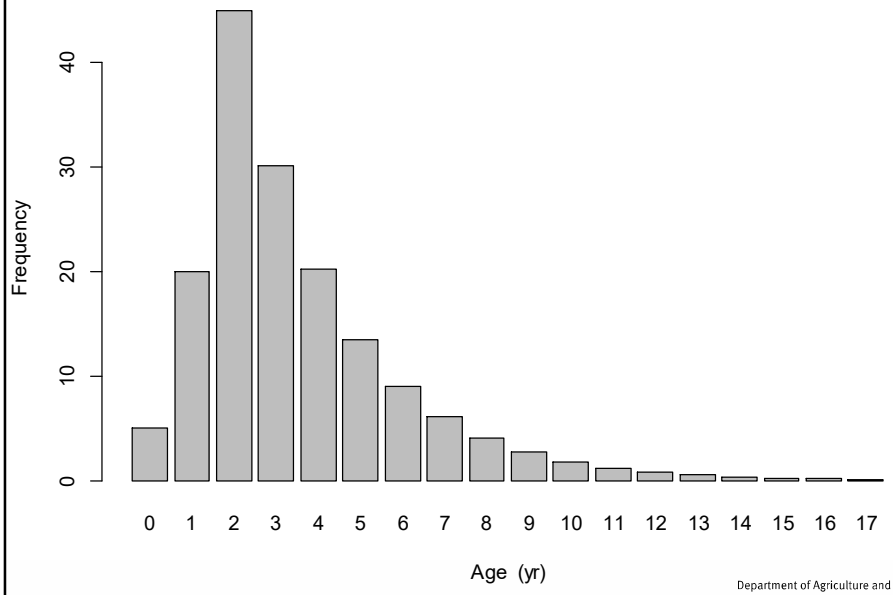
Age frequency



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Information from the biological data

- How long do the fish live?
- At what age do they change sex?
- At what age do they become vulnerable to fishing?
- What is the total mortality rate (Z)?
  - Sum of natural mortality (M) and fishing mortality (F)
  - If M is known, we can estimate how heavy the fishing pressure is.
- If we collect data every year (through a **monitoring plan**), we can better split Z into F + M and we can see how F changes through time.
- The monitoring plan is part of the harvest strategy and supports the harvest decision rules.

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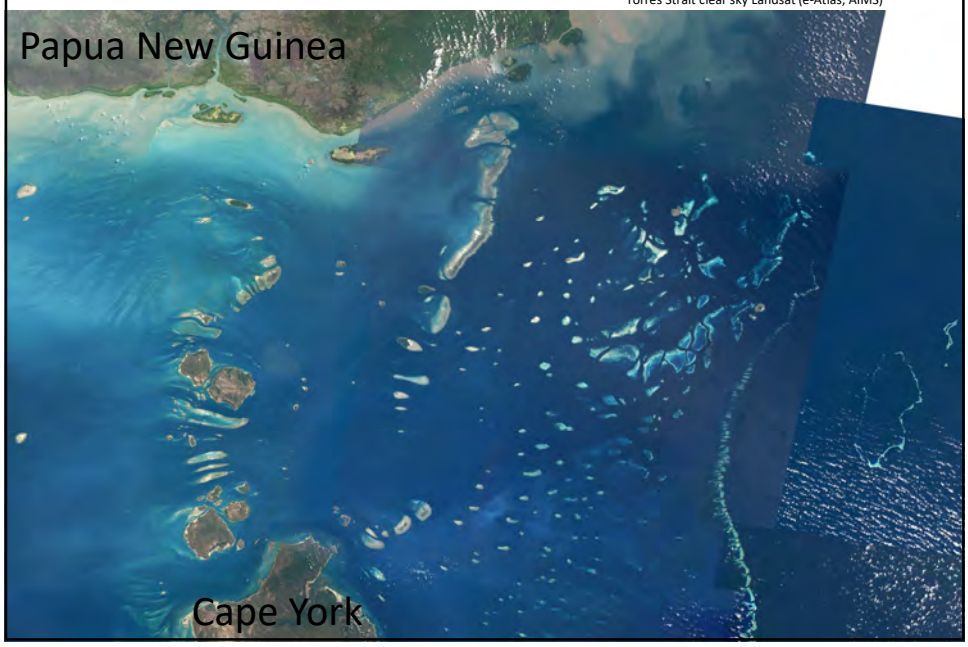
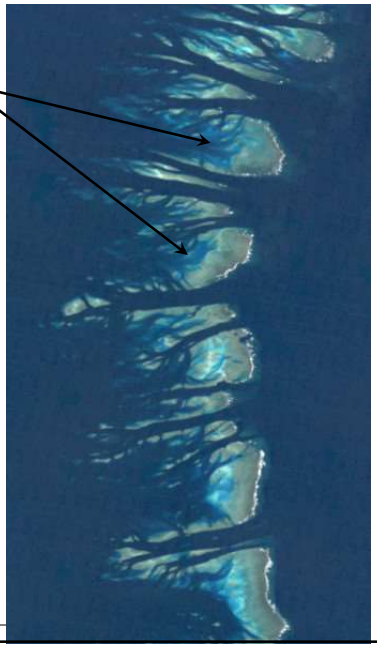
Torres Strait

Torres Strait clear sky Landsat (e-Atlas, AIMS)



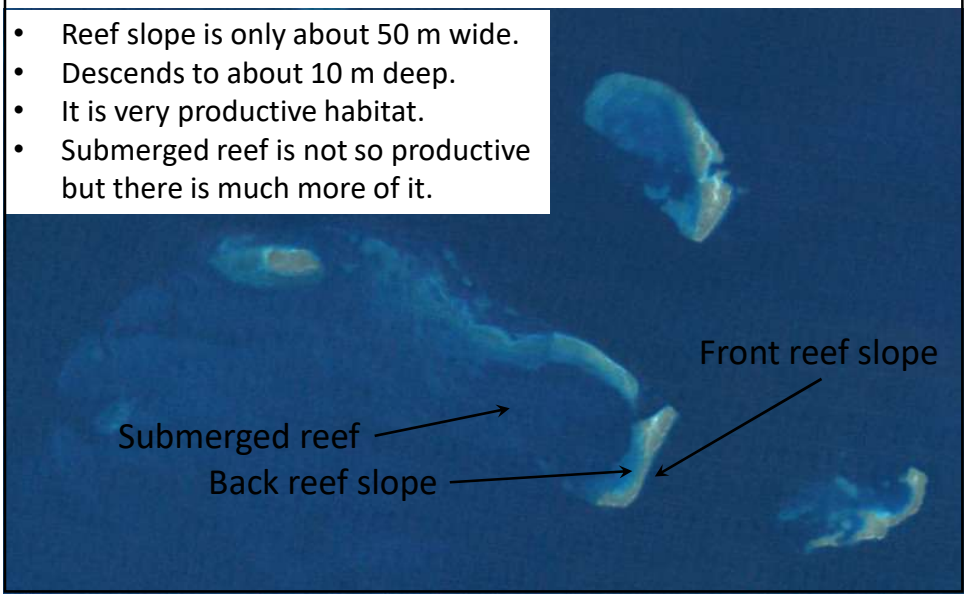
Coral trout habitat: Barrier reefs

Habitat on back reef slope

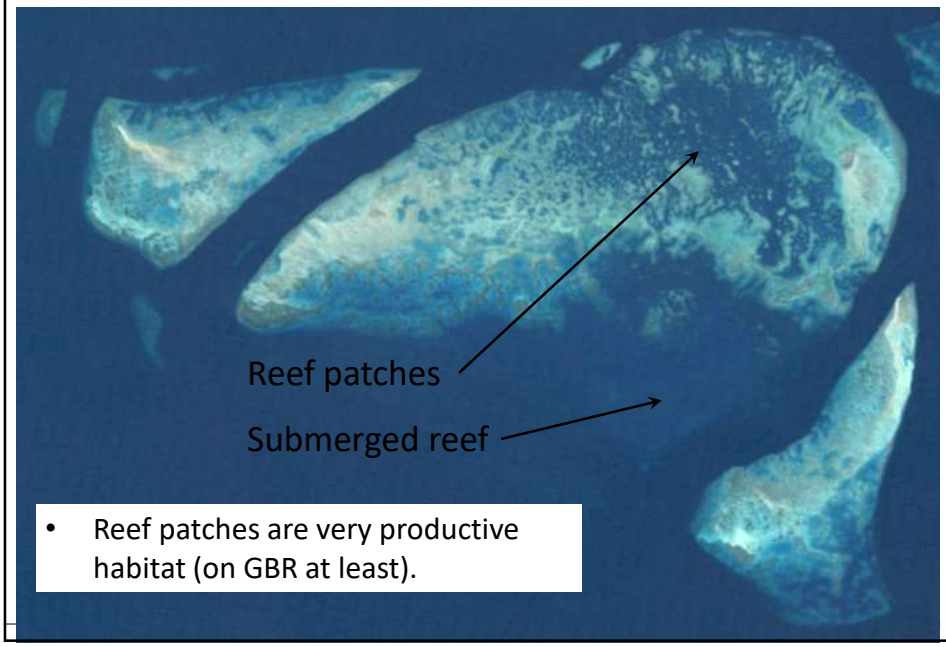


Coral trout habitat: Crescentic reefs

- Reef slope is only about 50 m wide.
- Descends to about 10 m deep.
- It is very productive habitat.
- Submerged reef is not so productive but there is much more of it.



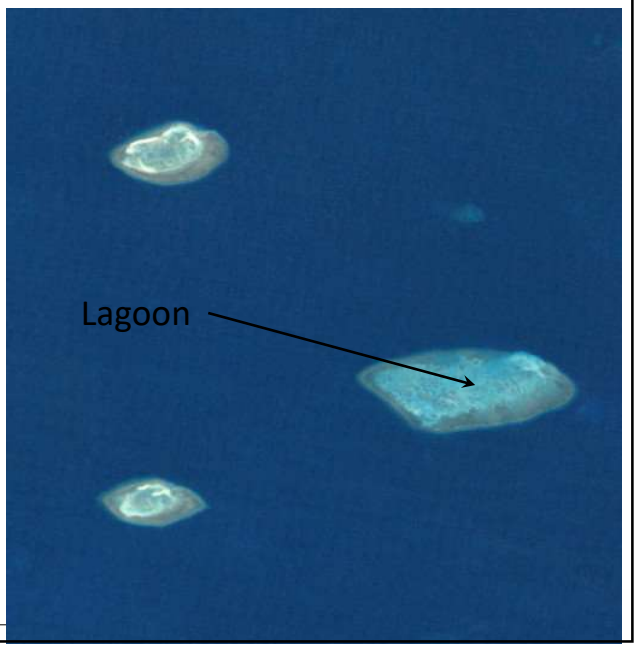
Coral trout habitat: Reef patches



- Reef patches are very productive habitat (on GBR at least).

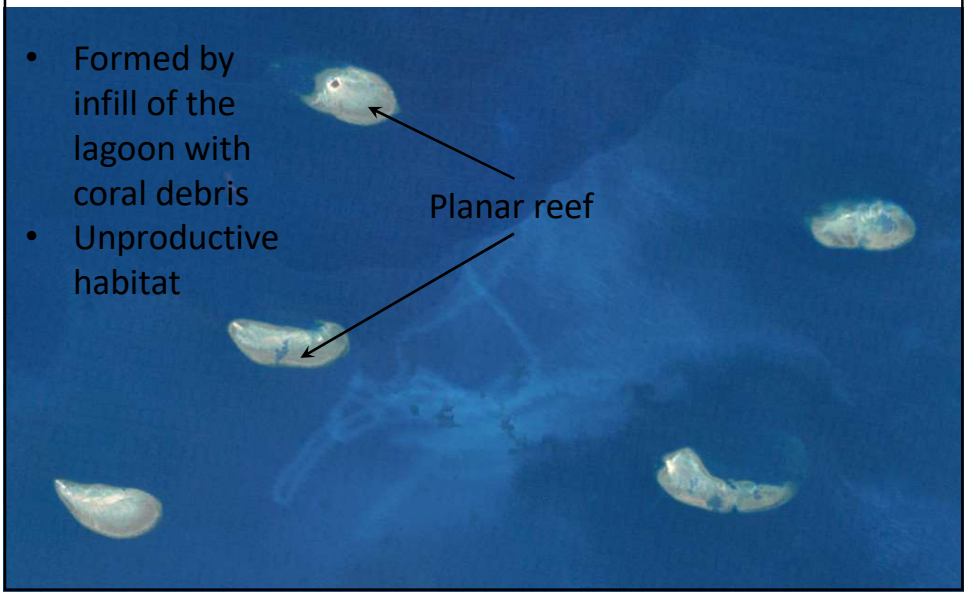
Coral trout habitat: Lagoonal reefs

- Lagoons may be difficult to access.
- Coral trout may be green instead of red.
- Front reef slope is still productive.



Coral trout habitat: Planar reefs

- Formed by infill of the lagoon with coral debris
- Unproductive habitat

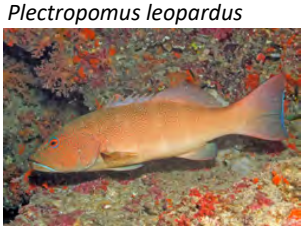


Torres Strait mapping data

- A recent project has mapped the reefs in Torres Strait
  - Lawrey, E. and Stewart, M. (2016) "Mapping the Torres Strait Reef and Island Features" (AIMS + TSRA)
- Data separates reefs, islands, sand bars, etc.
- It doesn't separate reef flat ("dry reef") from productive habitat ("wet reef").
- We have a dry reef data set for the Great Barrier Reef but not for Torres Strait.
  - We need it to quantify the productive habitat.
  - Could use the habitat proportions from the northern GBR.
  - Note GBR mapping includes the southern quarter of TS.
- Also need to infer virgin absolute abundance (number of coral trout per hectare) from underwater visual surveys of the GBR.

Coral trout species in Torres Strait

Common coral trout
Plectropomus leopardus



Graham Edgar
www.reeflifesurvey.com

Passionfruit coral trout
Plectropomus areolatus

John E. Randall

Rick Stuart-Smith
www.reeflifesurvey.com

Barcheek coral trout
Plectropomus maculatus

G. McDonald
http://cookislands.bishopmuseum.org

Bluespot coral trout
Plectropomus laevis

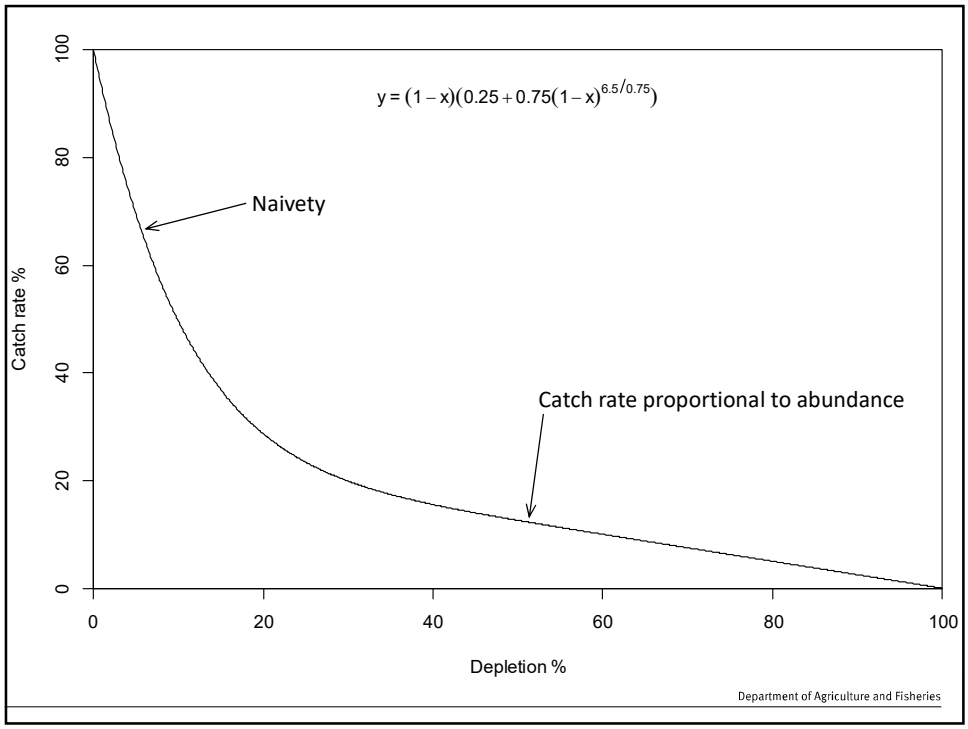
Barcheek coral trout is said to inhabit more turbid water.
Bluespot coral trout is said to inhabit the outer-shelf barrier reefs.
Bluespot coral trout grows much bigger than the other species.

Catch rates of coral trout

- Catch rates vary with many factors that are not related to abundance, e.g.
  - Tropical cyclones on the Great Barrier Reef (less of a problem in Torres Strait)
  - Social learning: when populations are fished by hook and line they quickly learn not to take bait.
  - "When brains were handed out to fish, coral trout got their share!"
- Catch rate is a poor indicator of abundance for coral trout.
  - But it may still be the best available.
  - Could consider age structure and underwater visual surveys.

Social learning in coral trout

- Major experiment with a replenishment closure of Boult Reef on the GBR from 1 July 1983 to 1 December 1986.
- Catch rates and absolute abundance of coral trout were monitored very closely when the reef reopened.
- Catch rates decreased very quickly when the reef was reopened, even though divers saw plenty of fish.
- Social learning is the only available plausible explanation.
  - Coral trout see or feel their fellows being hooked and quickly learn not to take bait.
  - May happen through chemical signals that travel through the water.
- Commercial fishers know that they have to change "hangs" frequently when the fish stop biting.


