Meeting Papers
for

14th MEETING OF THE TORRES STRAIT HAND COLLECTABLES WORKING GROUP

Wednesday 24 October 2018

8:30 am – 5:00 pm

Venue: Norah's Ark

Erub (Darnley) Island

14th MEETING OF THE HAND COLLECTABLES WORKING GROUP
Meeting Paper Index

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
PRELIMINARIES **Opening prayer, acknowledgement of Traditional Owners, welcome and apologies**	**Agenda Item 1.1** **For NOTING**

RECOMMENDATIONS

1. That the Working Group **note**:
   a. an opening prayer;
   b. an acknowledgement of Traditional Owners;
   c. the Chairperson's welcome address; and
   d. any apologies received from members unable to attend.

As of 5 September 2018 no apologies were received.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
PRELIMINARIES **Adoption of agenda**	**Agenda Item 1.2** **For DECISION**

RECOMMENDATION

1. That the Working Group consider and **adopt** the draft agenda (**Attachment 1.2a**).

BACKGROUND

2. A draft annotated agenda was circulated to members and other participants on 25 September 2018. No comments were received.

Torres Strait Beche-de-mer Fishery
Harvest Strategy Workshop

Tuesday 23 October 2018 (10:30 am – 4:00 pm)

Venue: Norah's Ark

Erub (Darnley) Island

DRAFT AGENDA v2

Workshop Chair: Anne Clarke

Workshop Coordinators: Éva Plagányi, Nicole Murphy, Tim Skewes and AFMA Staff

Morning tea, lunch and afternoon tea will be provided

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1. Workshop Opening

Opening prayer and acknowledgement of traditional owners.

2. Beche-de-mer Harvest Strategy

CSIRO will present on the draft final Harvest Strategy for the Torres Strait Beche-de-mer Fishery. Participants are invited to discuss and provide comments on all aspects of the harvest strategy.

3. Fish Receiver System and Catch Reporting Information Session

AFMA will provide an overview of the Fish Receiver System in Torres Strait Fisheries and present some beche-de-mer catch reporting information since the FRS was implemented in December 2017.

4. General AFMA / CSIRO Question & Answer

Participants are encouraged to engage with CSIRO and AFMA staff on all things Torres Strait Fisheries for a general question and answer session.

14th MEETING OF THE TORRES STRAIT HAND COLLECTABLES WORKING GROUP

Wednesday 24 October 2018 (8:30 am – 5:00 pm)

Venue: Norah's Ark

Erub (Darnley) Island

DRAFT AGENDA v2

The meeting will open at 8.30am on Wednesday 24 October 2018

AGENDA ITEM 1 PRELIMINARIES

1.1 Opening Prayer, acknowledgement of Traditional Owners, welcome and apologies

The Chair will welcome HCWG members, permanent observers, invited participants and observers to the 14th Torres Strait Hand Collectables Working Group.

1.2 Adoption of agenda

The working group is invited to adopt the draft agenda.

1.3 Declarations of interest

Working group members are invited to declare any real or potential conflicts of interests to the group and determine whether a member may or may not be present during discussion of or decisions made on the matter which is the subject of the conflict.

1.4 Action items from previous meetings

The working group is invited to note and discuss the status of action items arising from previous HCWG meetings.

1.5 Out of session correspondence

The working group will note any out of session correspondence on HCWG matters since the previous meeting.

AGENDA ITEM 2 WORKING GROUP UPDATES

2.1 Industry

Industry members and invited participants are invited to provide a brief verbal update on the fishery.

2.2 Government

2.2.1 Australian Fisheries Management Authority (AFMA)

2.2.2 Torres Strait Regional Authority (TSRA)

2.2.3 Queensland Department of Agriculture and Fisheries (QDAF)

The working group will note updates from each of the government agencies.

2.3 Native Title

The working group will note a verbal update from the Malu Lamar representative.

2.4 PNG National Fisheries Authority

The working group will note an update from the PNG NFA member, if present.

AGENDA ITEM 3 MANAGEMENT

3.1 Draft Beche-de-mer Harvest Strategy

CSIRO will present the draft Beche-de-mer Harvest Strategy. The Working Group is invited to provide advice on the final draft in consideration of putting the final document to the PZJA.

3.2 Catch Reporting & Fish Receiver System Update

The working group will note an update on the mandatory fish receiver system and a summary of catch reporting in the Torres Strait beche-de-mer fishery. The working group is also invited to discuss and provide advice on the likely accuracy of data in reflecting true catch and effort data for the BDM fishery.

3.3 Black Teatfish

The working group will consider and recommend catch reporting targets/benchmarks, management arrangements and monitoring mechanisms required to support a black teatfish opening in 2019, to be put forward for PZJA consideration.

3.4 Research

3.4.1 Research Update

The working group will note a verbal update from the HCWG Scientific member.

3.4.2 Five Year Fishery Research Plan

The working group will also discuss and provide advice on research priorities for the beche-de-mer, trochus and pearl shell fisheries under the Torres Strait for the Five-Year Rolling Research Plan 201920 – 2022/23.

3.5 Future Management Priorities

3.6 Budget update

AGENDA ITEM 4 **OTHER BUSINESS**

AGENDA ITEM 5 **DATE AND VENUE FOR NEXT MEETING**

CLOSE OF MEETING

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
PRELIMINARIES Declarations of interest	Agenda Item 1.3 For DECISION

RECOMMENDATIONS

1. That the Working Group members:
   a. **DECLARE** all real or potential conflicts of interest in Torres Strait hand collectable fisheries at the commencement of the meeting (**Table 1**).
   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 Working Group regarding the management of conflicts of interest.
   d. **NOTE** that the record of the meeting must record the fact of any disclosure, and the determination of the Working Group 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

2. 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.
3. Working Group members are asked to confirm the standing list of declared interests (**Table 1**) is accurate and provide an update to be tabled if it is not.
4. 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.
5. 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.
6. 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.

Table 1. HCWG Declarations of Interest from most recent meetings.

Name	Position	Declaration of interest
Members		
Anne Clarke	Chair	Nil.
Selina Stoute	AFMA Member	Employed by AFMA, no pecuniary interests or otherwise
Mark Anderson	TSRA Member	Employed by TSRA, no pecuniary interests or otherwise.
Tim Skewes	Research Member	CSIRO/Independent Consultant. Previous principal scientist for Torres Strait Scientific Advisory Committee (TSSAC) project to develop a harvest strategy for the TSBDMF.
Maluwap Nona	Industry Member	TIB licence holder, Traditional Inhabitant Gudumalulgal and Maluialgal; Chairperson of Malu Lamar.
Michael Passi	Industry Member	TIB licence holder, Traditional Inhabitant Kemer Kemer Meriam
Patrick Mills	Industry Member	TIB licence holder; Chairperson of the Torres Strait Fisheries Association, Traditional Inhabitant Kaiwalagal
Francis Pearson	Industry Member	TIB licence holder, Traditional Inhabitant Kulkalgal
Georgia Langdon	Executive Officer, AFMA	Employed by AFMA, no pecuniary interests or otherwise
Permanent Observers		
Jerry Stephen	TSRA Board Member	TIB licence holder; TSRA Fisheries Portfolio Member
Ian Liviko	PNG NFA	To be advised.
Jimmy Gela	Malu Lamar rep	Erub PBC Chair
Invited Participants		
Tony Salam	Industry, Thursday Is.	To be advised.
Patrick Bonner	Industry, Poruma	To be advised.
Wrench Larry	Industry, Poruma	To be advised.
TBC	Industry, Mer	To be advised.
TBC	Industry, Mer	To be advised.
Simon Naawi	Industry, Masig	To be advised.
Paul Lowatta	Industry, Masig	To be advised.
Patterson Mosby	Industry, Masig	To be advised.

Rocky Stephen	Industry, Ugar	Chair of Kos and Abob Fisheries Association
TBC	Industry, Erub	To be advised.
TBC	Industry, Erub	To be advised.
Mark David	Industyr, Iama	To be advised.
Dr Eva Plaganyi	CSIRO	Project staff for PZJA funded research projects
Nicole Murphy	CSIRO	Project staff for PZJA funded research projects

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	**Meeting 14** **24 October 2018**
PRELIMINARIES **Action items from HCWG13 and previous meetings**	**Agenda Item 1.4** **FOR NOTING**

RECOMMENDATIONS

1. That the Working Group **NOTE**:
   a. the progress against actions arising from previous meetings, including the 13th meeting of the Hand Collectable Working Group (HCWG13) held on 24 July 2018 (**Attachment 1.4a)**
   b. the final meeting record for HCWG 13, which was ratified out of session (**Attachment 1.4b)**

BACKGROUND

Actions arising

2. Updates are provided on the status of actions arising from the HCWG13 and previous meetings.

Minutes of the previous meeting

3. The meeting record for HCWG13 was ratified out of session.
4. A draft meeting record was circulated to all HCWG members on 4 September 2018 with comments closing on 21 September 2018.
5. After receiving only minor comments back from HCWG members the meeting record was closed out of session and emailed to members on 10 October 2018.

Attachment 1.4a

Status of actions arising from previous HCWG meetings

#	Meeting #	Action item	Responsibility	Status
1	9 (20-21 June 2016)	AFMA to review the size limits set for the Torres Strait Beche-de-mer Fishery taking into consideration the size limits in place in Queensland and the Commonwealth Coral Sea Fishery.	AFMA	**In progress** To be addressed as part of the Bech-de-mer Harvest Strategy Project
2	11 (27 June 2017)	Consideration on whether or not changes should be made to the current size limit for Prickly Redfish be undertaken during the Harvest Strategy Workshop noting relevant data will be presented.	AFMA	**In progress** Information on size limits was presented at the proceeding Harvest Strategy Workshop in June 2017. The Workshop agreed that first consideration should be at first maturity and next consideration could be to better align with the size limits used for the East Coast BDM Fishery which are generally more conservative. (Source: CSIRO HSW Milestone Report 2, June 2017) • Current Torres Strait size limit: 30cm • Current East Coast size limit: 50cm. • New proposed size limit for Torres Strait: 40cm As per action item 1, size limits will be reviewed as part of the Harvest strategy project.
8	12 (24 October 2017)	Working Group Members and Observers acknowledged the serious risk that a lack of data and catch reporting poses to the sustainable management of the TSBDMF and agreed to submit any outstanding catch records and to assist AFMA in obtaining catch records from the BDM TIB licence holders and buyers within their respective communities.	Industry	**Completed** AFMA received some catch records following the meeting. The voluntary docket book system has not been replaced with a Mandatory Fish receiver System (starting 1 December 2017).

				Industry however are still encouraged to submitted any historic docket book data they may still hold.
1	13 (24 July 2018)	AFMA to ensure Malu Lamar is included in all aspects of consultation regarding the proposed legislative amendments to the Act and the Regulations.	AFMA	**Ongoing** There has been no additional consultation on the proposed legislative amendments since the last HCWG13.
2	13 (24 July 2018)	AFMA to clarify the information in paragraphs 7 and 11 of Agenda Item paper 2.3 from HCWG13	AFMA	**Complete** Text from this paper was sourced directly from documents produced by the Native Title Office and the TSRA regarding the Akiba Decision. See **Attachments 1.4c & d.**
3	13 (24 July 2018)	AFMA to clarify answers and report back to industry regarding the rules about licencing and the fish receiver system.	AFMA	**Complete** An information sheet with answers to each of the questions raised at HCWG13 can be found at **Attachment 1.4e.**
4	Out of Session	The TSRA to assist TIB licence holders to develop a proposal to lift the hookah ban when fishing for white teatfish, to be put up to the PZJA for consideration.	TSRA	**Ongoing** The TSRA Fisheries Program is progressing this.

Attachment 1.4b

Australian Government

Australian Fisheries Management Authority

www.pzja.gov.au

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1 Preliminaries

1.1 Opening prayer, acknowledgement of Traditional Owners, welcome and apologies

1. Mr Arthur Naawi opened the meeting in prayer at 9:05 am.
2. The Chair welcomed attendees to the 13th meeting of the Torres Strait Hand Collectable Working Group (HCWG 13). The Chair acknowledged the Traditional Owners of the land on which the meeting was held and paid respect to Elders past and present. The Chair further acknowledged the value of the knowledge and experience attendees would impart at the meeting and thanked them for taking the time to attend.
3. Given the relatively high number of new participants to the Working Group, each attendee gave a brief introduction to the broader group.
4. Attendees at the Working Group are detailed in Table 1 below.

Table 1. List of attendees at the HCWG13.

Members	
Anne Clarke	Chair
Ian Butler	Australian Fisheries Management Authority (AFMA) Member
Mark Anderson	Torres Strait Regional Authority (TSRA) Member
Tim Skewes	Research Member
Maluwap Nona	Industry Member – Traditional Inhabitant representative for Gudumalulgal and Maluialgal
Michael Passi	Industry Member – Traditional Inhabitant representative for Kemer Meriam
Patrick Mills	Industry Member – Traditional Inhabitant representative for Kaiwalagal
Seriako Stephen	Malu Lamar representative
Georgia Langdon	Executive Officer, AFMA
Invited Participants	
Jerry Stephen	TSRA Board Member for Ugar and Portfolio Member for Fisheries
Rocky Stephen	Kos and Abob Fishers Association – Ugar (Stephens) Island
Patrick Bonner	Industry – Poruma (Coconut) Island
Observers	
Nick Boucher	TSRA
Eva Plaganyi	Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Leo Dutra	CSIRO
Phil Ketchell	Industry – Thursday Island

5. Apologies received are detailed in the Table 2 below.

Table 2. List of apologies for HCWG13.

Apologies	
Danielle Stewart	Queensland Department of Agriculture and Fisheries (QDAF) Member
Francis Pearson	Industry Member – Traditional Inhabitant representative for Kulkalgal
Ian Liviko	PNG National Fisheries Authority (NFA) Invited Participant
Simon Naawi	Industry – Masig (Yorke) Island

1.2 Adoption of agenda

6. The Working Group adopted the draft agenda (Attachment A). An industry member requested that agenda items 3.4 Black Teatfish and 3.5 Prickly Redfish be discussed before 3.3 pearl and trochus as these species are of a higher priority.

1.3 Declarations of interest

7. As outlined in PZJA Fisheries Management Paper No. 1, all members of the Working Group must declare all real or potential conflicts of interest in Torres Strait hand collectable fisheries at the commencement of the meeting (see Table 3 below). The Working Group noted that if a member discloses an interest, the Working Group must make a decision as to whether, for the relevant agenda items, they can participate in the discussion and in the making of recommendations or remain absent from the meeting.

Table 3. Declared interests from each participant.

Name	Position	Declaration of interest
Anne Clarke	Chair	Nil.
Ian Butler	AFMA Member	Nil.
Mark Anderson	TSRA Member	Nil.
Tim Skewes	Research Member	CSIRO/Independent Consultant. Previous principal scientist for Torres Strait Scientific Advisory Committee (TSSAC) project to develop a harvest strategy for the TSBDMF. Previous CSIRO researcher for TSSAC project investigating traditional take of finfish in Torres Strait.
Maluwap Nona	Industry Member	TIB licence holder and Chairperson of Malu Lamar.
Michael Passi	Industry Member	TIB licence holder.
Patrick Mills	Industry Member	TIB licence holder; Chairperson of the Torres Strait Fisheries Association.
Seriako Stephen	Malu Lamar rep	TIB licence holder.
Georgia Langdon	Executive Officer, AFMA	Nil.

Name	Position	Declaration of interest
Leo Dutra	CSIRO Observer	Receives funding from CSIRO
Jerry Stephen	TSRA Board	TIB licence holder; TSRA Fisheries Portfolio Member

8. The Working Group determined that no member was required to be absent during discussion of or, decisions made on matters which are the subject of conflicts.

1.4 Action items from HCWG 12 and previous meetings

9. The Working Group noted the report provided by the Executive Officer advising of the status of actions arising from previous HCWG meetings (see Table 4 below).

Table 4. Status of action items arising from previous HCWG meetings.

#	Meeting #	Action item	Responsibility	Status
1	9 (20-21 June 2016)	AFMA to review the size limits set for the Torres Strait Beche-de-mer Fishery taking into consideration the size limits in place in Queensland and the Commonwealth Coral Sea Fishery.	AFMA	**In progress** To be addressed as part of the Bech-de-mer Harvest Strategy Project
2	11 (27 June 2017)	Consideration on whether or not changes should be made to the current size limit for Prickly Redfish be undertaken during the Harvest Strategy Workshop noting relevant data will be presented.	AFMA	**In progress** Refer to action item 1
3	11 (27 June 2017)	Industry members and observers to submit any outstanding catch reports to AFMA as a matter of priority.	Industry	**Completed** Industry provided the outstanding catch data out of session.
4	11 (27 June 2017)	AFMA to confirm out-of-session the commitment from Masig and Ugar communities to voluntary spatial closures and size limits for Prickly Redfish.	AFMA	**Completed** AFMA sought comment from industry out of session following HCWG 11.
5	12 (24 October 2017)	AFMA to recirculate details of proposed legislative amendments to the Act and Regulations and as a standing item, make a report on the progress of these legislative amendments at future Working Groups	AFMA	**Completed** AFMA circulated the proposed amendments and will provide an update under Item 2.2.3
6	12 (24 October 2017)	AFMA to circulate the final report from the Smartphone Data Collection project to the Working Group.	AFMA	**Completed** The report was circulated to HCWG members out-of-session on 23 January 2018.

#	Meeting #	Action item	Responsibility	Status
7	12 (24 October 2017)	AFMA to circulate a copy of the Research Member's presentation to the Working Group.	AFMA	**Completed** The presentation was sent to members out-of-session on 23 January 2018
8	12 (24 October 2017)	Working Group Members and Observers acknowledged the serious risk that a lack of data and catch reporting poses to the sustainable management of the TSBDMF and agreed to submit any outstanding catch records and to assist AFMA in obtaining catch records from the BDM TIB licence holders and buyers within their respective communities.	Industry	**Ongoing** AFMA received some catch records following the meeting.

1.5 Out of session correspondence

10. The Working Group noted the correspondence circulated out of session since HCWG 12 held on 24 October 2017.

2 Fishery Updates

2.1 Industry update

11. The Working Group noted updates provided by Industry Members, invited participants and observers on the recent performance of hand collectable fisheries and strategic issues, including economic trends, affecting the management and development of these fisheries.
12. An industry member from Kemer Meriam raised the importance of discussing a Black Teatfish opening as "lots" have been observed on the reef. He advised, based on his observations over the past 12 months fishing for Prickly Redfish that it appears to be taking longer for species to return to the reefs. It is thought weather patterns can play a large role in the habitat associations of each species. He added that there is plenty of White Teatfish, but the only way to access this species is with hookah as it is a deep water species and rarely seen in shallow grounds.
13. The industry member and representative for Gudumalulgal, Maluialgal and Kemer Meriam reported an increased abundance of black and White Teatfish and questioned why White Teatfish remains closed to fishing and why the TAC for that species cannot be increased.
14. The representative for Malu Lamar advised the group that traditional owners will advocate strongly for the fundamental human rights of TIB operators, under the principles of Native Title, to access, to use and enjoy the resources of the sea. He stated Malu Lamar will strongly support two elements of fisheries arrangements; a) administrative arrangements and policy changes that will benefit the people through the use of hookah; and b) ways to increase the TAC of both black and White Teatfish. He also requested a focus on "closing the gap" by creating economic growth, employment and small business development.

15. The industry invited participant from Poruma supported the sentiments of the Malu Lamar representative and other industry members. He added that Black Teatfish appear to be abundant around Poruma Island and that Poruma community supports the use of hookah to fish for White Teatfish as it is too dangerous for free divers due to the depth of the species. He noted that curryfish appear to be coming back despite having been fished extensively throughout the year.
16. An industry observer supported the exploration of using hookah. He stated that while it is important to protect the views of those who oppose hookah, hookah is needed to support the development of the industry.
17. The research member noted that each species has different depth ranges, which is an important point for management and a fact that has served to protect some species from over harvest due to their lack of accessibility. Fishing access ultimately comes down to a management framework that ensures each species has at least 60 or 70 per cent of the population left behind to encourage reproduction at sustainable levels. This is particularly important for sea cucumber species that require a certain population density to ensure successful reproduction on the reef. He explained that the lower the density of sea cucumbers left behind on the reef, the lower fertilisation rate.in the water column. He added the key issue with opening up White Teatfish is around how the harvest would be monitored and controlled, even with a conservative TAC. He reiterated that good information from daily logbooks and CDRs is necessary to support any potential expansion of the TAC.
18. The TSRA fisheries portfolio member reminded the group that lifting the hookah ban on White Teatfish has been an ongoing issue for many years. Industry is very interested in gaining access to the deeper White Teatfish with the use of breathing apparatus so communities can earn an income.
19. An industry invited participant from Ugar described how their community is focussing on curry fish species, and strongly supported the idea of having a separate TAC for curryfish from the 80 tonne basket TAC. He noted the fragile nature of the species and high levels of discarded product. He questioned how discard information gets captured within the Fish Receiver System. He believed the high rate of unreported discarded product will have implications for a possible standalone TAC for curryfish species.
20. Industry members noted that discard rates of curryfish are reducing as people are learning better processing techniques. The temperature and time when boiling product is very important and that processing needs to commence as soon as the product is removed from the water. Another industry member added that using blocks of ice in the seawater helps to keep the product fresher for longer. The Malu Lamar representative reiterated that, the boat policy needs to change to allow larger vessels to support processing on board to better support the delicate operations of harvesting curryfish.

2.2 Government agencies update (AFMA, TSRA, QDAF)

2.2.1 Export approvals under the EPBC Act

21. The AFMA member provided a summary of the World Trade Organisation (WTO) export approval and acknowledged the pivotal importance of the ability to export fisheries product.
22. The Torres Strait Beche-de-merBeche-de-mer and Trochus fisheries have been declared approved Wildlife Trade Operations (WTO) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) until 18 December 2020 and 9 October 2026 respectively.

23. The Trochus Fishery has no conditions on the basis that the fishery is currently inactive. Any new activity within the Trochus Fishery will need to be reported to the Department of the Environment and Energy (DoEE). The Torres Strait Pearly Shell Fishery is not currently exporting.
24. The Beche-de-mer Fishery has six conditions attached to the approval. These include:
    - Operation of the Torres Strait Beche-de-mer Fishery will be carried out in accordance with the management regime in force under the Torres Strait Fisheries Act 1984.
    - The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Beche-de-mer Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.
    - The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the Guideline for the Ecologically Sustainable Management of Fisheries – 2nd Edition.
    - The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion for all species harvest in the fishery.
    - The Torres Strait Protected Zone Joint Authority to complete an ecological risk assessment and implement an ecological risk mitigation strategy to ensure all environmental and ecological risks are appropriately managed.
    - The Torres Strait Protected Zone Joint Authority to continue to pursue the changes necessary to facilitate reporting of interactions with species listed in Part 13 of the *Environmental Protection and Biodiversity Conservation Act 1999*.
25. The AFMA member noted that the export approvals apply to individual fisheries (i.e. the TSBDF) within Australia and the Torres Strait, and are in place to ensure that the Torres Strait BDM fishery is being harvested and managed in a sustainable manner, with minimal environmental impacts to be exported outside of Australia. It is not applicable to investors or buyers within the fishery. Should any significant changes occur within the BDM fishery, (e.g. an opening of the Black Teatfish) the DoEE needs to be notified and convinced that the fishery will continue to be managed sustainably.
26. The Fish Receiver System and catch reporting is critical to the management of the fishery in allowing AFMA to monitor catches against the TAC and to satisfy the concerns of the DoEE.
27. An industry member from Mer questioned why the provision of data to support the management of the fishery and keep operators accountable is not compulsory. He suggested that the Hand Collectables Working Group discuss and put forward a recommendation to the PZJA in the context of legislative amendments to the *Torres Strait Fisheries Act 1984*, to amend the Act and make catch reporting enforceable. The AFMA member noted that the Fish Receiver System is mandatory and that AFMA has e the ability to enforce this. The AFMA compliance officer reminded the group that it is an offence under the *Torres Strait Fisheries Act 1984* not to comply with the requirements of the Fish Receiver System.
28. An industry observer asked about the impacts of fisheries being closed (e.g. Black Teatfish) and if that data is not available a part of the story is missing. This is particularly important for species like White Teatfish which has a TAC but is inaccessible due to the hookah ban. A CSIRO observer acknowledged that the Harvest Strategy will try to capture these data gaps and provide guidance on how to best understand the fishery

using other data and information in other ways where there are unknowns. The research member added that obtaining data in the TSBDMF is one of the greatest challenges.

2.2.2 AFMA Compliance Update

29. An AFMA compliance officer provided a brief update regarding compliance activities in the Torres Strait. The Working Group noted the following key points:
    - AFMA has officially taken on the role of delivering the domestic compliance program from the Queensland Boating and Fisheries Patrol (QBFP) as of 1 July 2018.
    - There have been a number of seizures in tropical rock lobster and mud crab, as well as investigations of illegal hookah use and other potential offences.
    - Currently, there is no mechanism for administering infringement notices for minor offences, however AFMA is looking to amend the Regulations to enable this. Alternatively, the Commonwealth Prosecutor must be satisfied there is public interest in a case, for an offence to progress to court.
    - The Thursday Island compliance team is recruiting a third member to assist with the increase in work load.
    - Key focus areas of the compliance team include data recovery and intelligence, profile building and port and freight inspections.
    - Industry members are strongly encouraged to report any illegal or suspicious activity to AFMA.
30. An industry representative expressed frustration about the difficulties in understanding or finding out the outcomes of reported non-compliance. The AFMA compliance officer informed the group that if an investigation is taking place, with potential court action, then details around the case cannot be shared, however, once the case reaches the Courts, the information enters the public domain. He added that every report provided to AFMA does get recorded in the system, howeverit is not always possible to report back to the informant about the outcomes.
31. Industry members requested that a brief update or report back to the informant is appreciated.

2.2.3 Fish Receiver System

32. The AFMA member provided an overview of the Fish Receiver System (FRS). The Working Group noted the following key points:
    - The FRS has been in place for seven months, since December 2017.
    - AFMA has received some good catch and effort information through the new system, however some improvements are still needed.
    - The FRS is a critical component to fisheries management across Australia. Accurate reporting and catch monitoring against TACs and individual catch allocations is not only important to ensure the sustainability of fisheries but also to maintain general compliance and integrity of management arrangements. This is particularly important when considering openings of the Black Teatfish fishery, or the potential for the Prickly Redfish fishery to close.
    - The data received through the FRS is also very helpful in providing evidence to the DoEE regarding export approvals.
    - The data received through the fish receiver system has:
        a) been used to monitor catch in the Torres Strait Fisheries;

b) been used to create Catch Watch reports for the Tropical Rock Lobster fishery to keep industry informed of how the fishery is performing as a whole and how many kilograms of a TAC remain. AFMA is working to produce similar regular reports for each of the Torres Strait fisheries;

c) been used for Government reporting e.g. Australian Bureau of Agriculture and Resource Economics yearly fishery reports supported Compliance operations, and

d) been used by PZJA Working Groups to inform recommendations and management decisions.

- The AFMA member reminded the Working Group of the responsibilities of both fishers and fish receivers when landing commercial product under the fish receiver system.
- AFMA has identified a number of issues that are occurring in the Beche-de-merBeche-de-mer fishery that need to be resolved, including:
  a) Unauthorised agents completing catch disposal records.
  b) Product being landed at unregistered premises.
  c) Product not being landed directly when it is brought on to land.
  d) The product is then landed and a CDR completed when it is received on the mainland.
  e) CDRs not being returned within 3 days of the catch being landed. This is a condition of the fish receiver licence.
  f) CDRs not being completed when the catch is received. Feedback from fish receivers suggests that a single CDR is completed for each fisher, when enough product has been received. This is can occur over a number of landings.
  g) Unreported catch. AFMA suspect that there are Beche-de-merBeche-de-mer fishers and buyers that are not reporting their catch.

33. AFMA sought feedback from the Working Group about the FRS to better understand some of the barriers to reporting through the FRS, including ways to resolve these issues.
34. An industry member questioned why the Torres Strait Prawn industry is not required to use the fish receiver system. The AFMA member explained that alternative management controls are used in the Torres Strait Prawn fishery (TSPF). The TSPF has input control limits on how much effort (number of fishing days) is undertaken, rather than output controls limiting how much product is caught or landed. The TSPF also use very detailed mandatory logbooks which is compared to observer data for verification.
35. Another industry member questioned the reporting of bycatch, particularly tropical rock lobster and pearl shell in the TSPF, as there are reportedly large numbers of these species taken as bycatch. The AFMA member noted that bycatch details are recorded and supported by an independent observer data collection program. There are also stringent requirements for using bycatch reduction devices.
36. Industry recommend that the TSPF be subject to the mandatory fish receiver system in line with the rest of Torres Strait fisheries.
37. Industry sought clarification on the following questions:
    a) If a licenced receiver in Cairns has an agent in the Torres Strait, does that make the agent a receiver also?
    b) Does each person who receives the catch need to fill out a new CDR?
    c) As a fisher wanting to unload his catch to any island, does he need to find a licenced fish receiver on that island to unload to?

d) Does someone who fishes commercially by walking on the reef, not using a boat, still require a TIB licence?
e) Can an un-licenced traditional inhabitant person fish under another person's TIB licence in a boat?
f) What criteria does a person need to meet to become a licenced fish receiver?
g) Can a TIB fisher offload their own catch to themselves as a fish receiver?
h) Can a TIB fisher who is also a licenced fish receiver out on his boat (Fisher/Fish receiver A on boat A), receive catch from another licenced TIB fisher (Fisher B on boat B) who pulls up alongside him to offload his catch?
i) Further to that, can Fisher/Fish Receiver A contract those people from boat B to work as processors on boat A, if their vessels are not attached to boat A?