$y = (1-x)(0.25+0.75(1-x)^{6.5/0.75})$
Naivety
Catch rate proportional to abundance
Catch rate %
Depletion %
0
20
40
60
80
100
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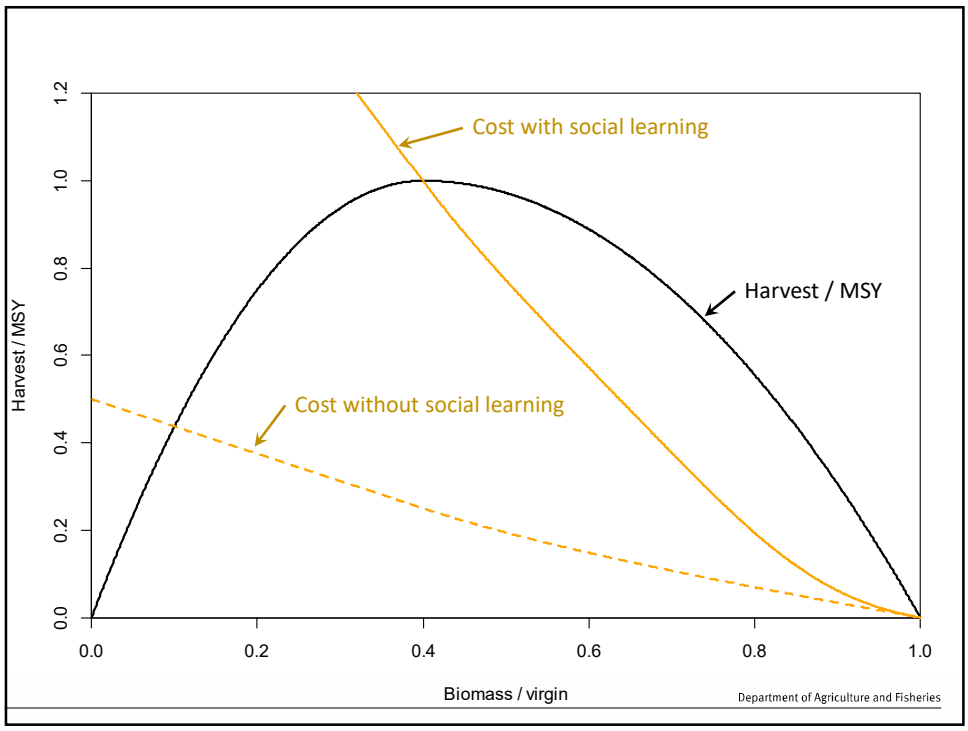
Cost with social learning
Harvest / MSY
Cost without social learning
Harvest / MSY
Biomass / virgin
0.0
0.2
0.4
0.6
0.8
1.0
1.2
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Tropical cyclones on the GBR

- Queensland has a harvest control rule for coral trout.
  - It is based on catch rates.
- TACC tends to go down after a major cyclone and up when there hasn't been one for a few years.
- Major cyclones (as established from wave height data):
  - Justin (1997)
  - Hamish (2009)
  - Ului (2010)
  - Yasi (2011)
  - Dylan (2014)
- Major cyclones are those that generate big waves in behind the GBR, from southeast winds.
  - Many powerful cyclones have very little effect on coral trout because the winds are from the wrong direction, e.g., Ita (2014), Marcia (2015), Debbie (2017).

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Torres Strait: Coral trout fishery data sources

- Commercial logbook data
  - Use for calculating harvest tonnages and standardised catch rates
  - AFMA logbooks (1989 onwards)
  - Queensland logbooks (1988 to approx. 2000)
- Freezer data for fishing by islanders
  - Use for estimating harvest tonnages
  - Maybe use for standardised catch rates?
- Some scientific data (Williams et al. reports & articles)
  - Age frequencies
  - Species split
  - No long time series of scientific data (long-term monitoring)
- Underwater visual surveys?
  - Need to transfer from GBR surveys (Ayling and Ayling)
  - Large number of GBR surveys conducted in mid-1980s

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Coral trout biology

- Live to about 20 years
- Mature early, around 2–3 years of age
- Change sex from female to male
- Grow to around 60 cm (except blue-spot about 100 cm).
- Generally stay on the same reef for life after settling as larvae.
  - Potential for local depletion if some reefs are heavily fished.
  - Larvae can move tens of km.
  - Recruits can come from parents on neighbouring reefs.
- Poor correlation between age and length
  - Assess using an age-structured model.
  - Get length from a growth curve fitted outside the model.

Advice on harvest strategy

- Carefully consider what indicators to use in the control rule.
  - Catch rates are easy to generate from logbook data but can cause the TAC to jump around from year to year.
  - Note that we are doing a preliminary assessment.
- Consider what monitoring to undertake, e.g.:
  - May collect otoliths (ear bones) for ageing by scientists.
  - May undertake underwater visual surveys by divers.
- Remember a harvest strategy is finally decided by stakeholders, not prescribed by scientists!!
  - It's up to you how you want to design it, with out input on design principles.

Future work

- Results of the stock assessment will be available later in the year.
  - Plan is for Matt Holden (UQ) to present them.
  - Stock assessment provides reference points for a harvest control rule, plus plenty of recommendations and background information.
- Project team will work closely with stakeholders to design the harvest strategy.

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Harvest Strategies for the Torres Strait Finfish fishery

AFMA project no. 2016/0824

Trevor Hutton (CSIRO), Michael O'Neill (QDAF), George Leigh (QDAF), Andrew Tobin (Tobin Fishtales Ltd.), Éva Plagányi (CSIRO), Matt Holden (UQ) and Roy Deng (CSIRO)

Progress Report, 20th June 2018

CSIRO Oceans and Atmosphere

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1 Preface

This Project Progress report details progress made since the completion of the Project Milestone Report (30th May 2018). It covers in brief the:

- Summary of progress with Coral trout data collation, CPUE analysis, collation of mapping data and planned methodology with stock assessment.
- Feedback on the key Action Items (Appendix A) from meeting held to workshop components for Harvest Strategy development (held on the 21st and 22nd of March 2018).

1.1 Project Objectives

The project will develop a draft harvest strategy for the Torres Strait Finfish fishery as per the design criteria in the Commonwealth Fisheries Harvest Strategy Policy and Guidelines. It will be focused on collating past management and research for both Spanish mackerel and Coral Trout in Torres Strait. The development with integrate the existing measures already in place such as the first order harvest strategy approaches such as global fishery TACs, size limits and any closures. It will include guidance for future sustainable fishing, the data requirements that underpin higher order management strategies, including indicators, reference points and decision rules, including data requirements for potential fishery expansion. Any harvest strategy development will need to be pragmatic given the limitations in terms of fishery operational characteristics, socio-economics and governance issues.

The objectives of the harvest strategy project are specifically to:

1. Collate and analyses available data to estimate variability and assess whether there is sufficient information to develop indicators of stock status over time.

2. Summarise updated stock assessments and reference points for Coral trout and Spanish mackerel.

3. Present Guidelines to working group; and with stakeholders and managers develop and evaluate a draft harvest strategy. The final adoption of final harvest strategy is Working Group/RAG responsibility.

2 Coral Trout

Matthew H. Holden and George M. Leigh

2.1 Coral trout data collation

We use five different data sources to perform the stock assessment, including: (1) commercial logbook data from AFMA (2) commercial logbook data from Queensland (3) Traditional Inhabitant Fishing Boat (TIB) freezer data from Murray Island (4) TIB freezer data from JCU and (5) a general TIB multi-island freezer data set. The logbook data sets provide standardized estimates of catch per unit effort (CPUE), whereas the freezer data are not of sufficient quality for this part of the analysis. However, all datasets are included in the total catch estimates that will be input into the stock assessment model.

2.2 Coral trout CPUE analysis

We use a standard, generalized linear model to estimate the CPUE accounting for vessel, spatial, and seasonal effects.

Currently, AFMA and Qld datasets do not consistently report the number of dories used in each record. The AFMA data has an entry titled 'shot.no' but this entry can be as high as 17. We believe it is possible that this could mean 17 independent trips are taken from the main vessel by an undisclosed number of dories. For example a value of 16 might mean 8 dories, each taking two trips, or it could mean 16 dories. The Qld data, on the other hand, report the number of dories rather than the number of trips taken by those dories. The number of crew is reported only in the Qld data set. Inconsistencies and systematic differences in the logbook could bias the CPUE estimates.

Therefore, we will perform the CPUE analysis without explicitly including the numbers of dories and crew, and we will absorb these factors into the vessel ID factor. This embodies the assumption that there is no consistent trend for individual vessels to use greater or lesser numbers of dories and crew over time.

We measure catch in kg whole weight rather than numbers of fish. In the relatively small number of cases where numbers were reported instead of weight, we performed a conversion using the average weight of coral trout in the AFMA database records that include both weight and the number.

Potential duplicate data entries are a concern in these data sets. There are many complete duplicate rows and also many records with most entries the same (e.g., boat ID, date, location, catch) but different 'weight.factor' entries. It is difficult to decide whether these are duplicates or instances where fishers split their reported catch evenly between different types of weight factors (e.g. fillet or whole fish). If we are unable to get clarification on these potential duplicate entries from stakeholders, we plan to run a scenario analysis to test whether different ways of treating duplicate entries affect the conclusions of the stock assessment.

Logbook data from charter fishers and commercial fishers targeting other species were excluded from the CPUE standardization because they do not provide consistent measures of effort. However, their total catch will still be input to the stock assessment. To do this we excluded all entries that did not use "line" fishing.

2.3 Mapping data

The Queensland coral trout assessment relies heavily on mapping data provided by the Great Barrier Reef Marine Park Authority (GBRMPA) to quantify the habitat available to coral trout. The assessment specifies three types of habitat: reef slope, reef patches and submerged reef. The GBRMPA mapping data come in two sets: "wet reef", the outlines of which are very roughly 10 m deep, and "dry reef" or more correctly "reef flat" which is much closer to sea level (Hopley et al. 2007, p. 140).

For Torres Strait one mapping data set is available, as a result of a recent research project (Lawrey and Stewart 2016). This data set was intended to provide wet reef outlines but occasionally these were too deep or the water was too turbid for them to be distinguished from satellite images (Eric Lawrey, AIMS, personal communication). The result is a data set that usually provides the equivalent of wet reef but for some reefs is more similar to dry reef.

We plan to use the mapping data to quantify habitat in Torres Strait and also use abundance data from the Great Barrier Reef (e.g., underwater visual surveys) to infer the absolute abundance of coral trout in Torres Strait (measured as the number of adult fish per hectare).

From satellite photographs we have divided Torres Strait into seven zones of different perceived reef types, as shown in Figure 1 below. Not all of the zones are open to fishing for finfish. We envisage that most of the fishing coral trout will take place in Region 5 which has large amounts of suitable coral trout habitat in reef patches and submerged reef. Region 3 appears to consist largely of planar reefs that have been infilled by

coral debris, while Region 6 contains barrier reefs which serve to shelter the mid-shelf reefs in Regions 5 and 3 from large waves.

2.4 Stock Assessment

We plan to extend the model from the 2014 Queensland coral trout stock assessment to Torres Strait. This will reduce the development time and provide consistency between the two assessments. Habitat area measurements from mapping data are an important input.

The model can also take into account the effect of social learning, whereby coral trout become reluctant to take bait after some of their fellows have been hooked. This effect was estimated by Leigh et al. (2014, ch. 2) from scientific studies of replenishment closures of Boult reef from 1983 to 1986 (Beinssen 1989) and Bramble Reef from 1992 to 1995 (Mapstone et al. 1996; Robertson et al. 1998; Davies and Mapstone 2012). It is plotted in Figure 2 below.

Tropical cyclones were important in the Queensland coral trout assessment and cause major falls in catch rates for up to two years after a major cyclone. Cyclones are believed not to be an important factor in Torres Strait, as it is too far north to be strongly affected by them.

Marine protected areas comprise about one third of the area of the Great Barrier Reef and were accounted for in the Queensland stock assessment. They are not a factor in Torres Strait.

In other respects the stock assessment model is a fairly standard, regional age-structured model.

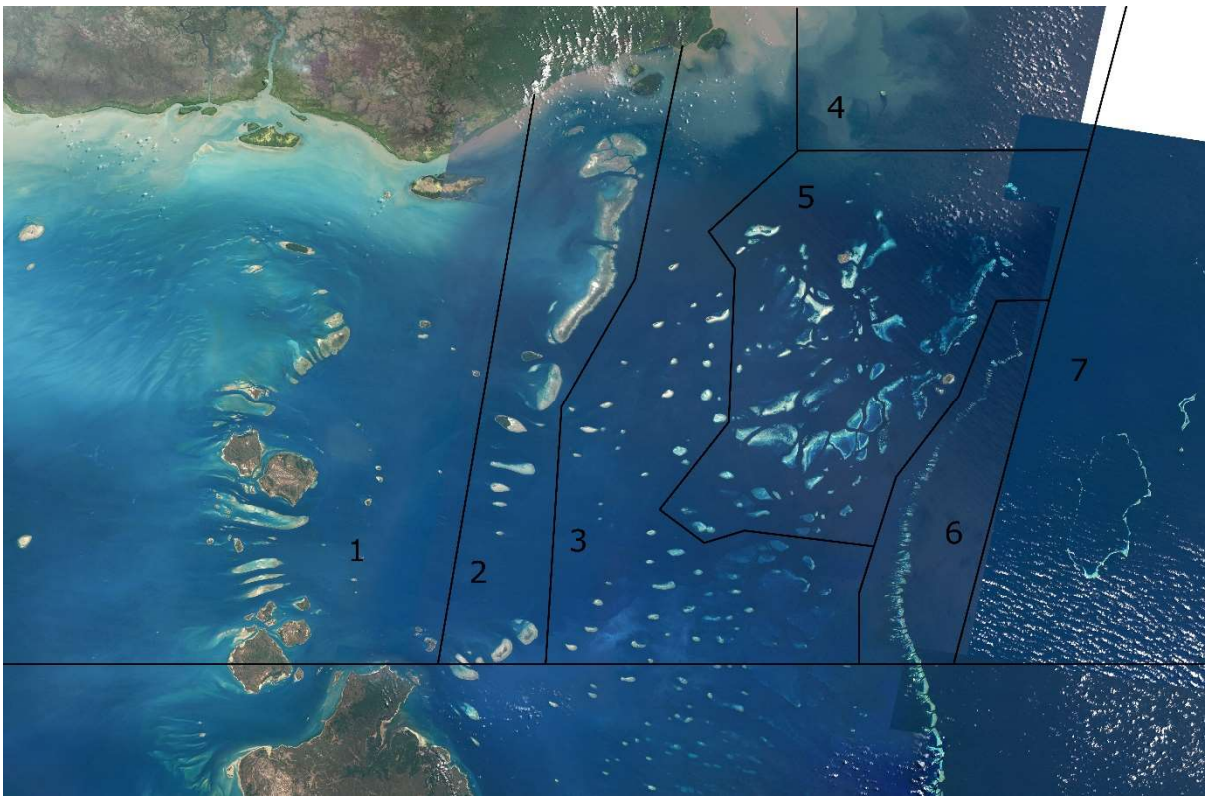

Figure 1: Landsat satellite image of Torres Strait, with numbered Regions shown. Source: eAtlas, www.eatlas.org.au, *originally from LandSat,* http://landsat.usgs.gov, *Creative Commons by Attribution licence.*

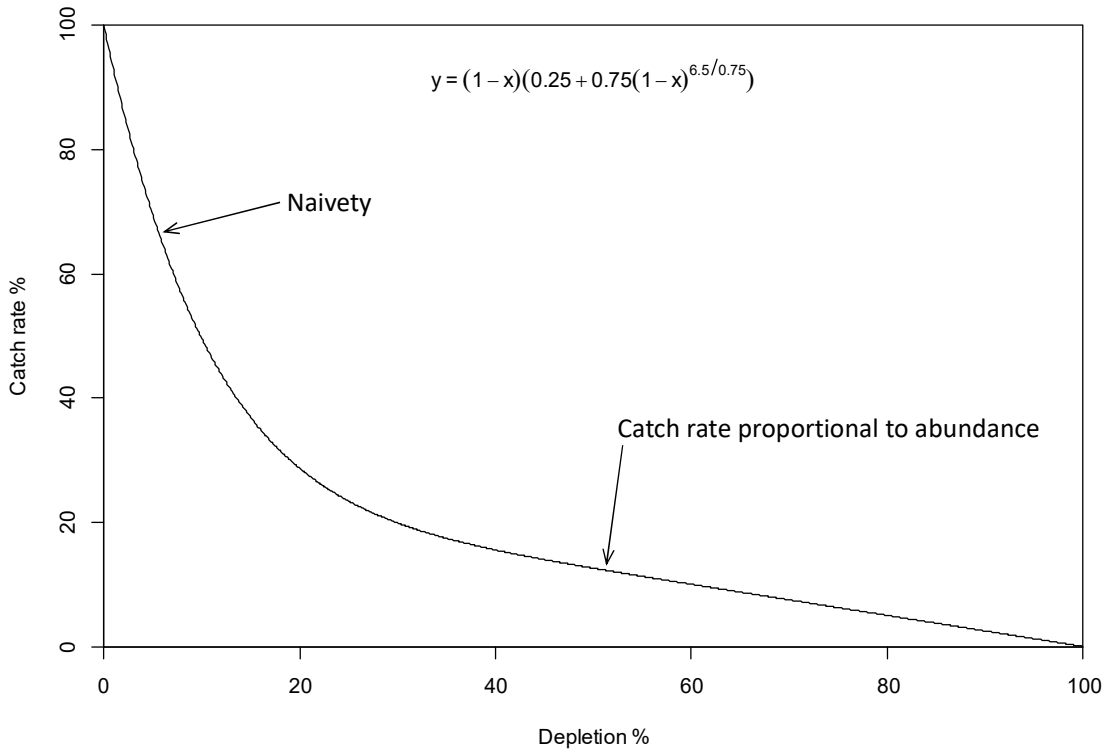

Figure 2: Estimated effect of social learning by a coral trout population in response to line fishing, showing naivety with light fishing when the fish have not yet learnt to avoid taking bait, and catch rate proportional to abundance after the population has been depleted by about 25%. Source: Leigh et al. (2014, ch. 2).

3 Other items

3.1 Decisions made to progress harvest strategy development

In order to initiate discussion and stakeholder feedback during the meeting and workshop various options, as series of meeting Action items (Appendix A) were tabled. Below is a summary of progress against each item:

Coral trout - Meeting Action 1: Review uncertainties and practical management issues of assessing Coral Trout on the basis of main species (*Plectropomus leopardus*).

For consistency a decision was made to assess the stock on the basis of the assumption that it is common coral trout only. In other words the life-history characteristics in the model will be those for common coral trout only. This is consistent with the approach in Williams et al. (2007) and Leigh *et al.* (2014).

Coral trout - Meeting Action 2: As part of (A.1) review the implications for setting aggregated catch limits (for group of species) if Coral Trout is assessed on the basis of single species. Conversely, document potential increased uncertainties (and risks) with non-species specific assessments.

If the stock assessment model for Coral Trout is based on common coral trout only and all the catch data is assumed to be common Coral trout, then any estimation of future harvest rates will be for all the species lumped under the heading Coral Trout. If this is the case then monitoring changes in species composition, in order to check if there are changes in 'species-split' becomes a necessity. How often this is undertaken and how this will impact on the stock assessment is unknown at this stage. There is no short term solution to this uncertainty unless catch records record species specific catches and correctly and consistently. There was no clear resolution on this matter, apart from the comment that is not a problem specific to the Torres Strait. Previous data exist on the 'species split' (as published in Williams et al. (2007)) and comment from the floor seemed to indicate that if commercial fishing effort on Coral Trout focused on certain regions and live caught fish (for live trade) then the majority of the fish landed would be *Plectropomus leopardus*. Also stakeholders were informed that if interim arrangements were put in place and preliminary stock assessments undertaken assuming life-history and productivity of the Coral

Trout group was such as that of *Plectropomus leopardus,* then it was possible retrospectively to evaluate the sensitivity of various models to this assumption.

Coral trout - Meeting Action 3: Ascertain what was rationale for setting the current interim magnitude of Coral Trout catch levels. Where did the numbers come from?

The harvest strategy project team wanted to seek clarification on the historical catch statistics of common coral trout. There was no clear explanation of how the TAC that was calculated as an average of historical data was actually computed. Essentially the average seemed higher than most of the records it is calculated over (bar one), when one considers the data plot of catch history.

Spanish mackerel -Meeting Action 4: Adopt a Limit Reference Point for Spanish mackerel.

A limit reference point of B20 was adopted as an interim LRP at this stage in order to progress. It was put to the table that B25 was also an option given it would be less conservative. However the Bmsy for Spanish mackerel is estimated to be approximately B40, this following proxies set by the Commonwealth Harvest Strategy Guidelines that LRP = 0.5 x Bmsy then B20 is the most 'appropriate' measure. A scientific member on the RAG also pointed the group to the paper by Pascoe et al. (2014) which was a key reference for choice of reference points.

Spanish mackerel -Meeting Action 5: Adopt performance metrics for Spanish mackerel based on current standard performance measures/metrics used in fisheries.

The stakeholders were presented with a range of performance metrics. There are displayed in Appendix B. The detail will be explored during future stakeholder meetings.

Spanish mackerel -Meeting Action 6: Discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points. Explore 'response' rules to each reference point.

Various option for the Spanish mackerel harvest control rule, that specifically includes the interim TRP and LRP were presented in by Michael O'Neil (and these are explained in full in the Milestone Report 1 (dated 30th June 2018). As for adopting 'hockey – stick' like harvest control rules, a scientific member on the RAG raised the point that there was maybe a need for some inflection points. These alternatives were explained to the stakeholders (see Appendix C).

Spanish mackerel -Meeting Action 7: Finalise agreement on different monitoring information that will be collected such as catch-at-age data (with consensus on who, when and by when?).

The outcomes of this discussion are covered in Section 3.2 below (*Data gaps identified during meeting/workshop proceedings*).

Finfish stocks - Meeting Action 8: Review potential use of additional indicators (e.g. profit).

The option of using CPUE as a performance indicator was discussed. The case was that it would be used as an UTILZATION index rather than a STATUS related index. In other words changes in CPUE would not be used a means to indirectly measure changes in abundance, but rather be used of a measure of 'success' and a lower threshold would an economic cut-off. Difference between TIB fishers economic variability and TVH economic variability was discussed by stakeholders and a lower 'limit' of 25kg/day was presented as lower limit that would be a break-even point for any fleet (TIB or TVH), as it would the lower limit for the dory.

Finfish stocks – Meeting Action 9: Review potential use of additional performance metrics.

If CPUE was chosen as a performance indicator with the performance metric being: CPUE > 25kg/day then the feasibility to present future projections of CPUE per day under alternative future harvest rates within the assessment were discussed.

Additional topic: Potential future Management Strategy Evaluation (MSE) of finfish stocks

It was agreed that any MSE of finfish stocks would

a) Consider Spanish mackerel and Coral trout separately

b) Operating models for each stock would need to be identified

c) For Coral trout, MSE would evaluate robustness of any assessment, management procedure to the single species assessment of the coral trout 'group' of species

d) For Spanish mackerel, MSE would evaluate robustness of any assessment, management procedure to the single stock in TS hypothesis, the effect of local aggregations (the spatial aspects) and environmental hypothesis concerning recruitment impacted on by fresh water/turbidity of rivers in Papua New Guinea (PNG).

3.2 Data gaps identified during meeting/workshop proceedings

A round table discussion was initiated by the RAG chair in order to elicit key data gaps for each species (i.e. Spanish mackerel and Coral Trout) separately.

Summary points relate to:

- **Spanish mackerel** - given the concerns about not observing older age fish, discussion focussed on data collection options to inform the age structure data. It was proposed that if for 5 trips a year (random times and areas) 30-50 fish per trip could be aged, then this data would be informative. The second option (or potential additional option) was to obtain 'frames' from the freezers (particularly the heads). Discussion then focussed on uncertainty as to timing logistics, and cost of ageing. Concerns over recent 'unexplained' declines in CPUE were discussed. Past data also needed to be validated, as there were a few years with unexplained high catches pre-dating the buy-backs. The connectedness between stocks are was also tabled, with tagging raised as an option to estimate fishing mortality. A scientific member proposed using F-based techniques for indirectly estimating impacts on stock status (Appendix D).

- **Coral Trout –** discussions around the table considered the utility of monitoring the 'species-split' for the different species group in the catch data under 'coral trout'. There was a need to check that proportions did not vary over time. Further discussion considered the requirement for habitat mapping, particularly due to the association of Coral trout to very distinct habitats. The option for undertaking dive surveys to get an absolute biomass estimate was tabled. Concerns about visibility were raised as an issue and so were high costs. Similarly to other stocks (as above) there was a need for updated age structure data. There were comments and questions pertaining to the validation of catch data and freezer data, and whether it was suitable for monitoring catch rates (CPUE). Further to data discussions – input was also provided by a Scientific Member on the RAG as to QLD current harvest control rule for Coral trout (Appendix E).

4 Acknowledgements

Funding for this project has been provided by AFMA and CSIRO Oceans and Atmosphere. We thank all the stakeholders, the TSRA and AFMA who have provided input via the RAG/WG meetings. We are grateful to Jerzy Filar (UQ) for supporting UQ's participation in the project.

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Appendix A - List of Meeting sessions and Action items

First session: Focus on Coral Trout

Meeting Action 1: Review uncertainties and practical management issues of assessing Coral Trout on the basis of main species (*Plectropomus leopardus*).

Meeting Action 2: As part of (A.1) review the implications for setting aggregated catch limits (for group of species) if Coral Trout is assessed on the basis of single species. Conversely, document potential increased uncertainties (and risks) with non-species specific assessments.

Meeting Action 3: Ascertain what was rationale for setting the current interim magnitude of Coral Trout catch levels. Where did the numbers come from? (we need information from WG and RAG).

Second session: Focus on Spanish mackerel

Meeting Action 4: Adopt a Limit Reference Point for Spanish mackerel.

Meeting Action 5: Adopt performance metrics for Spanish mackerel based on current standard performance measures/metrics used in fisheries.

Meeting Action 6: Discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points. Explore 'response' rules to each reference point.

Meeting Action 7: Finalise agreement on different monitoring information that will be collected such as catch-at-age data (with consensus on who, when and by when?).

Third session: Key challenges, risks and uncertainties

Meeting Action 8: Review potential use of additional indicators (e.g. profit).

Meeting Action 9: Review potential use of additional performance metrics.

Fourth session: Wrap up/key points raised not considered before meeting

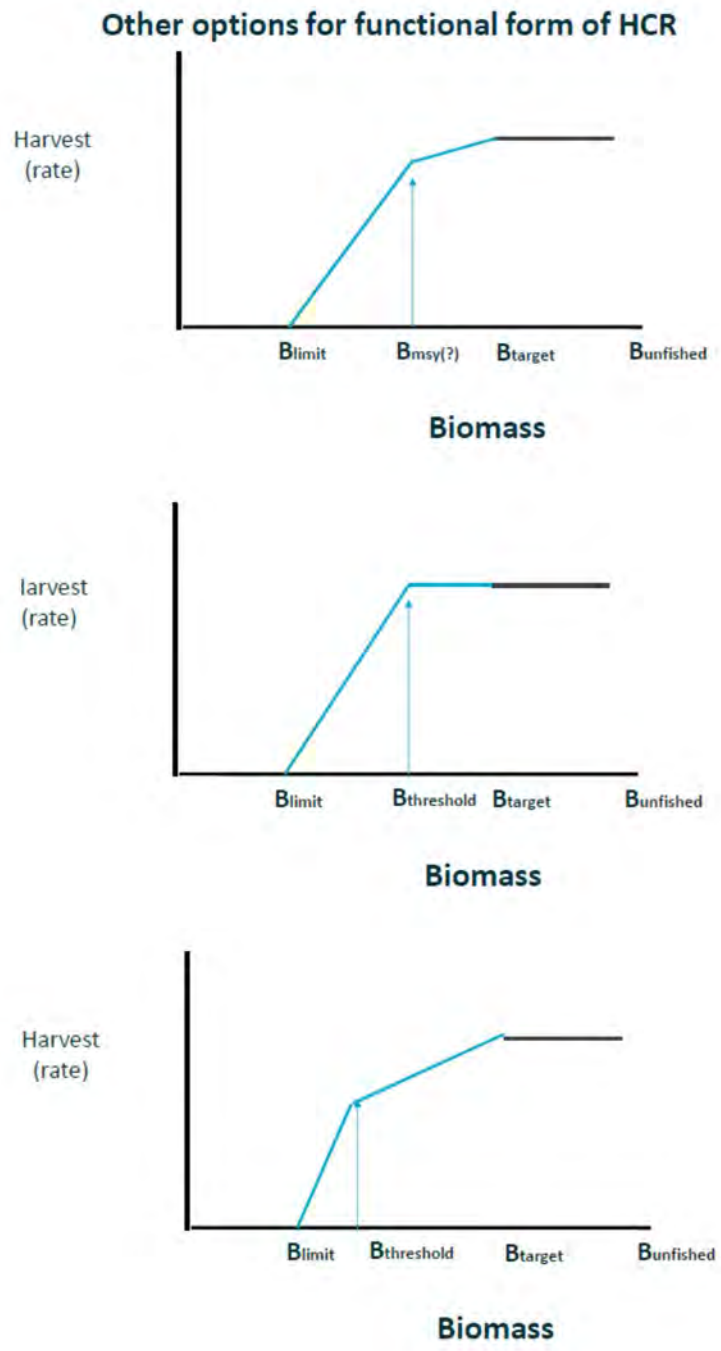
Meeting Action 10: Clearly document new points raised.

Appendix B – Potential performance metrics

Potential performance metrics that could be applied to Finfish stocks within a harvest strategy. CT – refers to Coral trout; SM refers to Spanish mackerel.

Performance Metric	Example: set value	Typical sub-rule	Rationale/additional aspects to note
Target Reference Point **Is Biomass<TRP**	60% of B(unfished) B60	Current Biomass must be = B60, of if not the lower catches to achieve it…. by a set time Note: if Current biomass > B60 then catches are too low (increase catch)	It is what you want to achieve – aspire too Represents an amount above BMSY in many cases to obtain higher catch rates (lower costs) and achieve greater economic benefits
Limit Reference Point **Is Biomass >LRP**	20% of B(unfished) B20	Current biomass > B20	The most critically important Performance Metric.
Catch (predicted future catch)	SITUATIONAL Depends on stocks 134 tonnes (CT) 125 tonnes (SM)	Catch at levels which sustain fishery	However, catch in future must vary around some amount which still meets Reference Point rules Over-ridden by above two rules
Average annual variation in catch (AAV) Catch variability	Depends on how much variability is acceptable 10%; 15%, 30%?	Catch variability must be <15% (over set time period)	Set the harvest rate (and take into account environmental variability) such that catch year on year is not too variable

Appendix C – Alternative forms for ‘hockey-stick’-like HCRs



Appendix D – Scientific members comments on F-based approaches

Comment's from Dr Rick Buckworth on F-based approaches

"*The discussion of the harvest strategy development is very focussed on methods which produce information that is fed into a stock assessment model, with stock biomass as a leading variable. Simplistically, current biomass B_t is estimated and related to unfished biomass B_0. Reference points are estimated as relative stock biomass e.g. B_{lim} is B_{20} and so forth.*

Many assumptions underlie stock assessment models, a primary one being that the assessed stock is all one simple well-mixed stock, the 'unit stock assumption'. This means that the models do not match the spatial structure of the fished stock, which might change over time in ways that are not predictable nor even observed readily. The models mis-specify the spatial dynamics of the stock.

It might be worthwhile considering fishing mortality rate-based (F-based) approaches to monitoring and managing spatially dynamic species such as Spanish mackerel and coral trout(s). These might be additional rather than alternative approaches -at this early stage in the harvest strategy development process, they are certainly worth considering and perhaps capturing in the harvest strategy.

Several WA fisheries, e.g. tropical reef fish, are currently managed using F-based methods.

A management strategy evaluation by Buckworth (2004) showed that F-based management that used simple tracking of F and catchability out-perform approaches that required annual stock assessment. Buckworth (2004) suggested that the information on F could be gathered using small annual mark-recapture experiments. Other methods of estimating F could potentially be used (e.g. catch curves from age structure information) additionally or alternatively, depending upon feasibility and costs.

It is worth noting that in fisheries with complex spatial structures, changes in catchability are very informative. One of the signs of trouble in a fishery is that catchability climbs suddenly and steeply."

Buckworth, R. C. (2004). Effects of Spatial Stock Structure and Effort Dynamics on the Performance of Alternative Assessment Procedures for the Fisheries of Northern Australia. PhD Thesis, University of British Columbia, 226 pp.

Appendix E – Coral trout: harvest control rule QLD fishery

BACKGROUND ON THE MANAGEMENT ARRANGEMENTS TO SET THE CORAL TROUT QUOTA ANNUALLY

1. The annual quotas for the Queensland Coral Reef Fin Fish Fishery are established through a declaration made by the Chief Executive in accordance with section 44 of the *Fisheries Act 1994*. The Deputy Director-General, Fisheries and Forestry, holds a delegation to make this declaration.

2. The declaration instrument is considered subordinate legislation.

3. The annual quota for the Coral Reef Fin Fish Fishery is reviewed annually and for coral trout is based upon analysis of catch and effort data from the fishery via agreed decision rules and advice from the Coral Reef Fin Fish Fishery Working Group.

4. The decision rules for coral trout were developed by the previous Line Working Group and adopted in 2014 following a targeted consultation process.

Decision Rules for Setting the Coral Trout Quota

Introduction	Two methods are used to set Quota in a five year cycle. In the first year, the results of the stock assessment (Method 1) and in the following four, the commercial catch rates (Method 2). In five years time, the stock assessment is updated and the cycle can be repeated. In this way the Quota can be reviewed and declared every year allowing adjustments to the Quota to reflect annual stock productivity changes and impacts of extreme weather events such as cyclones. Stock assessments provide the most comprehensive assessment of available data and take into account a long term historical perspective of the fishery (e.g. the catch and catch rates for this fishery for the last 20 plus years were used in the coral trout assessment). Elsewhere in Australia, and in other countries, stock assessments are used to assess the performance of the fishery over time and set quotas. Results for the Queensland coral trout stock assessment are now available with the assessment expected to be published later in 2014. As stock assessments address uncertainty in the data by generating results for different scenarios, deriving a Quota from the coral trout stock assessment results requires consideration of results for specific data scenarios. For example, the Quota can be derived for the area of commercial fishing only or include both area open and closed to fishing within the Great Barrier Reef Marine Park. The Quota will also vary depending on the measure of stock productivity used. The recruitment compensation ratio, *r*, is a measure of the reproductive productivity of the stock i.e. the average number of offspring of each adult fish that survive to spawning age, when the population size is very low. It is a measure of the productivity of the population when population size is not limited by competition between individuals. The higher *r* is, the more resilient the stock is. The Quota will also be dependent on the management targets chosen for the fishery. These targets are commonly based on proxies that are represented by the ratio of the current estimated biomass relative to the unfished biomass (B_0). The management targets commonly used in fisheries management in Australia and elsewhere are: $0.20B_0$ – 20% of the initial biomass is the limit reference point. Below this level, rebuilding strategies are implemented and usually involves closure of the fishery if required. $0.40B_0$ – proxy for Maximum Sustainable Yield (MSY). The level that best maximises stock productivity. $0.48B_0$ – proxy for Maximum Economic Yield (MEY). The value that best maximises economic returns from the fishery.