ACTION ITEM #3 – AFMA to clarify and report back to industry regarding rules about licencing and the fish receiver system.

38. An industry member reported an issue where fishers come to offload to a licenced fish receiver but depart before signing the 'fisher details' section of the CDR form.
39. Given the level of uncertainty from industry about the rules surrounding the fish receiver system, the Working Group recommended that additional visits out to the communities, and a specific workshop, would help industry members better understand the Fish Receiver System. It was suggested that local radio and media is a useful tool to help communicate information.

RECOMMENDATION #1 – AFMA and TSRA to hold a Fish Receiver System education and awareness workshop for industry ahead of the TSRA Fisheries Summit in late August 2018.

40. An industry observer highlighted the importance of ensuring the correct safeguards are in place to prevent mis-reporting and logbook manipulation by fishers who are also fish receivers. The AFMA member reminded the group that the FRS does try to mitigate that issue by requiring two different entities to sign each part of the document. If the fisher is also a fish receiver, he/she cannot sign both parts of the form. An authorised agent must sign on their behalf as the fish receiver. This is further strengthened with the requirement to return the CDR to AFMA within three days of landing.
41. Further, the group noted that all commercial catch must be landed at the first point of landing to a licenced fish receiver, whether they be on land, or another vessel/carrier. A catch disposal record (CDR must be completed at this point. It was noted the receiver at the first point of landing may not necessarily be a buyer.
42. An industry member from Mer queried whether there should be a limit on the number of fish receivers within the industry, believing that only those who are active in the industry should possess a licence. The AFMA member noted that at present, a proposal for any limitation on licences would need very strong rationale and require to be put forward to the PZJA. The PZJA's policy of maximising the opportunities for Island participation in all sectors of the commercial fishing industry would need to be considered.
43. The Malu Lamar representative proposed that the entire Torres Strait licencing arrangements need to be reviewed and this should be discussed at the upcoming TSRA Fisheries Summit.

2.2.4 Legislative Amendments

44. The AFMA member provided a brief overview of the status of the proposed amendments to the *Torres Strait Fisheries Act 1984* (the Act) and the *Torres Strait Fisheries Regulations 1985* (the Regulations). The Working Group noted the following key points:
    - AFMA is progressing amendments to the Act and Regulations. These amendments will provide for:
        a) the ability to require catch reporting across all licence holders;
        b) the ability to provide electronic licensing and monitoring to licence holders;
        c) the ability to delegate the powers to grant and vary scientific and development permits;
        d) the ability to simplify the renewal of fishing licences;
        e) the ability to delegate powers to contracted service providers;
        f) for the simplification of the disclosure of fisheries information; and
        g) the ability to issue Fisheries Infringement Notices.
    - 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.
    - Opportunities to provide comment on the proposed amendments will be provided to fishers, their communities and the general public as the amendments are progressed.
    - The amendment process is lengthy and complex, and is expected to take a number of years.
45. The Malu Lamar representative advised that Malu Lamar is a critical stakeholder and must be consulted on all issues. Other industry members strongly supported this, adding that Malu Lamar should be a member of the PZJA and be a part of the decision making process.

ACTION ITEM #1 – AFMA to ensure Malu Lamar is included in all aspects of consultation regarding the proposed legislative amendments to the Act and the Regulations.

46. The TSRA fisheries portfolio member advised that any changes to the composition of the PZJA forum memberships would need to be submitted as a proposal to the PZJA.
47. An industry observer asked if there will be an avenue for members to propose their own legislative amendments. The Chair clarified that stakeholders will be provided with a draft proposal for all legislative amendments which may be the opportunity to provide additional suggestions.
48. The Malu Lamar representative suggested to the group that the ban on hookah breathing apparatus in the White Teatfish fishery also be included in any legislative changes, and changes to the boat policy in the TSBDMF also be considered. The AFMA member reminded the group that legislative amendments to the Act or Regulations is not the appropriate mechanism for lifting the hookah ban in the White Teatfish fishery.
49. Given this, an industry observer questioned whether a request could be submitted to the PZJA to lift the ban on the use of hookah out of session. The TSRA fisheries portfolio member noted that such a proposal needs to be tabled at a Working Group initially.
50. Industry expressed concern that the process for change is too slow and asked why a request to lift the hookah ban cannot be expedited in a way that other changes to fisheries management appear to have occurred previously. The TSRA fisheries portfolio

member noted that the changes referred to were made by the CEO of AFMA who has the delegation under the Act to do so. The TSRA member added that he believed there are two mechanisms in which the PZJA can initiate change; either through legislative amendments to the Act and Regulations, which is typically a very long timeframe (2-3 years) or alternatively through legislative instruments which are enacted through a delegate under the Act. Instruments are used to make changes to the day-to-day management of the fishery as necessary and are the mechanism in which other changes have been made previously.

RECOMMENDATION #2 – AFMA to work on shortening the timeframe to progress the legislative amendments over concern that the process is too time-consuming.

2.2.5 TSRA Update

51. The TSRA member provided a verbal update on the latest activities in the fisheries program. The next milestone will be the Fisheries Summit in late August which is hoped to provide a platform for productive discussions on the way forward for all fisheries in the Torres Strait region. The membership of TIB representation in PZJA forums will also be discussed and will be informed by a review that is currently being undertaken by Tim Skewes. The review will cover the experiences that current members have had over their last term of representation and recommend ways forward for future membership representation and how the TSRA can better support members for the next term.
52. The TSRA recently secured funding (approximately $4.5 million) from the Northern Australia Fund for fisheries infrastructure upgrades in the Torres Strait aimed at repairing, upgrading or renewing facilities for fisheries infrastructure. Currently, a TSRA project officer is currently visiting Fishing Associations in islands in the Torres Strait as a follow up from the fisheries infrastructure audit that was conducted earlier in 2018.
53. A traditional inhabitant industry representative expressed concerns about the way consultation was undertaken for the infrastructure audit stating that consultation should have been targeted at individuals rather than communities, as it is individual TIB operators that are working in this industry.
54. The TSRA Fisheries Portfolio member expressed strong support for individual operators but noted there are terms and conditions associated with government funding packages which can be an issue when providing funding for communities. The TSRA needs to ensure that individuals can be well supported to access those communal facilities.
55. The Chair acknowledged that the distribution of these funds is very important and suggested that the portfolio member communicate any industry comments back to the TSRA Board.
56. Several industry members expressed concerns over past community infrastructure projects that have failed, adding that these failures must be recognised to ensure we learn from those lessons. There needs to be a way to support the individual operators to access the funds as individuals rather than as a community. The TSRA Fisheries Portfolio member and TSRA member advised that there are avenues for individuals to access those funds. A Fishery Business Grant Package under the Regional Economic Investment Strategy is available to Aboriginal and Torres Strait Islanders living and working in the region. These people can apply to the TSRA at an individual or company level for support through a combination of loans, grants and business support. To date, four successful applicants have accessed the funding package.

2.2.6 QDAF Update

57. The AFMA member provided a brief summary of the QDAF update on behalf of the QDAF member. The Working Group noted the following key points:
    - The Sustainable Fisheries Strategy was released in June 2018
    - The Sustainable Fisheries Expert Panel has been appointed comprised of experts in the fields of fish biology, fishery management, stock assessment modelling, economic and social science and will provide independent advice to the Minister responsible for fisheries and Fisheries Queensland on best practice fisheries management and implementation of the Sustainable Fisheries Strategy.
    - Fishery working groups will be established to provide operational advice and engage stakeholders from all sectors in the development of harvest strategies and day to day management of fisheries.
    - The Sea Cucumber Fishery Working Group has been appointed and since then have met in March and June 2018.
    - The East Coast Sea Cucumber Fishery has been operating under a Rotational Harvest Scheme for 15 years. A comprehensive catch data set has been recorded for each zone throughout this time and will be used to inform future management arrangements.
    - Industry has requested the TACC for Black Teatfish be increased from zero and include the species in the development of the harvest strategy. The Expert Panel will review the independent Black Teatfish survey results at the July meeting and provide further advice to Fisheries Queensland.
    - The Working Group is scheduled to meet again in November to review the draft harvest strategy.

2.3 Native Title update

58. The representative of the Malu Lamar (Torres Strait Islanders) Corporation RNTBC advised that the Part B Sea Claim is still in progress.
59. He also advised that Malu Lamar will continue to advocate for the Corporation to be a member on each PZJA forum as well as the PZJA itself
60. The Chair added that the involvement of Malu Lamar in the HCWG is highly valued and is a very beneficial component to the working group.
61. The Malu Lamar representative queried some of the information presented in paragraphs 7 and 11 of the agenda paper (2.3). The Chair advised the group to inform AFMA if there is any errors in the working group papers, so they may be corrected.

ACTION ITEM #2 – AFMA to clarify the information in paragraphs 7 and 11 of Agenda Item paper 2.3.

2.4 PNG National Fisheries Authority update

62. This agenda item was not discussed as the PNG NFA Invited Participant was not in attendance.

3 Management

3.1 Research update and priorities

63. The Research Member provided a brief verbal update on Beche-de-mer research projects and the Working Group noted the following key points:
    - The most recent surveys conducted in the Torres Strait were in 2009, the Warrior Reef survey in 2010 and the 2012 Warrior Reef experimental fishing survey.
    - The east coast fishery has conducted ongoing burrowing blackfish surveys.
    - A recent Black Teatfish survey has just been completed, which is showing signs of recovery and may support a re-opening of that fishery.
    - CITES listing for teatfish and sandfish is very likely. If successful, non-detriment findings will be required to export product out of the Torres Strait. This may provide greater marketability for Beche-de-mer product out of the Torres Strait, provided that sustainability can be demonstrated.
    - Western Australia fisheries are pursuing Marine Stewardship Council (MSC) certification in their Beche-de-mer fisheries to add value to their product.
    - Reports of poaching in the Moreton Bay area.
    - PNG fisheries have re-opened their sandfish fishery.

64. The AFMA member also provided a summary regarding the Torres Strait Scientific Advisory Committee (TSSAC) and Strategic Research Plan (SRP).
65. The TSSAC now requires each fishery to develop a five year fisheries research plan, which fits into the three themes identified in the SRP:
    a) Protecting the Torres Strait marine environment for the benefit of Traditional Inhabitants
    b) Social and economic benefits
    c) Technology and innovation
66. The five year plans are to be updated annually, thus always having a five year projection for research.
67. The HCWG was asked to consider the themes of the SRP and discuss and advise on future research priorities for hand collectable fisheries over the coming five years.
68. The Working Group agreed that progressing work on the Harvest Strategy would help to identify additional research priorities including:
    a) Standardising conversion ratios
    b) Understanding biological parameters (growth, mortality, breeding)
69. An industry member noted that Malu Lamar must be consulted regarding any research conducted in the Torres Strait and that the research protocols previously developed by Dr Nakata must be adhered to.
70. Industry members strongly recommended that full time TIB fishers take part in any research, noting that it is a good opportunity to encourage ownership in the process, and share in local knowledge.

3.2 Catch data summary

71. The AFMA member provided a brief overview of the catch data summary for the Torres Strait hand collectables fisheries. The Working Group noted the following key points:
    - Fishing activity in both the Pearl Shell and Trochus Fisheries remains negligible. The low level of catch and effort in the Pearl Shell and Trochus Fisheries is thought to be due to low market demand rather than a decline in stock availability.

- Fishing activity in the Beche-de-mer fishery has increased and is largely attributable to increased interest associated with two trial Black Teatfish openings in 2015 and 2016.
- As of 2 July 2018, the total number of issued licences by fishery and type were as follows:

Table 5. Summary of licences issued in each fishery.

Fishery	TIB licences	TVH licences	Carrier Boat licences
Beche-de-mer	123	1 package (held in trust by TSRA)	14 (B and C)
Pearl shell	61	9 packages	13 (A, B and C)
Trochus	69	-	7 (A, B and C)

- Total reported catch of Beche-de-mer through catch disposal records (TDB02) as of 29 June 2018 was 26.14 tonnes.
- 16.82 tonnes (approximately 64 per cent) of this total was from basket species including curryfish.
- Most notably, 8.64 tonnes of Prickly Redfish was reported. This equates to approximately 60 per cent of the TAC, half way through the season.

72. An industry member queried the seemingly high number of carrier boat licences listed in the TSBDMF. The group noted that this number includes barges or similar vessels such as Sea Swift boats and that the details of who holds these licences is available on the public register of Torres Strait licences, on the AFMA website.
73. The package of TVH beche-de-me licences held in trust by the TSRA was queried by an industry invited participant as it is widely understood that the Beche-de-mer is 100 per cent traditionally owned. The TSRA fisheries portfolio member and an industry observer to the meeting reminded the group that the licence was bought out by the TSRA when the PZJA took over the management of fisheries within the Torres Strait. In the event that the TVH licence was to be leased out, substantial consultation would be undertaken and any decision made would be for traditional inhabitants as a preference.
74. An industry observer questioned whether the 7m TIB boat length restrictions apply to the TVH licence, and advised the group that Malu Lamar will be seeking to have the 7m boat length restriction lifted.
75. Noting the catch summary provided for curryfish (15.37 tonnes), an industry invited participant highlighted that the numbers presented do not accurately reflect what is harvested as discarded product is not included. He added that the CDRs are not capturing the significant amount of wasted/discarded curryfish which is contributing to the overall total harvest. An additional field or code was suggested to help capture this data. Further, he suggested that with recent increased interest in that species, and high discard rates, there needs to be consideration of a separate TAC for curryfish species outside of the 80 tonne basket to ensure the sustainability of the species.
76. The AFMA member acknowledged that capturing information on discards is very important, however it might be best captured within the daily fishing log, rather than CDRs.
77. A CSIRO observer added that the idea of a separate TAC is being considered under the development of a harvest strategy for Beche-de-mer species. A recommendation was made through the last Harvest Strategy Workshop for a 60 tonne TAC for curryfish species with a trigger for *Stichopus vastus*, inclusive of discards. The remainder basket species TAC would then likely be reduced from 80 tonnes down to 60 tonnes. It is critical to understand species specific catch details including the amount of discarded product

as well as the conversion ratios for boiled product versus discarded product to inform these potential TAC numbers.

78. All industry members expressed support for a separate TAC for curryfish, in addition to the 80 tonne basket species TAC.
79. The research member reminded the group that in the last BDM survey, the estimate biomass for curryfish was 734 tonnes, with a recommended trigger for curryfish of 40 tonnes. At that time, the Working Group advised that a separate TAC was not necessary as curryfish was not heavily targeted. However, given that effort on curryfish has since increased, the 40 tonne trigger may still be relevant.
80. An industry invited participant advised that some industry members from Ugar have been proactive in reporting the different species, with retained and discarded weights to AFMA through CDRs.

RECOMMENDATION #3 – To implement a separate TAC for curryfish species, in addition to the 80 tonne basket species TAC through the Harvest Strategy.

3.3 Pearl Shell & Trochus Fisheries

81. This agenda item was not discussed due to the limited fishing effort in both fisheries.

3.4 Black Teatfish

82. The AFMA member provided an overview of agenda item paper 3.4 on Black Teatfish, including a brief summary of the history of the fishery. The Working Group noted the following key points:
    - Beche-de-mer species are particularly vulnerable to over catching, which is evident in the catches of Black Teatfish in the past.
    - The Black Teatfish fishery was opened as a trial in both 2014 and 2015. The 15 tonne TAC was exceeded in both instances.
    - The PZJA agreed (out of session, February 2017) that fishing for Black Teatfish will remain closed until the risk of exceeding the TAC is substantially reduced through cost-effective management tools;
    - As per a recommendation from the HCWG in 2016, a mandatory fish receiver system was implemented on 1 December 2017 to facilitate accurate catch reporting in the fishery.
83. The AFMA member noted that although the FRS still requires some improvements, AFMA is very supportive of undertaking another Black Teatfish opening. The Working Group was asked to discuss and advise on management arrangements needed to support any future opening for Black Teatfish, noting:
    a) the arrangements AFMA has implemented to date to support any future opening (VMS, FRS and the public licence register) and the review of the FRS presented at item 2.2.2;
    b) the work still underway on the Beche-de-mer harvest strategy and legislative amendments to the *Torres Strait Fisheries Act 1984* which will support the future development of the Beche-de-mer Fishery;
    c) previous management arrangements that have been considered to date by the Industry Workshop, Working Group and AFMA.
    d) that any management requirements discussed, would need to be met and consistently demonstrated for a period of time prior to a Black Teatfish opening being considered.

84. One industry member expressed concern about the potential increase in TIB fishing effort should the Black Teatfish re-open, particularly given that there was a rapid increase in TIB licences following the first opening of Black Teatfish. An influx of effort would pose a disadvantage for those full time industry members currently active within the fishery.
85. Another industry member supported the use of daily fishing logs, in addition to the fish receiver system for a Black Teatfish opening to provide catch and effort information. He advised that in a good days fishing, one dinghy may catch up to 400kg of product. With a small TAC and high fishing effort, a CSIRO observer questioned if there is capacity to cope with such high volumes of product over a short time frame and suggested it may be better to spread the fishing effort out.
86. An industry invited participant from Ugar raised similar concerns over increased fishing effort due to the high value of Black Teatfish. With additional concerns over the consistency in reporting through the FRS in the Beche-de-mer fishery overall, the potential increase of effort needs to be carefully managed. He suggested that only the five key eastern island communities, who are the most active in the Beche-de-mer fishery, be able to participate and that all Black Teatfish be channelled through these communities.
87. The Working Group discussed some management options to support a Black Teatfish opening:
    a) encouraging payment of a nominal fee to participate in a Black Teatfish opening, and to disperse the TAC among "access buyers".
    b) endorsing specific fish receivers in each of the five islands who can receive Black Teatfish. Some industry members expressed concern about limiting flexibility if only certain fish receivers are endorsed
    c) providing additional resourcing to support fishers in reporting their catches and requiring landed product to be reported by 9am daily.
    d) establishing an alert system to notify fishers when they are approaching the TAC limit – through VHF radio
    e) Holding an opening during the TRL season, but during a hookah closure to prevent a potential transfer of fishing effort.
    f) a mechanism to control the increase in people wanting to access the Black Teatfish fishery when it opens. Suggestion to only allow marked dinghies from the five key islands to fish.
88. The Executive officer noted that if improvements through the FRS can be demonstrated through other species (e.g. Prickly Redfish) over the coming months this will help towards building a solid proposal to the PZJA to reopen Black Teatfish. An opening is contingent on the FRS working well and demonstrating that the risk of over harvesting Black Teatfish can be mitigated.
89. Noting that decisions through the PZJA take some time with consultation, particularly if limited access is proposed, an opening is unlikely before the end of 2018. Consideration of the WTO Export Approval is also needed. Suggestions for a February or March opening, to align market availability with Chinese New Year and higher prices when the TRL catch rates tend to increase were put forward. A February opening is not supported by the community of Ugar.
90. November or December is preferred as the weather is calmer, and it provides economic opportunity for communities ahead of Christmas. This was supported by the industry invited participant from Ugar.
91. An industry observer suggested to double the TAC in one year with a defined period opening (e.g. 10 days) and have no opening the following year. This was not supported by Ugar.

92. The group acknowledged that the timeline for a decision by the PZJA will be determined by the type of model presented, i.e. limited access, or open access, and therefore determine when an opening may occur. It was also recognised that the more time available to improve catch reporting, the greater the chances of the PZJA being satisfied that the risk of over catching the TAC has been reduced.
93. Ugar and Erub remain unsupportive of an opening until there is more confidence in the FRS and the reporting of data.

RECOMMENDATION #4 – That AFMA prepare a proposal for the PZJA, for a Black Teatfish trial opening in December 2019, following consultation with communities about potential limited access for the five key eastern islands and to include a basis for scientific data to support the proposal after the finalisation of the harvest strategy.

3.5 Prickly Redfish

94. The AFMA member provided a brief update on the most recent management actions for Prickly Redfish. Most notably:
    - The PZJA Standing Committee endorsed the reduction of the Prickly Redfish TAC from 20 down to 15 tonnes effective as of 1 January 2018 through the variation of TIB licences.
    - The Standing Committee also agreed that any continued fishing for Prickly Redfish be contingent on having reliable catch data in order to monitor and enforce the TAC.
    - Without any new information on stock status, and if catch reporting is still considered to be unreliable, the PZJA will need to further consider closure of the Prickly Redfish fishery.
    - As of 29 June 2018, the reported catch of Prickly Redfish through catch disposal records was 8.64 tonnes, which equates to approximately 60 per cent of the TAC, half way into the fishing season. However, due to uncertainty in the completeness of the FRS data, the catch of Prickly Redfish is likely to be greater than what has been reported to date.
    - Industry have observed declines in abundance of Prickly Redfish across many key fishing grounds and with fishers having to fish further afield and/or for a longer time to maintain good catch rates.
95. Industry members supported the idea of regular catchwatch reports to alert BDM fishers when the TAC is being approached, and encourage regular reporting. Text messages, community notices and radio announcements are useful for communicating catchwatch alerts. Alerts may encourage a voluntary slowing of fishing effort to ensure the TAC is not over caught and provide a way for fishers to demonstrate responsiveness to the information in providing timely CDR reports.
96. Some concerns were raised that such notifications would encourage a “race to fish” to harvest the remainder of the TAC before the fishery is potentially closed.
97. The AFMA member noted that the cut off point for a potential closure will depend on the time lag in reporting with some understanding of catch rates.

RECOMMENDATION #5 – AFMA to consider using catchwatch alerts to advise BDM fishers how catches of Prickly Redfish are tracking relative to the TAC.

3.6 Future Management Priorities

98. The AFMA member noted that the key future management priorities for hand collectable fisheries are:
    - Progressing the Beche-de-mer Harvest Strategy
    - Developing a Beche-de-mer management plan
    - Continuing education and awareness training with the Fish Receiver System
    - Improving communication and engagement with industry

3.7 Budget for 2018/19

99. The Working Group noted a brief verbal breakdown of the allocated budget for conducting Hand Collectables Working Group meetings and Harvest Strategy workshops.
100. Fishers were reminded to advise of any travel changes for meetings well in advance to avoid penalty and cancellation fees with airlines.

4 Other business

4.1 PZJA forum traditional inhabitant representation

101. Traditional Inhabitant members were reminded that their membership expired on 30 June 2018. AFMA, on behalf of the PZJA is offering an extension to each members' current term of appointment on the Hand Collectables Working Group until 31 December 2018, or until the appointment of new members is finalised.
102. The Working Group noted that the nomination of new memberships would take place at the upcoming Fisheries Summit in August 2018.

4.2 Hookah ban and White Teatfish (out of session)

103. The issue of the hookah ban was discussed out of session during the CSIRO Harvest Strategy Workshop on Wednesday 25 July.
104. Industry members expressed concern over the existing ban on using hookah to fish for Beche-de-mer, particularly for high value species such as White Teatfish which inhabit deeper water (greater than 20m). White Teatfish is currently inaccessible due to its depth, and the occupational health and safety risks involved with freediving to such depths.
105. One industry invited participant from Ugar was not supportive of lifting the hookah ban unless the appropriate management controls could be implemented and demonstrated by industry to ensure the harvest could be managed sustainably.
106. CSIRO noted that the use of hookah poses a greater risk to Beche-de-mer fisheries and reiterated the importance of having stringent processes in place for reporting and monitoring to build a case to support lifting the hookah ban. CSIRO also acknowledged that the stock status of White Teatfish below 20m is not well understood as the species has never been surveyed past those depths.
107. Industry members were supportive of putting together a discussion paper to the PZJA to propose lifting the hookah ban in order to fish for White Teatfish. In support of this, the TSRA member made a commitment for the TSRA to assist traditional inhabitant licence holders in developing a discussion paper to the PZJA to propose lifting the hookah ban to fish for White Teatfish.

108. The group agreed that the White Teatfish hookah ban issue needs to be included on the next HCWG meeting agenda.

ACTION ITEM #4 – TSRA to assist TIB licence holders to develop a proposal to lift the hookah ban when fishing for White Teatfish, to be put to the PZJA for consideration.

5 Close of Meeting

109. The Chair thanked everyone for their contributions throughout the meeting and the meeting was closed at 5.45pm with a prayer by Mr Seriako Stephen.

Attachment A – Adopted Agenda

13th MEETING OF THE TORRES STRAIT HAND COLLECTABLES WORKING GROUP

24 July 2018 (8:30 am – 5:00 pm)

TSRA Board Room, Lv 1, 46 Victoria Parade

ADOPTED AGENDA

1. **Preliminaries**
   1.1. Opening prayer, acknowledgement of Traditional Owners, welcome and apologies
   1.2. Adoption of agenda
   1.3. Declarations of interest
   1.4. Action items from previous meetings
   1.5. Out of session correspondence

2. **Fishery Updates**
   2.1. Industry
   2.2. Government
      2.2.1. Export approvals under the EPBC Act
      2.2.2. AFMA Compliance Update
      2.2.3. Fish receiver system
      2.2.4. Legislative amendments
      2.2.5. TSRA Update
      2.2.6. QDAF Update
   2.3. Native Title
   2.4. PNG National Fisheries Authority

3. **Management**
   3.1. Research update and priorities
   3.2. Catch data summary
   3.3. Pearl and Trochus Shell Fisheries
   3.4. Black Teatfish
   3.5. Prickly Redfish
   3.6. Future management priorities
   3.7. Budget for 2018/19

4. **Other business**
5. **Date and venue for next meeting**

Summary of New Action Items

#	Meeting #	Action item	Responsibility
1	13 (24 July 2018)	AFMA to ensure Malu Lamar is included in all aspects of consultation regarding the proposed legislative amendments to the Act and the Regulations.	AFMA
2	13 (24 July 2018)	AFMA to clarify the information in paragraphs 7 and 11 of Agenda Item paper 2.3.	AFMA
3	13 (24 July 2018)	AFMA to clarify answers and report back to industry regarding the rules about licencing and the fish receiver system.	AFMA
4	Out of Session	The TSRA to assist TIB licence holders to develop a proposal to lift the hookah ban when fishing for White Teatfish, to be put up to the PZJA for consideration.	TSRA

Summary of Meeting Recommendations

#	Recommendation
1	AFMA and TSRA to hold a Fish Receiver System education and awareness workshop for industry the day before the TSRA Fisheries Summit in late August 2018.
2	AFMA to work on shortening the timeframe to progress the legislative amendments over concern that the process is too time-consuming.
3	To implement a separate TAC for curryfish species, in addition to the 80 tonne basket species TAC through the Harvest Strategy.
4	That AFMA prepare a proposal for the PZJA, for a Black Teatfish trial opening in December 2019, following consultation with communities about potential limited access for the five key eastern islands and to include a basis for scientific data to support the proposal after the finalisation of the harvest strategy.
5	AFMA to consider using catchwatch alerts to advise BDM fishers how catches of Prickly Redfish are tracking relative to the TAC.

Attachment 1.4c

Assistance: Mariana Nahas/ TSRA

OUTCOME SOUGHT

- To **inform** the meeting of the developments in relation to the Torres Strait Native Title Sea Claim

TALKING POINTS

⇒ In making its Determination in relation to the Torres Strait Native Title Sea Claim, the High Court of Australia directed that a Prescribed Body Corporate for the Sea Claim Determination Area Part A be formed by August 2014.

⇒ In June 2014, Malu Lamar (Torres Strait Islander) Corporation became the registered native title body corporate (RNTBC) for the Determination Area and holds the native title rights and interests in the area in trust for the native title holders.

⇒ The Board of Malu Lamar is comprised of every island RNTBC Chair or delegate.

⇒ Malu Lamar is now responsible for performing all of the functions of a RNTBC in the Determination Area.

BACKGROUND

On 23 August 2010 the Federal Court of Australia in *Leo Akiba and George Mye on behalf of the Torres Strait Islander Regional Sea Claim Group v State of Queensland* recognised native title rights and interests of Torres Strait Islanders to around 40,000km^2 of Torres Strait seas (Determination Area).

On 7 August 2013 that decision was upheld by the High Court of Australia, which found that the native title rights and interests include a right to take resources in the Determination Area for any purpose (including fisheries resources for commercial purposes).

The High Court held that successive Commonwealth and Queensland legislation, which prohibited taking fish and other aquatic life for commercial purposes without a licence, did not extinguish the native title right of certain island communities in the Torres Strait to take resources from defined areas of water.

The Determination Area overlaps with the area of all Torres Strait Fisheries. However, the area of commercial fisheries in the Torres Strait extends beyond the Determination Area. Although the Determination Area includes seabed and subsoil, these are not included in the area known as the ‘top hat’.