	$0.58B_0$ – alternate proxy for Maximum Economic Yield as recent economic research in Queensland trawl fisheries have shown that when operating costs are high, 0.58 (or higher e.g. 0.68) provides a more realistic approximation of MEY. The empirical catch rate method uses the current catch rates of the commercial fleet as an indicator of the performance of the stock compared to a target catch rate for the commercial fleet to achieve in order to optimise profitability. The further the current catch rates are from the target catch rate the more the Quota needs to be adjusted up or down. This method relies on the following information with all catch rates measured as kg/dory day. At present, catch rates are based on the whole fleet and unstandardised: • Average catch rate (the catch rate of the previous two years for the whole fleet) • Target catch rate (the catch rate being targeted for future years) • Limit catch rate (the catch rate below which would indicate stock problems) • Target catch (taken as the average total catch between 2006-2008) • Maximum Quota (the maximum Quota that can be set for the fishery)
Decision Rules	<u>Rule 1</u> Derive Quota using Method 1 every five years and Method 2 in the four years following. <u>Method 1 – Stock assessment based</u> The Quota is derived from the stock assessment by applying the following scenarios and rules: i) *Value of the recruitment compensation ratio, r = 10* Rationale: A value of 10 is considered to be conservative but is reasonable for coral trout based on its life history. A value of 10 is also used for similar species, such as grouper, in stock assessments overseas. ii) *Quota to be based on the area of the fishery open to fishing* Rationale: Most Quota is taken from areas in the Great Barrier Reef Marine Park open to fishing. This means that stock in marine park zones closed to fishing are not included in Quota setting. iii) *Management target = 68% of unfished biomass* Rationale: The economics of the fishery, where costs are high, means that high catch rates are needed to ensure a return in received. The current Quota of 1,288 tonnes is not being reached meaning that catch is not effectively being restricted and therefore catch rates, and therefore profitability, can be driven down. This is a high risk approach to maintaining industry profitability. Aiming for the stock to be at 68% of unfished biomass will increase the resilience of the stock and therefore the resilience of the fishery. <u>Method 2 – Catch rate based</u> The Quota is calculated by applying a scaling factor, *SF*, to the target catch as described in Equation 1 below subject to a maximum limit. The ratio of average catch rate with respect to the target and limit catch rates is used to calculate the scaling factor. The maximum of the terms within the brackets in Equation 2, either 0 (if the average catch rate is less than the limit catch rate) or the ratio of the catch rate values, is the scaling factor. Generally, under this method, the catch rate relationship between implicit management targets such as MSY (a proxy being $0.4B_0$) or MEY (a proxy being $0.68B_0$), is not explicitly known. In this case, an average catch rate is chosen reflecting a period of profitability and/or stability. B_0 denotes the virgin biomass or unfished biomass, the subscript $_0$ signifying year 0. $$\text{Quota} = \min(C_{t\,arg} \times SF, \text{Quota}_{max}) \quad (1)$$ Where C_{targ} is the catch target (i.e. target harvest) =1,150 tonnes SF is the Scaling Factor as described in Equation 2 Quota_{max} is the upper limit to which the Quota can be set = 1,288 tonnes

	$$\text{ScalingFactor} = SF = \max\left(0, \frac{\overline{cpue} - cpue_{lim}}{cpue_{targ} - cpue_{lim}}\right) \quad (2)$$ Where $\overline{cpue}$ is the average annual catch rate of the previous two years $cpue_{lim}$ is the limit catch rate = 7.35 kg/dory/day (i.e. 20/68 * $cpue_{targ}$) $cpue_{targ}$ is the target catch rate = 25 kg/dory/day <u>Rule 2</u> To minimise impacts on business planning and markets, small or large changes to the Quota in any one year will be avoided by applying additional rules. These rules will ensure there is a fair balance between ecological and economic needs. If the decision rules recommend a Quota change of less than 50 tonnes no change would be made unless this occurred in two consecutive years. Likewise if the rules recommend a Quota increase or decrease over 200 tonnes the maximum change to the Quota would be 200 tonnes, unless there is an exceptional circumstance. An exceptional circumstance would include a severe weather event impacting key areas of the fishery. For example, in the event of evidence of a sudden decline in the fishery as a result of a major cyclone, such as occurred following tropical cyclone Hamish, the Quota may be reduced by more than 200 tonnes. Prior to the decision rules being applied the Line Working Group would be asked to review the assessment results to ensure that it is in line with observations and experience of fishers involved with the fishery.
Timelines	Jan Feb Apply Quota decision rules to calculate the Quota Mar Line Working Group review of calculated Quota Apr Chief Executive decides and declares Quota for next season May Jun Jul New Quota applies Aug Sep Oct Nov Dec
Additional Information	1) The catch rate method has been developed from the Australian Government Tier 4 assessment for the Southern and Eastern Scalefish and Shark Fishery (SESSF) (i.e. uses catch and catch rate information from the fishery only). The Commonwealth fisheries use a Tier 1 to Tier 4 assessment system to determine allowable catches with Tier 1 based on quantitative stock assessments and Tier 4 based only on fishery catch and catch rates. 2) The empirical catch rate assessment is used when alternate stock assessment information exists on current biomass or exploitation rate. 3) Tier 4 harvest control rules have been applied in the SESSF since 2005. Subsequent testing and review resulted in revised decision rules in 2008 and 2009 and are now in place (AFMA 2009, Wayte (*Ed*) 2009, Little *et. al*, 2011). *References* AFMA (2009) Harvest Strategy Framework. For the Southern and Eastern Scalefish and Shark Fishery. September 2009. Australian Government. Australian Fisheries Management Authority. http://www.afma.gov.au/managing-our-fisheries/harvest-strategies/southern-and-eastern-scalefish-and-shark-fishery-harvest-strategy/ [December 2013].

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PZJA Torres Strait Finfish Resource Assessment Group	**Meeting 3** **19-20 November 2018**
CORAL TROUT **Preliminary assessment and harvest strategy development**	**Agenda Item No. 4** **FOR ADVICE**

RECOMMENDATIONS

That the RAG:

1. **NOTE** the presentation of a preliminary stock assessment for coral trout**;**

2. **DISCUSS** and **PROVIDE ADVICE** to the Harvest Strategy project team on reference points and control rules for coral trout.

KEY ISSUES

3. Management arrangements and catch limits for the Torres Strait stock of coral trout are based on Management Strategy Evaluation work performed in 2007.

4. Under the funded project to develop a Harvest Strategy for the Torres Strait Finfish Fishery the first ever empirical stock assessment for the Torres Strait coral trout stock assessment is to be performed by QDAF and UQ stock assessment scientists. The RAG is asked to note the presentation of a draft stock assessment and review its utility for gauging the health of the Torres Strait coral trout stock (biomass estimate provided) and its use to support decision making by the PZJA on sustainable catch limits.

5. The Harvest Strategy project team are seeking additional technical advice from Finfish RAG on components of the Strategy under development, including reference points and potential control rules to support management of coral trout, noting that broader stakeholder consultation is planned for early 2019.

BACKGROUND

Preliminary stock assessment

1. In the absence of a formal stock assessment, the status of the coral trout stock has been evaluated against the results of Management Strategy Evaluation work (Williams *et al.* 2011, 2007). In this MSE work four constant catch scenarios of 80, 110, 140 and 170 tonnes were tested which all achieved a biomass of at least 60 per cent of virgin total biomass by 2025.
2. The biomass in 2004 was estimated to be more than 60 per cent of unfished levels (Williams *et al*. 2011, 2007).
3. Commercial catch in recent years has been below historical catch levels and well below the lowest catch level simulated in the MSE (80 t per year).
4. The results of the 80 t catch simulation indicated that the stock would increase to more than 80 per cent of the unfished biomass within 20 years at that catch level (Williams et al. 2007, 2011).
5. Although based on older data, this MSE work represents the best available evidence for decision making and supports the 134.9 t TAC for coral trout. The MSE suggests that catches up to 170 tonnes would support a healthy biomass with building occurring.

6. The FWG has considered the coral trout notional TAC in recent fishing seasons (2016/17 and 2017/18) and recommended that the coral trout TAC (134.9 t) remain unchanged.
7. In considering its advice for the 2017/18 fishing season, the FWG noted that there was no new information to guide a different recommendation at the time. It was further noted that the harvest strategy to be developed will guide future assessments and TAC recommendations.
6. QDAF and UQ will now present the RAG with an assessment based on a statistical model of the Torres Strait population of coral trout.
7. The data that informs this model was provided by fishers to AFMA through daily fishing logbooks (TSF01), the current TDB02 Catch Disposal Records and the older (now defunct) TDB01 docket book. Data from both Traditional Inhabitant Boat fishers, island freezers and non-traditional inhabitant fishers is captured. These fishing data have been provided to CSIRO, QDAF and UQ under a strict deed of confidentiality and are treated with the utmost confidentiality.
8. Fishing data are used to produce a standardised Catch Per Unit Effort (CPUE) time series which enables stakeholders to track how the fishery harvests have performed over time.
9. Mapping data (Geographic Information System, GIS) for Torres Strait coral reefs has been used to measure the amount of suitable coral trout habitat within Torres Strait.
10. Estimates of trout per hectare from the northern most areas of the Great Barrier Reef (for which there is available survey data) have been overlaid across habitat types in the Torres Strait to provide an estimate of absolute biomass for coral trout.
11. A number of other assumptions are used to inform the model e.g. age at sexual maturity, length at age which are drawn from proven east coast assessment methodologies.
12. Finfish RAG are requested to provide views and advice to the stock assessment team on the preliminary model presented.

Advice on Harvest Strategy components

13. At its second meeting (20-21 March 2018) the Finfish RAG provided a range of advice to the harvest strategy project team, lead by CSIRO, to support developing a harvest strategy for coral trout and Spanish mackerel.
14. The RAG advice on initial actions to develop a harvest strategy for coral trout was as follows:

    Actions 1 and 2. Strategy to cover assessing either a basket of coral trout species or assess individually split species.

    The RAG provided advice on the options of either assessing the stock on the basis of the main coral trout species targeted (common coral trout *Plectropomus leopardus*) or alternatively splitting the assessment of the stock into the four species found and fished commercially in the Torres Strait. The RAG also provided advice to the project team on the implications for setting aggregated catch limits (for a basket of four coral trout species) versus non-species specific assessments.

    The following points were noted:

    - RAG noted that for a period of five years since leasing began in June 2008 only one sunset sector boat has consistently been fishing for trout fillets rather than fishing for live trout, which had only really begun in the 2017/18 season. Individual species did not matter too much to this boat targeting trouts for fillets as colouration was not an important factor for market for fillets.

- It was advised that live boats will mainly preferentially target *P. leopardus* (common coral trout) due to strong red colouration and will actively avoid portions of the Torres Strait which have higher proportions of the other lower value species (bar-cheeked, blue-spot, passionfruit) for the live trout trade.
- RAG advised that a multi-species approach could be adopted with a strong focus on data collection and the percentage break down of species captured. It was suggested that a trigger could be developed for consideration that if more than '*X*' per cent of a one species is caught management could then revert to single species approach focusing on that key species.
- RAG advised that the east coast coral trout stock is assessed as a basket but is less of an issue as common coral trout are mainly caught with fewer of the other species compared to Torres Strait.
- Both the Catch Disposal Record and Daily Fishing Logbook have the capacity to record multiple trout species (percentage splits for the four Torres Strait species) but this relies on the ability of fishers to identify species. This will require support from management in encouraging fishers with identification material and encouraging accurate reporting.
- It was noted that the analysis of historic coral trout catch data is challenging (fillets versus live boat) and the project team will examine how these data can best be used in the assessment.
- The RAG noted a strong need for:
    a. increased reporting on coral trout catches from the TIB sector;
    b. AFMA to encourage new fishers entering the fishery to complete daily fishing logbooks; and
    c. all fishers are to provide species-split data for coral trout.

Action 3. Coral trout catch data underlying the level of the nominal TAC

RAG noted the current 134.9 t TAC is based on average catches from 2001 to 2005 (113.2 t average for TVH and 21.7 t for TIB sector). RAG noted the need for detailed data validation on coral trout (and also Spanish mackerel) and supported an industry meeting being held that could help to characterise these older data and fisher/fleet behavioural changes over time.

The project team advised that the original data set used for analysis for the 2008 Management Strategy Evaluation work (Evaluation of the eastern Torres Strait reef line fishery, Williams et al. 2007) would be very useful for this purpose. It was advised that the data set had been located (held by CSIRO) and the project team would put in a data request to acquire access. RAG advised that the older island freezer data (part of this data set collected by JCU) would need scrutiny to check its completeness and usefulness for CPUE analysis given that it may not have associated effort data.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
SPANISH MACKEREL **Updated Stock Assessment and Harvest Strategy Development**	**Agenda Item No. 5** **FOR ADVICE**

RECOMMENDATIONS

That the Finfish RAG:

1. **NOTE** the updated stock assessment for Torres Strait Spanish mackerel provided by QDAF using additional data supplied by AFMA;

2. **DISCUSS** and **PROVIDE ADVICE** based on this assessment for a recommended biological catch (RBC) for Spanish mackerel for the upcoming 2019/20 season (starting 1 July 2019), noting that the harvest strategy under development will guide future advice on RBCs based on pre-agreed reference points and control rules.

3. **DISCUSS** and **PROVIDE ADVICE** to the Harvest Strategy Project Team on reference points and control rules for Spanish mackerel.

KEY ISSUES

4. The Spanish mackerel stock assessment model has been updated and accepted. In recommending the notional Total Allowable Catch for the 2017/18 season, an interim target reference point was agreed by the Finfish Working Group.

5. The PZJA Standing Committee has agreed that in the absence of new or updated information, future Spanish mackerel catches should be managed in line with the RBC of 125t.

6. The present 2018/19 seasons 115 t commercial TAC reflects this limit (125 t minus a 10 t deduction to account for subsistence take).

7. RAG advice is sought on whether the outcomes from the updated assessment are reflective of the stock status and whether the outcomes can support a recommendation for a different RBC for next season.

8. Developing a harvest strategy is a key research and management priority for the Torres Strait Finfish Fishery. The presently funded project, led by CSIRO, is seeking further RAG advice to support drafting components of the harvest strategy ahead of broader stakeholder consultation in early 2019.

BACKGROUND

Stock assessment update

9. Additional mackerel catch and effort data from Daily Fishing Logbooks (TSF01) and Catch Disposal Records (TDB02) have been provided by AFMA to QDAF under a strict deed of confidentiality to inform and update the Spanish mackerel stock assessment model. These data are treated with the utmost confidentiality.

10. The model includes an historic Catch Per Unit Effort dataset built from data provided by Traditional Inhabitant Boat fishers, island community freezers and non-traditional inhabitant fishers fishing either under TVH permits (pre-2007 buyout) or sunset permits

post-buyout.

11. Newly available catch data since the last assessment will be input into the model which will output an estimate of biomass and catch tables to support consideration of whether a revised RBC is required.

Advice on Harvest Strategy components

12. At its second meeting (20-21 March 2018) the Finfish RAG provided a range of advice to the harvest strategy project team, lead by CSIRO, to support developing a harvest strategy for Spanish mackerel.

13. The RAG advice on initial actions to develop a harvest strategy for Spanish mackerel was as follows:

Action 4. Adopt a Limit Reference Point for Spanish mackerel.

RAG recommended B20 (20 per cent of virgin biomass) as an interim limit reference point in line with the Commonwealth Harvest Strategy Policy and Guidelines 2007. RAG suggested a higher level of associated P (e.g. P 0.95) could be adopted to add increased certainty the stock would not breach this point.

Action 5. Adopt performance metrics for Spanish mackerel based on current standard performance measures/metrics used in fisheries.

RAG discussed the use of CPUE as an indicator in detail and provided input to the HS Project Team on a range of likely factors affecting CPUE standardisation as detailed below.

The RAG noted that catch per unit effort is traditionally used in assessments and harvest strategies as a powerful indicator (a signal) for how the fishery is performing and also for informing management responses under a harvest strategy. The RAG proposed that CPUE could be used as an indicator during the development of the harvest strategy framework and advised that a number of examinations would need to be performed to increase our understanding.

The RAG noted the apparent downwards trend in standardised catch per unit effort (Nov. 2017 examination of catch data up to 2016) from the last Spanish mackerel stock assessment (Figure 1. below).

It was noted that a number of assumptions underlie such analyses including:

- No fishing power change through time.
- No spatial information.
- No zero catches.
- No “hours fished” before 2003.

The RAG advised that examination of these assumptions is required and that consideration of large changes in the fishery might also need to be taken account of. RAG advised that in recent history (post 2003) the fishery has gone through a period of significant change including the buyout of the TVH sector in 2007 and transition to Sunset sector leasing arrangements since 2008/09, changes to daily fishing logbooks (new logbook in 2003), fluctuations in docket book reporting levels (TIB sector), experienced TIB fishers leaving the fishery and island freezers ceasing operation.

RAG identified that there is a need for consistent daily fishing logbook reporting of the following information to ensure the most accurate data is available to support assessments:

- Identify fishing trips over multiple days

- Target species and gear
- Vessels and skippers
- Locations fished (noting that coral trout data has location of the primary only, no tender fishing location is recorded).
- Time spent searching for fish and time spent fishing.

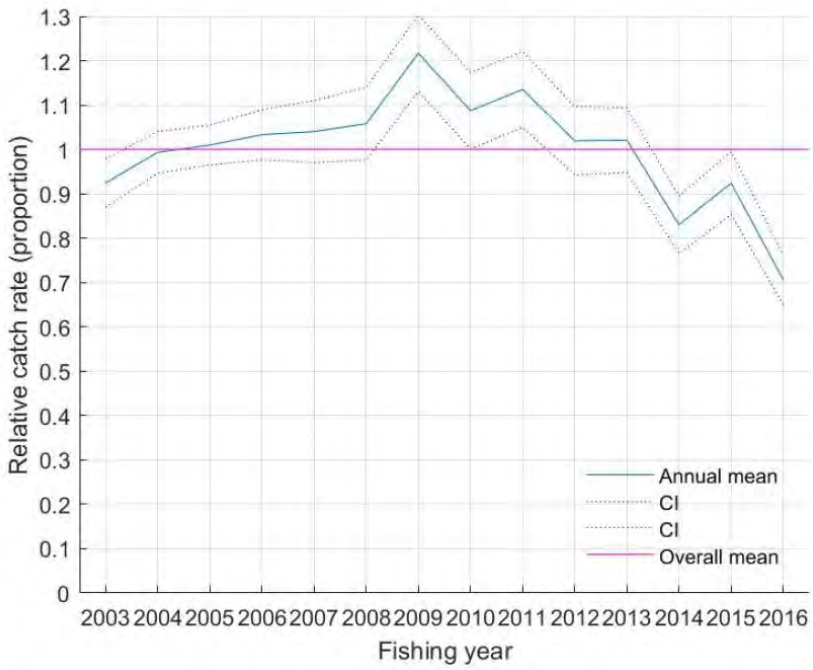

Figure 1. CPUE time series from most recent Spanish mackerel stock assessment.

Other factors were considered to be influencing the utility of CPUE as an indicator for Spanish mackerel including environmental factors, such as droughts in PNG (e.g. 2015/16). An industry member advised that such droughts could be a factor influencing catch rates in the Mackerel sector of the fishery, particularly at Bramble Cay where outflow from the Fly River was known to influence both water turbidity and salinity. AFMA advised that analysis of the historic data set could show which years had poor CPUE and this could be matched against known data from PNG droughts.

RAG encouraged AFMA and the project team to further investigate getting extra input from stakeholders about performance indicators, for example, what is a good number of mackerel per dingy per day for the TIB sector? These data would help inform development of indicators for Spanish mackerel.

Action 6. Discuss options for adopting a harvest control rule that takes into account the current stock assessment of Spanish mackerel, and responds to all the reference points. Explore 'response' rules to each reference point.

RAG noted that a range of harvest control rules would be developed and provided for analysis and discussion as the project progresses.

Action 7. Finalise agreement on different monitoring information that will be collected such as catch-at-age data (with consensus on who, when and by when?).

RAG tabled a range of data needs and perceived value-for-money analyses (for coral trout and Spanish mackerel) which would inform development of a sampling program. RAG noted that these could be condensed with the live document tabling research and data needs developed at the Nov 2017 meeting. RAG science members can table business cases for sampling designs (age, length data) to meet data needs as they are analysed and agreed as the project progresses.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
DATA NEEDS Torres Strait Finfish Fishery Data Needs	Agenda Item No.6 FOR ADVICE

RECOMMENDATIONS

That the RAG:

1. **DISCUSS** and **PROVIDE ADVICE** on the table of Finfish Fishery identified research and data needs (**Table 1**) and actions, both tactical and strategic, to help meet these needs;

2. That the RAG **NOTE** a presentation from the QDAF Long Term Monitoring Program (LTMP) on monitoring practices for Spanish mackerel and coral trout in Queensland State based reef-line fisheries managed by QDAF and how this monitoring meets the data needs of this fishery and is used for assessment purposes.

KEY ISSUES

3. At its first and second meetings (19 November 2017 & 20-21 March 2018) the RAG agreed to a list of research and data needs (**Table 1** below).

4. The RAG is asked to review this table and provide any changes and suggestions for meeting these strategic or tactical needs noting that strategic research priorities for distinct research programs (essential or desirable) will be discussed under agenda item 7 – Rolling Five Year Research Plan.

5. The collection of additional tactical fishery data such as ageing data, length-frequency or frames for genetic sampling will be subject to available funding. The RAG is asked to provide advice on short term, tactical needs and potential budget required to support collection of these data should they remain a priority.

6. Noting the presentation from QDAF LTMP, the RAG is asked to provide advice on the design of a strategic data collection program for the Finfish Fishery which will assist in setting future funding priorities, noting that the outcomes of the Harvest Strategy development will help guide these requirements for monitoring and data collection.

BACKGROUND

7. Biological data is fundamental in understanding the parameters used in structured stock assessment models.

8. The last biological data for Spanish mackerel from the Torres Strait Finfish Fishery was collected through the QLD LTMP from 2000 to 2005 which included length-frequency measurements and ear bones (otoliths) which were removed and measured to determine fish age. These data were used to inform the assumptions of the current Spanish mackerel model.

9. Periodic checks through the collection and analysis of biological data are generally required at intervals to determine whether the assumptions of a stock assessment model (such as age structure of the fish being captured or length at age) still hold true.

10. The agreed stock assessment model for Spanish mackerel has the capacity to incorporate regular biological data which improves the outputs of the model, making it more useful to

support our understanding of the stock.

11. At its initial meeting on 9-10 November 2017 the Finfish RAG noted:

    - that in future biological data needs for assessment purposes would be informed from the harvest strategy project team.
    - the age of available biological data for the Spanish mackerel stock assessment which was last collected in the early to mid-2000's (Table 1.3, pp 11 of Begg *et al.* 2006 below).
    - a need was identified to validate the biological parameters of the Spanish mackerel age-structured population model, ideally at agreed intervals to ensure the assumptions are correct over time.
    - there is a need for monitoring to understand the age structure of the stocks as this factor is linked to vulnerability which is one of the key assumptions of the model.

    RAG consideration was given to using fish frames retained by industry for biological sampling. It was noted that ageing data from otoliths collected from fish frames were very powerful data but would require an appropriate program with the right structure and stratification (e.g. random sampling from catch, whole-of-fishery representation, different size classes of fish, males and females etc.).

Table 1.3. Number of Spanish mackerel aged and measured in the DPI&F LTMP (2000-2002) and AFMA voluntary fisher logbooks (2004).

Year	Number aged			Number measured			
	Oct	Nov	Total	Sep	Oct	Nov	Total
2000	795	97	892		802	98	900
2001	874		874		909		909
2002	602		602		612		612
2004				721	662	406	1789
2005[1]	710		710		719		719
Total	2981	97	3078	721	3704	504	4929

[1]Data collected in 2005 as part of the CRC Torres Strait project were not included in the assessment.

12. At its second meeting on 20-21 March 2018 the Finfish RAG discussed the following points on biological data collection:
    - RAG noted the previous data collection had occurred from 2000 to 2005 and was detailed in the agenda paper.
    - RAG advised that there was a need for the collection of fish frames for the collection of ageing data from both TIB and sunset fishers. These data would aid our understanding of age structure, particularly the ongoing issue for investigation on domed vs. non-domed selectivity of Spanish mackerel.
    - To examine the usefulness of these data, sensitivity analyses could be performed on stock assessment runs this year to examine the impacts of including biological data versus running the model without these data.
    - It was suggested that the QDAF Long Term Monitoring Program could provide advice on sampling methodology and it was suggested that RAG members could begin discussion though out-of-session teleconferences to better inform what data would likely be required and advice obtained on collection. RAG members advised that any out-of-session fact finding needs to be reported back to the RAG and that a clear process should be mapped out and agreed by the RAG on deciding what data is to be collected and the associated methodology
13. In addition to advice on biological data collection, the RAG provided some additional commentary on other data-needs in the Finfish Fishery as noted below.

    Noting the focus for the present meeting was on progressing the harvest strategy, the RAG flagged that future meetings of the group could provide more commentary on shaping the data needs, assessment issues and advice on meeting both short

term data gaps and longer term priorities. The following points on data needs were discussed:

- QDAF will be actioning sensitivity analyses in the updated 2018 Spanish mackerel assessment to examine:
    - whether dome-shaped selectivity is important to the model - if this has an important influence on the model this might highlight the need to acquire biological data to further assess;
    - how unreported catches affect the model (noting an inflated estimate model x1.75 was presented but not accepted in the last assessment update); and
    - unexpected declines in Catch Per Unit Effort for Spanish mackerel.
- Visual dive surveys to assess virgin biomass for coral trout in Torres Strait may not be possible given poor visibility in the Torres Strait compared to Queensland east coast.
- Examining available habitat mapping data for the Torres Strait, and its utility, should be addressed in the short term (e.g. examining the amount of wet reef versus dry reef). At the moment the perimeter of reefs from visual mapping data is used as the proxy.
- Species specific data for coral trout was identified as a key item for investigation (reporting on all four species versus assuming all management applies to the basket of four species). RAG considered that there was likely little or no cost associated with getting individual species catch data from fishers, but this relies on accurate identification of species. A review of the logbook was flagged as a method to improve species ID and reporting accuracy. It was suggested that a program could be run to validate fisher logbooks against species identifications and that this could be run in Cairns during unloads. It was noted this program would likely have associated costs.
- Harvest strategy project team members presentation advised that industry and PZJA forums should be involved in any work on validating available and future fishing data collection. The RAG noted that it could support the Harvest Strategy project team.
- RAG advised that industry member Mr Tony Vass would be well placed to assist with logbook validation based on older logbook data and that he could aid investigation and validation of data ahead of the industry workshop.
- RAG noted previous work had been carried out on researching the connectivity between Bramble Cay and the remainder of the fishery. RAG advised that this was no longer a research priority due to the expense associated with these forms of research. It was advised that a full feedback Management Strategy Evaluation can examine the impacts of various stock structure scenarios e.g. most catches coming from Bramble Cay versus the rest of fishery.
- Members noted that traditional inhabitants have a strong interest in supporting fisheries management and have expressed interest in data collection and were able to assist.

Table 1. Research and data needs for the Finfish Fishery together with possible actions to be conducted by the RAG. Agreed by Finfish RAG at its first meeting: FRAG 1, 9-10 November 2017.

Research and data needs	Action to address and comment
Catch and effort data needs to improve utility for assessments (SM and CT).	Review TSF01 daily fishing logbook to make sure it is best capturing data for assessment and management. Carry out industry workshop to review logbook/ discuss filling out logbook and raise awareness with fishers about the need for accurate CPUE data and accurate spatial data – including the importance of recording zero-catches. Verify catch disposal record data against logbooks to understand variance between fishers. Consider how VMS data might be analysed for stock assessment purposes.
Need to capture important data of zero-catches	
Spatial data issues with sunset logbooks – limited utility in past Spanish mackerel assessments.	
Need to capture TIB sector effort data – CDRs capture catch data but limited effort data.	Raise awareness among TIB finfish fishers about the need for accurate fishery data.
Need to reliably capture island freezer data.	Ensure operational island freezers are filling out CDRs and awareness raising on value of accurate data for assessments and Harvest Strategy development.
Need monitoring for take from non-commercial sectors.	Subsistence take project in progress. RAG advice is that recreational and charter catches are likely to be minimal.
Biological data issues	
Need to improve biological data inputs to stock assessment models due to age of most recent samples. Need to validate assumptions such as: age at maturity, age at length, length frequency.	Develop design of a sampling program alongside the Harvest Strategy project. Once designed evaluate how it might be delivered; e.g. through industry based sample collection, or an at-sea program funded through research channels. Investigate collection of samples to validate assumptions in the short term.
Stock structure	
Need to understand the relatedness within the Torres Strait SM and CT stocks to test the single-stock theory. Also important to understand connectedness to other adjacent stocks.	Previous acoustic monitoring carried out to examine SM exchange with Bramble Cay with limited findings. Genetic sampling could be carried out though this would likely be an involved project which would need to attract appropriate funding.
Assessment issues (SM)	
Need to understand how the SM assessment deals with most of the data coming from the Bramble Cay breeding aggregation of fish.	Next assessment update is to investigate.
Need to investigate the sudden peak of catches in the mid 2000's prior to the buyout and whether any of these catch data were 'paper' fish and the reported harvest level accurate.	Industry workshop and work on characterising the data, examining which boats entered the fishery and assess the accuracy of the available catch data from this time.
Ensure TIB sector changes such as experienced fishers leaving the fishery, freezers closing down, have been reflected in the assessment -	Data characterisation and industry workshop.
Ensure the impacts and benefits of the 2008 implementation of the 10 nm closures are understood and captured in the model (SM)	Next SM assessment update is to investigate. Industry workshop can record the impacts of the closures on reef-line sector marks (initial feedback is that this mainly impacted the SM sector)
Fish vulnerability (mainly SM issue)	
Improve understanding of fisher behaviour and how this varies across the fleet – including variation in gear setup, targeting practices, daily fishing effort.	Industry workshop to help stock assessment scientists and management characterise fishing practices.
Investigate SM 'domed' vulnerability where large fish are assumed to be less available to capture.	Next SM assessment update is to investigate.

	Next Spanish mackerel stock assessment		Ongoing education
	Industry workshop		Funded research
	Subject to future funding and advice on project design.		

Table 2. Finfish RAG input on monitoring data to support management and harvest strategy development including prioritisation and potential costs (RAG meeting #2, 20-21 March 2018) *(Areas considered higher priority by the RAG are highlighted in yellow).*

Priority (P)	Potential Cost (C)
High priority = 3	<$50 k = 3
Medium priority = 2	$50 - $150 k = 2
Low priority = 1	$>$150 k = 1

Spanish Mackerel				Coral Trout			
	P	**C**			**P**	**C**	
1. Age structure (domed – non-domed selectivity - sunset)	2			1. Species specific data (via fishery data)	3	3	
2. Unexplained CPUE declines, sensitivity analyses (covered?)	3	3		2. Habitat mapping	2	3	
3. Data validation (via existing workshops) after logbook validation and analyses	3	3		3. Virgin biomass estimate	3	1	
4. Ageing data TIB (student)	2	3		4. Ageing (student)			
5. Ageing data TIB (researcher)	2	2		5. Ageing (researcher)			
6. Connectedness between stocks	1	1		6. UVC (Dive survey)		1	
7. Investigation of tagging for fishing mortality data and confirming stock structure.	2	1		7. Unexplained CPUE declines, sensitivity analyses	3		
8. Estimating F (Fishing mortality)	2	2		8. Data validation (via scheduled workshops)	3	3	

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 30-31 October 2018
RESEARCH PLAN **Rolling Five-Year Research Plan 2019/20 - 2022/23**	**Agenda Item No. 7** **FOR ADVICE**

RECOMMENDATIONS

1. That the Working Group:
    a) **NOTE** that a rolling five-year research plan for the Torres Strait Finfish Fishery will be used to inform the Torres Strait Scientific Advisory Committee's (TSSAC) annual call for research funding proposals;
    b) **DISCUSS** and **PROVIDE ADVICE** on a rolling five-year research plan 2019/20 - 2022/23 for the Fishery (**Attachment A**).

KEY ISSUES

2. Research needs for the Fishery have previously been identified in the TSSAC Annual Operational Plan (AOP). The needs identified in the last AOP (2015) together with recent research that has been conducted in the Fishery is provided at **Table 1**.
3. In summary the key focus of research investment and management resources in the Fishery has been to develop a harvest strategy for the Torres Strait Finfish Fishery. A harvest strategy is fundamental to guiding cost-effective research investment in the future.
4. While the Harvest Strategy is likely to inform much of the future research needs in the Fishery, the RAG has provided advice on research and data needs over the last few years. This advice is summarised in **Attachment B**.
5. Based on RAG advice received to date, AFMA has drafted a Rolling Five Year Fishery Research Plan 2019/20 – 2022/23 for the Fishery (**Attachment A**). This has been prepared as a starting point for RAG discussion at this agenda item.
6. Research priorities proposed align with the new TSSAC Strategic Research Plan (SRP) Theme 1, Strategy 1a – Fishery stocks, biology and marine environment, Theme 1, Strategy 1b – Catch Sharing with Papua New Guinea and Theme 3, Strategy 3a – Develop technology to support the management of Torres Strait fisheries. It is open to the RAG to provide advice on broader priorities.

Climate Change

7. Understanding the impacts of climate change and having adaptable management arrangements is a priority for fisheries management.
8. AFMA is leading a project with wide collaboration on the adaption of Commonwealth fisheries management to climate change. The project is due for completion in 2020 and is likely to guide future research investment into possible management responses to the impacts of climate change on Torres Strait fisheries. The objectives are:
    a. How well does the existing Commonwealth fisheries management framework cope with climate change impacts (i.e. Risk Assessment)
    b. Develop methodology and approach for AFMA (and other fisheries) to adapt regulatory environment to climate change impacts
9. While the AFMA adaption project is likely to give some guidance around future research investment into possible management responses to the impacts of climate change on

Torres Strait Fisheries, advice is sought on other possible priorities, in particular to address any gaps in assessing vulnerability.

10. A range of projects have been undertaken to assess the likely impacts of climate change on Torres Strait Fisheries. Some have focused solely on Tropical Rock Lobster however subject to further evaluation of cost-effectiveness and feasibility some of the TRL work may be adapted for finfish overtime. The projects include:

    a) Qualitative Sensitivity Analysis: Assessing the vulnerability of Torres Strait fisheries and supporting habitats to climate change (Welch and Johnson 2013);

    b) Management Strategy Evaluation:

        i. Risk management tools for sustainable fisheries management under changing climate: a sea cucumber example (Plaganyi *et al* 2013).

        ii. An Integrated Management Strategy Evaluation (MSE) for the Torres Strait Rock Lobster *Panulirus ornatus* fishery (Plaganyi *et al* 2012) - to integrate of climate changes into the TRL Stock Assessment;

    c) System Modelling: Models of Intermediate Complexity of Ecosystems (MICE) – applied to TRL in the Torres Strait. Used in the following projects:

        i. AFMA project 2017/0816 – Environmental drivers of variability and climate projections for the Torres Strait tropical lobster *Panulirus ornatus*. (Plaganyi *et al* 2018); and
        ii. Decadal-Scale Forecasting of Australian Fish and Fisheries (Fulton *et al 2018*).

11. In June 2018 the TSRA and National Environmental Science Programs (NESP) Earth Systems and Climate Change Hub convened a workshop on climate change implications for fisheries and marine ecosystems in the Torres Strait. The workshop identified initial thoughts on priority areas for research that may help fisheries and marine ecosystem management in the Torres Strait.

12. The quantitative assessment conducted by Welch and Johnson (2013)[1] provided the following assessment of the vulnerability of coral trout and Spanish mackerel to climate change:

    Spanish mackerel were assessed as having low relative vulnerability to climate change. This was due to their high mobility and productivity resulting in low scores for exposure and sensitivity, while also having the highest adaptive capacity score. Temperature is known to be a potential cue for spawning and may be important in the longer term especially as they are thought to be a separate stock in the Torres Strait. However, more data is needed to determine whether they are in fact a separate stock and the temperature threshold for optimum spawning activity.

    Coral trout. All three species of coral trout were assessed as having a low relative vulnerability to climate change. This was largely because they all had high adaptive capacity being highly productive species that are targeted as part of a multi-species fishery with potentially many alternative species. Notwithstanding this, recent evidence of a thermal tolerance threshold at 28 °C for larval development and the known importance of temperature as a spawning cue (common coral trout: Samoilys 1997, Pratchett et al. 2013) means projections of SST increases for the Torres Strait that will exceed this threshold are of concern. Also, the documented importance of particular coral reef habitat for juveniles (barcheek coral trout: Wen et al. 2012) infers some sensitivity to environmental change for coral trout species in the Torres Strait.

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1 https://www.researchgate.net/profile/Johanna_Johnson4/publication/271770401_Assessing_the_vulnerability_of_Torres_Strait_fisheries_and_supporting_habitats_to_climate_change/links/54d1a58e0cf25ba0f0418c13/Assessing-the-vulnerability-of-Torres-Strait-fisheries-and-supporting-habitats-to-climate-change.pdf

Table 1. Summary of research needs identified in the last TSSAC Annual Operating Plan (AOP) 2015: Research Priorities for the Finfish Fishery

Research Area	Research Need	Actions to address identified need
1) Efficacy of management arrangements	1a) Investigating improvement of efficient, long term monitoring for all sectors of the fishery. 1b) Developing efficient harvest strategies for the fishery	Project to develop a harvest strategy for Spanish mackerel and coral trout is funded and underway led by CSIRO. This is the present priority for management and research in the Fishery and will be used to guide data needs and monitoring once adopted.
2) Fisheries assessment	2a) Development of an efficient stock status/abundance assessment. 2b) Development of operational management objectives, performance measures and decision rules to inform future management strategy evaluation. 2c) Understanding the nature and magnitude of PNG cross jurisdictional finfish migration.	Under the harvest strategy project, budget and staff time from the project team has been allocated to 1) updating the existing Spanish mackerel assessment and 2) developing and performing the first stock assessment for coral trout, to be delivered in 2018. MSE work needs to be funded and carried out once a draft harvest strategy framework is developed.
3) Stock structure of Torres Strait Spanish mackerel	3a) Defining the spatial scale of management and connectivity of Torres Strait (TS) populations of Spanish mackerel with neighbouring jurisdictions (PNG: east and west of TS; and QLD adjacent to TS). 3b) Assessment of whether TS stocks of Spanish mackerel comprise a shared stock with PNG and/or QLD jurisdictions.	Funded research (Defining the aggregating and movement behaviour of Spanish mackerel to inform future fisheries allocation and sustainable fishing) was performed to examine spatial connectivity between areas of Torres Strait. Outcomes were limited and further research is required.