The determined native title rights and interests did not affect the validity of other interests that were specifically listed. These other interests included any subsisting public right to fish, and the rights and interests of holders of licences, permits, authorities or endorsements issued under, amongst other acts, the *Torres Strait Fisheries Act 1984*.

The Determination also found that Native Title did not exist in some of the outer extremities of the area of the Torres Strait Native Title Sea Claim, although one or more of these areas may be subject to potential further determination under separate Claims. These areas are marked in red in the attached map.

The native title rights and interests set out in the Determination are not exclusive. Native title holders are required to comply with common law and all international, federal and state laws governing licence requirements for commercial fishing in the Torres Strait.

Proposed acts to take place in the Determination Area and that may affect native title are subject to the future acts regime in the *Native Title Act 1993.*A proposed act affects native title if it extinguishes the native title rights and interests or if it is inconsistent with their continued existence, enjoyment or exercise Before the proposed act is undertaken, the proponent must notify representative bodies, registered native title bodies corporate and registered native title claimants in relation to the waters that will be affected by the act. The proponent must also give those persons an opportunity to comment on the act and have regard to any comments made.

SUPPLEMENTARY MATERIAL

Attachment A: Map of Torres Strait Regional Sea Claim area.

Plain English summary of

Akiba on behalf of the Torres Strait Islanders of the Regional Seas Claim Group v State of Queensland (No 2) [2010] FCA 643 as upheld in the High Court of Australia in *Akiba on behalf of the Torres Strait Regional Seas Claim Group v Commonwealth of Australia* [2013] HCA 33 7 August 2013 B58/2012

Prepared by R Blowes for use by TSRA Native Title Office for purposes of consultations with claimants

- The recent High Court judgement which was handed down on 7 August 2013, in effect confirmed the decision of Justice Finn in July 2010 represents a very significant win by Torres Strait Islanders.
- The Judge and the High Court recognised that Torres Strait Islanders were a very strong maritime people who very much look to the sea and have a long and important history and tradition of trading and travelling and using the sea.
- The win means that the traditional rights of Torres Strait Islanders in the seas that belong to the island communities and the seas they share with other islands are now not just traditional and recognised amongst themselves – they are <u>legal</u> rights <u>recognised and protected</u> by the law of Australia. The rights can no longer be taken away without consultation and compensation.
- The rights that have been recognised in this way are the rights to:
    - Go out into the waters and use them under your traditional laws and customs in whatever way you choose; and
    - Take any resources from the waters (including water and things on or under the sea floor) and use them according to your traditional laws and customs in whatever way you choose (including for your livelihood, for your community and commercially).
- The win does not give you any new rights – it recognises your traditional rights as legal rights and gives them the same protection that the law gives to other people's property rights.
- The win does not mean that you can fish commercially without a community or commercial licence. You still have to obey the laws about fishing. But, any new laws cannot take away your native title rights. And when you are fishing commercially (with a licence) you are still exercising a native title right, not just a right given to you by the licence. He argued very strongly that your rights to use resources for commercial purposes

had not been extinguished by the long history of regulation of fishing in the Torres Strait by Queensland and Commonwealth legislation.

- The Court found that there were some parts of the claimed area in which the rights do not exist. These are shown on the map in red. They are in the extreme west, north, east and south of the claim area. There are also some very small areas around some of the older navigation aids where the native title rights have been extinguished. Also, because of the Treaty between Australia and PNG, in the Top Hat area out from the Top Western islands, the native title rights do not include the sea floor or subsoil because in that area the sea bed (but not the water above it) is part of PNG.
- The Court rejected the arguments of the State and the Commonwealth that your traditional rights only cover small areas around the islands; and found the rights covered a very large area with no gaps between the sea areas and shared areas of the communities.
- The judge did not find that everybody has the same rights in every part of the sea. He found that across the Torres Strait some parts were owned by the people of the different community islands and some parts were shared between two or more communities. In this way he recognised that under your traditional laws and customs people have their own areas and their shared areas and that the people of Boigu do not claim to be the owners of the waters around Mer, for example.
- The judge recognised the cultural and traditional importance of Ailan Pasin. He also found that there were laws and customs about relationships and sharing between people and communities which included rights and obligations. He found that these things were very important and traditional but that the rights involved were not native title rights that could be recognised under the *Native Title Act*. This was only because they are more based on the importance of the relationships between people and are not 'ownership' rights.
- The Court only made a decision about the parts of the claim area that were not also claimed by Kaurareg and some mainland people. Those areas are shown on the map in pink. The claim to these areas will be dealt with in negotiations with those people or by the Court at a later date.
- The Judge commented in his decision that he found the evidence of the Torres Strait Islander witnesses to be very strong and very helpful. He commented about how much they knew about the seas and about the use of its re resources and how important things like feasting, dancing, singing and Ailan Pasin were in your culture.
- Since the matter has been finalised, a PBC will have to be set up to hold the native title rights and interests in the Sea Claim area. The NTO will carry out community consultations

about possible models for a PBC, to decide the rules about who shall control the PBC and who can become members. As part of this process, it is proposed to arrange a meeting of PBC chairs to form a working group with the NTO to carry out these consultations.

- Part B of the Sea Claim is now proceeding through the Federal Court system. Negotiations will have to be carried out with the Kaurareg and Gudang Peoples who's claim overlap with the area of the sea claim.

Attachment 1.4e

Action Item 3 from HCWG13

AFMA to clarify answers and report back to industry regarding the rules about licencing and the fish receiver system.

a) If a licenced receiver in Cairns has an agent in the Torres Strait, does that make the agent a receiver also?

The agent is not a licenced fish receiver, but is an authorised agent which allows a person to act on a licence holders behalf. In other words, an authorised agent is able to sign Catch Disposal Records on behalf of a licenced fish receiver, under that persons licence.

b) Does each person who receives the catch need to fill out a new CDR?

No, only the receiver who receives the product at the first point of landing needs to weigh the product and record it on a CDR. If the product is then passed to another person/receiver, that person does not need to fill out a CDR. If the second person receiving the product is unsure about whether a CDR has already been filled, they can circle NOT SURE at the top of the page.

c) As a fisher wanting to unload his/her catch to any island, does he/she need to find a licenced fish receiver on that island to unload to?

Yes. All commercial catch must be landed to a licenced fish receiver and that receiver must weigh and record the catch on a Catch Disposal Record and submit the CDR to AFMA within three business days. The fisher must also provide their name and licence details.

A public register of all licence holders (fishers, carriers and receivers) is available on the PZJA website, or by contacting AFMA directly.

d) Does someone who fishes commercially by walking on the reef, not using a boat, still require a TIB licence?

A traditional inhabitant must be licenced to commercial fish. Please note regulatory reforms are being assessed to make it clear that licences can be granted without a boat.

e) Can an un-licenced traditional inhabitant person fish under another person's TIB licence in a boat?

Yes. It should be noted however that fisher is operating under the authority of the licence granted to the licence holder. The catch must still be landed to a licenced fish receiver, and the TIB licence holder details must be recorded on the CDR.

f) What criteria does a person need to meet to become a licenced fish receiver?

Anyone can apply to AFMA to become a licenced fish receiver. You can apply for a fish receiver licence by downloading the application form from the PZJA website or by contacting the AFMA Thursday Island office on (07) 4069 1990, emailing FisheriesTI@afma.gov.au or drop into the AFMA Office at the Pearls Building on Thursday Island.

g) Can a TIB fisher offload their own catch to themselves as a fish receiver?

The same person cannot land product and complete a CDR for that product. Using Authorised Agents however it is possible for the same person to be the relevant TIB and fish receiver licence holder. This flexibility recognises the benefit from getting catches declared as quickly as possible upon landing and the diverse operations within industries. Some operators, particularly in the BDM Fishery, retain and process landings for some time before passing onto a third party.

h) Can a TIB fisher who is also a licenced fish receiver out on his boat (Fisher/Fish receiver A on boat A), receive catch from another licenced TIB fisher (Fisher B on boat B) who pulls up alongside him to offload his catch?

To take product from another boat the vessel must be authorised to carry. There are three different types of carrier and carrier/processor licences.

1. Carrier A licences only allow catches taken by tenders to be carried and processed by the primary boat licenced for those tenders. Carrier A licences do not allow the carrying or processing of catch taken by any other licences.

2. Carrier B licences allow catches taken:
    a. by tenders to carried (carried only, no processing) by the primary boat licenced for those tenders; and
    b. other licenced boats.

3. Carrier C licences allow catches taken by other licence boats to be carried and processed by the vessel. Carrier C licences do not permit the towing of tenders to and from the fishing grounds or the accommodation of crew from other boats.

As described above only Carrier B and C licences allow the carrying of product taken by other boats (boats that are not within the licenced primary / tender package). The Fish Receiver system requires a Carrier B and C licence holder to also be a Fish Receiver and complete a CDR when product is landed to their carrier vessel from other boats. In this case the carrier vessel must be listed as a registered premises for receiving catch.

i) Further to that, can Fisher/Fish Receiver A contract those people from boat B to work as processors on boat A, if their vessels are not attached to boat A?

Yes, provided that those crew being employed or contracted are Traditional Inhabitants.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
PRELIMINARIES **Out of session correspondence**	**Agenda Item 1.5** **For NOTING**

RECOMMENDATIONS

1. That the Working Group **NOTE** the correspondence circulated out of session since the last meeting.

BACKGROUND

2. The following correspondence was circulated out of session since HCWG 13 held on 24 July 2018.

Date	Item
17 August 2018	Email to Harvest Strategy Workshop participants with provision of Beche-de-mer harvest strategy talking points.
6 September 2018	Email to members seeking comment on the draft HCWG13 meeting record. Comments closed on Thursday 20 September.
11 September 2018	Email to members announcing next Hand Collectables Working Group meeting (HCWG14) on 24 October 2018.
10 October 2018	Email to HCWG members circulating final meeting record from HCWG13.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
WORKING GROUP UPDATES **Industry update**	**Agenda Item 2.1** **For DISCUSSION**

RECOMMENDATIONS

1. That the Working Group:
   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

2. Verbal reports will be provided by industry members under this item.
3. It is important that the Working Group develops a 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 Working Group are focused and may more effectively address each issue.
4. Working group 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 in future.
5. At the previous meetings of the Working Group, members discussed a range of strategic issues affecting the management and development of Torres Strait fisheries.
6. At HCWG 13 noted the following updates:
   a. The targeting of curryfish is continuing as operators are improving processing methods and reducing the amount of wasted product. Industry supported the idea of a separate TAC for curryfish from the 80 tonne basket species TAC.
   b. Black teatfish have been observed to me more abundant around Poruma, and that curryfish appear to be coming back despite having been fished extensively this year.
   c. Prickly redfish are considered to be taking longer to return to the reefs and it is thought that weather patterns may have some influence on this.
   d. High numbers of white teatfish have been observed around Mer, however they are difficult to access due to their depth.
   e. Industry recognised the importance of good fishery and catch data to support management decisions and the future of the industry.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
GOVERNMENT UPDATES AFMA Update	Agenda Item 2.2.2 FOR NOTING

RECOMMENDATIONS

1. That the Hand Collectible Working Group **NOTE** the updates provided by the AFMA member and AFMA compliance officer, in particular:

Legislative Amendments

2. 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.
3. 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.
4. 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

5. 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.

6. 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.

Australian National Audit Office (ANAO) update

7. 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.

8. 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.

9. 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

10. 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.

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

11. 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).

12. 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.

13. In summary, the biological status for the Torres Strait Tropical Rock Lobster Fishery has been assessed for the 2017 period as follows:

Status	2016		2017		Comments
Biological status	**Fishing mortality**	**Biomass**	**Fishing mortality**	**Biomass**	
Black teatfish (*Holothuria whitmaei*)					No catch in 2017. Recent survey indicates a recovering stock.
Prickly redfish (*Thelenota ananas*)					Catch is below TAC. Survey indicates relatively stable densities.
Sandfish (*Holothuria scabra*)					No catch in 2017. Most recent full survey (2009) indicated that stock was overfished.
White teatfish (*Holothuria fuscogilva*)					Catch is below TAC. Survey indicates relatively stable densities.
Other sea cucumbers (up to 18 species)					Uncertain biomass and fishing mortality status for at least one species taken in 2017.
Trochus (*Trochus niloticus*)					Minimal catch in 2017. Uncertain biomass status.
Economic status	Estimates of NER are not available. NER are uncertain in the 2017 fishing season. The catch of valuable species such a prickly redfish decreased significantly; however, there was a significant increase in the catch of other sea cucumber species.				

Notes: **NER** Net economic returns. **TAC** Total allowable catch.

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

14. 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

AFMA Compliance Program

15. 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).
16. Since this time, a number of patrols have taken place in key Beche-de-mer Fishery areas and inspections have been undertaken on processing premises and fishing grounds.
17. They key areas of concern for AFMA compliance in the Beche-de-mer 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)
    - Accurate species identification and reporting. There have been a number of reports of prohibited Beche-de-mer species recorded on CDRs.
18. 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.

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

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
GOVERNMENT UPDATES TSRA Update	Agenda Item 2.2.2 FOR NOTING

RECOMMENDATIONS

1. That the Hand Collectable Working Group **NOTE** the verbal update provided by the TSRA member.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
GOVERNMENT UPDATES QDAF Update	Agenda Item 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.

Responsible officer: Danielle Stewart

Position: Fisheries Manager

Date: 3 October 2018

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

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

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

All actions on track

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

CS8428 07/18

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
WORKING GROUP UPDATES **Native Title update**	**Agenda Item 2.3** **FOR NOTING**

RECOMMENDATION

1. That the Working Group **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.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 July 2018
WORKING GROUP UPDATES **PNG National Fisheries Authority update**	**Agenda Item 2.4** **For NOTING**

RECOMMENDATIONS

1. That the Working Group **NOTE** the update provided by the PNG National Fisheries Authority if an officer is in attendance.

KEY ISSUES

2. AFMA has a standing invite for officials from the PNG National Fisheries Authority (NFA) to attend all PZJA consultative forums. If in attendance, NFA officials will provide an update on the PNG hand collectable fisheries at the meeting. Of particular interest is the outcomes of the recent season opening and the review of management arrangements for the Beche-de-mer Fishery.

BACKGROUND

3. PNG BDM Fishery was opened again this year on 1 April 2018. This is the second year the PNG Fishery has been opened since the PNG's long standing moratorium was lifted on 1 April 2017.

4. Following this opening, five provincial closures were published in The National on 7 September 2018 (effective as of 31 August 2018) as the calculated TACs had been reached (**Attachment 2.4a**).

5. All selling and buying of beche-de-mer was ceased on Friday 7 September 2018.

6. The closures were:
   a. Autonomous Region of Bougainville
   b. Western Province
   c. West Bew Britain
   d. Oro
   e. East New Britain

7. PNG media recently reported the fishery generated approximately K50 million (~$21.6 million AUD) (The National, 8 October 2018) from exports in 2017.

8. A Fisheries Committee Bilateral Meeting between Australia and Papua New Guinea was held on 5 February 2018. The meeting noted that PNG NFA was currently reviewing management arrangements for the Fishery in consultation with stakeholders and monitoring stocks with monitoring staff regularly visiting fishing communities.

9. The outcomes of the review were to inform an additional season opening in 2018. If in attendance at HWCG14, the PNG NFA official in attendance is welcomed to provide an update on the review and any subsequent changes to management arrangements for the Fishery.

PUBLIC NOTICE

NATIONAL FISHERIES AUOTHORITY

PUBLIC NOTICE

National Beche-de.mer Fishery Management Plan 2018

BECHE-DE-MER FISHERY CLOSURE NOTICE

1. **AUTONOMOUS REGION OF BOUGAINVILLE**
2. **WESTERN PROVINCE**
3. **WEST NEW BRITAIN**
4. **ORO**
5. **EAST NEW BRITAIN**

This Notice is issued in accordance with the requirement under Clause 9 (f) of the National Beche-de-mer Fishery Management Plan 2018 (G368) to all fishers (men) and women), buyers and exporters and the general public engaged on the Beche-de-mer fishery in the **Autonomous Region of Bougainville, Western, West New Britain, Oro and East New Britain Provinces.**

The calculated Total Allowable Catch (TAC) for the provinces listed above has been reached. **NFA now declares that the harvesting of sea cucumber in these provinces will cease immediately as of today Friday 31st August 2018. Fishermen and fisherwomen who have in their possession any dried Beche-de-mer must sell their products to licensed Buyer by Friday 7th September 2018 (inclusive)**

ALL SELLING AND BUYING OF BECHE-DE-MER MUST ALL CEASE ON FRIDAY 07TH SEPTEMBER 2018.

Any Fishermen and fisherwomen, harvesting or collecting after the 31st August 2018 and selling after the official closing date on 07th September 2018 and any buyers and exporters buying after the official fishery closure date which is Friday 07th September 2018 will be deemed as **ILLEGAL** and perpetrators will be prosecuted and may lose their license as a consequence.

For further information, please contact Mr. Leban Gisawa, executive Manager – Fisheries Management Unit on phone: 309 0444 or lgisawa@fisheries.gov.pg

Authorised by:

Mr. John E Kasu
Managing Director

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT Draft Beche-de-mer Harvest Strategy	Agenda Item 3.1 For DISCUSSION & ADVICE

RECOMMENDATIONS

1. That the Working Group:
    a. **NOTE** the background information on the development of the Beche-de-mer (BDM) Harvest Strategy
    b. **NOTE** the discussion and outcomes of the Harvest Strategy Workshop to be held on Tuesday 23 October and earlier workshops (**Attachments 3.1a - d**)
    c. **NOTE** the process for finalising the harvest strategy;
    d. **DISCUSS** and **ADVISE** on the draft Beche-de-mer Harvest Strategy to be circulated to members before the meeting (**Attachment 3.1e**).

KEY ISSUES

2. The Hand Collectables Working Group together with broader stakeholders have provided advice on the development of a draft harvest strategy over its last three meetings (HCWG 11, HCWG12 and HCWG 13).
3. A draft harvest strategy will be circulated to members before the meeting. To assist the HCWG develop a final draft harvest strategy AFMA is convening an industry workshop on 23 October at Erub. Guided by advice from industry associations based in communities with active BDM fishers, an additional 12 fishers will join HCWG members at the workshop. A representative from Malu Lamar will also be participating. Outcomes of the workshop will be summarised overnight for the meeting.
4. The draft harvest strategy is intended to specify the different types of monitoring, the types of data collected for use as indicators, the way in which these data contribute to first order and supplementary decision rules for adjusting TACs and implementing pre-specified management actions.
5. In line with advice received to date the harvest strategy approach being developed is based on a tier system whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible.
6. The harvest strategy should map pathways for ongoing improvements and refinements such as through further data collection as well as a clear role to contribute community-level data and local knowledge.
7. A mix of management tools have been proposed including:
    a. Effort controls to limit fishers and limit times one can fish; (e.g. seasonal closures);
    b. Spatial management (limit where to fish (e.g. spatial rotation, closed areas);
    c. TACs: limit total amount caught, e.g. based on surveys; and
    d. PLUS minimum size limit complements all approaches by allowing animals a chance to breed before being caught.

8. Similarly a range of control rules have been discussed and developed for:
    a. Monitoring and adjusting catches annually, with agreement that a fishery will be closed if no data are provided;

b. Rules for managing mixed species/basket catches. To support future growth of the fishery, careful monitoring is necessary and hence as many target species as possible will be monitored as individual species. By starting to collect data on all species now, this means it will be easier to support future development of selected species in response to growing market demands;

c. Rules for how to re-open a fishery that has been closed. For example, there are very strict rules being developed to support re-opening the black teatfish fishery. This includes the need to very accurately report catches on a daily basis as if total catch exceeds the Total Allowable Catch (TAC) or data are not accurately recorded this could put at risk future fishery openings. For overfished species such as sandfish, there are guidelines for supporting recovery as well as how surveys (either full scale scientific surveys or smaller experimental surveys with fisher participation) can be used to inform whether or not the fishery could be re-opened;

d. Rules for how to increase catches (TACs) if good quality fishery data are available and indicate an increase is possible; and

e. Rules for how to further increase catches (TACs) if high quality survey data become available.

9. At the last HCWG harvest strategy workshop, participants discussed the following operational objectives for the draft harvest strategy:

   a. to provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;
   b. to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;
   c. to acknowledge area-specific issues;
   d. where possible, to consider an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and
   e. to develop long-term recovery strategies for species, where appropriate.

10. Participants further discussed an overarching objective to acknowledge, empower and operationalise Native Title Rights and interests including customary and traditional laws of individual nation groups: Malo ra GELAR (Malo's Law) of Kemer Kemer Meriam Nation, Saabi law of Maluilgal Nation, Saabi law of Gudamalulgal Nation, Kulkalgal Nation and Saabi law of Kaurareg Nation. This also includes acknowledging and incorporating local knowledge and the ability to locally manage resources.

11. Members should note that native title rights are created and regulated under the Native Title Act 1993 and not the Torres Strait Fisheries Act 1984. To ensure clarity for stakeholders on the scope of the harvest strategy members should review how this overarching objective is described. One option would be to include a statement that the harvest strategy has been developed and designed to enable customary and traditional laws of individual nation groups to be acknowledged and operationalised and in acknowledgement and support for incorporating local knowledge and the ability to locally manage resources.

Next Steps

12. Having regard to HCWG advice, the final draft BDM Harvest Strategy is due for completion in May 2019. Once the draft is finalised, it will be tabled with the PZJA for agreement to release the draft for public comment. Subject to public consultation outcomes and further

advice from the HCWG the PZJA will then consider finalise a harvest strategy for the Fishery.

13. The Harvest Strategy Milestone Reports and Progress Reports for the June 2017, October 2017 and July 2018 workshops are included in **Attachments 3.1a - d**.

BACKGROUND

14. 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."
15. 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. A harvest strategy provides a transparent protocol, for monitoring, information gathering, assessment and management into the foreseeable future.
16. At its meeting on 30 April 2015 (HCWG 9), the Hand Collectables Working Group recommended that a strategic management approach be developed to guide any future expansion in the fishery based on, among other things, a harvest strategy.
17. To develop a BDM harvest strategy AFMA funded CSIRO to deliver the project: *Harvest strategies for the Torres Strait bech-de-mer (sea cucumber) fishery* (AFMA project no. 2016/0823).
18. The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been discussed at the HCWG over the past several years. In consultation with the HCWG, AFMA, TSRA, Malu Lamar and other stakeholders, CSIRO have been drafting a scientifically-sound harvest strategy.
19. The future growth and successful management of the BDM fishery will be greatly strengthened by a combination of reliable data collection and an agreed harvest strategy to guide the sustainable and optimal use of bêche-de-mer in line with agreed objectives for the fishery.
20. The harvest strategy depends critically on the new Fish Receiver System and also fisher logbook data. It specifies the data that are needed to effectively manage the fishery and how these data will be used to adjust catches and manage the fishery to meet the biological, social and economic objectives.

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Harvest Strategies for the Torres Strait Beche-de-mer (sea cucumber) fishery – background for stakeholder workshop

AFMA project no. 2016/0823

Éva Plagányi, Nicole Murphy, Natalie Dowling

Milestone Report 2, June 2017

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1 Introduction

The need to formalise a harvest strategy for the Torres Strait beche-de-mer (sea cucumber) fishery has been the subject of some discussion at management forums (e.g. HCWG) and community meetings for some time. 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.

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).

This report summarises planning and background information for a dedicated workshop to be held as part of a Hand Collectable Working Group meeting, 27-29 June 2017, Thursday Island, Torres Strait, to collaboratively progress the development of a harvest strategy. The workshop will include relevant stakeholders in addition to the HCWG members. The CSIRO project team – Éva Plagányi, Nicole Murphy and Natalie Dowling – supported by independent scientific expert Tim Skewes, will facilitate discussions with participants in plenary and in small group discussions, in line with the project objectives as specified below.

1.1 Project Objectives

The project will develop and ratify a single harvest strategy for the Torres Strait beche-de-mer (TS BDM) 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 sea cucumbers in Torres Strait, and establishing first order harvest strategy approaches such as global fishery TACs, size limits and temporal closures. It will include clear 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.

2 Workshop planning and background information

2.1 Overview of fishery and harvest strategies

The workshop will commence with a summary of background information pertaining to the fishery, as well as harvest strategies in general and lessons learnt from previous work. This includes consideration of previous recommendations as summarised in the Appendix 1.

Analysis of fishery data

TS BDM data were kindly provided by AFMA and have been analysed to assist in development of an appropriate harvest strategy for the fishery. The database includes records for the years 2004, 2005, 2007, 2010-2016 and the following species/groups: bêche-de-mer, black teatfish, blackfish, curryfish, prickly redfish, white teatfish as well as elephant's trunkfish, and sand fish (pre-2013).

Figure 1 summarises the zonal names used in the previous MSE analysis, which is similar to the complete list of names recorded in the database.

Badu
Barrier
Cumberland
Darnley
Don Cay
Great North East Channel
Seven Reefs
Turu Cay
Unknown
Warrior

A short summary will then be provided of inputs and recommendations arising from discussions at the first workshop, as detailed in milestone report 1 (Plaganyi et al. 2017).

Box 1 summarises background questions circulated to stakeholders to consider in preparing for the second workshop.

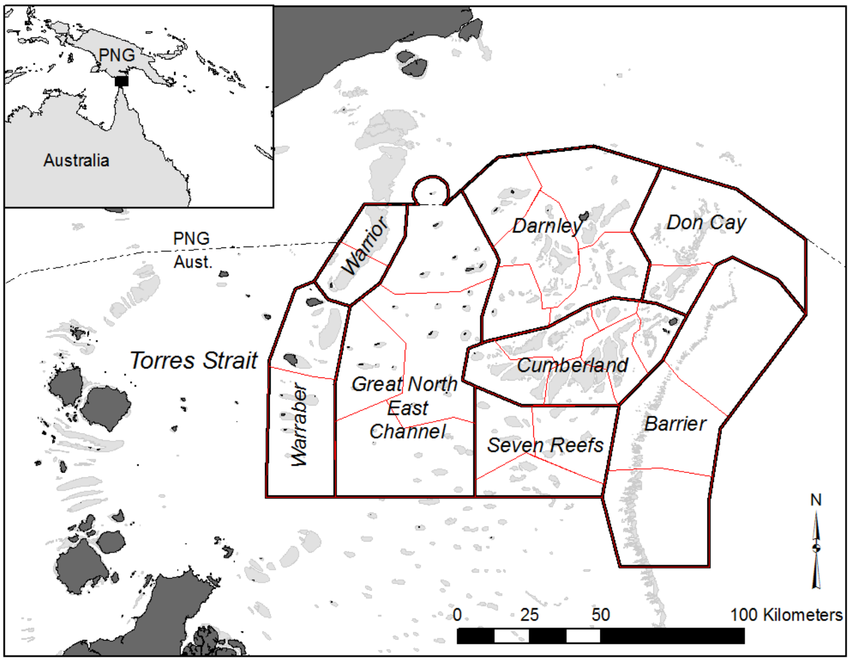

Fig. 1 Spatial zones for the Torres Strait sea cucumber MSE analysis of Plagányi et al. (2013). There are 27 spatial subzones that are explicitly differentiated in the operating model, with these in turn grouped into 8 zones as shown.

Table 1. Summary of areas that species occur, with shaded blocks indicating presence in an area based on surveys, as described in (Skewes et al. 2010), and area names as shown in Fig. 1.

	Barrier	Cumberland	Darnley	Don Cay	Great North East Channel	Seven Reefs	Warraber	Warrior
Holothuria scabra								
Holothuria whitmaei								
Actinopyga mauritiana								
Holothuria fuscogilva								
Thelenota ananus								
Actinopyga echinites								
Actinopyga miliaris								
Bohadschia argus								

BOX 1 – Background questions for stakeholders

1. Our primary concern is to get reliable catch information for as many species as possible.
2. We will also be asking attendees to consider some recommendations for changes to some size limits (eg to bring them in line with East Coast regulations and better account for size at maturity). Are there data available on the size of the catches of the different species? If not, could this information be readily obtained?
3. We would like an honest appraisal of the ability of fishers to identify the different species, and in particular distinguish redfish and blackfish
4. We will be asking attendees to help develop simple harvest strategies so are interested in their views around what they think beforehand works well eg we heard at the last meeting that there was some support for community-run rotational strategies.
5. We are interested in views regarding whether some species that are currently part of a lumped TAC are becoming important enough that they should have their own TAC
6. We will be seeking information as to how reliably and timeously catch of a particular species can be monitored so that there is feedback to know that the overall limit has been reached, or eg if there is a need to move on to a new location as per a move-on rule for example
7. We will need to know whether additional data will be collected and available (and how soon after catching) on other variables such as effort (eg diving time) and location – we will need an idea of which areas (& depths) are mostly fished
8. We will be asking questions regarding the cost of moving to different fishing locations (eg if there was a spatial rotation system, what would the extra cost be compared with fishing local area and how far would they be prepared to move to spread their fishing effort)
9. Is there interest in communities undertaking transects? (note a training workshop was help in the past and practical examples run with transects etc to mimic data collection and understand the reasons for it; 2 islands participated in survey in the past but this wasn't continued). Future transects would need to be run independently by communities, although further training could be provided by CSIRO, as well as assistance with analysing survey data.
10. Do community members have a preference (and why?) for the fishery of some or all species to be closed for some seasons, or in some areas?
11. Are there any interactions with any other fisheries of which we should be aware
12. Any idea how big the illegal take is, and which species and areas mostly targeted?
13. BROADER QUESTION: What do you think are the main anthropogenic (eg polluted river runoff) and natural (eg sand incursions) environmental factors influencing the sea cucumbers and how?

2.2 Specify Management Objectives:

The Protected Zone Joint Authority (PZJA) is responsible for management of commercial and traditional fishing in the Australian area of the Torres Strait. The PZJA objectives adopted for the Torres Strait Bêche-de-mer Fishery are:

- to provide for the sustainable use of all bêche-de-mer stocks in Torres Strait;
- to develop bêche-de-mer stocks for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty); and
- to develop an appropriate long term management strategy for sandfish.

Other considerations discussed at the workshop included: rebuilding black teatfish, optimising economically / employment / equity (e.g. spatial) / improve processing and supply chain.

<u>Workshop Action 1:</u> obtain consensus on key management objectives for the fishery as well as more specific objectives for individual species

2.3 Management controls endorsed by previous work

Recent research on Australia's sea cucumber fisheries recommended the following for data-poor species in regions where more sophisticated management controls are difficult to implement (Plagányi et al. 2015): (1) A minimum legal size (MLS) limit enhances benefits (and where data are available to inform as to the choice of this, selected to protect at least the first age-at-maturity); and (2) A cap on total catch or effort per locality (if feasible to monitor); and (3) Utilise a rotational cycle (with longer cycle time for longer-lived species). Considerations regarding incorporating each of these in a harvest strategy are summarised below.

2.3.1 Review of minimum legal sizes for individual species

Minimum size limits have been in place for several TS BDM species for some time, and are considered an important component of any harvest strategy for BDM because they allow the animals time to breed and grow before being captured. Ideally the MLS should protect at least the first age-at-maturity and consider yield-per-recruit theory which suggests that it is more optimal to only start catching larger animals due to changes in average fecundity and body size. The HCWG agreed that it would be useful to review the current minimum sizes specified for selected TS BDM species taking into account: (1) whether the minimum size is larger than the size at maturity as assessed from the latest available scientific information; (2) comparison with MLS for the same species of the East Coast; (3) whether a species-specific limit should be applied to any of the species currently lumped in the general category; and (4) whether the generic limit should be changed.

Table 1 summarises current information on the minimum size limit. Appendix Table 2 provides a detailed comparison between the current minimum size limits and those for the East Coast and Coral Sea fisheries, together with information on the size at maturity. This information will be used at the workshop to assist in deciding whether or not it is advisable to revise any of the minimum size limits taking into account comparisons with size at maturity (so the animals have a chance to grow and breed before being caught), possibly standardising with limits in other areas, model simulation recommendations as well as any other relevant factors such as market preferences.

Workshop Action 2: Update and obtain consensus on revised minimum size limits for individual species and generic limit for remaining species

Workshop Action 3: Discuss feasibility of reliably measuring size of animals, and whether additional resources would facilitate this process (eg ruler or size gauge)

Table 1. Summary of key bêche de mer species in Torres Strait, together with their minimum size limit and Total Allowable Catch (TAC) in tonnes (from (Murphy et al. 2014))

Common name	Scientific name	Commercial value	Minimum size limit (mm)	TAC (t)
Sandfish	*Holothuria scabra*	High	180	Closed
Surf redfish	*Actintopyga mauritiana*	High	220	Closed
Black teatfish	*Holothuria whitmaei*	High	250	Closed#
White teatfish	*Holothuria fuscogilva*	High	320	15$
Prickly redfish	*Thelenota ananas*	Medium	300	20
Hairy blackfish	*Actinopyga miliaris*	Medium	220	Part of 80t limit
Curryfish common	*Stichopus herrmanni*	Medium	270	Part of 80t limit
Elephant trunkfish	*Holothuria fuscopunctata*	Low	240	Part of 80t limit
Lollyfish	*Holothuria atra*	Low	150	Part of 80t limit
Deepwater redfish	*Actintopyga echinites*	Medium	120	Part of 80t limit
Curryfish vastus	*Stichopus vastus*	Medium	270	Part of 80t limit
Burrowing blackfish	*Actinopyga spinea*	Medium	220	Part of 80t limit
Deepwater blackfish	*Actinopyga palauensis*	Medium	220	Part of 80t limit
Golden sandfish	*Holothuria lessoni*	High	180	Part of 80t limit
Brown sandfish	*Bohadschia vitiensis*	Medium	nil	Part of 80t limit
Leopardfish	*Bohadschia argus*	Medium	nil	Part of 80t limit
Greenfish	*Stichopus chloronotus*	Medium	nil	Part of 80t limit
Stonefish	*Actinopyga lecanora*	Medium	nil	Part of 80t limit

*Size limits off PZ JA website – http://pzja.gov.au/the-fisheries/torres-strait-beche-de-mer-fishery/

#WG agreed risks in fishery and until managed wouldn't recommend fishery reopened.

$ WG discussed considerations for trial opening and proposed use of hookah

2.3.2 Total Catch Limits and triggers

The current Total Allowable Catches (TAC) for the different species are summarised in Table 1. This session will review and discuss the potential use of these TACs, use of triggers, feasibility of collecting accurate and timely data, as well as which species the use of a lumped TAC is appropriate for.

The three species that fishing has been closed for in recent years will be discussed separately.

Workshop Action 4: Review conversion ratios for sea cucumbers

The current database includes a number of different categories of product form and it is important to correctly convert these to a consistent unit of whole live weight so that this can be compared with the TAC. Current categories recorded include whole, gutted, salted, gilled and gutted and bait.

Workshop Action 5: Review and update species names for sea cucumbers

The database includes some old and incorrect scientific names, and future records should be updated with the latest available information, as summarised in Murphy et al. (2014).

In particular, black teatfish is *Holothuria whitmaei,* and no longer *H. nobilis*.

Curryfish species need to be assigned common names agreed by all stakeholders in order to correctly distinguish the different species given growing interest in curryfish as a harvested species – for example common curryfish *Stichopus herrmanni* and curryfish vastus *Stichopus vastus.* Note the database currently lists curryfish as *Stichopus horrens*

Workshop Action 6: Discussion of species identification challenges for sea cucumbers

- Redfish – correcting misidentification; Surf redfish *A. mauritiana* review
- Deepwater redfish *A. echinitis* – increase size limit?
- Blackfish – identification challenges

Workshop Action 7: Additional species-specific limits for individual or groups of sea cucumbers

Consider whether an individual species limit should be assigned to the hairy blackfish *Actinopyga miliaris*.

Consider whether a separate species limit and trigger should be assigned to the two curryfish species - common curryfish *Stichopus herrmanni* and curryfish vastus *Stichopus vastus* given growing interest in these species. Consider whether a trigger could be used if the proportion of vastus in the catch starts exceeding some pre-specified limit.

2.3.3 Closed species and rules if re-opened

Workshop Action 8: Review and discuss sandfish

Workshop Action 9: Review and discuss black teatfish

Workshop Action 10: Review and discuss white teatfish

2.3.4 Spatial rotation strategies and move-on provisions

Discuss potential use of spatial rotation strategies and move-on provisions, including consideration of the following: advantages; species and areas that could potentially be applied to; scale of implementation; how to enforce – community co-operation

1. We will be asking questions regarding the cost of moving to different fishing locations (eg if there was a spatial rotation system, what would the extra cost be compared with fishing local area and how far would they be prepared to move to spread their fishing effort)
2. Do community members have a preference (and why?) for the fishery of some or all species to be closed for some seasons, or in some areas?

Workshop Action 11: Review and discuss potential use of spatial rotation strategies and move-on provisions

2.4 Identifying additional indicators that could be used to provide feedback on stock abundance and utilisation

Given limited data for many of the species, this session will explore the potential use of alternative indicators, such as changes in catch composition, triggers pertaining to spatial changes (eg. % of area fished), CPUE for species, species –specific catch trigger values for high risk/vulnerable and key species, total catch triggers.

Workshop Action 12: Review potential use of additional indicators

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

This session will review not only current monitoring data that is collected for some species, but building on discussions above will explore whether individual catch data could be recorded for additional species, whether additional data could be collected such as fishing effort (eg hours fished), species composition, size/age monitoring.

We will discuss whether there is interest in communities undertaking transects? (note a training workshop was help in the past and practical examples run with transects etc to mimic data collection and understand the reasons for it; 2 islands participated in survey in the past but this wasn't continued). Future transects would need to be run independently by communities, although further training could be provided by CSIRO, as well as assistance with analysing survey data.

This discussion will also include reference to potential development of a tiered harvest strategy that takes into account the reduction in risk that occurs as more data and information are collected on a harvested species, and therefore applies different rules based on survey effort (and conversely catch penalties if less data are available).

Workshop Action 13: Finalise agreement on different monitoring information that will be collected

Workshop Action 14: Review tiered harvest strategy potential framework

2.6 Harvest Strategy Draft

The steps to be followed in developing a data-poor harvest strategy are as summarised in Dowling et al. (2015):

- 1. Compile and review information
- 2. Identify possible indicators e.g. changes in catch composition, triggers pertaining to spatial changes (eg. % of area fished), CPUE for species, species –specific catch trigger values for high risk/vulnerable and key species, total catch triggers
- 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

Based on the discussions in all the sub-sections above, this session will commence with an overview of some alternative options for harvest strategies per species and for the fishery as a whole. The workshop will then focus on developing a draft harvest strategy as a basis for obtaining further feedback form the HCWG and other stakeholders, as well as to guide any additional research and data collection needs before a final draft can be developed.

Suggested approaches will acknowledge the challenges and limitations to harvest strategy development and implementation in the Torres Strait, as there is need to be cognisant of their ability to be implemented in the context of the fishery's operational and socio-economic issues.

Workshop Action 15: Develop draft harvest strategies

3 List of Workshop sessions and action items

First session:

Introduction and background: Overview of Harvest Strategies and recap from first workshop

Workshop Action 1: Obtain consensus on key management objectives for the fishery as well as more specific objectives for individual species

Workshop Action 2: Update and obtain consensus on revised minimum size limits for individual species and generic limit for remaining species

Workshop Action 3: Discuss feasibility of reliably measuring size of animals, and whether additional resources would facilitate this process (eg ruler or size gauge)

Workshop Action 4: Review conversion ratios for sea cucumbers

Workshop Action 5: Review and update species names for sea cucumbers

Workshop Action 6: Discussion of species identification challenges for sea cucumbers

Second session:

Workshop Action 7: Additional species-specific limits for individual or groups of sea cucumbers

Workshop Action 8: Review and discuss sandfish

Workshop Action 9: Review and discuss black teatfish

Workshop Action 10: Review and discuss white teatfish

Third session:

Workshop Action 11: Review and discuss potential use of spatial rotation strategies and move-on provisions

Workshop Action 12: Review potential use of additional indicators

Workshop Action 13: Finalise agreement on different monitoring information that will be collected

Workshop Action 14: Review tiered harvest strategy potential framework

Fourth session:

Workshop Action 15: Develop draft harvest strategies

4 Acknowledgements

We are grateful to Tim Skewes for sharing his extensive knowledge and insights on this fishery. We thank AFMA, TSRA and all stakeholders for their inputs and participation. Funding for this project has been provided jointly by AFMA and CSIRO Oceans and Atmosphere. Catch data provided by AFMA.

5 Glossary of technical terms

Assessment:	A mathematical population model coupled to a statistical estimation process that integrates data from a variety of sources to provide estimates of past and present abundance, fishing mortality and productivity of a resource
BDM:	bêche de mer or sea cucumber
CPUE:	Catch Per Unit Effort
Harvest Strategy HS:	Harvest Strategy: a framework that specifies the pre-determined management actions in a fishery necessary to achieve the agreed ecological, economic and/or social management objectives
Limit reference points:	highlight conditions to be avoided
Management objectives:	Broad objectives pertaining to the management of a resource as set by decision makers and stakeholders
MSE:	Management Strategy Evaluation – the process of testing alternative decision rules by simulation, in particular for robust performance in the presence of uncertainty
MSY:	Maximum Sustainable Yield – the maximum yield/catch that can be taken from a resource on an ongoing sustainable basis
Reference Point:	particular levels that reflect stock status (eg spawning Biomass *Bsp* or fishing mortality rate *F)*
TAC:	Total Allowable Catch to be taken from a resource within a specified period
Target reference points:	specify where management should aim, which stakeholders usually decide

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Appendix 1 – Summary of previous recommendations

As part of a previous project on evaluating management strategies for data-poor bêche de mer species in Torres Strait by Plagányi, Skewes, Dowling and Haddon (2011), the following recommendations were made:

Overview:

"Large areas of uncertainty remain in the assessment of the status and trends of the Torres Strait bêche-de-mer fishery. The largest uncertainty is the nature and dynamics of recruitment, and although it is difficult to improve our understanding of this process, the historical survey data was useful in narrowing the hypotheses that were consistent with the data. …

The current harvest strategy for the Torres Strait is very simple - limited TACs (Total Allowable Catch) and size limits, however, a move to a more responsive and potentially robust co-management strategy, where communities will have more say in management, is currently under way. …

There is currently no explicit spatial management of the bêche-de-mer fisheries in the Torres Strait, and hence the overall species biomass is the statistic of interest used for management. However, our simulations suggested that in several cases this was problematic because although the overall average biomass stayed at an acceptable level, there was an unacceptable high level of local depletion in some zones with heavy fishing pressure. Whether this reflected real fishing behaviour would be worthy of attention, because it seems possible that under a limited TAC fishers would move from relatively depleted areas to areas where catches could be obtained more easily.

The TAC for black teatfish, surf redfish and sandfish is currently zero. MSE analyses suggest that sandfish may not recover in the short term even in the absence of fishing, supporting the current zero TAC for this species. Moreover, results suggested that a larger size limit might be more appropriate for this species. Simulations suggested that black teatfish and surf redfish could sustain small experimental quotas without unduly increasing risk. However, there is a relatively greater risk of localised depletion occurring at Warraber and Warrior.

The MSE simulations suggested that the current TACs for white teatfish and prickly redfish perform well with regard to controlling the risk of overfishing.

The remaining three species (deepwater redfish, hairy blackfish and leopardfish) are regulated as part of a joint 80t TAC. Across all model simulations there was a relatively greater risk to deepwater redfish than to the other species, and model results suggested this may reflect a need to increase the size limit for this species. The current TACs were conservative enough if fishing continues in roughly the same way as in the past, but if spatial and species-selection fishing patterns change (for example if they are driven predominantly by profit considerations), then there is a greater risk posed by a joint rather than species-specific TAC, for deepwater redfish and hairy blackfish in particular. "

Minimum legal size

As a simple test of the efficacy of the current size limit restrictions for the various bêche-de-mer species, a simulation was run with the size limit assumed reduced. This was implemented by changing the fishing selectivity to allow full selectivity of one younger age class for each species. The illustrative simulations used the current catches for all species, even weighting of utility function components, and set small catches for the first three species as previously. In general, decreasing the size limits slightly increased the risk of depletion of species, with the most dramatic effect evident for *A. echinites* (Fig. 1). This suggested that *A. echinites* may be particularly sensitive to the choice of size limit, and a review of model inputs showed that it has a substantially smaller MLS limit than all the other species in the model except *H. scabra* which also has a fairly small MLS limit. It thus appears that the reason *A. echinities* and *H. scabra* appear more high risk than other species across a range of model scenarios may be because the MLS is not set sufficiently high for these species. In the case of *H. scabra*, this is attributed to our growth curve analysis which suggested that it is possibly the slowest growing species and hence should have a relatively higher size limit. For *A. echinities,* increasing the MLS in the model increased the lower 90% depletion relative to no-fishing level from 0.47 up to 0.59. The MLS limit of these two species may thus need to be reviewed in the current harvest strategy.

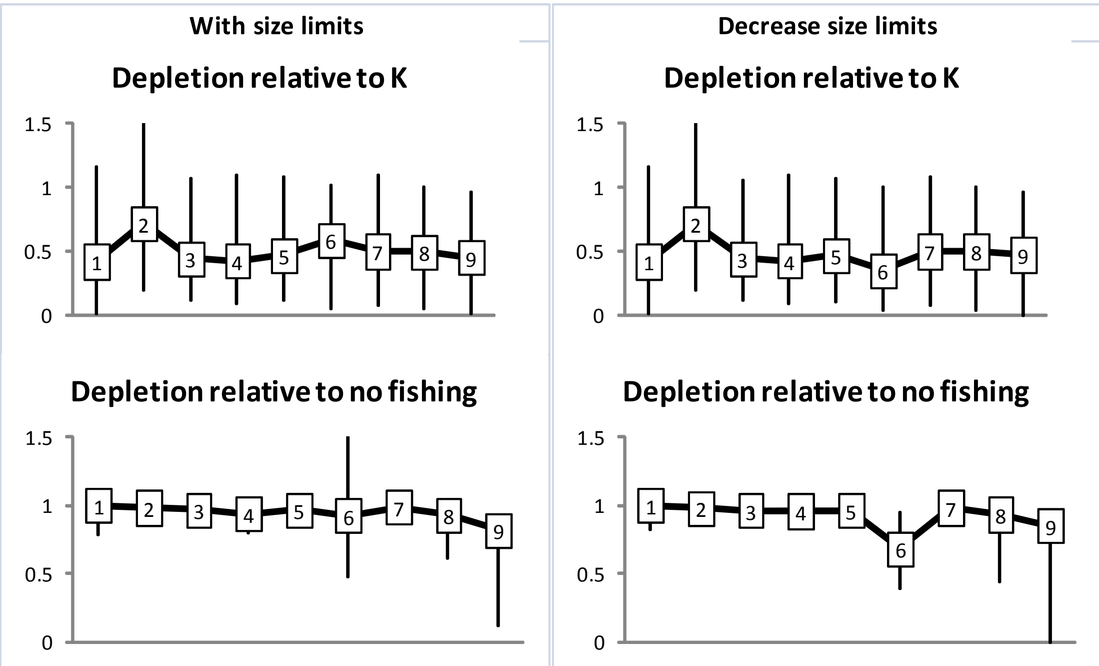


Figure 1.Summary performance statistics compared when implementing the current size limits compared to decreasing these for each species (from Plagányi et al. (2011).

Spatial rotation harvest strategies

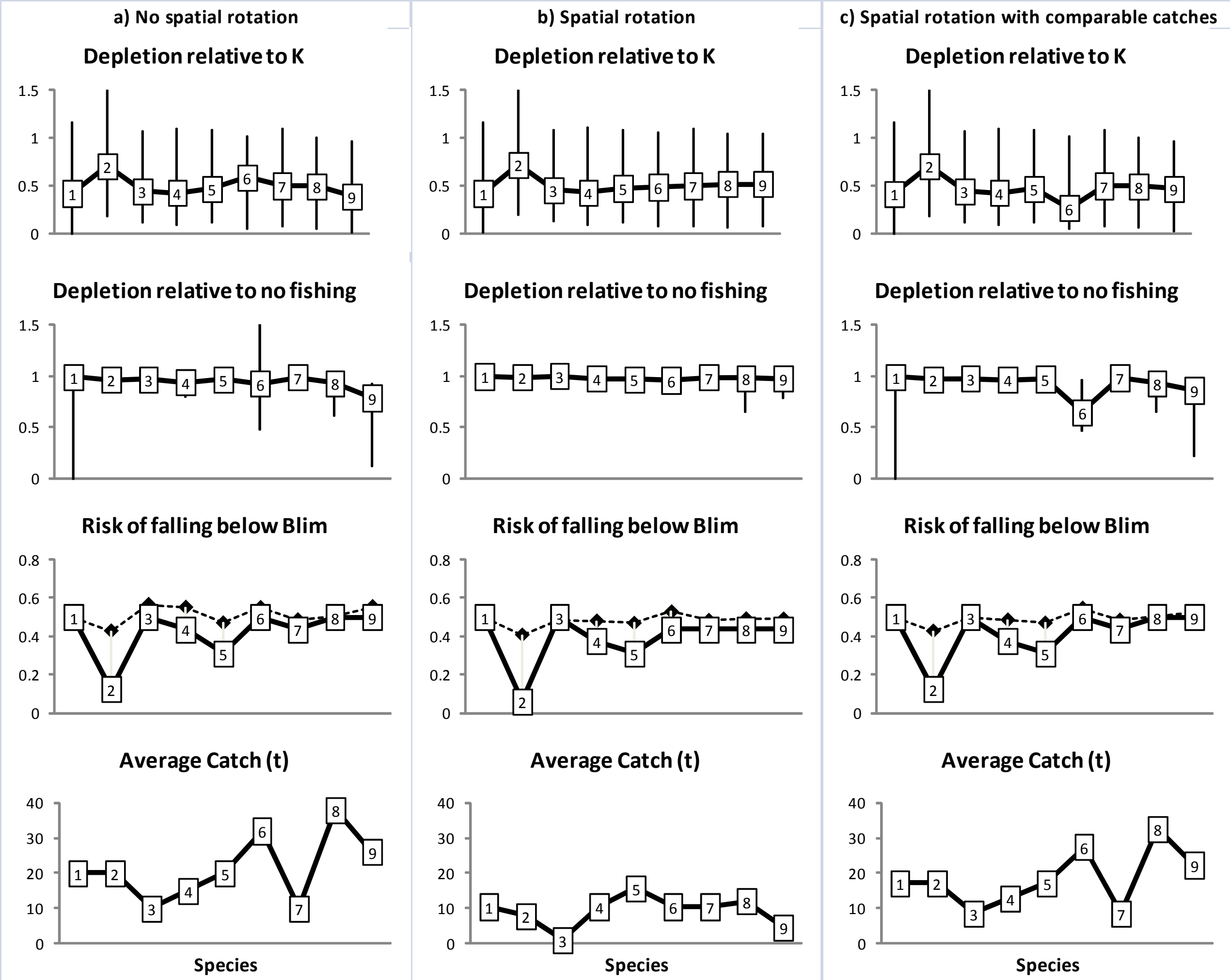
Spatial harvest rotation strategies are not currently implemented for bêche-de-mer in the Torres Strait, and hence detailed examination of such strategies is beyond the scope of this report. However, as a preliminary test of the performance of a spatial rotation strategy, we ran simulations assuming reefs were closed in sequence every three years. This dramatically reduces the risk to individual species and maintains resource status relative to the no-fishing comparable trials (**Error! Reference source not found.**). Moreover, it is clear from Fig. 2 (see for example *H. whitmaei* at Warrior and *H. fuscogilva* at Barrier) that a spatial rotation strategy is effective in reducing localised depletion.

Under a spatial rotation strategy, average catches are necessarily less when averaged over the entire projection period. As a fairer comparison, a simulation is run with catches increased in zones open to fishing to compensate for the closures, such that overall catches are approximately the same as the no-spatial-rotation scenario. Even given the high concentrated catches in some years, this strategy performs better (Fig. 2). Interestingly, the median depletion level decreases for *A. echinites ,* presumably because of the higher localised catches, even if they are sporadic. However there is no increased risk to this species as assessed from the lower confidence interval.

In a separate study, Plagányi et al. (2015) estimated the benefits of a Rotational Zone Strategy (RZS) applied to the sea cucumber fishery of Australia's Great Barrier Reef , which has a 3-year rotation cycle through 154 zones. Under pressure from management over historical over-exploitation of high value species, and a perceived high risk of overexploitation of other species, the fishers of the GBR sea cucumber fishery designed and implemented a Rotational Zone Strategy in 2004, where the entire GBR fishery area was split into 154 zones with each zone fished only once every three years.The modelling approach they applied to this data-poor multispecies fishery included testing across a broad range of uncertainty by using alternative models (a Reference Set), stochastic replicates, and alternative life histories (nine species). Their modelling approach showed that a RZS can contribute to more sustainable management of sedentary small-scale fisheries generally. They concluded the RZS of the ECBDMF achieves its objectives of reducing localised depletion and reducing the risk to overall fishery sustainability (Fig. 3). In addition, we evaluate the performance of rotation cycles of different length and demonstrate an improvement in biological and economic performance with increasing time between harvests up to 6 years (Fig. 4).

They suggested the following guidelines for rotational harvest strategies applied to data-poor species in regions where more sophisticated management controls are difficult to implement: (1) Utilise a rotational cycle (with longer cycle time for longer-lived species); (2) A minimum legal size limit enhances benefits (and where data are available to inform as to the choice of this, selected to protect at least the first age-at-maturity); and (3) A cap on total catch or effort per locality (if feasible to monitor). Provided there is some overall and reasonable cap on catch or effort, their analysis suggests that a RZS provides a less data hungry method to reduce risk to the resource and improve (but not necessarily optimize) economic performance. Moreover, they simulated actual legal size limits as well as reduced size limits and found that the best outcomes are obtained when a RZS is used in combination with a size limit that protects at least the first age-at-maturity, because the RZS allows the biomass of larger more fecund animals to accumulate, thereby boosting overall yields as well as enhancing catch rates (in turn an indicator of the cost of fishing).

Mechanistically, the benefits of implementing a RZS arise because fishing alters population age compositions with associated changes in so-called yield-per-recruit due to changes in average fecundities and individual body size (Hilborn and Walters 1992).



Key	Species
1	*Holothuria scabra*
2	*Holothuria whitmaei*
3	*Actinopyga Mauritiana*
4	*Holothuria fuscogilva*
5	*Thelenota ananus*
6	*Actinopyga echinites*
7	*Actinopyga miliaris*
8	*Bohadschia argus*
9	*Trochus niloticus*

Fig 2. Comparison of performance statistics when assuming a) catches are applied every year , compared with b) a 3-yr spatial rotation harvest strategy and c) a spatial rotation harvest strategy with higher catches when reefs are assumed to be open to fishing, so that the overall catches are comparable. The simulations use the current catches, apart from illustrative catches assigned to the first three species, and even weights are used for the utility function.

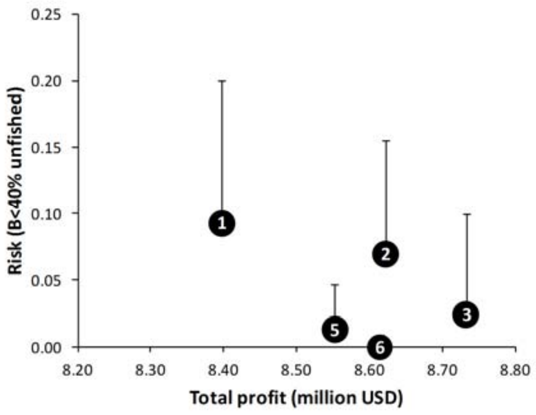


Fig. Trade-off curve showing median risk performance statistic (defined as probability of biomass being reduced below 40% of the comparable no-fishing scenario) (+ 1 standard deviation encompassing variation across the nine species) as a function of the total profit (million USD) for Rotational Zone Strategies (RZS) with different cycle times (year) as indicated on the symbols.

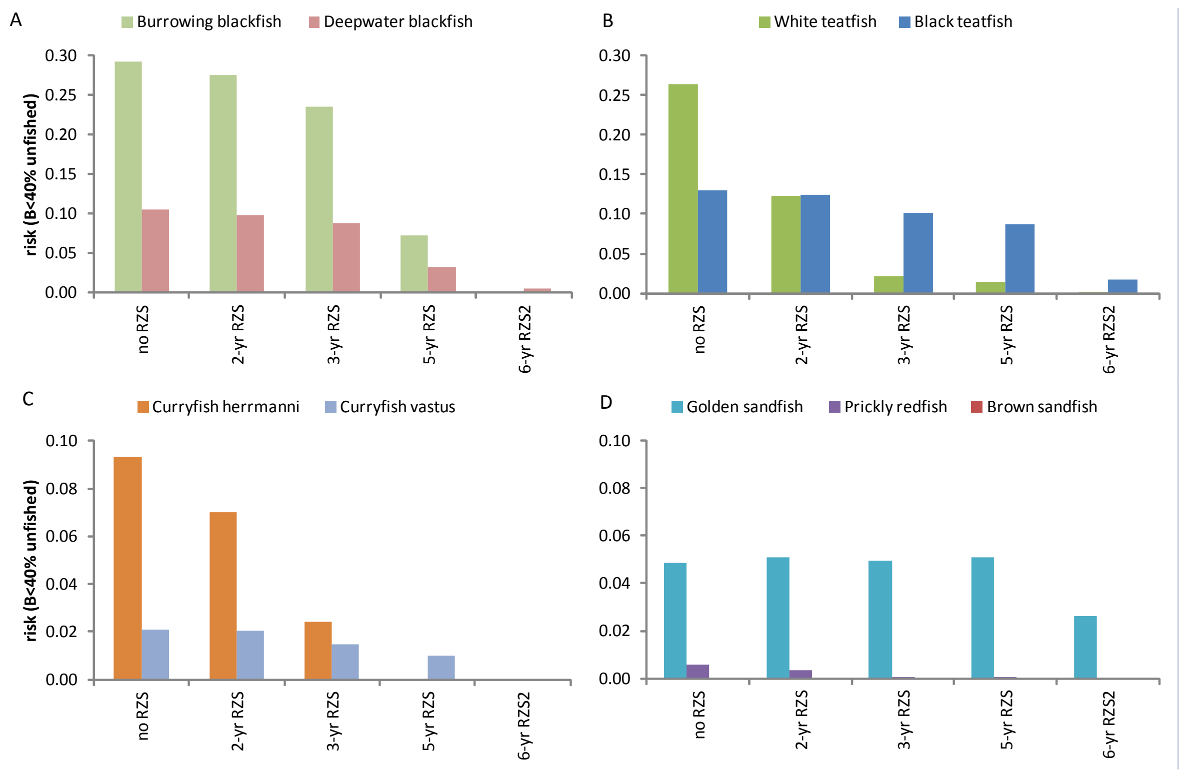


Fig. 1 Comparison of risk performance statistic (defined as probability of biomass being reduced below 40% of the comparable no-fishing scenario) for the nine major species targeted in the ECBDMF, in the absence of a Rotational Zone Strategy (RZS) compared with different cycle times of RZS implementations as indicated, and for the same catch (from Plagányi et al. 2015).