BACKGROUND

13. Over the past 12 months, AFMA and the Torres Strait Scientific Advisory Committee have been drafting a new five year SRP for Torres Strait research. The SRP is the overarching document providing the TSSAC's strategic themes which guide priority setting for research in the Torres Strait fisheries over a five year period. The document identifies three research themes, and under these, strategies and possible research activities against these themes. The document also provides guidance to researchers on research application development and the TSSAC and PZJA forums in assessing applications through the assessment criteria in the SRPs appendices. The SRP was finalised by the TSSAC in mid-July. A copy of the SRP is at **Attachment C.**

14. The TSSAC now requires each fishery to develop a five year fisheries research plan, which fits into the themes identified in this SRP.

Torres Strait Fisheries Strategic Research Plan 2018-2023

15. The SRP specifies the research priorities and strategies that the PZJA intend to pursue in Torres Strait fisheries, and provides background to the processes used to call for, and assess, research proposals. The research priorities can be broad, covering all topics within the SRP, some of which may be funded by AFMA, and some of which may require funding from other funding bodies.

16. There are three research themes, under which the RAG could identify research priorities for the Fishery (**Attachment D**). This has been taken from the SRP. There are several strategies under each theme and suggested ideas to help the Working Group to get thinking about the sorts of projects which may go under these themes and strategies.

Rolling Five Year Fishery Research Plans

17. In the past, fishery specific research planning was undertaken through fishery specific research priorities being included in the SRP and each Torres Strait fishery completing a list of annual research priorities, which fed into the TSSAC annual research statement. This process has now been simplified by combining individual fishery planning into one rolling five year research plan per fishery. The plans are written by the relevant Torres Strait forum (Working group, MAC or RAG) based on the themes and strategies identified in the 5 year SRP. These plans are then used by AFMA and the TSSAC to create an annual research statement (ARS), listing annual priorities for Torres Strait research across all fisheries. The new plan should simplify this process.

18. The rolling five year research plans will be updated annually, thus always having a five year projection for research. It is possible that these plans will not be finalised in time for the development of the TSSAC 2019-20 ARS. In this case, fisheries will be asked to submit a one year list of research priorities for 2019-20, and the rolling five year research plan will be applied to the following year (2020-2021 and beyond).

TSSAC Annual Research Statement

19. In the past, the TSSAC has had an Annual Operational Plan (AOP) which detailed its annual research priorities, in addition to the fishery specific annual priorities. The AOP has been changed to the Annual Research Statement (ARS). The ARS includes only the limited number of priority projects selected by the TSSAC to progress to funding application stage through a ranking process.

20. It is developed based on the project ideas and priorities identified in each rolling five year research plan. The number of projects in the ARS will vary each year depending on the available funding. The ARS details:

    a. Current research project ideas identified by the TSSAC, as priority areas for research. The TSSAC will prioritise the projects based on the evaluation criteria and develop

project scopes for the chosen priorities. This document will then be sent to researchers in a call for research each year.

b. The operational aspects of assessment and evaluation of research proposals considered by the TSSAC including:

   i. How the TSSAC prioritise research projects;

   ii. The criteria used for assessing research proposals.

21. The TSSAC has an annual research cycle, which with the AFMA budgeting cycle (**Attachment E**).

Agenda Item 7 - LIST OF ATTACHMENTS

Attachment A – Torres Strait Finfish Fishery Draft Five Year Rolling Research Plan, 2019/20 to 2022/23.

Attachment B – Advice from Finfish RAG on Torres Strait Finfish Fishery Data & Research Needs from Meeting 1, November 2017 and Meeting 2, March 2018.

Attachment C – TSSAC Strategic Research Plan – Torres Strait Fisheries.

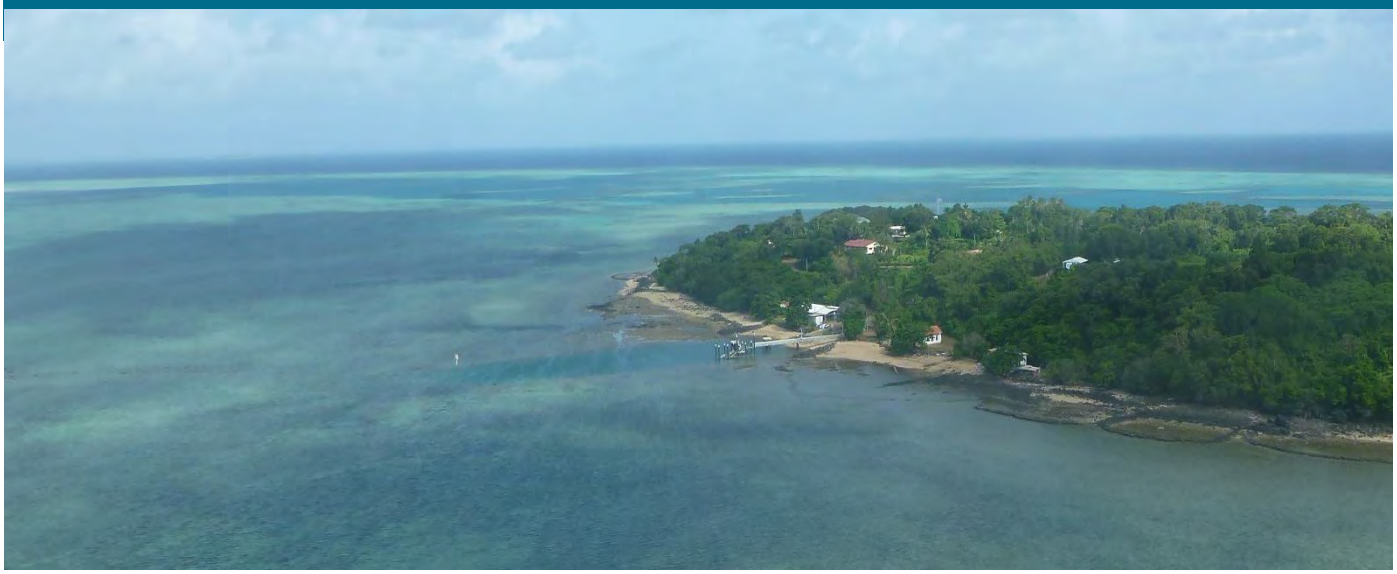
Attachment D – Torres Strait fisheries strategic research themes, strategies and research. activities

Attachment E – TSSAC Annual Research Cycle.

Australian Government | TSRA www.tsra.gov.au | Australian Government Department of Agriculture | Australian Government Australian Fisheries Management Authority | Queensland Government | TORRES STRAIT PZJA PROTECTED ZONE JOINT AUTHORITY

Five-year Research Plan 2019/20 - 2022/23

Torres Strait Finfish Fishery



Draft Compiled by the PZJA Torres Strait Finfish Resource Assessment Group, November 2018

ABOUT THIS PLAN

The Torres Strait Scientific Advisory Committee (TSSAC) seeks input from each fishery advisory body (Resource Assessment Group (RAG), Management Advisory Committee (MAC) or Working Group (WG)) to identify research priorities over five year periods from 2019/2020 to 2022/23. This template is to be used by the relevant advisory body to complete their five-year plan. The plans are to be developed in conjunction with the TSSAC Five-year Strategic Research Plan (SRP) with a focus on the three research themes and associated strategies within the SRP.

All fishery five-year plans will be assessed by the TSSAC using a set of criteria, and used to produce an Annual Research Statement for all Torres Strait fisheries.

The TSSAC then develop scopes for the highest ranking projects in order to publish its annual call for research proposals. There are likely to be more scopes that funding will provide for so TSSAC can consider a number of proposals before deciding where to commit funding.

The fishery five-year plans are to be reviewed and updated annually by the Torres Strait forums to add an additional year onto the end to ensure the plans maintain a five year projection for priority research. Priorities may also change during the review if needed.

Table 1. Research priorities for Torres Strait Finfish Fishery for 2018/19 – 2022/23.

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost*						Other funding bodies[1]	Evaluation		
		2018/19	2019/20	2020/21	2021/22	2022/23	Notes on project timings		Priority essential /desirable	Priority ranking (1-5)	Theme
Finalisation of Harvest Strategy	Finfish Harvest Strategy (Project No. 2016/0824) currently funded. Final HS draft expected by EOFY 2018/19.	$44,719 (for final Harvest Strategy)					HS Project established in 2016/17.		Essential	1	1a
Management Strategy Evaluation (MSE) of draft harvest strategy	Requirements of Cwth HS Policy and Guidelines to undertake MSE prior to implementation.	MSE – requires funding.	MSE work - requires funding. Advice pending.						Essential	1	1a
Stock assessments	Need for ongoing assessment of key commercial species.	Advice pending and HS will inform frequency. Maximum is yearly. Funding is required.							Desirable	2	
Age and length data sampling program	Develop costed options for the collection of age and length data for Spanish mackerel to support present and future stock assessments.	Not costed – advice pending.							Desirable	2	1a
Stock structure of Spanish mackerel.	Define the spatial scale of management and connectivity of Torres Strait populations of SM with adjacent areas (Gulf, Qld, Coral Sea, PNG) potentially through collection of samples for genetic relatedness.	Not costed – advice pending.							Desirable	2	1a, 1b
Ecological Risk Assessment (ERA)	All Torres Strait fisheries to be put through Ecological Risk Management framework over the next three financial years.		ERA due 2019/20. $20,400 allocated.					AFMA	Desirable	3	1a
Estimating catches outside the commercial fishery.	Current project: Monitoring the traditional take of finfish in the TSPZ (RR2015/0823) Project is under review. May require a revised project plan and or/tender.	~$140k budget remaining.	Future work on this project is pending advice.				Project established 2015.	TSRA total funding $199,802 (not from Torres Strait research budget)	Desirable.	3	1a

Agenda Item 7 - Attachment B
Advice from the Finfish RAG on research and data needs

Table 1. Research and data needs for the Finfish Fishery together with possible actions to be conducted by the RAG. Agreed by Finfish RAG at its first meeting: FRAG 1, 9-10 November 2017.

Research and data needs	Action to address and comment
Catch and effort data needs to improve utility for assessments (SM and CT).	Review TSF01 daily fishing logbook to make sure it is best capturing data for assessment and management. Carry out industry workshop to review logbook/ discuss filling out logbook and raise awareness with fishers about the need for accurate CPUE data and accurate spatial data – including the importance of recording zero-catches. Verify catch disposal record data against logbooks to understand variance between fishers. Consider how VMS data might be analysed for stock assessment purposes.
Need to capture important data of zero-catches	
Spatial data issues with sunset logbooks – limited utility in past Spanish mackerel assessments.	
Need to capture TIB sector effort data – CDRs capture catch data but limited effort data.	Raise awareness among TIB finfish fishers about the need for accurate fishery data.
Need to reliably capture island freezer data.	Ensure operational island freezers are filling out CDRs and awareness raising on value of accurate data for assessments and Harvest Strategy development.
Need monitoring for take from non-commercial sectors.	Subsistence take project in progress. RAG advice is that recreational and charter catches are likely to be minimal.
Biological data issues	
Need to improve biological data inputs to stock assessment models due to age of most recent samples. Need to validate assumptions such as: age at maturity, age at length, length frequency.	Develop design of a sampling program alongside the Harvest Strategy project. Once designed evaluate how it might be delivered; e.g. through industry based sample collection, or an at-sea program funded through research channels. Investigate collection of samples to validate assumptions in the short term.
Stock structure	
Need to understand the relatedness within the Torres Strait SM and CT stocks to test the single-stock theory. Also important to understand connectedness to other adjacent stocks.	Previous acoustic monitoring carried out to examine SM exchange with Bramble Cay with limited findings. Genetic sampling could be carried out though this would likely be an involved project which would need to attract appropriate funding.
Assessment issues (SM)	
Need to understand how the SM assessment deals with most of the data coming from the Bramble Cay breeding aggregation of fish.	Next assessment update is to investigate.
Need to investigate the sudden peak of catches in the mid 2000's prior to the buyout and whether any of these catch data were 'paper' fish and the reported harvest level accurate.	Industry workshop and work on characterising the data, examining which boats entered the fishery and assess the accuracy of the available catch data from this time.
Ensure TIB sector changes such as experienced fishers leaving the fishery, freezers closing down, have been reflected in the assessment -	Data characterisation and industry workshop.
Ensure the impacts and benefits of the 2008 implementation of the 10 nm closures are understood and captured in the model (SM)	Next SM assessment update is to investigate. Industry workshop can record the impacts of the closures on reef-line sector marks (initial feedback is that this mainly impacted the SM sector)
Fish vulnerability (mainly SM issue)	
Improve understanding of fisher behaviour and how this varies across the fleet – including variation in gear setup, targeting practices, daily fishing effort.	Industry workshop to help stock assessment scientists and management characterise fishing practices.
Investigate SM 'domed' vulnerability where large fish are assumed to be less available to capture.	Next SM assessment update is to investigate.

	Next Spanish mackerel stock assessment		Ongoing education
	Industry workshop		Funded research
	Subject to future funding and advice on project design.		

Table 2. Finfish RAG input on monitoring data to support management and harvest strategy development including prioritisation and potential costs (RAG meeting #2, 20-21 March 2018) *(Areas considered higher priority by the RAG are highlighted in yellow).*

Priority (P)	**Potential Cost (C)**
High priority = 3	<$50 k = 3
Medium priority = 2	$50 - $150 k = 2
Low priority = 1	$>$150 k = 1

Spanish Mackerel				**Coral Trout**			
	P	**C**			**P**	**C**	
1. Age structure (domed – non-domed selectivity - sunset)	2			1. Species specific data (via fishery data)	3	3	
2. Unexplained CPUE declines, sensitivity analyses (covered?)	3	3		2. Habitat mapping	2	3	
3. Data validation (via existing workshops) after logbook validation and analyses	3	3		3. Virgin biomass estimate	3	1	
4. Ageing data TIB (student)	2	3		4. Ageing (student)			
5. Ageing data TIB (researcher)	2	2		5. Ageing (researcher)			
6. Connectedness between stocks	1	1		6. UVC (Dive survey)		1	
7. Investigation of tagging for fishing mortality data and confirming stock structure.	2	1		7. Unexplained CPUE declines, sensitivity analyses	3		
8. Estimating F (Fishing mortality)	2	2		8. Data validation (via scheduled workshops)	3	3	

Torres Strait Fisheries Strategic Research Plan 2018-2023

TORRES STRAIT
PZJA
PROTECTED ZONE
JOINT AUTHORITY

Australian Government
Australian Fisheries
Management Authority

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Torres Strait Scientific Advisory Committee

The Torres Strait Scientific Advisory Committee (TSSAC) includes members from each of the three main Protected Zone Joint Authority (PZJA) agencies (the Australian Fisheries Management Authority, the Torres Strait Regional Authority and Fisheries Queensland), industry members and scientific research members. TSSAC is responsible for providing advice to the Australian Fisheries Management Authority (AFMA) Executive on the use of AFMA research funds for Torres Strait fisheries research. This Torres Strait research provides critical information to the Minister and the Protected Zone Joint Authority (PZJA) for the management of Torres Strait commercial fisheries.

As part of its role the TSSAC:

- develops research priorities for PZJA fisheries in conjunction with the Resource Assessment Groups (RAGs) (or Management Advisory Committees (MACs) and Working Groups (WG)) and addresses PZJA's management needs and objectives as specified in the *Torres Strait Fisheries Act 1984* (the Act) and this plan;
- reviews and advises (where required) on individual fishery research plans for PZJA managed fisheries;
- advises the AFMA Executive on the allocation of research funds, and provides milestone reports and accounts against the use of funds.
- informs Torres Strait communities of project outcomes.

AFMA provides the TSSAC secretariat duties, including organising meetings and managing research contracts and projects milestones.

The TSSAC relies on the assistance of the various PZJA advisory groups (MACs, RAGs and Working Groups) to develop fishery-specific research plans and priorities based on this Strategic Research Plan (SRP). These groups provide current and up to date scientific and operational advice to the TSSAC as it relates to research proposals and fishery. More information about the advisory groups is provided at section 2.4 below.

The Terms of Reference for the TSSAC is at (Appendix A)

About this plan

This plan specifies the research priorities and strategies that the PZJA intend to pursue in Torres Strait fisheries, and provides background to the processes used to call for, and assess, research proposals.

This SRP has been developed by AFMA in consultation with TSSAC to assist the PZJA to pursue the objectives of the *Torres Strait Fisheries Act 1984* (the Act) through research.

This document sets out the five year strategic plan (2018-2023) for research in Torres Strait fisheries to support a framework for fishery-specific, five-year research plans, and a TSSAC annual research statement.

1. Part one sets out the research planning and priorities, including the current research themes, strategies and possible research activities (Part 1 and Appendix B). It also provides guidance to researchers developing applications for research funding.
2. Part two provides guidance for the TSSAC and PZJA advisory groups when assessing research applications (see Appendix C).

Supporting information for the TSSAC and researchers can be found in appendices and referenced documents, which are useful when developing research applications.

It is intended that the SRP be a living document that responds to a changing environment. In line with this intent, this plan will be reviewed by the TSSAC as needed, but not later than 2022.

Part 1 Research planning and priorities

1.1 Role of five year fishery research plans and link to the TSSAC Strategic Research Plan

The three research themes described in this section are strategic priorities for Torres Strait and provide a basis for advisory forums (RAGs, MACs and working groups) when developing their five-year fishery research plans (see section 2.3.2).

The five year fishery research plans will vary between fisheries depending on the status of the fishery, its information requirements and particular knowledge gaps. Although it is a five year plan, the advisory forums are required to review and update the fishery plan annually so the plan will always have a five year projection.