Appendix 2 – Summary of size limit information

Common name	Species	Maximum length cm (guide)	Size at maturity (Female) cm	Size at maturity (Male) cm	Size at maturity (unknown) cm	Size limit TS	Proposed size limit TS*	Size limit EC (DAFF report)	Size limit CS (AFMA report)	Age at maturity TS yrs (model)	Weight or age (unknown sex)	TAC TS t
Sandfish	*Holothuria scabra*	32	16.9[11], 21[6], 19.9[6]	17.7[11], 21.3[6], 13.6[6]	16.8, 15[10], 21[7], 25[7], 16[2,7], 14[6], 20-23[6]	18	25 (2,3)	20	16	2 (16.5)	184gr[6] (total wt), 22.6gr[3]gr (total wt), 18 mths[6]	No take
Surf Redfish	*Actintopyga mauritiana*	38	-	-	23[7], 22[2], 22[10], 23	22	25 (1,2)	25	15	3 (13.8)	125-350gr[7], 153gr[9]	Part of 80t limit
Black Teatfish	*Holothuria whitmaei*	30	-	-	26[2], 26[10], 22.7[9], 23[12]	25	30 (1,2)	30	25	4 (24)	580gr[9]	No take
White Teatfish	*Holothuria fuscogilva*	55	-	-	32.4[9,10], 32[2]	32	35 (1) 40?	40	32	4 (30.4)	1167[3]gr (total wt), 1100gr[7](total wt) 900gr[9], 1500gr[12]	15
Prickly Redfish	*Thelenota ananas*	70	-	-	34.5[10], 30[9], 30[2]	30	40 (2)	50	30	4 (30.4)	1150gr[9], 1200gr[7] (total wt)	20
Hairy Blackfish	*Actinopyga miliaris*	35	-	-	12[10]	22	-	20	15	3 (19.2)	-	Part of 80t limit
Curryfish (common)	*Stichopus herrmanni*	55	-	-	27[2], 27[10], 31[7], 31[12]	27	30 (1,2)	35	15	-	-	Part of 80t limit

Common name	Species	Maximum length cm(guide)	Size at maturity (Female) cm	Size at maturity (Male) cm	Size at maturity (unknown) cm	Size limit TS	Proposed size limit TS*	Size limit EC (DAFF)	Size limit CS (AFMA)	Age at maturity TS yrs (model)	Weight or age (unknown sex)	TAC TS t
Elephants Trunkfish	*Holothuria fuscopunctata*	*66*	-	-	*35[2], 35[10]*	24	40 (1,2)	*40*	*15*	-	*1200gr[7] (total wt)*	*Part of 80t limit*
Lollyfish	*Holothuria atra*	*65*	*14.8[11], 15.5[4]*	*16.5[4], 14.8[11]*	*12[10], 16.5[2], 19[1], 15.2[4],16[4]*	*15*	20 (1,2)	*20*	*15*	-	*80gr[7](drained wt), 18gr[1] (gutted wt)*	*Part of 80t limit*
Deepwater Redfish	*Actinopyga echinites*	*35*	-	*9.3[11]*	*12[2], 12[7], 12[10]*	*12*	20 (2,3)	*20*	*15*	*3 (19.5)*	*65gr[3,5] (total wt), 46-55gr[3] (gutted wt), 45-90gr[7], 45gr[12]*	*Part of 80t limit*
Curryfish (vastus)	*Stichopus vastus*	*35*	-	-	-	*nil*	*5t trigger*	*15*	*15*	-	-	*Part of 80t limit*
Burrowing blackfish	*Actinopyga spinea*	*40*	-	-	-	*22*	-	*20*	*15*	-	-	*Part of 80t limit*
Deepwater blackfish	*Actinopyga palauensis*	*35*	-	-	-	*22*	-	*20*	*15*	-	-	*Part of 80t limit*
Golden sandfish	*Holothuria lessoni*	*46*	-	-	*22[2], 22[6]*	*18*	25 (2)	*15*	*15*	-	*490gr[6] (total wt), 480gr[7]*	*Part of 80t limit*
Brown sandfish	*Bohadschia vitiensis*	*40*	*26.1[8]*	*24.5[8]*	*15[10]*	*nil*	25 (1)	*25*	*15*	-	-	*Part of 80t limit*
Leopardfish	*Bohadschia argus*	*60*	-	-	*30[10]*	*nil*	35 (1)	*35*	*15*	*3 (size)*	-	*Part of 80t limit*
Greenfish	*Stichopus chloronatus*	*38*	-	-	*14[10]*	*nil*	20 (1)	*20*	*15*	-	*50gr[5]*	*Part of 80t limit*
Stonefish	*Actinopyga lecanora*	*24*	-	-	-	*nil*	15 (1)	*15*	*15*	-	-	*Part of 80t limit*

*Proposed size limit (Torres Strait): 1= Better align with EC (East Coast BDM fishery); 2 = too small relative to age at maturity and 3= based on model simulation recommendation (TS BDM Milestone Report, Appendix/Summary).

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Harvest Strategies for the Torres Strait Beche-de-mer (sea cucumber) fishery – Progress Report from June 2017 Workshop

AFMA project no. 2016/0823

Éva Plagányi, Nicole Murphy, Natalie Dowling

27-29 June 2017

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List of Figures

1 Non-Technical Summary

Australia's Commonwealth Harvest Strategy Policy defines a harvest strategy 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. The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been the subject of some discussion at management forums (e.g. HCWG) and community meetings for some time. 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.

Research in consultation with stakeholders is underway to develop and ratify a single harvest strategy for the Torres Strait bêche-de-mer (TS BDM) 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 sea cucumbers in Torres Strait, and establishing first order harvest strategy approaches such as global fishery TACs, size limits and temporal closures. It will include clear 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.

This Report summarises progress made at a HCWG meeting and Harvest Strategy Workshop, Thursday Island, 27-29 June 2017, to develop a harvest strategy framework, which is summarised in Figure 1. The framework specifies the different types of monitoring that could contribute to this process, the types of data collected for use as indicators, the way in which these data contribute to first order and supplementary decision rules for adjusting TACs and implementing pre-specified management actions. The framework also includes a number of static controls such as size limits, spatial or seasonal closures and proposed processing restrictions that could be used as complementary management measures. The draft framework encapsulates the principles of a tier system whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible. The framework acknowledges that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order adjustments needed. Simultaneously the framework clearly maps pathways for ongoing improvements and refinements such as through further data collection as well as a clear role to contribute community-level data and local knowledge. In addition, consistent with the proposed fishery objectives, participants encouraged development of a management system that also included community-enforced or community-regulated local spatial or temporal exclusion bans where appropriate – for example the proposed 10 nm ban on fishing for prickly redfish around home reefs, with devolved responsibility to native title holders.

The next steps in the process are outlined and the next workshop will focus on filling in some of the more detailed specifications needed to operationalise the harvest strategy. Finally, the workshop discussed that the Harvest Strategy would be drafted over the next 18 months with the next workshop preferably being held within 6 months. Broader industry representation and broader consultation would form part of the process. Any policy would ultimately need to be approved by the PZJA.

The success and progress made during the workshop was largely due to the collaborative and enthusiastic participation and inputs from all stakeholders, and the project team thanked everyone for their participation.

2 Introduction

The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been the subject of some discussion at management forums (e.g. HCWG) and community meetings for some time. 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.

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).

This report summarises progress made in developing a harvest strategy framework at a workshop held in conjunction with a Hand Collectable Working Group meeting, 27-29 June 2017, Thursday Island, Torres Strait, to collaboratively progress the development of a harvest strategy. The workshop included relevant stakeholders in addition to the HCWG members.

The CSIRO project team – Éva Plagányi, Nicole Murphy and Natalie Dowling – supported by independent scientific expert Tim Skewes, facilitated discussions with participants in plenary and in small group discussions, and this report summarises some of the key discussion items.

2.1 Project Objectives

The project will develop and ratify a single harvest strategy for the Torres Strait bêche-de-mer (TS BDM) 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 sea cucumbers in Torres Strait, and establishing first order harvest strategy approaches such as global fishery TACs, size limits and temporal closures. It will include clear 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.

Initial discussions to provide an overview of harvest strategies, summarise biological and life history information on bêche de mer as well as results of previous studies, were held as part of a HCWG meeting on Thursday Island, 3 November 2016, under the following Agenda item:

Harvest strategy – getting information to inform the next steps

1.1. Overview of Commonwealth Harvest Strategy Policy
1.2. Environmental information relevant to understanding stocks status
1.3. Overview of previous management strategy evaluation work and examples of harvest strategy options
1.4. Industry fishing trends and objectives for the fishery
1.5. Work plan for Harvest Strategy

These discussions highlighted the need for improved data collection in particular, from both logbooks and a fish receiver system, with these data needed as inputs to inform on the status and trends in the fishery, and hence on appropriate management actions via decision rules that will form part of a harvest strategy. As the TS bêche de mer fishery is relatively data-poor, so-called data-poor harvest strategy approaches (Dowling et al. 2008) will be used, but with a minimum criterion of not using subjective qualitative information only (i.e. quantitative catch estimates are a minimum requirement) and with a transparent pathway for incorporating additional data as these become available (i.e., embracing an adaptive approach).

The objectives of the harvest strategy workshop held 28-29 June 2017 were to expand on these discussions, collate information on all aspects of the fishery, potential monitoring and data gathering options, discuss the operational and socio-cultural feasibility of a range of alternative management controls that could be used, and integrate all available information into a harvest strategy framework. The workshop aimed to explore both static management controls such as size limits and spatial and temporal closures, as well as adaptive approaches, such as using fishery data as inputs to rules for adjusting TACs. The latter also necessitated discussion as to whether the current TAC allocations are appropriate for individual and lumped species groups, and a number of associated logistical aspects were tabled for discussion, such as the need to accurately identify and record information on individual species to inform management at a species-specific level for key species. The workshop also introduced examples of decision rules that could be used as part of a harvest strategy, but the specific details of these and other aspects of the harvest strategy will be discussed in more detail at the next harvest strategy workshop. Where relevant, the results of previous studies are being used to evaluate the effectiveness of proposed approaches.

Simulation models are increasingly being used to evaluate alternative management approaches or harvest control rules, to identify the potential for trade-offs among fisheries management objectives, using the approach of Management Strategy Evaluation (MSE) (Butterworth and Punt 1999; Dankel and Edwards 2016; Pascoe et al. 2016; Smith et al. 2007). MSE approaches can serve as formal risk assessment methods, given their focus on the identification and modelling of uncertainties as well as in balancing different representations of resource dynamics rules (Plagányi et al. 2013c; Rademeyer et al. 2007; Sainsbury et al. 2000). This includes consideration of the implications, for both the resource and its stakeholders, of alternative combinations of monitoring data, analytical procedures, and decision rules (Rademeyer et al. 2007; Sainsbury et al. 2000; Smith et al. 2007). By identifying and evaluating trade-offs in performance across a range of management objectives, it provides indicators on whether different objectives can be reconciled and whether the outcomes are robust to inherent uncertainties in the inputs and assumptions on which decisions are based (Cooke 1999).

Management Strategy Evaluation (MSE) has been used to evaluate management procedures for several bêche de mer fisheries in Australia (Plagányi et al. 2011; Plaganyi et al. 2015; Plagányi et al. 2013a) and these studies will be used to inform the current study. There are also a considerable number of surveys and other biological studies (Long et al. 1996; Skewes et al. 2000; Skewes et al. 2002; Skewes et al. 2010) conducted in Torres Strait which are being used to inform aspects of harvest strategy development. Finally, harvest strategies are also under development for other Torres Strait fisheries, namely finfish and the more data-rich tropical rock lobster fishery, and lessons learnt from these applications are also being used to inform development of harvest strategies for the Torres Strait bêche de mer fishery.

3 Progress on Harvest Strategy Development

3.1 Specify Management Objectives:

The Protected Zone Joint Authority (PZJA) is responsible for management of commercial and traditional fishing in the Australian area of the Torres Strait. The PZJA objectives adopted for the Torres Strait Bêche-de-mer Fishery are:

- to provide for the sustainable use of all bêche-de-mer stocks in Torres Strait;
- to develop bêche-de-mer stocks for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty); and
- to develop an appropriate long term management strategy for sandfish.

The workshop discussed modifying and extending these objectives to include mention of overarching objectives for the Torres Strait Bêche-de-mer Fishery such as to acknowledge, empower and operationalise Native Title Rights and customary and traditional laws including Malo's law of other communities. This also includes acknowledging and incorporating local knowledge and the ability to locally manage resources. The operational objectives include the following:

- to provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;
- to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;
- to acknowledge area-specific issues;
- where possible, to consider an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and
- to develop long-term recovery strategies for species, where appropriate.

Revisions to the draft above will be discussed further at the next workshop.

3.2 Harvest Strategy Development

A harvest strategy for the Torres Strait bêche de mer fishery needs to apply to all bêche de mer species (Table 1) and set out the management actions necessary to achieve the objectives outlined above. It will be a formal framework for guiding the overall management of a fishery rather than dictating day-to-day fishing activities or decisions. Hence there are pre-agreed transparent set of rules for making tactical management decisions including specifications for:

(i) a monitoring program
(ii) the indicators to be calculated from monitoring data (usually via a stock assessment but this can be a relatively simple assessment for fisheries with limited data)
(iii) the use of those indicators and their associated reference points in management decisions, through application of decision (or control) rules.

The process currently underway to develop a Harvest Strategy for the Torres Strait bêche de mer fishery in consultation with stakeholders is following the steps outlined in Dowling et al. (2015):

1. Compile and review information
2. Identify possible indicators e.g. changes in catch composition, triggers pertaining to spatial changes (eg. % of area fished), CPUE for species, species –specific catch trigger values for high risk/vulnerable and key species, total catch triggers
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

The progress made at the June 2017 workshop to develop a harvest strategy is summarised in the next section, which encompasses feedback from workshop participants on all aspects. More detailed summaries of the three small group brainstorming sessions are provided in Appendices 1-3. Additional broader considerations are also summarised and the final section summarises progress against pre-specified workshop action items designed to capture all relevant information as a basis for developing a harvest strategy.

Table 1. Summary of key bêche de mer species in Torres Strait, together with their minimum size limit and Total Allowable Catch (TAC) in tonnes (from (Murphy et al. 2014))

Common name	Scientific name	Commercial value	Minimum size limit (mm)	TAC (t)
Sandfish	*Holothuria scabra*	High	180	Closed
Surf redfish	*Actintopyga mauritiana*	Medium	220	Closed
Black teatfish	*Holothuria whitmaei*	High	250	Closed[#]
White teatfish	*Holothuria fuscogilva*	High	320	15[$]
Prickly redfish	*Thelenota ananas*	High	300	20
Hairy blackfish	*Actinopyga miliaris*	Medium	220	Part of 80t limit
Curryfish common	*Stichopus herrmanni*	Medium	270	Part of 80t limit
Elephant trunkfish	*Holothuria fuscopunctata*	Low	240	Part of 80t limit
Lollyfish	*Holothuria atra*	Low	150	Part of 80t limit
Deepwater redfish	*Actintopyga echinites*	Medium	120	Part of 80t limit
Curryfish vastus	*Stichopus vastus*	Medium	270	Part of 80t limit
Burrowing blackfish	*Actinopyga spinea*	Medium	220	Part of 80t limit
Deepwater blackfish	*Actinopyga palauensis*	Medium	220	Part of 80t limit
Golden sandfish	*Holothuria lessoni*	High	180	Part of 80t limit
Brown sandfish	*Bohadschia vitiensis*	Medium	nil	Part of 80t limit
Leopardfish	*Bohadschia argus*	Medium	nil	Part of 80t limit
Greenfish	*Stichopus chloronotus*	Medium	nil	Part of 80t limit
Stonefish	*Actinopyga lecanora*	Medium	nil	Part of 80t limit

***Size limits off PZ JA website – http://pzja.gov.au/the-fisheries/torres-strait-beche-de-mer-fishery/**

[#]WG agreed Black teatfish has had some trial re-openings already but that it will not be re-opened again until the compulsory catch reporting is in place.

[$] WG discussed considerations for proposed allowance for hookah to use on White teatfish

4 Draft TS BDM Harvest Strategy Framework

A Harvest Strategy needs to include the following components (Dowling et al. 2015):

(1) Indicators (data from the fishery; Docket books & Logbooks)
(2) Reference points (targets and limits, and/or intermediate triggers; Stock biomass, Fishing mortality)
(3) Monitoring (agreed protocols to obtain data; Population surveys, Size/age monitoring)
(4) Method of assessment (Stock assessment, Catch per Unit of Effort (CPUE) trends, Species composition changes)
(5) Decision rules (agreed rules for setting catch levels; called Harvest Control Rules)

The schematic in Figure 1 was developed based on inputs from participants at the June 2017 workshop, and shows the connections between the different components which collectively constitute the harvest strategy. A brief description is provided below.

4.1 Monitoring and data collection to determine indicators

The draft framework encapsulates the principles of a tier system (see also Fig. 5) whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible. Hence as per the framework in Figure 1, participants agreed that:

(1) If there are no data (red shading = lowest tier) provided for the BDM fishery (species-specific or for a group) then no quota should be allocated. There was also strong support for the right of a TIB license holder to have access to the resources to be contingent on the provision of data.

(2) Next, the basic data, (together with monitoring methods) that need to be collected for use as primary indicators are shown in light green shading: the most critical data are total catch per species as well as CPUE (Catch Per Unit Effort) (which could be measured as total catch per species per day or similar measures such as the number of tubs per day). If data are accurately recorded in logbooks, then other useful indicators can be derived, such as the spatial footprint of the fishery (eg. whether the area fished or depth fished is expanding, species composition and discard mortality). Representative (species-specific) size frequencies from samples of catches were identified as another useful primary indicator. For species subgroups where it might be difficult to accurately record the composition of the catch, participants suggested that other methods could be used, such as photo samples of catches to be analysed by experts.

(3) The next step up in the tier system would be to use scientific or community-based surveys (dark green shading = top tier) to provide fishery-independent data (eg biomass surveys) for use as an indicator of relative abundance and density of key species.

(4) Finally, there is considerable potential for local community collection of additional data (turquoise) which could be used as secondary indicators. A draft community-level multiple indicator framework was developed at the workshop (see Appendix 3 for fuller description) based on local knowledge and provides a platform for establishing and implementing a spatial multiple indicator status categorisation and corresponding colour-coded strength of

adjustment. As local depletion is a concern for bêche de mer fisheries, this community-based monitoring and feedback system could improve sustainable management of stocks in community clusters and thereby empower local recommendations from communities as well as facilitate self-organisation of allocations amongst community clusters. Over time, demonstrated success in implementation could see these indicators being upgraded to primary indicators for use in decision rules.

The framework therefore acknowledges that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order adjustments needed. Simultaneously the framework clearly maps pathways for ongoing improvements and refinements such as through further data collection as well as a clear role to contribute community-level data and local knowledge. In addition, consistent with the proposed fishery objectives, participants encouraged development of a management system that also included community-enforced or community-regulated local spatial or temporal exclusion bans where appropriate – for example the proposed 10 nm ban on fishing for prickly redfish around home reefs, with devolved responsibility to native title holders.

4.2 Reference points, Method of Assessment and Decision Rules

The above process is intended to provide data that can be used as indicators to inform on the status of each species. Whether or not the status is considered good, bad or average for example, depends on comparison with some agreed Reference Points – for example if total catch exceeds a pre-specified limit or CPUE is below a pre-specified limit reference level then it may mean that species is being fished too heavily. An assessment process is therefore needed to assess the current status and trends in the biomass of each species. A decision rule is then used to describe what action is needed to adjust catches to achieve desired targets and satisfy the overall fishery objectives. Decision rules could be hierarchical or based on multiple indicators, which may be weighted or not.

The choice of reference points, assessment method and decision rules have not yet been finalsied but are under development as part of the current project, and will be reviewed in an iterative fashion with stakeholders. It was noted at the workshop that there are a number of existing approaches which would be suitable for adoption in this fishery.

4.2.1 Example decision rules for species-specific recommended biological catches

Two examples of decision rules discussed at the workshop are as listed below. The first includes an example as to how to accommodate rules around the carry-over of a TAC overshoot as proposed by some stakeholders, as well as imposing increasingly stringent penalties where total catch exceeds the recommended biological catch.

(I) Catch-Based Decision Rule (see also Figure 2)

- Hierarchical: First Apply Catch Decision Rule (operational fishery):
    - If no data then TAC = 0

- If exceed by >5% and <20% then carry over catch and subtract from following year's total
- if exceed by >20% and <50% then pause fishing on that species following year
- If exceed by >50% and <100% (double) pause fishing 2 years
- If exceed by more than double, close fishery 4 years

(II) Rule using survey or CPUE to adjust catches

- If Average (3 yr) Catch between 80% and total TAC, use index of abundance (eg CPUE or survey) to adjust:
  - TAC = (1+b*slope)*C_{CUR} and maximum increase pre-specified
- where CCUR is average catch over the past three years, and includes landings plus discards; "slope" is the slope in the trend in standardised CPUE (or other relevant indicator) over the past 3 years (Smith and Smith 2005; Smith et al. 2008)
- Parameter *b* differs based on how reliable data are (eg survey allows bigger catch change)
  - Develop rules to include/augment with other available indicators – size information, effort, spatial footprint of fishery, species composition of catch

4.2.2 Example decision rules for lumped species category

The draft framework in Figure 1 also accommodates combined species groups, for which triggers need to be specified such that when the catch of a particular species reaches or exceeds a trigger, the reasons need to be established and appropriate management action implemented (Figure 3). This could include specifying the need for additional data to monitor the expansion of a fishery for a species, a good example being the recent growth in fishing effort on curryfish due to improved processing methods and market opportunities. Discussion is still underway as part of this project as to which species that are currently included as part of a joint TAC, should have their own TAC. Workshop participants supported a separate TAC for curryfish given the growing interest and expansion of the fishery for these species. Although there are several curryfish species, the focus is predominantly on two species (*Stichopus hermanni* and *S. vastus*). A draft plan for determining an initial curryfish TAC and trigger level is as follows:

1. Compute TAC for each of these species based on same methods as previously and add together = Joint curryfish TAC
2. As vastus lower abundance (based on survey), set trigger = 2 x vastus-specific TAC calculation
3. If trigger reached, implement decision rules for case where trigger exceeded

A summary of suggested triggers based on surveys and earlier work will be tabled at the next meeting.

4.2.3 Example decision rules for re-opening a fishery or area

The draft harvest strategy framework (Figure 1) also specifies that in some instances decision rules are needed to inform decisions related to re-opening a closed fishery or closed area. Participants agreed that evidence of recovery was a necessary criterion and could be assessed based on data such as a biomass estimate from a survey. Consistent with the fishery objectives, a strategy for a gradual return was then needed, including a conservative initial TAC for example, and ongoing monitoring would be essential (Figure 4).

Flowchart diagrams as per the examples in Figures 1-3 are a useful way of summarising decision rules as clearly detail the action to be followed based on pre-agreed criteria. The Flowcharts 1-3 summarise broad agreement by participants at the workshop regarding potential decision rule structures, but the exact details, together with associated choices for the triggers and limits, still needs to be decided.

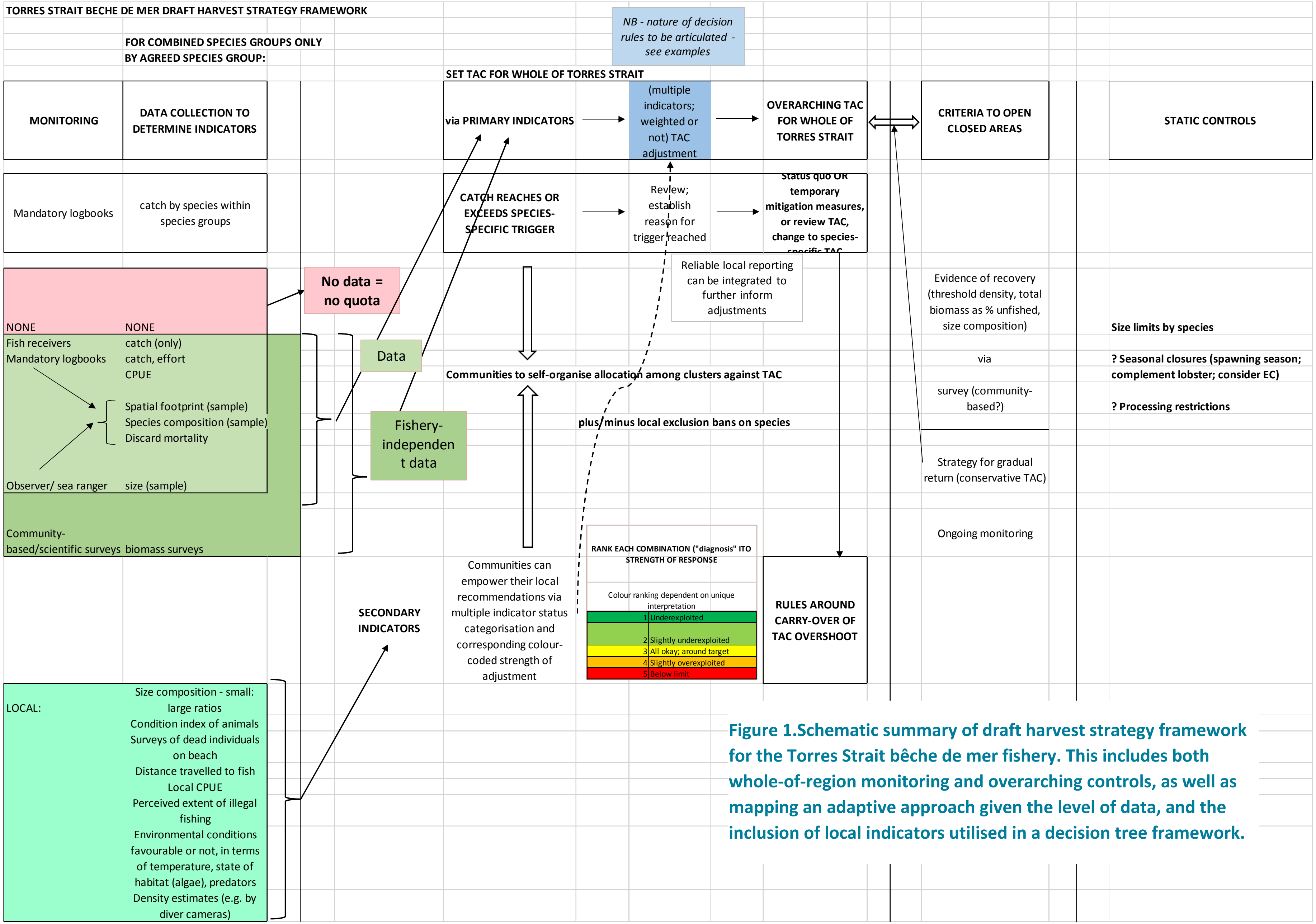


Figure 1.Schematic summary of draft harvest strategy framework for the Torres Strait bêche de mer fishery. This includes both whole-of-region monitoring and overarching controls, as well as mapping an adaptive approach given the level of data, and the inclusion of local indicators utilised in a decision tree framework.

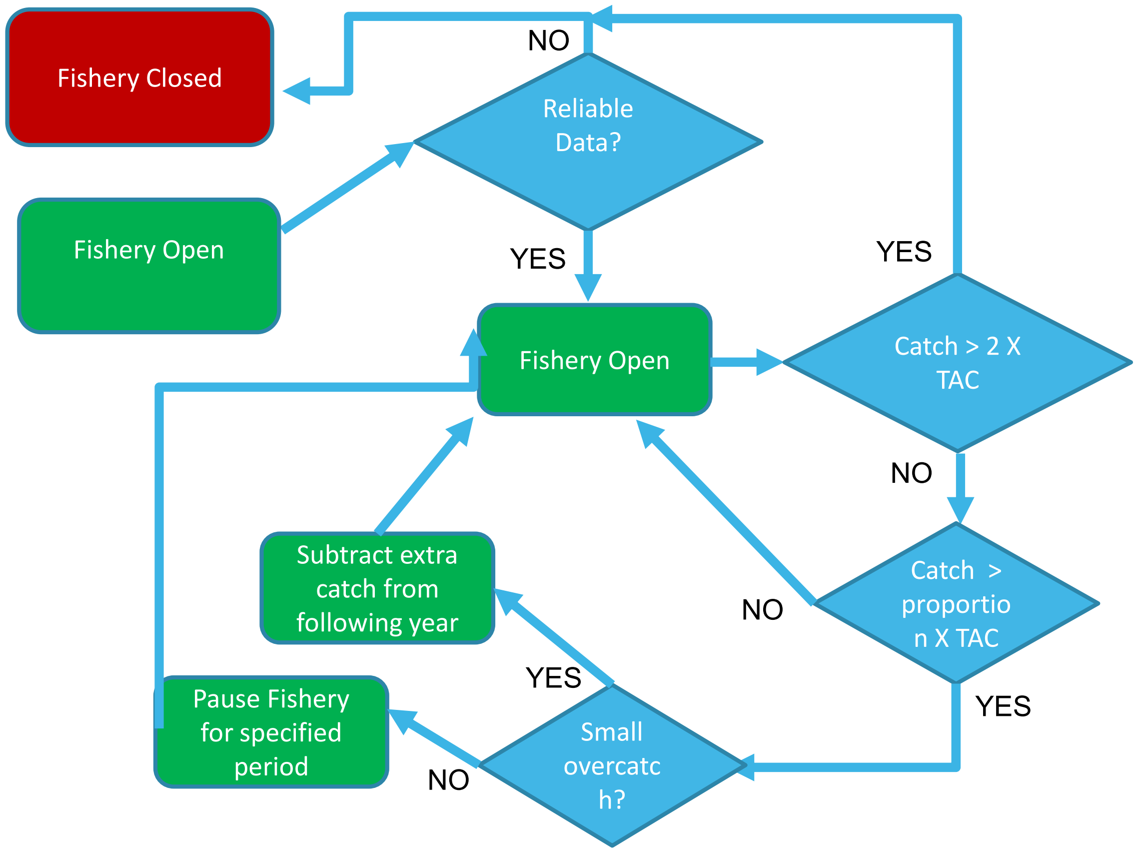


Figure 2. Flowchart summarising illustrative decision rule based on catch

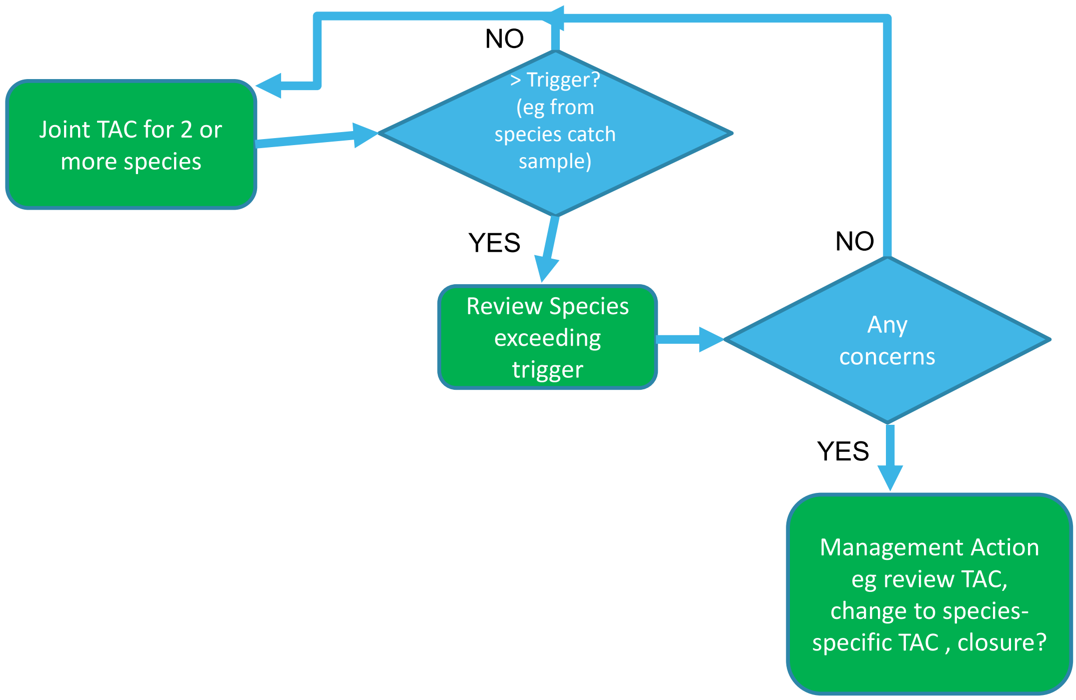


Figure 3. Flowchart summarising illustrative decision rule for reviewing whether a trigger is exceeded for any species caught as part of a lumped species allocation.

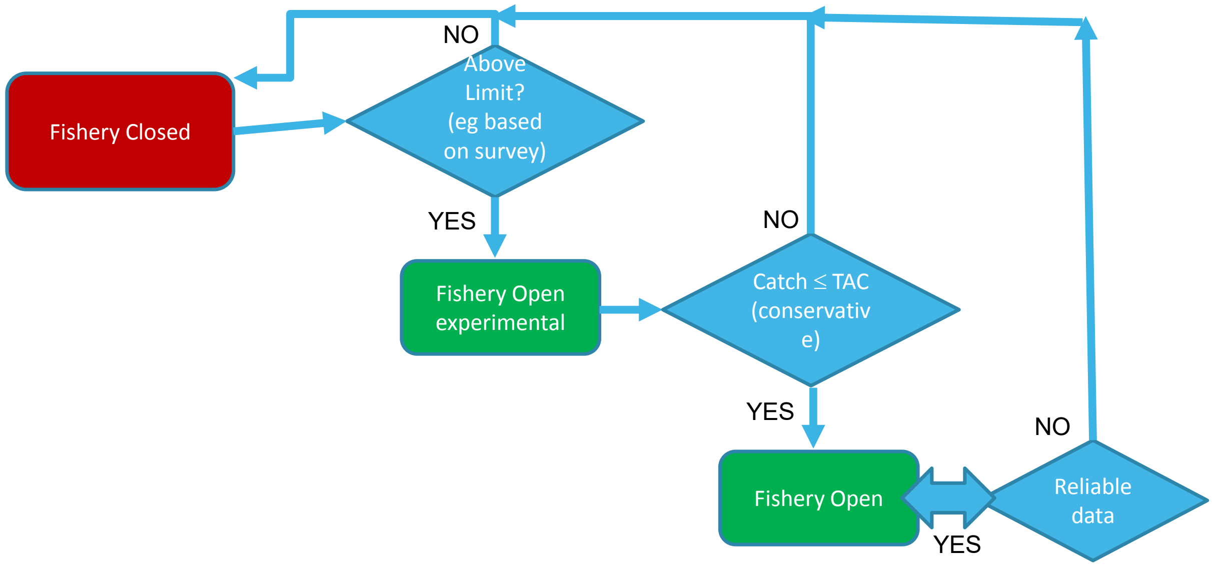


Figure 4. Flowchart summarising proposed process for re-opening a closed fishery.

4.3 Management controls – static

The draft harvest strategy framework (Figure 1) specifies a number of static controls that can be implemented to complement and strengthen other management actions. The key controls proposed by participants are briefly discussed below.

4.3.1 Size limits

Recent research on Australia's sea cucumber fisheries recommended that for data-poor species in regions where more sophisticated management controls are difficult to implement (Plagányi et al. 2015) a minimum legal size (MLS) limit enhances benefits. Where data are available to inform as to the choice of this, it should be selected to protect at least the first age-at-maturity. Workshop participants endorsed that changes in some current size limits would be advisable to bring them in line with updated information on the age-at-first-maturity (Table 1 & Appendix 4) A secondary consideration in reviewing current size limits would be to better align them with comparable size limits from other fisheries such as the East Coast Bêche de Mer Fishery. Table 1 summarises this information for ongoing consideration by the HCWG. There was also discussion around providing tools, such as stickers with size measures on the side of boats. In addition, it was noted that it would be useful to apply conversion ratios to the MLS to facilitate cross-checking different product forms. A document summarising conversion ratios is being prepared for discussion at the next meeting.

4.3.2 Spatial and temporal closures

Several workshop participants expressed that there might be value in bans on fishing during part or all of the peak bêche de mer spawning time, which was identified from Appendix 5 as November to January. Moreover, it was felt that another advantage of banning fishing over this period was because it coincides with a closure and hookah-ban closure in place for the tropical lobster fishery (and hence prevents shifting effort from one fishery to another).

There was also considerable support for communities self-regulating and overseeing spatial exclusions such as the proposed 10 nm exclusion zone around home reefs for fishing prickly redfish.

4.3.3 Processing restrictions

Workshop participants proposed that a new management control in the form of a restriction on allowing processing of BDM onboard fishing vessels.

4.4 Value Adding and economic considerations

The workshop included discussion on opportunities for value adding – such as improved processing and handling of curryfish. These initiatives were encouraged as ways to optimise utilisation of the resource form a biological, economic and social perspective as outlined in the objectives.

4.5 Environmental Influences

Brief mention re some environmental indicators that could be included longer term; climate change considerations

- Link to SST etc data: Water temperature monitored daily at automated weather stations located at Thursday Island, Masig and Saibai – http://data.aims.gov.au/aimsrtds/

4.6 Operationalising Fishery Objectives

The Table below provides a preliminary overview of proposed components of the harvest strategy that will be used to operationalise the agreed fishery objectives:

Objective	How being operationalised
Consider Native Title Rights and customary and traditional laws and acknowledging and incorporating local knowledge and the ability to locally manage resources	• Community-controlled and enforced complementary management controls such as 10nm closures • Clearly identified pathway for incorporating local knowledge and building a platform to move to greater spatial and community management
To provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;	• Specification of monitoring and data needs, together with rules for adjusting management to ensure sustainability of stocks • Rules for closing or re-opening to ensure consistent with sustainability objectives
To develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;	• Transparent tier system for improving and growing monitoring and data collection to support increasing fishing on species/areas where appropriate • Measures to take economic considerations into account eg timing of harvest considered relative to East Coast BDM fishery, trigger limits to instigate action when there is increased focus on selected species
Acknowledging area-specific issues;	• Drawing on community systems to complement controls • Identified pathway for communities to self-regulate to avoid local depletion effects
Where possible, considering an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and	• Consider interactions with TRL fishery eg timing of closed seasons • Identify indicators that could be collected to start identifying impacts of different harvest levels on the ecosystem – for example state of the habitat (algae) indicator
Develop long-term recovery strategies for species where appropriate	• Include decision rules to guide recovery strategies

4.7 Formal evaluation of whether the harvest strategy options are likely to achieve the management objectives

The development of the harvest strategy draws extensively on testing done using a Management Strategy Evaluation (MSE) approach, during research on sea cucumber fisheries on the Queensland east coast (Plagányi et al. 2015) and in Torres Strait (Plagányi et al. 2013b; Skewes et al. 2010). These studies form part of the workshop discussions and aspects and key recommendations have also been summarised in the project milestone reports 1 and 2 (Plagányi et al. 2017a; Plagányi et al. 2017b).

4.8 Implementation

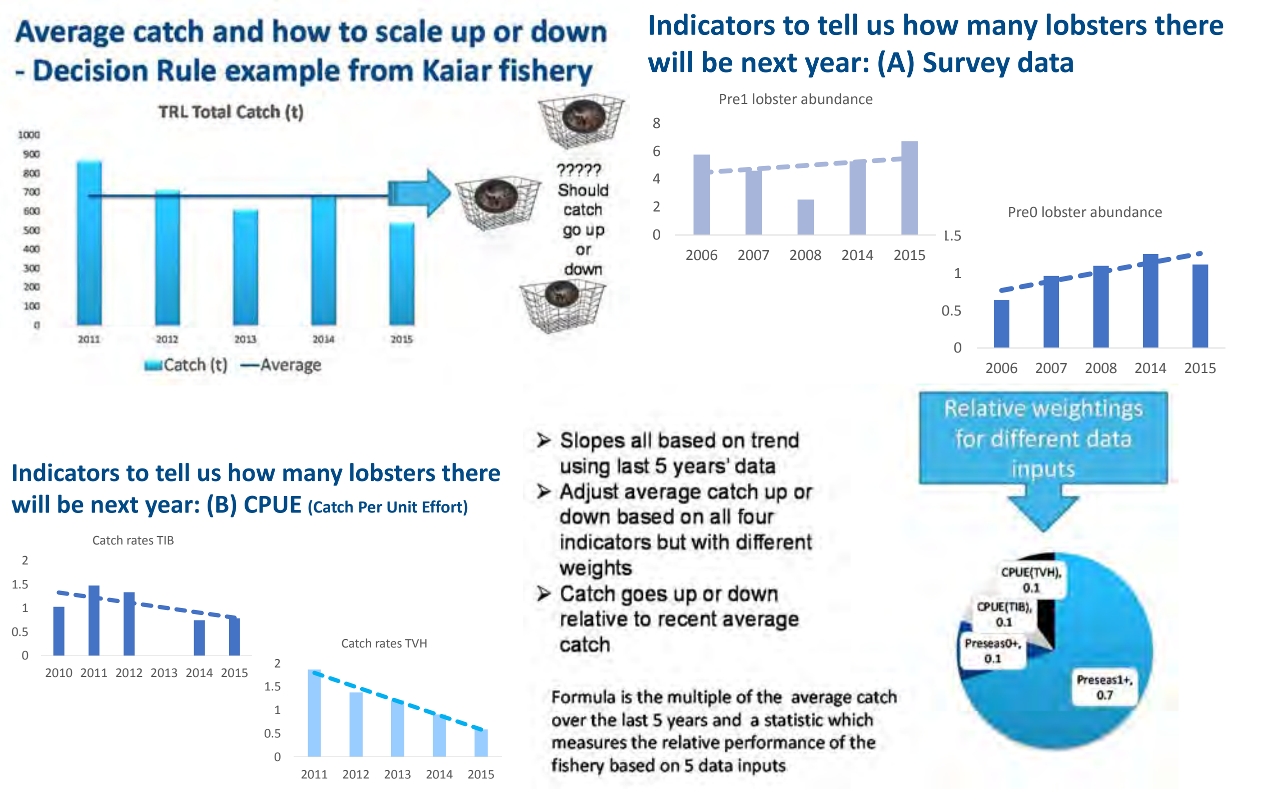
The Harvest Strategy Workshops are focussing on developing a draft harvest strategy as a basis for obtaining further feedback from the HCWG and other stakeholders, as well as to guide any additional research and data collection needs before a final draft can be developed. Two further Harvest Strategy Workshops are being planned for the coming year. Additional communication outreach options are also being planned to complement this process – for example, a science communication workshop and nontechnical summary.

Suggested approaches will acknowledge the challenges and limitations to harvest strategy development and implementation in the Torres Strait, as there is need to be cognisant of their ability to be implemented in the context of the fishery's operational and socio-economic issues.

5 List of Workshop sessions and key summary points discussed

Introduction and background: Overview of Harvest Strategies and recap from first workshop

- Showed example of previous modelling work highlighting the need to maintain catches at sustainable levels, especially for longer-lived species such as prickly redfish which could fairly rapidly become depleted and then take a very long time to recover (see Torres Strait Hand Collectables Working Group No.11 Meeting Record, 27 June 2017)
- Boom and bust cycles observed in other sea cucumber fisheries discussed.
- Recommendations from previous studies being used to inform this study, including from a previous project on evaluating management strategies for data-poor bêche de mer species in Torres Strait by Plagányi, Skewes, Dowling and Haddon (2011) and lessons from the East Coast Bêche de Mer Fishery (ECBDMF)
- An example from the tropical rock lobster harvest control rule was used to illustrate how monitoring information can be combined in a decision rule to adjust a Recommended Biological Catch upwards or down – as per example below.



Workshop Action 1: Obtain consensus on key management objectives for the fishery as well as more specific objectives for individual species

- Recorded key points (see for example Figure 5 below) and a revised draft is under preparation for comment and review

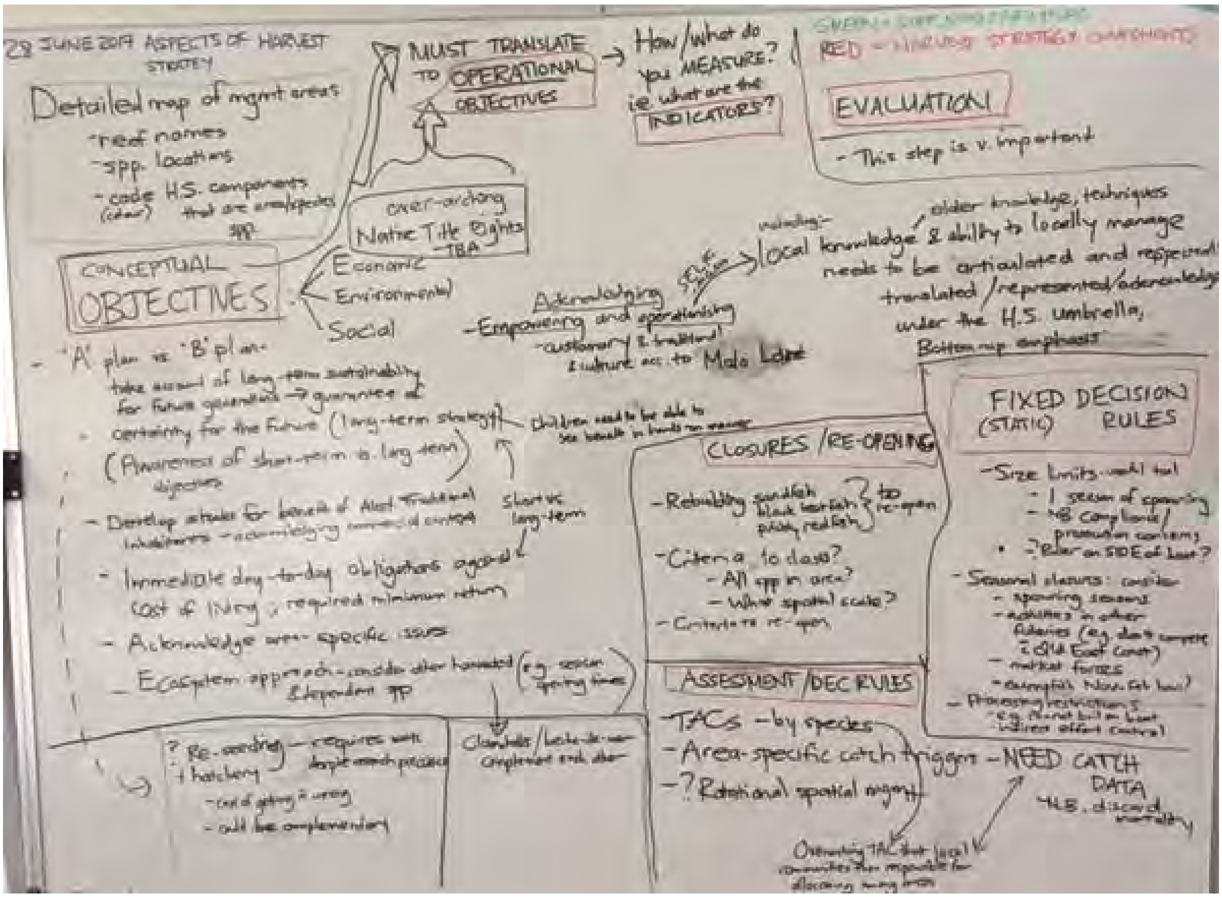


Figure 5. Copy of whiteboard notes from workshop summarising fishery objectives considered important by stakeholders, together with suggestions for static and adaptive management controls and rules for consideration in developing a harvest strategy for the Torres Strait bêche de mer fishery.

Workshop Action 2: Update and obtain consensus on revised minimum size limits for individual species and generic limit for remaining species

- Discussed principles of setting size limits so size set larger than size at maturity
- Allows for sea cucumbers to spawn before being fished
- Reviewed literature for size at maturity for sea cucumber species
- More information on some species than others
- Recorded all information eg. sizes for male or female, age at maturity, weight – base line data for species
- Proposed size limits for Torres Strait

- Noted size limits for Torres Strait, East Coast and Coral Sea Fisheries
- Reviewed based on:
    - Increased as smaller than size at maturity (literature)
    - Better align with East Coast BDM Fishery size limits
    - Based on model recommendation
- Extensive discussion on suggested revisions to size limits (see Appendix 4), with agreement that first consideration should be age at first maturity and next consideration could be to better align with the size limits used for the east Coast BDM Fishery, which are generally more conservative.

Workshop Action 3: Discuss feasibility of reliably measuring size of animals, and whether additional resources would facilitate this process (eg ruler or size gauge)

- Useful suggestions tabled such as a sticker with size measures on the side of boats
- Challenges acknowledged in measuring animals that can shrink or need to be processed rapidly and hence conversion ratios necessary

Workshop Action 4: Review conversion ratios for sea cucumbers

- Request for conversion ratios to facilitate assessing size of animals in different processed forms

Workshop Action 5: Review and update species names for sea cucumbers

- Various actions to improve species identification and naming

Workshop Action 6: Discussion of species identification challenges for sea cucumbers

- Further materials were made available to assist identification of hard-to-identify species such as redfish (Surf Redfish, Deepwater redfish) as well as blackfish (hairy blackfish, burrowing blackfish, deepwater blackfish) as summarised in Appendix 6 – from presentation re size limits and identification, which was also printed and circulated.
- Spatial morphological variation in prickly redfish was acknowledged
- Further materials will also be provided at the next meeting or as part of a science workshop to assist in identification of the different curryfish species

Workshop Action 7: Additional species-specific limits for individual or groups of sea cucumbers

- Curryfish were identified as a group that should be allocated their own TAC, possibly with a trigger limit for individual species
- Other species that were proposed as needing their own TAC included Deepwater redfish and Hairy blackfish as these are both target species that probably need TACs. Greenfish was suggested although is not currently targeted.

Workshop Action 8: Review and discuss sandfish

- Discussion focused on need for a survey to assess the extent to which this species has recovered and whether the fishery could be re-opened

- Full scale stock survey of Warrior Reef, potentially in collaboration with Papua New Guinea is recommended

Workshop Action 9: Review and discuss black teatfish

- Broad agreement consistent with other workshop discussions that a primary requirement before considering re-opening would be demonstration of reliable data reporting for all bêche de mer species

Workshop Action 10: Review and discuss white teatfish

- Discussion as to whether or not hookah should be allowed was discussed primarily as part of the HCWG meeting on 27 June 2017, and is summarised in the minutes from that meeting

Workshop Action 11: Review and discuss potential use of spatial rotation strategies and move-on provisions

- Discussion acknowledged that this could be challenging to implement, but that some communities already use this sort of system for self-management, and hence further and ongoing use of spatial rotation strategies should be encouraged as community-level self-management tools.

Workshop Action 12: Review potential use of additional indicators

- Fishery logbook sheets were examined and discussed to confirm the range of data that could be collected for use as indicators (catch per species, species composition, catch rate measures, spatial location of catches)
- Participants proposed several additional indicators that could potentially be used, such as the condition index of animals, surveys of dead animals, state of habitat (algal relative abundance) – see Appendix 3, Table A3.1

Workshop Action 13: Finalise agreement on different monitoring information that will be collected

- Agreement that fisher logbooks provide critical information that is needed as primary indicators to inform decision rules, and workshop encouraged communication of need to fill in as many of the data entry fields as possible
- Fish receiver system discussed as critical and also providing a way to validate total catches (but it doesn't provide more detailed information as above) – these data are needed as soon as possible to assist in keeping track of total catch during a season, whereas more detailed logbook information is needed at the end of the season to assess fishery status etc.
- There was some discussion of the need for and use of biomass surveys (fishery-independent surveys), particularly for key species such as sandfish, but no firm decisions as to who would do these, how frequently, as well as the process for planning these.

Workshop Action 14: Review tiered harvest strategy potential framework

- As per the framework in Figure 1, there was broad support for using a tier system that acknowledges the advantages and benefits of collecting more information, as per the broad overview presented at the meeting and summarised also in Fig. 6.

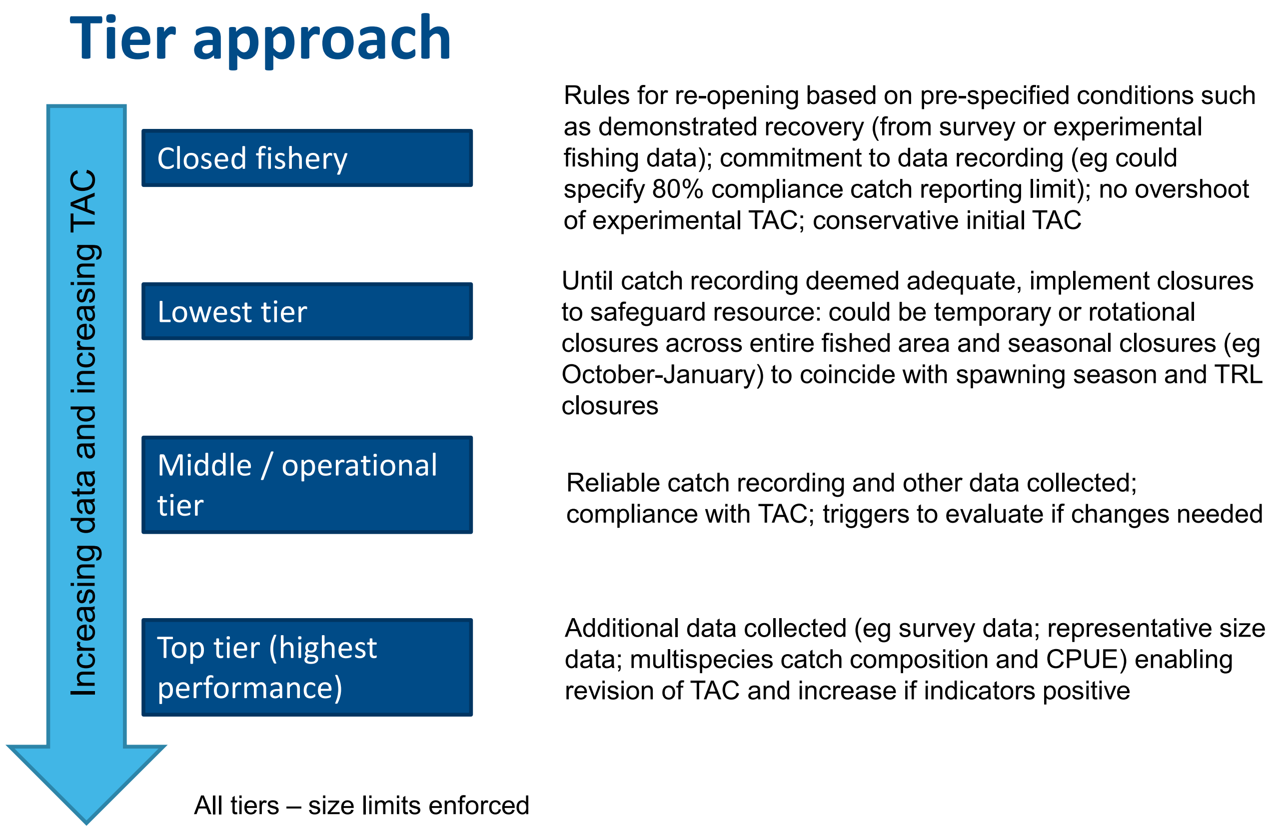


Figure 6. Conceptual overview of tier approach

Workshop Action 15: Develop draft harvest strategies

- As per Figure 1 and summary in this workshop report, substantial progress was made in close collaboration with participants to develop a draft harvest strategy for further review, comment and fleshing out of the details.

6 Next Steps

The workshop concluded by outlining the following next steps with regard to filling in detail on the Harvest Strategy Framework:

Indicators:

- Support and strengthen data recording and collation

Monitoring:

- develop plan for biomass surveys

Assessment:

- Quantify reference levels used for assessing stock status e.g. limit level that is to be avoided and target to aim for
- Quantify recovery criteria for closed species

Decision Rules:

- Develop decision rules for adjusting TACs up or down based on multiple indicators (weighted or not) with pre-specified constraints such as maximum annual permissible change (eg 20%)
- Agree on how frequently (annual, every 2nd or 3rd year etc) assessments performed and TAC adjustments recommended

The following overarching action items were also identified:

- Refine Framework
- Agree separate TAC for curryfish (other species?)
- Refine development and support implementation of community multiple indicator scoring framework
- Static Controls:
  - Revise and recirculate size limit summary information for consideration and comment
  - Action items re size measures (eg sticker on side of boat); table showing conversions between different product forms
  - Consider seasonal closure recommendation Nov-Jan
  - Add restriction to prevent allowing processing of BDM onboard fishing vessels
- Circulate link to East Coast BDMF quota tracking website
- Circulate web links to sea surface temperature & environmental information

Finally, the workshop discussed that the Harvest Strategy would be drafted over the next 18 months with the next workshop preferably being held within 6 months. Broader industry representation and broader consultation would form part of the process. Any policy would ultimately need to be approved by the PZJA.