The TSSAC uses both the strategic priorities in the SRP and the specific priorities within individual fisheries research plans to compile the TSSAC Annual Research Statement (ARS). The ARS is the list of priority research for a given year that researchers will focus on when developing research proposals. The ARS is also the key document for RAGs, MACs and WGs in their prioritisation of research applications for TSSAC funding consideration. All groups including TSSAC and researchers should refer to the 'criteria for assessing research investment' (Appendix C) when developing, assessing and ranking research proposals.

1.2 Torres Strait Fisheries Research Themes, Strategies and Research Activities

The TSSAC has identified three research themes, related strategies and possible research activities (basis for proposals) for the next five years that will help the PZJA to pursue the objectives of the *Torres Strait Fisheries Act 1984* (Appendix A) and improve fisheries management in the Torres Strait.

Researchers are encouraged to use this SRP and the five year fishery plans when considering and planning their proposed research in the Torres Strait, regardless of where they may seek funding. The TSSAC process ensures

robust consultation with a broad range of stakeholders regarding funding priorities through the PZJA advisory forums.

Theme 1: Protecting the Torres Strait marine environment for the benefit of Traditional Inhabitants

Aim

Effective management of fishery stocks based on understanding species and their biology and ecological dependencies so it can support Traditional Inhabitant social and economic needs.

Strategy 1a - Fishery stocks, biology and marine environment

Possible research activities under this theme may include:

- Stock assessment and fishery harvest strategies for key commercial species.
- Ecological risk assessments and management strategies for fisheries.
- Minimising marine debris in the Torres Strait.
- Addressing the effects of climate change on Torres Strait fisheries through adaptation pathways for management, the fishing industry and communities.
- Incorporating Traditional Ecological Knowledge into fisheries management.
- Methods for estimating traditional and recreational catch to improve fisheries sustainability.

Strategy 1b – Catch sharing with Papua New Guinea

Possible research activities under this theme may include:

- Status of commercial stocks and catches by all sectors within PNG jurisdiction of the TSPZ.
- Good cross-jurisdictional fisheries management through better monitoring and use of technology.

Theme 2: Social and Economic Benefits

Aim

Increase social and economic benefits to Traditional Inhabitants from Torres Strait Fisheries.

Strategy 2a - Promoting social benefits and economic development in the Torres Strait, including employment opportunities for Traditional Inhabitants

Possible research activities under this theme may include:

- Models for managing/administering Traditional Inhabitant quota
- Understanding what influences participation in commercial fishing by Traditional Inhabitants.
- Understanding the role and contribution of women in fisheries.
- Capacity building for the governance of industry representative bodies
- Methods for valuing social outcomes for participation in Torres Strait fisheries.
- Identifying opportunities and take-up strategies to increase economic benefits from Torres Strait fisheries.

Theme 3: Technology and Innovation

Aim

To have policies and technology that promote economic, environmental and social benefits from the fishing sector.

Strategy 3a – Develop technology to support the management of Torres Strait fisheries.

Possible research activities under this theme may include:

- Electronic reporting and monitoring in the Torres Strait, including for small craft.
- Technologies or systems that support more efficient and effective fisheries management and fishing industry operations.

Part 2 Research management and administration

The PZJA, established under the Act, is responsible for the management of fisheries in the Australian Jurisdiction of the Torres Strait Protected Zone (Figure 1). The PZJA members comprise the Commonwealth and Queensland Ministers responsible for fisheries, and the Chair of the Torres Strait Regional Authority.

Fisheries research findings are critical to the PZJA exercising its functions, and in particular, for monitoring the condition of the Torres Strait fisheries, Good research more broadly assists the PZJA to pursue the legislated objectives. For more information about the PZJA or the PZJA agencies responsible for the day to day management of Torres Strait fisheries see annual reports on the PZJA website (www.pzja.gov.au).

The TSSAC is the only committee that is solely focused on Torres Strait fisheries research, although other committees or agencies (see below) may sometimes fund and manage research projects relevant to Torres Strait fisheries. The different funding sources and management are discussed below.

Research in the Torres Strait comes with a unique set of challenges. The traditional way of life and Torres Strait Island culture are critically important to the communities residing across the many remote islands in the Protected Zone. Consequently, research needs to pay special attention to the social and economic contexts which are unique to the region. This includes consideration of the potential impacts that research may have on Torres Strait communities, both overt through direct interaction with communities and the more subtle emotional or psychological impacts of research activities taking place in and around culturally significant places.

2.1 Research Funding Environment

Torres Strait fisheries operate in a complex management environment with social, economic and cultural objectives being pursued alongside contemporary environmental and fisheries management objectives.

Therefore, the scope of potential fisheries research is necessarily broad. Research ranges from assisting Traditional Inhabitants to pursue their aspirations within local fisheries, undertaking routine science stock assessments and surveys, adaptation to the effects of climate change and ways to improve sustainability of, and economic and social benefits from the Torres Strait fisheries.

2.2 AFMA research funds

The TSSAC primarily funds research through AFMA's annual research contribution (currently at $410 000 annually).

These funds are allocated at the discretion of the AFMA executive, based on recommendations of the TSSAC. The TSSAC considers research proposals based on the priorities set in this SRP and the ARS. When the TSSAC is unable to recommend funding for a project due to funding constraint, it may recommend that researchers go to other funding bodies. Depending on the priority and degree of funding constraint the TSSAC may support the project but ask the researcher to seek co-funding from another body.

Research priorities identified by the TSSAC in its SRP are also intended to implicitly influence other funding agencies in the research they may fund as it relates to Torres Strait fisheries. Equally, the TSSAC should be mindful of research being funded by other bodies, particularly where it may overlap with TSSAC priorities.

It is not possible to meet all Torres Strait research needs through the AFMA funds. Funding constraints are not likely to change and it would be beneficial for the TSSAC to play a greater role in supporting researchers to find other funding opportunities in order to broaden research delivery in the Torres Strait. This could be achieved through improved collaboration among research providers with an interest in the Torres Strait region. AFMA will actively engage in seeking greater collaboration between the TSSAC and other bodies.

2.3 Other funding bodies

Funding for Torres Strait fisheries related projects is sometimes provided by other government agencies or external funding bodies for Torres Strait research. This can take the form of contributions towards AFMA funded TSSAC projects, or be completely funded external to TSSAC and AFMA. In these cases, the funding body will manage the project themselves with little or no TSSAC comment. Information on some of these funding bodies and agencies is provided below. Further information about their role and research programs can be found on the agency websites.

2.3.1 Government Agencies

The Department of Agriculture and Water Resources, along with the Torres Strait Regional Authority and the Queensland Government may provide funding support for certain Torres Strait fisheries projects based on the relevance to their jurisdiction and their current priorities. Sometimes these projects and funds are managed by the TSSAC. TSRA in particular inject significant funds for Torres Strait fisheries research on a regular basis. TSRA funded projects generally have a focus on capacity building and traditional fisheries, or commercial fisheries with an indigenous interest, and generally compliment the TSRA core program work.

2.3.2 The Fisheries Research and Development Corporation (FRDC)

The FRDC is a statutory authority within the portfolio of the Federal Minister for Agriculture and Water Resources, jointly funded by the Australian Government and the commercial fishing The FRDC may fund projects in the Torres Strait if such projects fit within the FRDC's Research, Development and Extension (RD&E) plan. The FRDC uses Commonwealth, State and Territory research advisory committees at to assess and recommend projects for funding in line with the RD&E Plan.

The Indigenous Reference Group (IRG), FRDC

The IRG is the FRDC's Indigenous Fishing sub-program advisory partner. The IRG was established by the FRDC in 2012 to assist in working towards a

RD&E plan for indigenous Australians to improve economic, environmental and social benefits to Australia's indigenous people. The current priorities for the IRG, can be found at the FRDC website (www.frdc.com.au) Some of these priorities are highly relevant to Torres Strait fisheries, including;

- Primacy for Indigenous People
- Acknowledgement of Indigenous Cultural Practices
- Self-determination of indigenous rights to use and manage cultural assets and resources
- Economic development opportunities arising from Indigenous peoples cultural assets and associated rights
- Capacity building opportunities for Indigenous people are enhanced.

Human Dimensions Program, FRDC

The FRDC also has a new Human Dimensions Program, focusing on social-science and economic research related to fisheries. Information on this program can also be found on the FRDC website (www.frdc.com.au).

2.3.4 The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

The CSIRO has a long history of contributing funding support for CSIRO-led Torres Strait research. This generally occurs as a co-funding of project managed through the TSSAC.

2.3.6 Collaboration among research providers

There are both formal and informal links between staff from many of these external funding bodies and agencies that contributes to successful funding of research in the Torres Strait. Improved collaboration among research providers may lead to more efficient use of research funds.

AFMA, as a key funding agency for Torres Strait fisheries research, will consult with external research providers and key research stakeholders in an

effort to improve collaboration among these groups and transparency about proposed Torres Strait fisheries research.

2.4 MACs, RAGs and Working Groups

MACs, RAGs and WGs are actively involved in the PZJA's research planning process for the Torres Strait.

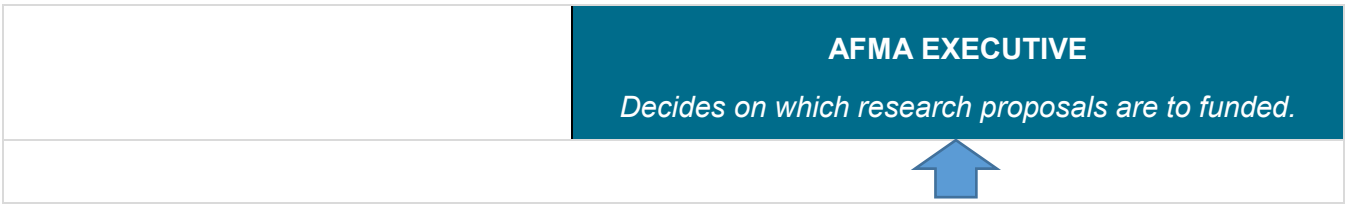
The roles of these different groups are less distinct than in the AFMA Commonwealth fisheries forums, as the working groups and MAC (there is currently only one MAC operating in Torres Strait) have a very similar function. There are now two RAGs within Torres Strait fisheries. Both Torres Prawn MAC and the hand collectible working group also perform RAG functions (primarily scientific advice).

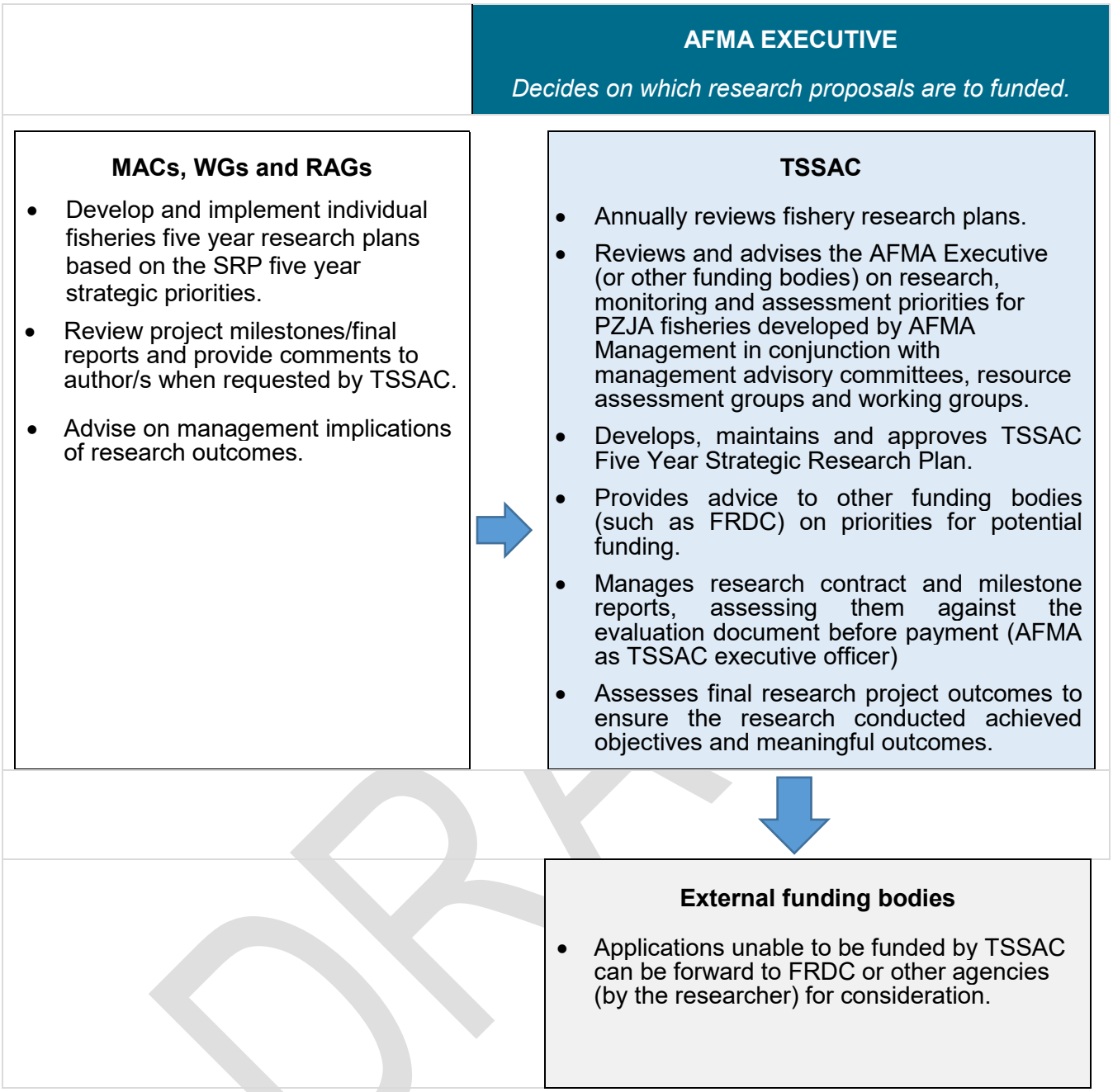
The collective scientific functions of these groups are to review scientific data and information and provide advice to the PZJA on the status of fish stocks, sub-stocks, species (target and non-target species) and the impact of fishing on the marine environment. This advice assists the Minister and PZJA in the role of managing commercial fishing within PZJA fisheries, particularly in relation to monitoring the condition of the Torres Strait fisheries.

The collective management advisory function is to provide advice on fishery-specific management policies and plans to assists the Minister and PZJA in the role of managing commercial fishing across the PZJA fisheries.

In relation to the TSSAC function, each of these groups will lead the preparation of the rolling five year, fishery-specific research plans which are underpinned by the SRP. See Figure 2 below for a map of roles and responsibilities during the TSSAC funding application process.

Figure 2. Roles and responsibilities of key participants in the PZJA's annual research cycle for Torres Strait fisheries





2.4 Confidentiality of community fishing data and intellectual property

Data collected during research projects can be regarded as confidential to local communities, or non-indigenous fishers. Confidentiality requirements should be considered for all research projects that may generate intellectual property related to traditional knowledge, or contain data, such as fishing grounds or catch data, of individual communities or fisheries. This data should be treated in the same way as commercial in confidence commercial fishing data. Researchers should consider the types of data they will be

collecting, and gain prior agreement from each community or relevant stakeholder/s as to how the data will be used for example. only for decision making or to be published in the public domain.

TSSAC's annual research cycle

Table 1. TSSAC funding Cycle

	TSSAC PROCESS
February	Research providers submit pre-proposals for assessment, which meet the scopes provided by TSSAC in November. EOIs submitted are circulated to fisheries managers/ RAGs & MACs for comment; Fisheries Managers, RAGs/MACs identify any additional research priorities for potential FRDC funding.
March	TSSAC meets via teleconference to assess pre-proposals and Management/RAG/MAC comments. Applicants notified of TSSAC comments on their pre-proposals and asked to develop the consultation package (for review by AFMA by end of March) for use during full proposal development.
April	Researchers to complete full proposal (6 weeks total with consultation period)
May	Late May/ early June. TSSAC meet face to face to review full proposals and endorse final applications, or suggest necessary changes before endorsement. Applicants advised of the TSSAC's final evaluation.
June	
July **(START)**	TSSAC confirm the research budget for the new financial year (it doesn't generally change from year to year - $410 000). New contracts and variations for essential research projects prepared and put in place, confirming forward budgets. RAGs, WGs and MACs to identify THEIR PRIORITY RESEARCH NEEDS for funding in the next financial year by updating their *five year rolling fisheries research plan*. This should be framed around strategies in the 5 year strategic research plan. Provide to TSSAC EO by end August.
August	RAGs/MACs submit their five year rolling fishery research plan to the TSSAC

	Executive Officer, currently lisa.cocking@afma.gov.au, by end August.
September	TSSAC EO drafts the TSSAC Annual Research Statement (ARS) with each fisheries priorities for the current year.
October	TSSAC meets (face to face or via teleconference) to finalise the PZJA ARS and agree on priorities for the TSSACs call for applications in November. AFMA develop scopes for the priority research projects and send to TSSAC out of session for consideration.
November	The annual research call opens in November. Scopes sent to researchers seeking pre-proposals.

Appendix A: TSSAC Terms of Reference

Terms Of Reference

i. Identify and document research gaps, needs and priorities for fisheries in the Torres Strait in conjunction with the PZJA advisory groups.
ii. develop, maintain and approve the Torres Strait Five Year Strategic Research Plan. This includes balancing tactical short term needs and strategic needs to identify research gaps and priorities.
iii. review rolling five (5) year research plans for Torres Strait fisheries
iv. provide advice to the AFMA executive on priorities for the allocation of AFMA research funds and potential risks to achieving intended outcomes.
v. Provide advice on effective consultation strategies with communities regarding research projects to ensure engagement throughout the project.
vi. Consider the level of community support for research proposals and advise researchers on any actions needed to improve community consultation before a project is supported.
vii. ensure research outcomes are communicated to community stakeholders.
viii. provide advice to FRDC or other research providers on Torres Strait research priorities for potential funding consideration.
ix. assess research investment and outcomes for the Torres Strait fisheries to measure the extent to which intended sustainability, social and economic needs are being met.
x. provide a forum for expert consideration of scientific issues referred to the TSSSAC by the Torres Strait advisory groups.
xi. provide other advice to the Torres Strait advisory groups on matters consistent with TSSAC functions.
xii. review research / consultancies, stock assessments, and other reports and outputs relevant to Torres Strait fisheries and advise the Torres Strait advisory groups on their technical merit.
xiii. convene Fisheries Assessment workshops as appropriate to review and address assessment needs for Torres Strait fisheries.