7 Acknowledgements

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8 Glossary of technical terms

Assessment:	A mathematical population model coupled to a statistical estimation process that integrates data from a variety of sources to provide estimates of past and present abundance, fishing mortality and productivity of a resource
BDM:	bêche de mer or sea cucumber
CPUE:	Catch Per Unit Effort
Harvest Strategy HS:	Harvest Strategy: a framework that specifies the pre-determined management actions in a fishery necessary to achieve the agreed ecological, economic and/or social management objectives
Limit reference points:	highlight conditions to be avoided
Management objectives:	Broad objectives pertaining to the management of a resource as set by decision makers and stakeholders
MSE:	Management Strategy Evaluation – the process of testing alternative decision rules by simulation, in particular for robust performance in the presence of uncertainty
MSY:	Maximum Sustainable Yield – the maximum yield/catch that can be taken from a resource on an ongoing sustainable basis
Reference Point:	particular levels that reflect stock status (eg spawning Biomass *Bsp* or fishing mortality rate *F)*
TAC:	Total Allowable Catch to be taken from a resource within a specified period
Target reference points:	specify where management should aim, which stakeholders usually decide

Note that several of these definitions are taken from (Rademeyer et al. 2007).

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Appendix 1 Summary discussion points from Sub-Group 1

Indicators:

- Stressed need for good data: TIB fishers to take responsibility – need greater awareness and education as data needed to inform decisions
- Identify committed divers/industry – ongoing fishing needs to be dependent on reporting – particularly important for high value species; communities also have responsibility in overseeing the number of active fishers; fishers do not need to reveal individual confidential information but it needs to be clear whether they are reporting their data
- Agreement if there are no data, fishery should be closed
- Need data from buyers and logbooks
- Challenge: getting data from logbooks to AFMA eg fax, mailing – risk if lost; electronic poses challenges eg on Murray Island there isn't often reception; need additional resources?
- How to get information recorded in timely period?
- Buyers considered important for data collection
- Logbooks – data recorded that could be used as indicators includes:
    - Catch
    - Species – which species recorded; mainly 5 species
    - Effort – fishers daily catch is recorded so have Catch/day
    - Spatial longitude and latitude co-ords can be used as indicator of spatial footprint
    - Depth not usually recorded
    - The area fished can be recorded eg reefs around Thursday Island are numbered

Monitoring Methods – the following categories were proposed as valuable:

- Logbooks
- Docketbooks / Fish Receiver System
- Scientific surveys (eg biomass or density surveys)
- Onboard Observers, possibly Sea Rangers – discussed whether TSRA/AFMA could resource scientific observers for analysing Torres Strait catch composition for example
- Use of camera monitoring eg changes in product size could be monitored by camera; could take sample photos and use to review which species – particularly for curryfish, area fished, size of animals; could also use cameras as part of scientific surveys. Could use camera on specific dives; bus stop approach taking photos at set

time periods/locations for comparison; could compare densities at different depths; could possibly see changes in aggregation over seasons; need resources.

- Agreement at meeting regarding voluntary closures
- Need surveys to look at biomass at periodic intervals to check on status of key species such as prickly redfish

Management Controls in the form of Exclusion Zones:

- o Recommend 10nm exclusion zone for prickly redfish
- o Need to recognise differences in terms of where/depth different species can be fished, and there are also differences between different areas – for example for Ugar and Erub Islands need to fish closer than for Murray Island
- o Might be a good idea to set up exclusion zones around some areas thought to be important for large breeding animals

Decision Rules for Adjusting

- o Suggested needed to split curryfish and allocate separate TAC
- o Need trigger level set for different species
- o To implement, need to know how many of each species – for difficult to identify species, suggested could use a skipper with training to look at catch composition say once per month. Also suggested scientific observers could be used.
- o Discussed comparison with rules used for ECBDMF to adjust TAC up or down
- o Reference levels (target and limit) can be based on survey biomass estimates or density estimates

Rules for Re-Opening a Fishery

- o Use a survey to analyse trends and inform whether recovery taking place
- o If recovering, re-open with conservative TAC
- o Comparison with east Coast approach where CPUE information from logbooks is used to adjust TAC up or down

Regional Management

- o Need care in managing data so doesn't lead to more exploitation – native title stakeholders to decide how to protect.
- o Suggest could set total catch limit and devolve responsibility to native title stakeholders regarding allocations such as spatial sharing
- o Need mapping of Native Title spatial structure
- o Need to follow local rules
- o Ownership is key – people take ownership for looking after their own area

Appendix 2 Summary discussion points from Sub-Group 2

- Impediments to data recording:

Not compulsory; lack of education/awareness; sporadic fishing; records not going to AFMA; concern about confidentiality; concern about reaching TAC; doesn't capture damaged, lost or discarded catches.

- Which species need own quota – mentioned curryfish:

Curryfish, Prickly Redfish, Greenfish.

- Does this change as marketing changes and new markets emerge – can we have rule to accommodate?

Changes with market demand/value – aim to have TAC or triggers for each species, with the triggers having associated actions.

- What are minimum information requirements to re-open fishery eg. sandfish:

Reliable catch reporting/monitoring. Assessment and knowledge of current stock level. A conservative TAC. Consideration of harvest strategy outcomes.

- Should we have minimum and maximum size limits (eg. prickly redfish discussion):

Definite minimum sizes. Maximum where science convinces.

- Breeding/egg area closures (seasonal closures?); green areas – support and ideas for these? Don't close same time as TRL. How to monitor and enforce:

Spatial closures difficult to manage/compliance/conflict. Suggestion – close BDM fishery Dec/Jan (coincides with spawning season for most cucumber species, gives all species chance to rest and spawn), allow free dive of TRL for TIB Dec/Jan. No primary vessels.

- Is there a preference for closing areas around reefs (eg. 10nm exclusion zone/voluntary closure proposed for prickly redfish) – target species only or several species:

Prefer whole areas eg. within 10nm rather than specific reefs and is voluntary – more likely to be supported. Noted that it may not be respected if voluntary, especially if fishers not from adjacent island community.

- Is there a way to increase economic profit and value adding through consideration of harvest control rules:

There may be ways to increase economic profit and value adding through diversifying, more awareness and co-ordination. Suggestion to work as a cluster to attract higher prices, co-ordinating product and can control quality. Example for community TAC eg. 5-7 tonnes each, if you overfish it comes off your allocation/TAC the following year - with built in review (species/catch).

- Data that could be used as indicators – could we get effort information, species size composition, spatial extent of fishery:

Can get catch and species. Numbers and size are not recorded. Some note down co-ordinates/where fished. Suggestion to write down in comment section some observations/environmental eg. reef dead, algae over grown. Question – can this data be captured on other logbooks.

- If there is a lag before confirmation that total TAC reached, should this be averaged in some way over 3 years or so eg. fishery TAC zero in 2nd year if large over catch in first year:

Yes, there is a lag/no real time fishery management. Support for idea of a community TAC eg. 5-7 tonnes each, if you overfish it comes off your allocation/TAC the following year - with built in review.

- What actions are required short-term in response to problem or concern detected vs how to manage risks, longer term harvest strategy to ensure sustainability:

Short term actions – Compulsory catch monitoring, better understanding eg biology and specific actions per species, size limits, triggers.

Long term – Ability for real time management.

- Spatial management – thoughts re allocations to home communities as discussed at the hand collectable working group. Could this be implemented? Would facilitate ownership and not being penalised for over catches in other areas. How feasible to draw up and get agreement on spatial boundaries and catch sharing? Would have to be done and agreed by community not scientist or managers:

Not supported/not recommended.

- How to integrate community plans into harvest strategy:

Community plans are important for informing the harvest strategy eg. indicators and also need evidence.

- TIER approach:

All about risk, TIER approach is supported.

Appendix 3 Summary from Sub-Group 3 including Community-level framework

Sub-Group 3 identified a number of indicators that collectively reflected the general status of the bêche de mer stocks locally. These indicators were felt to be easy to report at a local level, and were in currencies relatable to local industry members.

The Sub-Group indicated that TIB fishers are eager to undertake local reporting and to take responsibility for local management. As such, the Sub-Group sought to operationalise these indicators in a decision framework to provide a defensible basis on which to make recommendations for cluster catch allocations and for other local management measures.

Under the proposed harvest strategy, clusters of communities would be responsible for monitoring key species and species groups, which could in future inform local allocations of a regional total allowable catch. The framework presented here provides a bottom-up means to diagnose the status of bêche-de-mer stocks locally, and thus provide a transparent, replicable and defensible basis by which to seek local allocations, and/or to adjust management at a local level.

Industry representatives in the Sub-Group felt that such a framework provided a formal means to assimilate their local knowledge, and drew an analogy to a doctor considering a range of symptoms in combination to form a diagnosis, and then responding with an appropriate level of severity.

Such an approach could empower stakeholders through operationalising their local knowledge and providing a vehicle for determining allocation and for responding to local conditions and changes. If the approach is broadly embraced, and is deemed to work well, there is scope for the indicators to become considered in the higher level determination of the TAC and/or for this to influence a regional TAC.

Within the draft hierarchical decision tree framework considered two groups of local indicators: “primary” local indicators (those felt to be most reliable/important, and thus invoking the greatest change in management), and “secondary” local indicators (used to make further, more minor adjustments to management recommendations) (noting that the use of “primary” and “secondary” here is specific to the local decision tree context, and does not equate to the use of these terms in the main document (per Figure 1). An example of a hierarchical decision tree may be found in Prince et al. (2011).

For the draft decision framework presented, the delineation of local indicators as “primary” or “secondary” was somewhat arbitrary; this would require further discussion prior to these being finalised.

Table A3.1 summarises the list of local indicators determined by Sub-Group 3. For ease of use in a decision tree context, these indicators are summarised into 6 groups of broad performance measures. Performance measures can be considered as “diagnostics” in terms of assigning where the indicator sits relative to a target or limit reference point.

A first draft ‘straw man’ decision tree is presented in Table A3.2. This takes two sets of “primary” indicators (each with two possible alternative performance measure categories), and, according to the 4 corresponding combinations of performance measures, assigns an initial strength of response (increase, status quo, or decrease) in terms of a catch adjustment. The 16 possible combinations of the 4 "secondary" sets of performance indicators (each with two possible alternative performance measure categories, highlighted by red or green coloured text in Table A3.2) were then used to further weight the strength of the proposed catch adjustment, such that there were 7 possible levels of response: strong increase in catch, moderate increase in catch, small increase in catch, maintain status quo, small decrease in catch, moderate decrease in catch, and fishery closure.

Note that the exact magnitude of these catch adjustments was not specified, and indeed, that the strength of responses could instead equate to (for example), spatial measures in combination with catch adjustments.

The distribution of the strength of management responses was such that the majority of indicator combinations resulted in a status quo response of no change, while a "strongest increase" or "closure" response occurred with the least frequency.

Some of the combinations of secondary performance measures were deemed to be unrealistic (not sensible) or unlikely/unusual, with no strength of management response assigned to the former. In total, there were 64 combinations of primary and secondary performance measures.

Erub and Ugar representatives proposed initial target levels of local annual catch for curryfish, black teatfish (when open), prickly redfish, and white teatfish.

References:

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Table A3.1 Proposed local indicators, provisionally assigned as “primary” or “secondary”, and combined into 6 performance measures.

			"Diagnosis" (performance measure)
Primary indicators	Catch		At/above or below target
		Temperature	Favourable or not
	Environmental conditions favourable or not, in terms of	Condition of feeding grounds (algae etc.)	
		Predators	
Secondary indicators	Density, estimated by	Diver camera surveys	At/above or below target
		By habitat type (sand, algae, seagrass)	
	Size composition		recruitment and spawning potential
	Distance travelled to fish		localised depletion
	Catch-per-unit-effort	Tubs per day OR kg/day, fuel cost/day	
	Condition index of animals		animals under external stress
	Surveys of dead individuals on beach		
	Perceived extent of illegal fishing		
	Recovery time of hotspots		

Table A3.2 Initial draft of a proposed decision tree framework to assist with assessing bêche de mer stocks at a local scale, and to provide a defensible basis on which to make recommendations for cluster catch allocations and for other local management measures.

PRIMARY INDICATORS		PRIMARY (largest) ADJUSTMENT (to catch)	SECONDARY (smaller) ADJUSTMENT (to catch, and/or spatial/temporal)	SECONDARY INDICATORS				
Catch at or above target	Environmental conditions favourable (2-3 indicators okay)	INCREASE IN CATCH		Density at or above target	No concerns about recruits or spawners	no localised depletion	no external stress	
				Density at or above target	No concerns about recruits or spawners	no localised depletion	external stressors (1 or more indicators)	
				Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
				Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	Not sensible to see acceptable density if localised depletion
				Density at or above target	Poor recruitment OR low spawner potential	no localised depletion	no external stress	
				Density at or above target	Poor recruitment OR low spawner potential	no localised depletion	external stressors (1 or more indicators)	
				Density at or above target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
				Density at or above target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	Not sensible to see acceptable density if localised depletion
				Density below target	No concerns about recruits or spawners	no localised depletion	no external stress	Would be unusual to have low density but no localised depletion
				Density below target	No concerns about recruits or spawners	no localised depletion	external stressors (1 or more indicators)	Would be unusual to have low density but no localised depletion
				Density below target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	no external stress	
				Density below target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	
				Density below target	Poor recruitment OR low spawner potential	no localised depletion	no external stress	Would be unusual to have low density but no localised depletion
				Density below target	Poor recruitment OR low spawner potential	no localised depletion	external stressors (1 or more indicators)	Would be unusual to have low density but no localised depletion
				Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	
				Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	

Catch at or above target	Environmental conditions unfavourable (only 1, or zero indicators okay)	STATUS QUO		Density at or above target	No concerns about recruits or spawners	no localised depletion	no external stress	
				Density at or above target	No concerns about recruits or spawners	no localised depletion	external stressors (1 or more indicators)	
				Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
				Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	Not sensible to see acceptable density if localised depletion
				Density at or above target	Poor recruitment OR low spawner potential	no localised depletion	no external stress	
				Density at or above target	Poor recruitment OR low spawner potential	no localised depletion	external stressors (1 or more indicators)	
				Density at or above target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
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				Density below target	Poor recruitment OR low spawner potential	no localised depletion	no external stress	Would be unusual to have low density but no localised depletion
				Density below target	Poor recruitment OR low spawner potential	no localised depletion	external stressors (1 or more indicators)	Would be unusual to have low density but no localised depletion
				Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	
				Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	

Catch below target	Environmental conditions favourable (all 3 indicators okay)	STATUS QUO		Density at or above target	No concerns about recruits or spawners	no localised depletion	no external stress	
				Density at or above target	No concerns about recruits or spawners	no localised depletion	external stressors (1 or more indicators)	
				Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
				Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	Not sensible to see acceptable density if localised depletion
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				Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	
				Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	

Catch below target	Environmental conditions unfavourable (only 1, or zero indicators okay)	DECREASE IN CATCH	Density at or above target	No concerns about recruits or spawners	no localised depletion	no external stress	
			Density at or above target	No concerns about recruits or spawners	no localised depletion	external stressors (1 or more indicators)	
			Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
			Density at or above target	No concerns about recruits or spawners	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	Not sensible to see acceptable density if localised depletion
			Density at or above target	Poor recruitment OR low spawner potential	no localised depletion	no external stress	
			Density at or above target	Poor recruitment OR low spawner potential	no localised depletion	external stressors (1 or more indicators)	
			Density at or above target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	Not sensible to see acceptable density if localised depletion
			Density at or above target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	Not sensible to see acceptable density if localised depletion
			Density below target	No concerns about recruits or spawners	no localised depletion	no external stress	Would be unusual to have low density but no localised depletion
			Density below target	No concerns about recruits or spawners	no localised depletion	external stressors (1 or more indicators)	Would be unusual to have low density but no localised depletion
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			Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	no external stress	
			Density below target	Poor recruitment OR low spawner potential	localised depletion (1 or both indicators)	external stressors (1 or more indicators)	

Appendix 4 – Revised size limit information

Common name	Species	Maximum length cm	Size maturity cm Australia	Size maturity cm Other *countries	Size maturity Unknown country	Size TS	Proposed size TS*	Size EC	TAC TS t	*Countries
Sandfish	*Holothuria scabra*	*32*	*16.8, 25[7], 20-23[6], 16.9[11], 19.9[6], 17.7[11], 15[13]*	*16[2], 13.6[6/1], 19.9[6/1], 14[6/1], 21[6/2], 21.3[6/2], 21[7/1], 25[7/2], 16[7/3]*	*15[10#]*	*18*	*20 (2,3)*	*20*	*No take*	*New Caledonia[2,7/3] Papua New Guinea[6/1] India[6/2,7/2] Mauritius[7/1] [#]QDI&F report*
Surf Redfish	*Actintopyga mauritiana*	*38*		*22[2], 23[12]*	*23[7],22[10#]*	22	*25 (1,2)*	*25*	*Part of 80t limit*	*New Caledonia[2] Africa, Indian Ocean[12] [#]QDI&F report*
Black Teatfish	*Holothuria whitmaei*	*30*		*26[2], 22.7[9], 23[12]*	*26[10#]*	*25*	*30 (1,2)*	*30*	*No take*	*New Caledonia[2,9] Africa, Indian Ocean[12] [#]QDI&F report*
White Teatfish	*Holothuria fuscogilva*	*55*		*32[2], 32.4[9]*	*32.4[10#]*	*32*	*40 (1,2)*	*40*	*15*	*New Caledonia[2,9] [#]QDI&F report*
Prickly Redfish	*Thelenota ananas*	*70*		*30[2], 30[9]*	*34.5[10#]*	*30*	*50 (1,2)*	*50*	*20*	*New Caledonia[2,9]*
Hairy Blackfish	*Actinopyga miliaris*	*35*			*12[10#]*	*22*	*(leave)*	*20*	*Part of 80t limit*	
Deepwater Redfish	*Actinopyga echinites*	*35*		*12[2], 9.3[11]*	*12[7], 12[10#]*	*12*	*20 (2,3)*	*20*	*Part of 80t limit*	*New Caledonia[2] Réunion Is, Indian Ocean[7]*
Burrowing Blackfish	*Actinopyga spinea*	*40*	-			*22*	*(leave)*	*20*	*Part of 80t limit*	
Deepwater Blackfish	*Actinopyga palauensis*	*35*	-			*22*	*(leave)*	*20*	*Part of 80t limit*	
Golden Sandfish	*Holothuria lessoni*	*46*	*22[6]*	*22[2]*		*18*	*25 (2)*	*15*	*Part of 80t limit*	*New Caledonia[2]*

Proposed size limit Torres Strait: 1= Better align with East Coast BDM fishery 2= Too small relative to age at maturity3= Based on model recommendation

Common name	Species	Maximum length cm	Size at maturity cm Australia	Size maturity cm *Other countries	Size maturity cm Unknown country	Size TS	Proposed size TS*	Size EC	TAC TS t	*Country
Curryfish (common)	*Stichopus herrmanni*	*55*		*27[2], 31[7]*	*31[12], 27[10#]*	27	*35(1, 2)*	*35*	*Part of 80t limit*	*New Caledonia[2]* *Réunion Is, Indian Ocean[7]* *#QDI&F report*
Elephants Trunkfish	*Holothuria fuscopunctata*	*66*		*35[2]*	*35[10#]*	24	*40 (1,2)*	*40*	*Part of 80t limit*	*New Caledonia[2]* *#QDI&F report*
Lollyfish	*Holothuria atra*	*65*		*16[4], 16.5[2], 15.2[4], 19[1], 14.8[11], 14.8[11]*	*12[10#]*	*15*	*20 (1,2)*	*20*	*Part of 80t limit*	*New Caledonia[2]* *Fiji[1]* *Sri Lanka[4]* *Réunion Is, Indian Ocean[7]* *#QDI&F report*
Curryfish (*vastus*)	*Stichopus vastus*	*35*	-			*nil*	*5t trigger* *15 (1)*	*15*	*Part of 80t limit*	
Brown Sandfish	*Bohadschia vitiensis*	*40*		*26.1[8], 24.5[8]*	*15[10#]*	*nil*	*25 (1) or 30(1,2)*	*25*	*Part of 80t limit*	*Hurghada, Red Sea, Egypt[8]* *#QDI&F report*
Leopardfish	*Bohadschia argus*	*60*			*30[10#]*	*nil*	*35 (1)*	*35*	*Part of 80t limit*	*#QDI&F report*
Greenfish	*Stichopus chloronatus*	*38*			*14[10#]*	*nil*	*20 (1)*	*20*	*Part of 80t limit*	*#QDI&F report*
Stonefish	*Actinopyga lecanora*	*24*	-			*nil*	*15 (1)*	*15*	*Part of 80t limit*	

Proposed size limit Torres Strait: 1= Better align with East Coast BDM fishery 2= Too small relative to age at maturity3= Based on model recommendation

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Appendix 5 – Sea cucumber Spawning Information

Common name	Species	Spawning time	Country
Sandfish	*Holothuria scabra*	*October to January**	*Australia**
		March to May, November to December	*India*
		December, January, August, September	*New Caledonia*
		November to December	*Papua New Guinea*
Surf Redfish	*Actintopyga mauritiana*	*June to April*	*Guam*
		December, January	*New Caledonia*
Black Teatfish	*Holothuria whitmaei*	*June, July*	*New Caledonia*
		April	*Aldabra, Seychelles*
		*December**	*GBR, Australia**
White Teatfish	*Holothuria fuscogilva*	*Part of November, December, January*	*New Caledonia*
Prickly Redfish	*Thelenota ananas*	*January, February, March*	*New Caledonia*
		*December**	*John Brewer Reef, GBR, Australia**
Hairy Blackfish	*Actinopyga miliaris*	*July (new moon)*	*Japan*
		May, November to December	*New Caledonia*
		*November**	*Orpheus Island, Australia**
Curryfish (common)	*Stichopus herrmanni*	*December, January*	*New Caledonia*
		June to July	*Straits of Malacca, Malaysia*
		*November, December, January**	*Little Broadhurst Reef, GBR, Australia**
Elephants Trunkfish	*Holothuria fuscopunctata*	*December, January, part of February*	*New Caledonia*
		*December**	*Lizard Island, Australia**
		*December**	*John Brewer, GBR, Australia**
Lollyfish	*Holothuria atra*	*November*	*Solomon Islands*
		August	*Peninsular Malaysia*
		*October**	*Davies Reef, GBR, Australia**
Deepwater Redfish	*Actinopyga echinites*	*January, February*	*New Caledonia*
Curryfish (*vastus*)	*Stichopus vastus*	-	-
Burrowing blackfish	*Actinopyga spinea*	-	-
Deepwater blackfish	*Actinopyga palauensis*	-	-
Golden sandfish	*Holothuria lessoni*	*November, December, January, part of February*	*New Caledonia*
		November	*New Caledonia*
Brown sandfish	*Bohadschia vitiensis*	*November, December*	*New Caledonia*
Leopardfish	*Bohadschia argus*	*October to January**	*GBR, Australia**

		*October , November, December, January**	*GBR, Australia**
Greenfish	*Stichopus chloronatus*	*April to June, December to February*	*Straits of Malacca, Malaysia*
		*November, January**	*Myrmidon Reef, Davies Reef, GBR, Australia**
Stonefish	*Actinopyga lecanora*	*July*	*Peninsular Malaysia*
		*December**	*GBR, Australia**

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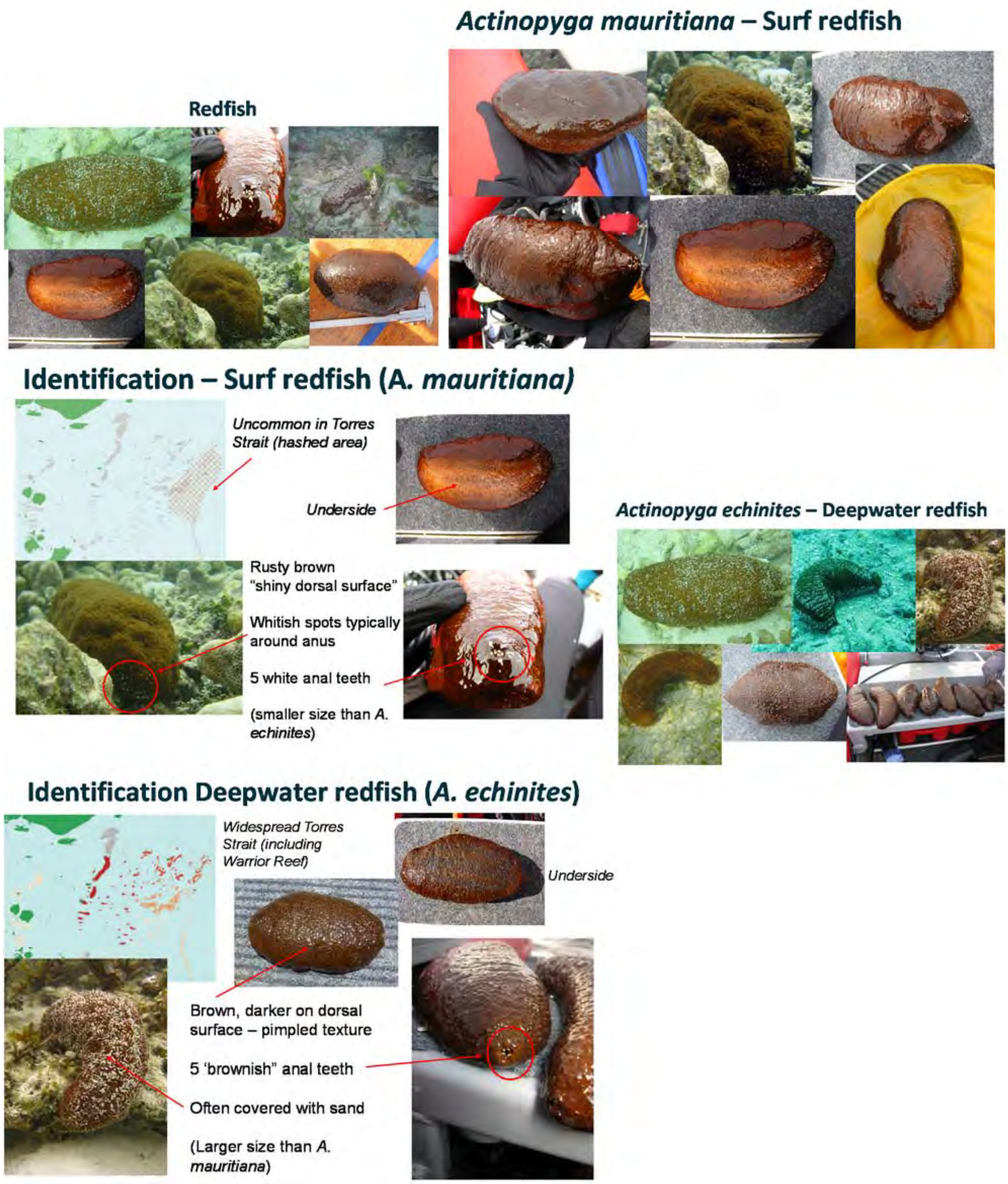
Appendix 6 - Species identification support materials

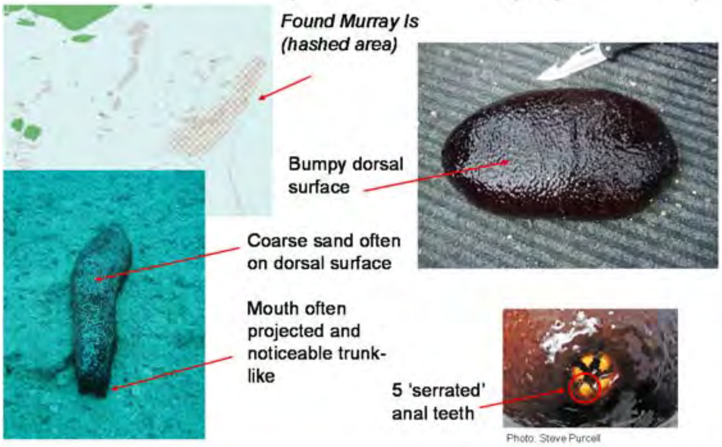


Blackfish

Identification – Hairy blackfish *(A. miliaris)*

Identification – Burrowing blackfish *(A. spinea)*

Identification – Deepwater blackfish *(A. palauensis)*



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Harvest Strategies for the Torres Strait Beche-de-mer (sea cucumber) fishery – Progress Report from October 2017 Workshop

AFMA project no. 2016/0823

Éva Plagányi, Nicole Murphy, Natalie Dowling

25-26 October 2017

Update to June 2017 Report

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1 Non-Technical Summary

Australia's Commonwealth Harvest Strategy Policy defines a harvest strategy 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. The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been the subject of some discussion at management forums (e.g. HCWG) and community meetings for some time. 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.

Research in consultation with stakeholders is underway to develop and ratify a single harvest strategy for the Torres Strait bêche-de-mer (TS BDM) 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 sea cucumbers in Torres Strait, and establishing first order harvest strategy approaches such as global fishery TACs, size limits and temporal closures. It will include clear 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.