Appendix B: Key factors influencing Torres Strait fisheries research needs

In developing this plan and the drivers for research in the Torres Strait, there are a number of factors which have been taken into account. This includes whole of Government policies and objectives relevant to the Torres Strait. These are explained in some detail below.

The Torres Strait Fisheries Act 1984 (the Act)

The PZJA is created under the Act; the legislation used by the Australian and Queensland Governments when managing Torres Strait fisheries.

The Act makes the PZJA responsible for monitoring the condition of the fisheries under its control and formulating policies and plans for their good management. In performing these functions, the Act requires the PZJA to have regard to the rights and obligations conferred on Australia by the Torres Strait Treaty' (https://www.legislation.gov.au/Details/C2016C00677), and in particular, the following management priorities:

(a) to acknowledge and protect the traditional way of life and livelihood of traditional inhabitants, including their rights in relation to traditional fishing;

(b) to protect and preserve the marine environment and indigenous fauna and flora in and in the vicinity of the Protected Zone;

(c) to adopt conservation measures necessary for the conservation of a species in such a way as to minimise any restrictive effects of the measures on traditional fishing;

(d) to administer the provisions of Part 5 of the Torres Strait Treaty (relating to commercial fisheries) so as not to prejudice the achievement of the purposes of Part 4 of the Torres Strait Treaty in regard to traditional fishing;

(e) to manage commercial fisheries for optimum utilisation;

(f) to share the allowable catch of relevant Protected Zone commercial fisheries with Papua New Guinea in accordance with the Torres Strait Treaty;

(g) to have regard, in developing and implementing licensing policy, to the desirability of promoting economic development in the Torres Strait area and employment opportunities for traditional inhabitants.

Australian Government priorities

The Australian Government has identified priorities for research that are significant in shaping fisheries research effort and its reporting, namely:

- Global trends
- National Research Priorities
- Rural Research and Development Priorities

Global Trends

The five major trends that are expected to influence primary industries globally during the next 20 years, as identified by the Rural Industries Research and Development Corporation in its report *Rural Industry Futures – Megatrends impacting Australian agriculture over the coming twenty years*, include:

A hungrier world: Population growth will drive demand for food and fibre

A bumpier ride: Globalisation, climate change and environmental change will reshape the risk profile for agriculture

A wealthier world: A new middle class will increase food consumption, diversify diets and eat more protein

Transformative technologies: Advances in digital technology, genetic science and synthetics will change the way food and fibre products are made and transported

Choosy customers: Information-empowered customers of the future will have expectations for health, provenance, sustainability and ethics

National RD&E Strategy for Fishing and Aquaculture

The National Fishing and Aquaculture RD&E Strategy 2015-20 provides direction to improve the focus, efficiency and effectiveness of RD&E to support Australia's fishing and aquaculture industry.

The identified goals and key strategies are:

- Australia's fisheries and aquaculture sectors are managed, and acknowledged, to be ecologically sustainable.
- Security of access and resource allocation.
- Maximising benefits and value from fisheries and aquaculture resources.
- Streamlining governance and regulatory systems.
- Maintain the health of habitats and environments upon which fisheries and aquaculture rely.
- Aquatic animal health, and biosecurity (inclusive of pests) Aquaplan 2015-2019.

FRDC Research Development and Extension Plan 2015-20

The FRDC's RD&E Plan 2015-20[1] is focused on maximising impacts by concentrating on knowledge development around three national priorities:

1. Ensuring that Australian fishing and aquaculture products are sustainable and acknowledged to be so.
2. Improving productivity and profitability of fishing and aquaculture.
3. Developing new and emerging aquaculture growth opportunities.

[1] http://frdc.com.au/research/Documents/FRDC_RDE-Plan_2015-20.pdf

Appendix C: Criteria for assessing research investment in Torres Strait fisheries

The TSSAC will apply these criteria in assessing and ranking research proposals. Researchers should use the criteria as a guide when developing research applications and RAGs, MACs and WGs should also use these criteria when assessing proposals.

	Strongly disagree ----------→ strongly agree											Notes
Attractiveness	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**N/A**	
1. Is there a priority need for the research (does it align with the Torres Strait Strategic Research Plan and Annual Research statement)?												
2. Is/are the end-user/s identified?												
3. Do the outcomes have relevance and are they appropriate to the end-users?												
4. Do the outputs contribute towards outcomes and are they measureable?												
5. Does the proposal actively engage Traditional Inhabitants and Torres Strait Islanders in the research?												
6. Are there employment opportunities for Traditional Inhabitants and Torres Strait Islanders?												
7. Does the research contribute to the knowledge that underpins ecosystem based fisheries management (EBFM) to improve the quality of decisions made?												

8. Does the project involve capacity development for Communities? If so, TSSAC to discuss if there is funding from other agencies such as the IRG or TSRA that could support this project.												
Feasibility												
9. Does the applicant and their team / resources have the capacity to produce the outputs?												
10. Is the budget appropriate to meet the outputs and outcomes?												
11. Does the proposal outline a coherent strategy surrounding data collection, analysis, and storage?												
12. Does the proposal include appropriate plans (for example, adoption, communication and/or commercialisation plans) to ensure that the full potential of the research is realised through adoption of research outputs by end-users?												
13. Are the methods scientifically sound, well described and consistent with the projects objectives?												

14. Research will be most effective when there is effective engagement with fishery stakeholders, particularly Traditional Inhabitants of the Torres Strait, and where the research has widespread stakeholder support (refer to procedural framework for undertaking research in the Torres Strait and the TSSAC research proposal application). Does the project identify the key stakeholders and how they will be engaged regarding the project in a culturally appropriate way?												

Agenda Item 7 - Attachment D

Torres Strait fisheries strategic research themes, strategies and research activities

Theme 1: Protecting the Torres Strait marine environment for the benefit of Traditional Inhabitants	
Aim: Effective management of fishery stocks based on understanding species and their biology and ecological dependencies so it can support Traditional Inhabitant social and economic needs.	
Strategy 1a - Fishery stocks, biology and marine environment	Possible research activities under this theme may include: a. Stock assessment and fishery harvest strategies for key commercial species. b. Ecological risk assessments and management strategies for fisheries. c. Minimising marine debris in the Torres Strait. d. Addressing the effects of climate change on Torres Strait fisheries through adaptation pathways for management, the fishing industry and communities. e. Incorporating Traditional Ecological Knowledge into fisheries management. f. Methods for estimating traditional and recreational catch to improve fisheries sustainability.
Strategy 1b – Catch sharing with Papua New Guinea	Possible research activities under this theme may include: a. Status of commercial stocks and catches by all sectors within PNG jurisdiction of the TSPZ. b. Good cross-jurisdictional fisheries management through better monitoring and use of technology.
Theme 2: Social and Economic Benefits	
Aim: Increase social and economic benefits to Traditional Inhabitants from Torres Strait Fisheries.	
Strategy 2a - Promoting social benefits and economic development in the Torres Strait, including employment opportunities for Traditional Inhabitants	Possible research activities under this theme may include: a. Models for managing/administering Traditional Inhabitant quota b. Understanding what influences participation in commercial fishing by Traditional Inhabitants. c. Understanding the role and contribution of women in fisheries. d. Capacity building for the governance of industry representative bodies e. Methods for valuing social outcomes for participation in Torres Strait fisheries. f. Identifying opportunities and take-up strategies to increase economic benefits from Torres Strait fisheries.
Theme 3: Technology and Innovation	
Aim: To have policies and technology that promote economic, environmental and social benefits from the fishing sector.	
Strategy 3a – Develop technology to support the management of Torres Strait fisheries.	Possible research activities under this theme may include: a. Electronic reporting and monitoring in the Torres Strait, including for small craft. b. Technologies or systems that support more efficient and effective fisheries management and fishing industry operations.

Agenda Item 7 – Attachment E
TSSAC annual research cycle

	TSSAC Process
February	Research providers submit pre-proposals for assessment, which meet the scopes provided by TSSAC in November. EOIs submitted are circulated to fisheries managers/ RAGs & MACs for comment; Fisheries Managers, RAGs/MACs identify any additional research priorities for potential FRDC funding.
March	TSSAC meets via teleconference to assess pre-proposals and Management/RAG/MAC comments. Applicants notified of TSSAC comments on their pre-proposals and asked to develop the consultation package (for review by AFMA by end of March) for use during full proposal development.
April	Researchers to complete full proposal (6 weeks total with consultation period)
May	Late May/ early June. TSSAC meet face to face to review full proposals and endorse final applications, or suggest necessary changes before endorsement. Applicants advised of the TSSAC's final evaluation.
June	
July **(START)**	TSSAC confirm the research budget for the new financial year (it doesn't generally change from year to year - $410 000). New contracts and variations for essential research projects prepared and put in place, confirming forward budgets. RAGs, WGs and MACs to identify THEIR PRIORITY RESEARCH NEEDS for funding in the next financial year by updating their *five year rolling fisheries research plan*. This should be framed around strategies in the 5 year strategic research plan. Provide to TSSAC EO by end August.
August	RAGs/MACs submit their five year rolling fishery research plan to the TSSAC Executive Officer, currently lisa.cocking@afma.gov.au, by end August.
September	TSSAC EO drafts the TSSAC Annual Research Statement (ARS) with each fisheries priorities for the current year.
October	TSSAC meets (face to face or via teleconference) to finalise the PZJA ARS and agree on priorities for the TSSACs call for applications in November. AFMA develop scopes for the priority research projects and send to TSSAC out of session for consideration.
November	The annual research call opens in November. Scopes sent to researchers seeking pre-proposals.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
WESTERN LINE CLOSURE	Agenda Item No. 8 FOR ADVICE

RECOMMENDATIONS

That the Finfish RAG:

1. Provide any additional **ADVICE** to support the removal of the western line closure.

KEY ISSUES

1. Commercial harvest of reef-line finfish species in the Torres Strait Finfish Fishery is generally undertaken in the north eastern region of Torres Strait Protected Zone. Commercial fishing for reef-line finfish species west of 142˚32'E is prohibited under the *Torres Strait Fisheries Management Instrument No. 8 - Torres Strait Finfish Fishery*. This is referred to as the 'western line closure' (**Figure 1** below).
2. The closure only relates to the reef-line sector of the Fishery (mainly targeting coral trout) and not to the Spanish mackerel sector.
3. The removal of the western line closure of the reef-line fishery has been a long standing item which has been supported in-principle by the Finfish Working Group. The key for progressing this matter to the PZJA for decision is undertaking adequate stakeholder consultation.
4. AFMA is seeking RAG views (in addition to preliminary advice tabled at Meeting 1) on what technical work will likely be required to progress this issue e.g. stock impacts, stock structure, risk assessments.

BACKGROUND

5. The removal of the western closure of the reef-line sector (**Figure 1**) has been a long standing item which has been supported in-principle by the Finfish Working Group.
6. The western line closure reflects a historical jurisdictional boundary that was rolled over into the Finfish Fishery management arrangements when the fishery came under a single jurisdiction under the PZJA. The closure only relates to the Reef Line sector of the fishery and not to the Spanish mackerel sector of the fishery.
7. At the Finfish Working Group meeting (20 March 2012), TSRA indicated that there was community interest in removing the western closure.
8. At its July 2016 meeting the Finfish Working Group noted members had varying views on whether or not sufficient consultation on removing the closure had occurred. A key development since initial consultation on this issue has been the Native Title Determination on the Regional Sea Claim, and it was noted that notification to the relevant Registered Native Title Bodies Corporate groups would be undertaken prior to the PZJA making a decision.
9. At its March 2017 meeting the Working Group noted progress since the last FWG meeting to remove the western line closure (as detailed in the agenda paper, work is ongoing to compile outcomes of previous consultation processes). An industry member advised that if the area of the western closure was to be reopened consideration should first be given to:

a. how much fishing the area could support noting that the fishing grounds are different from those in the east and concern that the area may not be able to support the number of licences in the fishery; and

b. the potential for alternative livelihoods or business opportunities for traditional owners such as ecotourism.

10. Other industry members were generally supportive of this proposal and advised that further community consultation should occur before the western area of the fishery was reopened, to gauge community aspirations on future usage.

11. Noting there are no existing agreements in place to guide resource sharing between sectors (fishing, tourism etc.) the FWG agreed for following action:

    a. AFMA, TSRA and Malu Lamar to meet out-of-session to consider an appropriate process to canvass community aspirations and considerations for removing the western line closure.

12. AFMA convened a meeting with Malu Lamar and TSRA on 5 April 2017. The following was agreed:

- Removal of the western line closure is to be contingent on further community consultation with the western communities and consideration of any sustainability risks. The aim of the consultation will be to determine how communities may/or may not like the resources to be managed to benefit both commercial and tourism industries;

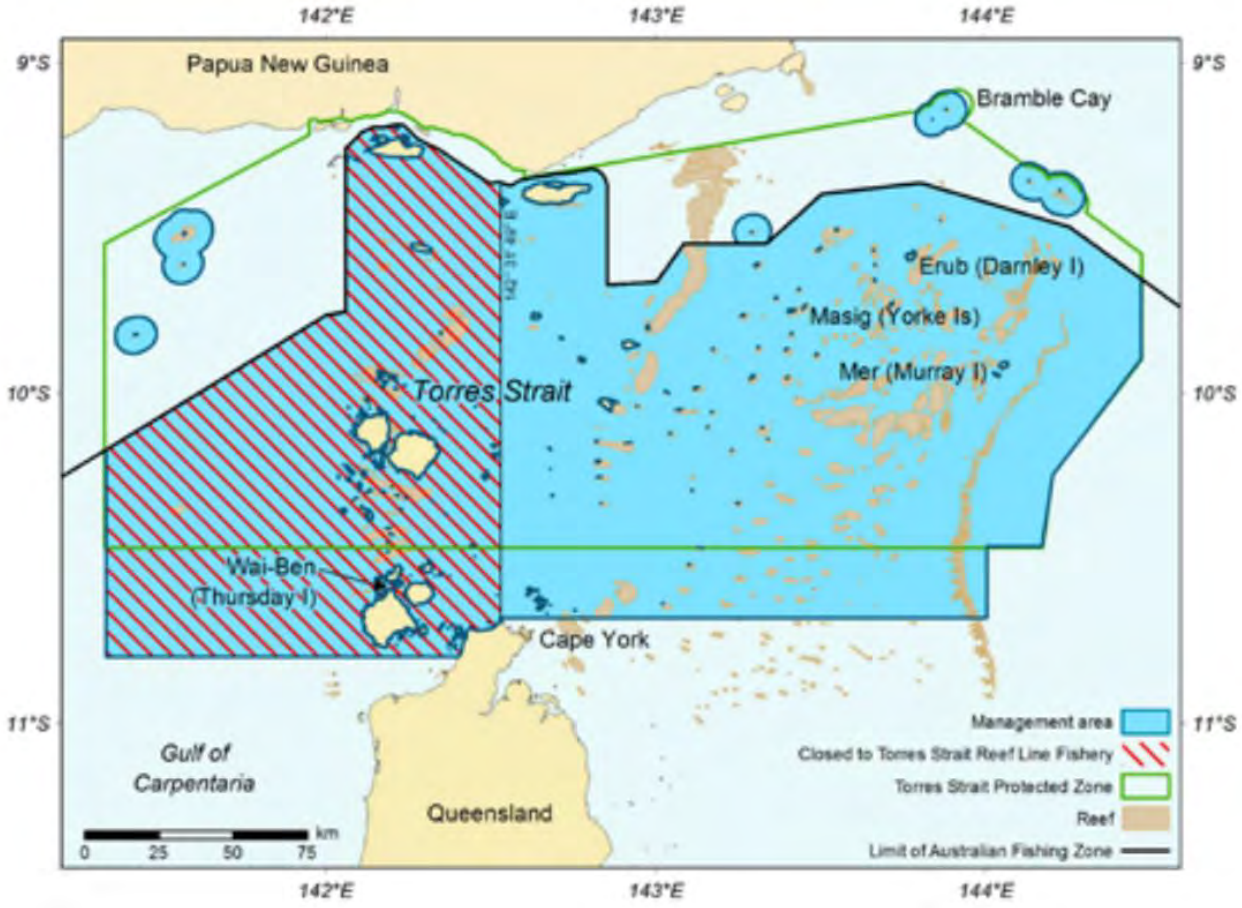
- TSRA will lead this consultation process (undertaking meetings / report findings etc). TSRA will undertake consultation opportunistically combining with other meetings (e.g. AFMA fish receiver meetings, top western projects);

- AFMA will seek scientific advice (through the future Finfish RAG) on the possible impacts of removing the closure on stocks, noting advice that the fishing grounds/habitat may be different in the west compared to the eastern area. There is concerned that the reefs are shallower and possibly more susceptible to localised depletion.

13. AFMA sought preliminary technical advice form the Finfish Resource Assessment Group (FRAG) on what inter-sessional work will likely be required to assess the likely stock impacts from removing the western line closure (in-session meeting 1, 9-10 November 2017). The FRAG had limited amount of time available and FRAG requested a further opportunity to consider the matter. The FRAG did however provide the following preliminary observations:

- Management is not proposing to increase the TACs for coral trout. In line with this it was suggested that removing the closure might spread the current commercial fishing effort to a broader area.
- RAG noted previous considerations about coral trout catch rates and considered that economic impacts would likely come into effect (hook-shy fish leading to a drop in local catch rates) before ecological impacts might occur.
- Some consideration was given to how the western habitats may be shallower than eastern habitats but data would be required to assess this.
- More fishing operations and freezers may open in the western Torres Strait in line with the outcomes of the current TSRA infrastructure project meaning there may be a total increase in fishing effort with more fishers entering the sector.

Figure 1. Map of the Western Line Closure.



PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
OTHER BUSINESS	Agenda Item No. 9 FOR NOTING

RECOMMENDATION

1. That the RAG **NOMINATE** any additional items of business for the meeting.

PZJA Torres Strait Finfish Resource Assessment Group	Meeting 3 19-20 November 2018
NEXT MEETING and MEETING CLOSE	Agenda Item 10 For DISCUSSION and ADVICE

RECOMMENDATIONS

1. That the RAG **DISCUSS** and **ADVISE** on a date for the next meeting of the Finfish RAG.
2. If time permits the RAG are asked to **AGREE** to the wording of a short message for stakeholders on the key outcomes of the present meeting.
3. The RAG are to **NOTE** closing remarks from the chairperson and a closing prayer.