This Report summarises progress made at a HCWG meeting and Harvest Strategy Workshop, Thursday Island, 25-26 October 2017, building on progress made at the previous workshop 27-29 June 2017. The draft harvest strategy framework, which is summarised in Figure 1, specifies the different types of monitoring that could contribute to this process, the types of data collected for use as indicators, the way in which these data contribute to first order and supplementary decision rules for adjusting TACs and implementing pre-specified management actions. The framework also includes a number of static controls such as size limits, spatial or seasonal closures and proposed processing restrictions that could be used as complementary management measures. The draft framework encapsulates the principles of a tier system whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible. The framework acknowledges that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order adjustments needed. Simultaneously the framework clearly maps pathways for ongoing improvements and refinements such as through further data collection as well as a clear role to contribute community-level data and local knowledge. In addition, consistent with the proposed fishery objectives, participants encouraged development of a management system that also included community-enforced or community-regulated local spatial or temporal exclusion bans where appropriate – for example the proposed 10 nm ban on fishing for prickly redfish around home reefs, with devolved responsibility to native title holders.

The next steps in the process are outlined and the next workshop will focus on filling in some of the more detailed specifications needed to operationalise the harvest strategy. The Harvest Strategy is in the process of being drafted with a further workshop planned to be held within 6 months. Broader industry representation and broader consultation would form part of the process. Any policy would ultimately need to be approved by the PZJA.

The success and progress made during the workshop was largely due to the collaborative and enthusiastic participation and inputs from all stakeholders, and the project team thanked everyone for their participation.

2 Introduction

The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been the subject of some discussion at management forums (e.g. HCWG) and community meetings for some time. 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.

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).

This report summarises progress made in developing a harvest strategy framework at a workshop held in conjunction with a Hand Collectable Working Group meeting, 27-29 June, as well as a second workshop 25-26 October 2017, Thursday Island, Torres Strait, to collaboratively progress the development of a harvest strategy. The workshop included relevant stakeholders in addition to the HCWG members. The CSIRO project team – Éva Plagányi and Nicole Murphy– supported by independent scientific expert Tim Skewes, facilitated discussions with participants in plenary and in small group discussions, and this report summarises some of the key discussion items.

2.1 Project Objectives

The project will develop and ratify a single harvest strategy for the Torres Strait bêche-de-mer (TS BDM) 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 sea cucumbers in Torres Strait, and establishing first order harvest strategy approaches such as global fishery TACs, size limits and temporal closures. It will include clear 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.

Initial discussions to provide an overview of harvest strategies, summarise biological and life history information on bêche de mer as well as results of previous studies, were held as part of a HCWG meeting on Thursday Island, 3 November 2016, under the following Agenda item:

Harvest strategy – getting information to inform the next steps

1.1. Overview of Commonwealth Harvest Strategy Policy
1.2. Environmental information relevant to understanding stocks status
1.3. Overview of previous management strategy evaluation work and examples of harvest strategy options
1.4. Industry fishing trends and objectives for the fishery
1.5. Work plan for Harvest Strategy

These discussions highlighted the need for improved data collection in particular, from both logbooks and a fish receiver system, with these data needed as inputs to inform on the status and trends in the fishery, and hence on appropriate management actions via decision rules that will form part of a harvest strategy. As the TS bêche de mer fishery is relatively data-poor, so-called data-poor harvest strategy approaches (Dowling et al. 2008) will be used, but with a minimum criterion of not using subjective qualitative information only (i.e. quantitative catch estimates are a minimum requirement) and with a transparent pathway for incorporating additional data as these become available (i.e., embracing an adaptive approach).

The objectives of the harvest strategy workshops were to expand on these discussions, collate information on all aspects of the fishery, potential monitoring and data gathering options, discuss the operational and socio-cultural feasibility of a range of alternative management controls that could be used, and integrate all available information into a harvest strategy framework. The workshops aimed to explore both static management controls such as size limits and spatial and temporal closures, as well as adaptive approaches, such as using fishery data as inputs to rules for adjusting TACs. The latter also necessitated discussion as to whether the current TAC allocations are appropriate for individual and lumped species groups, and a number of associated logistical aspects were tabled for discussion, such as the need to accurately identify and record information on individual species to inform management at a species-specific level for key species. The workshop also introduced examples of decision rules that could be used as part of a harvest strategy, and these are continuing to be refined with stakeholder input. Where relevant, the results of previous studies are being used to evaluate the effectiveness of proposed approaches.

Simulation models are increasingly being used to evaluate alternative management approaches or harvest control rules, to identify the potential for trade-offs among fisheries management objectives, using the approach of Management Strategy Evaluation (MSE) (Butterworth and Punt 1999; Dankel and Edwards 2016; Pascoe et al. 2016; Smith et al. 2007). MSE approaches can serve as formal risk assessment methods, given their focus on the identification and modelling of uncertainties as well as in balancing different representations of resource dynamics rules (Plagányi et al. 2013c; Rademeyer et al. 2007; Sainsbury et al. 2000). This includes consideration of the implications, for both the resource and its stakeholders, of alternative combinations of monitoring data, analytical procedures, and decision rules (Rademeyer et al. 2007; Sainsbury et al. 2000; Smith et al. 2007). By identifying and evaluating trade-offs in performance across a range of management objectives, it provides indicators on whether different objectives can be reconciled and whether the outcomes are robust to inherent uncertainties in the inputs and assumptions on which decisions are based (Cooke 1999).

Management Strategy Evaluation (MSE) has been used to evaluate management procedures for several bêche de mer fisheries in Australia (Plagányi et al. 2011; Plaganyi et al. 2015; Plagányi et al. 2013a) and these studies will be used to inform the current study. There are also a considerable number of surveys and other biological studies (Long et al. 1996; Skewes et al. 2000; Skewes et al. 2002; Skewes et al. 2010) conducted in Torres Strait which are being used to inform aspects of harvest strategy development. Finally, harvest strategies are also under development for other Torres Strait fisheries, namely finfish and the more data-rich tropical rock lobster fishery, and lessons learnt from these applications are also being used to inform development of harvest strategies for the Torres Strait bêche de mer fishery.

3 Progress on Harvest Strategy Development

3.1 Specify Management Objectives:

The Protected Zone Joint Authority (PZJA) is responsible for management of commercial and traditional fishing in the Australian area of the Torres Strait. The PZJA objectives adopted for the Torres Strait Bêche-de-mer Fishery are:

- to provide for the sustainable use of all bêche-de-mer stocks in Torres Strait;
- to develop bêche-de-mer stocks for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty); and
- to develop an appropriate long term management strategy for sandfish.

The workshop discussed modifying and extending these objectives to include mention of overarching objectives for the Torres Strait Bêche-de-mer Fishery such as to acknowledge, empower and operationalise Native Title Rights and customary and traditional laws including Malo's law of other communities. This also includes acknowledging and incorporating local knowledge and the ability to locally manage resources. The operational objectives include the following:

- to provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;
- to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;
- to acknowledge area-specific issues;
- where possible, to consider an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and
- to develop long-term recovery strategies for species, where appropriate.

Changes to the above were discussed at the October 2017 workshop and the revised draft for consideration by stakeholders is as follows:

- To acknowledge, empower and operationalise Native Title Rights and customary and traditional laws including Malo's law of other communities. This also includes acknowledging and incorporating local knowledge and the ability to locally manage resources. The operational objectives include the following:
- to provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;
- to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;
- to acknowledge area-specific issues;
- where possible, to consider an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and
- to develop long-term recovery strategies for species, where appropriate.

3.2 Harvest Strategy Development

A harvest strategy for the Torres Strait bêche de mer fishery needs to apply to all bêche de mer species (Table 1) and set out the management actions necessary to achieve the objectives outlined above. It will be a formal framework for guiding the overall management of a fishery rather than dictating day-to-day fishing activities or decisions. Hence there are pre-agreed transparent set of rules for making tactical management decisions including specifications for:

(i) a monitoring program

(ii) the indicators to be calculated from monitoring data (usually via a stock assessment but this can be a relatively simple assessment for fisheries with limited data)
(iii) the use of those indicators and their associated reference points in management decisions, through application of decision (or control) rules.

The process currently underway to develop a Harvest Strategy for the Torres Strait bêche de mer fishery in consultation with stakeholders is following the steps outlined in Dowling et al. (2015):

1. Compile and review information
2. Identify possible indicators e.g. changes in catch composition, triggers pertaining to spatial changes (eg. % of area fished), CPUE for species, species –specific catch trigger values for high risk/vulnerable and key species, total catch triggers
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

The progress made at the two workshops to develop a harvest strategy is summarised in the next section, which encompasses feedback from workshop participants on all aspects. More detailed summaries of the three small group brainstorming sessions during June 2017 are provided in Appendices 1-3 of the previous (June 2017) workshop report. Summaries of the small group discussions at the October 2017 workshop are provided in Appendix 2. Additional broader considerations are also summarised and the final section summarises progress against pre-specified workshop action items designed to capture all relevant information as a basis for developing a harvest strategy.

Table 1. Summary of key bêche de mer species in Torres Strait, together with their minimum size limit and Total Allowable Catch (TAC) in tonnes (from (Murphy et al. 2014))

Common name	Scientific name	Commercial value	Minimum size limit (mm)	TAC (t)
Sandfish	*Holothuria scabra*	High	180	Closed
Surf redfish	*Actintopyga mauritiana*	Medium	220	Closed
Black teatfish	*Holothuria whitmaei*	High	250	Closed[#]
White teatfish	*Holothuria fuscogilva*	High	320	15[$]
Prickly redfish	*Thelenota ananas*	High	300	20
Hairy blackfish	*Actinopyga miliaris*	Medium	220	Part of 80t limit
Curryfish common	*Stichopus herrmanni*	Medium	270	Part of 80t limit
Elephant trunkfish	*Holothuria fuscopunctata*	Low	240	Part of 80t limit
Lollyfish	*Holothuria atra*	Low	150	Part of 80t limit
Deepwater redfish	*Actintopyga echinites*	Medium	120	Part of 80t limit
Curryfish vastus	*Stichopus vastus*	Medium	270	Part of 80t limit
Burrowing blackfish	*Actinopyga spinea*	Medium	220	Part of 80t limit
Deepwater blackfish	*Actinopyga palauensis*	Medium	220	Part of 80t limit
Golden sandfish	*Holothuria lessoni*	High	180	Part of 80t limit
Brown sandfish	*Bohadschia vitiensis*	Medium	nil	Part of 80t limit
Leopardfish	*Bohadschia argus*	Medium	nil	Part of 80t limit
Greenfish	*Stichopus chloronotus*	Medium	nil	Part of 80t limit
Stonefish	*Actinopyga lecanora*	Medium	nil	Part of 80t limit

***Size limits off PZ JA website –** http://pzja.gov.au/the-fisheries/torres-strait-beche-de-mer-fishery/

[#]WG agreed Black teatfish has had some trial re-openings already but that it will not be re-opened again until the compulsory catch reporting is in place.

[$] WG discussed considerations for proposed allowance for hookah to use on White teatfish

4 Draft TS BDM Harvest Strategy Framework

A Harvest Strategy needs to include the following components (Dowling et al. 2015):

(1) Indicators (data from the fishery; Docket books & Logbooks)
(2) Reference points (targets and limits, and/or intermediate triggers; Stock biomass, Fishing mortality)
(3) Monitoring (agreed protocols to obtain data; Population surveys, Size/age monitoring)
(4) Method of assessment (Stock assessment, Catch per Unit of Effort (CPUE) trends, Species composition changes)
(5) Decision rules (agreed rules for setting catch levels; called Harvest Control Rules)

The schematic in Figure 1 was developed based on inputs from participants at the June 2017 workshop, and shows the connections between the different components which collectively constitute the harvest strategy. A description of the individual components is provided below.

In addition, the draft framework encapsulates the principles of a tier system whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible. The framework overall structure is shown in Fig. 2. and acknowledges that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order adjustments needed. Simultaneously the framework clearly maps pathways for ongoing improvements and refinements such as through further data collection as well as a clear role to contribute community-level data and local knowledge.

4.1 Monitoring and data collection to determine indicators

The draft framework encapsulates the principles of a tier system (see also Fig. 5) whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible. Hence as per the framework in Figure 1, participants agreed that:

(1) If there are no data (red shading = lowest tier) provided for the BDM fishery (species-specific or for a group) then no quota should be allocated. There was also strong support for the right of a TIB license holder to have access to the resources to be contingent on the provision of data.

(2) Next, the basic data, (together with monitoring methods) that need to be collected for use as primary indicators are shown in light green shading: the most critical data are total catch per species as well as CPUE (Catch Per Unit Effort) (which could be measured as total catch per species per day or similar measures such as the number of tubs per day). If data are accurately recorded in logbooks, then other useful indicators can be derived, such as the spatial footprint of the fishery (eg. whether the area fished or depth fished is expanding, species composition and discard mortality). Representative (species-specific) size frequencies from samples of catches were identified as another useful primary indicator. For

species subgroups where it might be difficult to accurately record the composition of the catch, participants suggested that other methods could be used, such as photo samples of catches to be analysed by experts.

(3) The next step up in the tier system would be to use scientific or community-based surveys (dark green shading = top tier) to provide fishery-independent data (eg biomass surveys) for use as an indicator of relative abundance and density of key species.

(4) Finally, there is considerable potential for local community collection of additional data (turquoise) which could be used as secondary indicators. A draft community-level multiple indicator framework was developed at the June 2017 workshop (see Appendix 3 of the June report for fuller description) based on local knowledge and provides a platform for establishing and implementing a spatial multiple indicator status categorisation and corresponding colour-coded strength of adjustment. As local depletion is a concern for bêche de mer fisheries, this community-based monitoring and feedback system could improve sustainable management of stocks in community clusters and thereby empower local recommendations from communities as well as facilitate self-organisation of allocations amongst community clusters. Over time, demonstrated success in implementation could see these indicators being upgraded to primary indicators for use in decision rules.

The framework therefore acknowledges that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order adjustments needed. Simultaneously the framework clearly maps pathways for ongoing improvements and refinements such as through further data collection as well as a clear role to contribute community-level data and local knowledge. In addition, consistent with the proposed fishery objectives, participants encouraged development of a management system that also included community-enforced or community-regulated local spatial or temporal exclusion bans where appropriate – for example the proposed 10 nm ban on fishing for prickly redfish around home reefs, with devolved responsibility to native title holders.

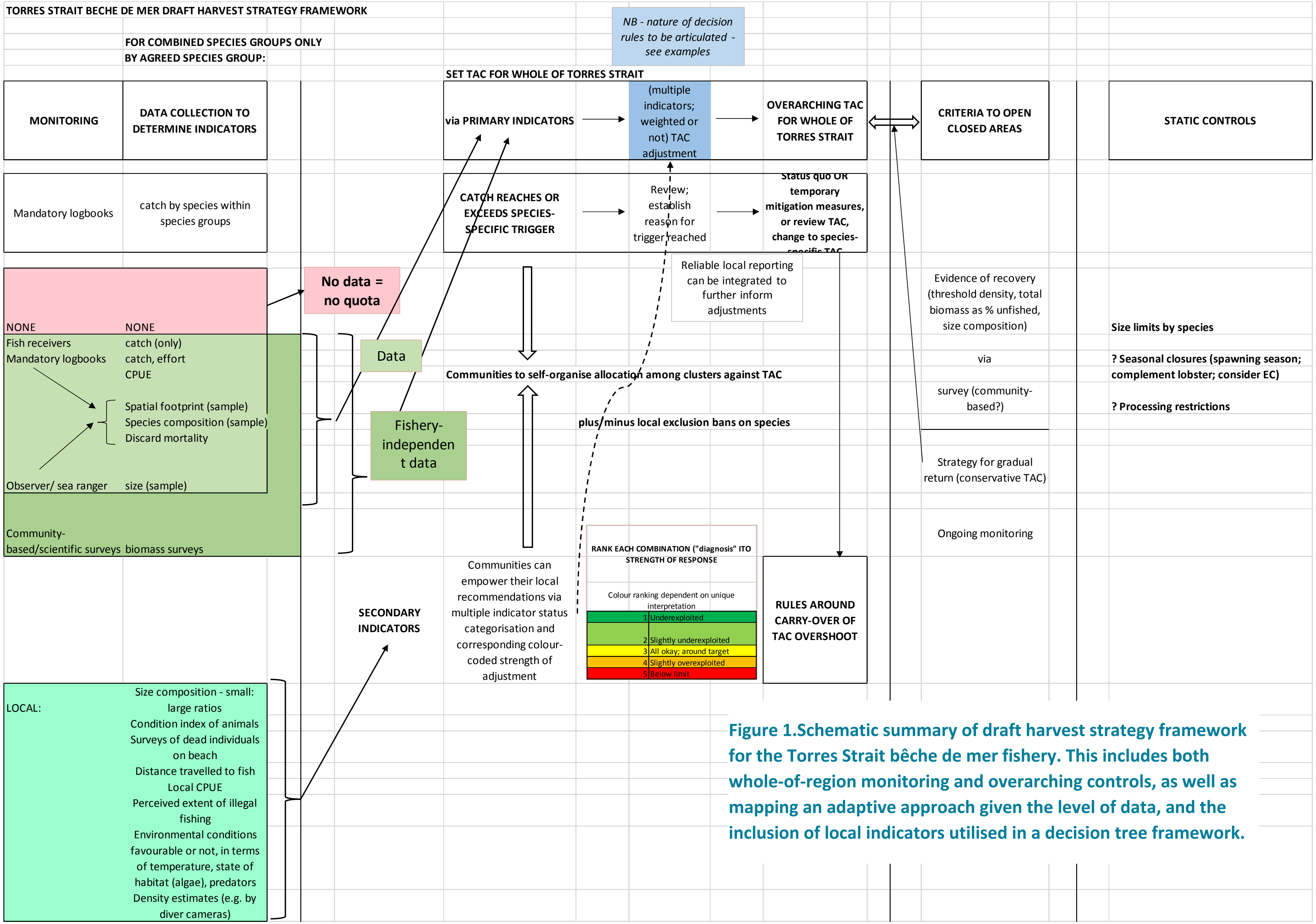


Figure 1.Schematic summary of draft harvest strategy framework for the Torres Strait bêche de mer fishery. This includes both whole-of-region monitoring and overarching controls, as well as mapping an adaptive approach given the level of data, and the inclusion of local indicators utilised in a decision tree framework.

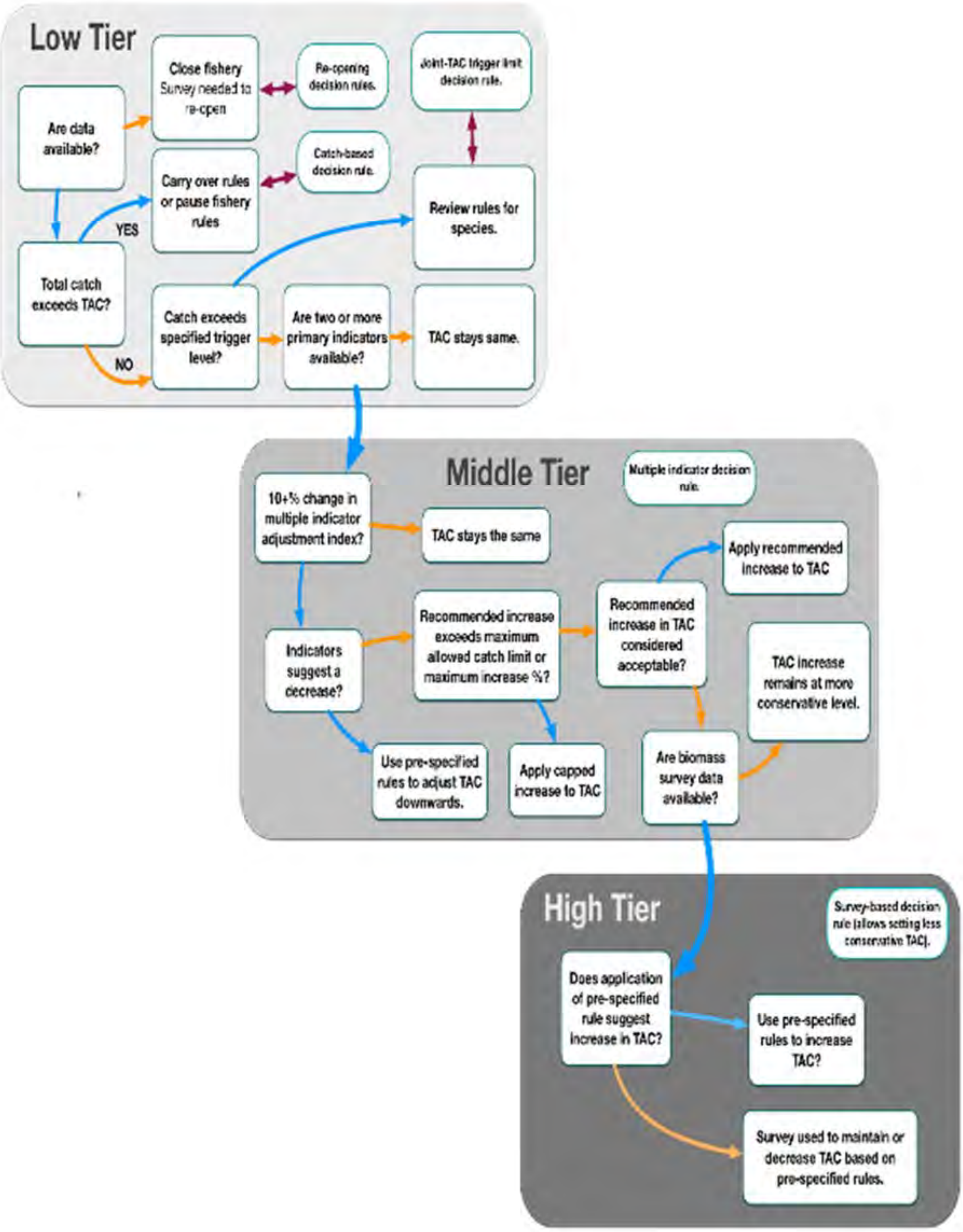


Figure 2. Schematic summary of draft harvest strategy rules and framework being developed for Torres Strait bêche de mer

4.2 Reference points, Method of Assessment and Decision Rules

The above process is intended to provide data that can be used as indicators to inform on the status of each species. Whether or not the status is considered good, bad or average for example, depends on comparison with some agreed Reference Points – for example if total catch exceeds a pre-specified limit or CPUE is below a pre-specified limit reference level then it may mean that species is being fished too heavily. An assessment process is therefore needed to assess the current status and trends in the biomass of each species. A decision rule is then used to describe what action is needed to adjust catches to achieve desired targets and satisfy the overall fishery objectives. Decision rules could be hierarchical or based on multiple indicators, which may be weighted or not.

The choice of reference points, assessment method and decision rules have not yet been finalised but are under development as part of the current project, and will be reviewed in an iterative fashion with stakeholders. It was noted at the workshop that there are a number of existing approaches which would be suitable for adoption in this fishery. Below we first summarise the basis and justification for selecting different decision rules under different circumstances.

4.2.1 Example decision rules for species-specific recommended biological catches

Two examples of decision rules discussed at the workshop are as listed below. The first includes an example as to how to accommodate rules around the carry-over of a TAC overshoot as proposed by some stakeholders, as well as imposing increasingly stringent penalties where total catch exceeds the recommended biological catch.

(I) Catch-Based Decision Rule (see also Figure 3)

- Hierarchical: First Apply Catch Decision Rule (operational fishery):
    - If no data then TAC = 0
    - If exceed by >5% and <20% then carry over catch and subtract from following year's total
    - if exceed by >20% and <50% then pause fishing on that species following year
    - If exceed by >50% and <100% (double) pause fishing 2 years
    - If exceed by more than double, close fishery 4 years

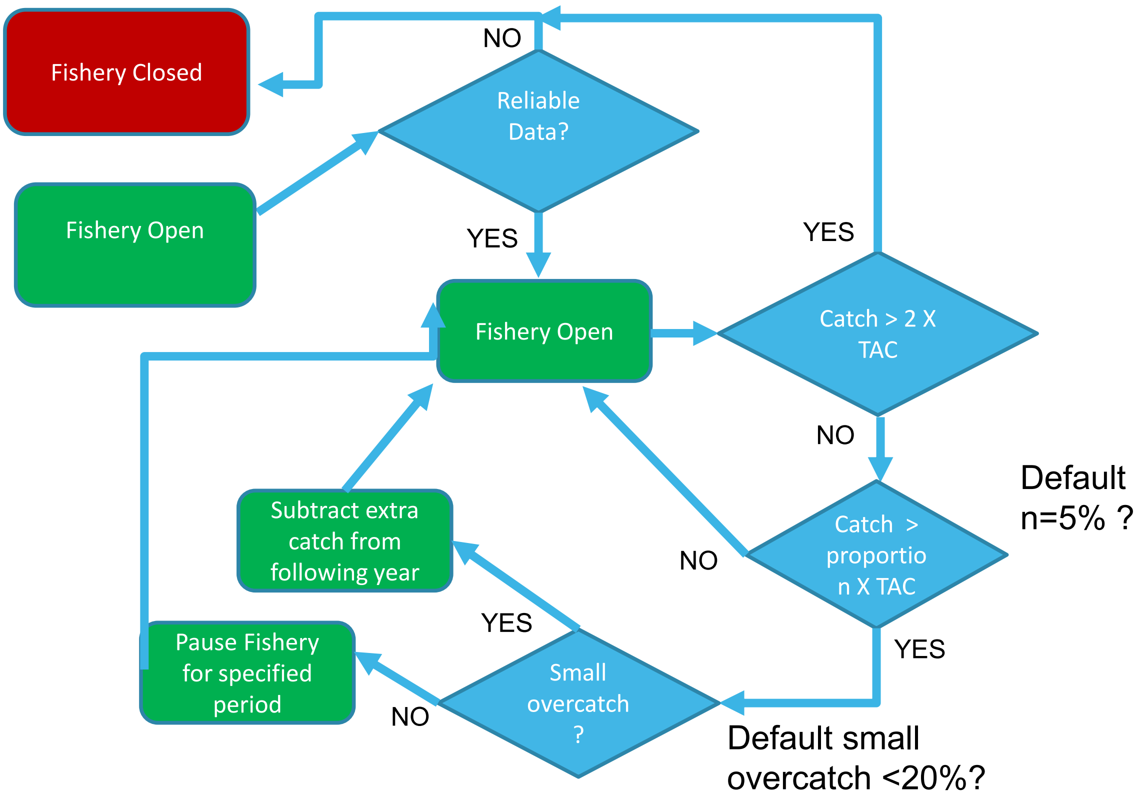


Figure 3. Flowchart summarising illustrative decision rule based on catch

(II) Rule using survey or CPUE to adjust catches

- If Average (3 yr) Catch between 80% and total TAC, use index of abundance (eg CPUE or survey) to adjust:
  - TAC = (1+b*slope)*C_{CUR} and maximum increase pre-specified
- where CCUR is average catch over the past three years, and includes landings plus discards; "slope" is the slope in the trend in standardised CPUE (or other relevant indicator) over the past 3 years (Smith and Smith 2005; Smith et al. 2008)
- Parameter *b* differs based on how reliable data are (eg survey allows bigger catch change)
  - Develop rules to include/augment with other available indicators – size information, effort, spatial footprint of fishery, species composition of catch

Draft Decision Rule using (A) survey or (B) multiple indicators (eg CPUE, size composition, spatial footprint) to adjust catches

(A) Survey

- If Average (3 yr) Catch between 80% and total TAC, use index of abundance (survey) to adjust:
  - TAC = (1+b*slope)*C_{CUR} and maximum increase pre-specified
- where C_{CUR} is average catch over the past three years, and includes landings plus discards;

- "slope" is the slope in the trend in standardised biomass survey index (or other relevant indicator) over the past 3 years for which data are available
- Parameter *b* differs based on how reliable data are (eg survey extent, intensity and standard error)

Settings:

If excellent survey data available, set ***b* = 1**

If survey less comprehensive and lag since last survey, set ***b* = 0.8**

Lower *b* adjusts for data being less reliable

Slope:

If slope is positive it suggests resource is increasing and TAC can be increased

Conversely, if slope is negative, it suggests resource is decreasing and TAC should be decreased

If slope is large positive ie fast increase, may need to cap (limit) maximum increase in TAC allowed for fixed period (which could be 1, 2 or 3 years)

Is there a preference for also setting a lower cap to control how much the TAC should be decreased if the trend is decreasing?

Example presented during the workshop:

Example - increasing resource:

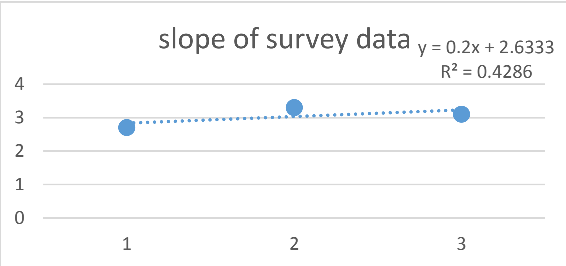
	2013	2014	2015	2016		Average last 3 yrs	slope
Catch	10	15	25	32		24	
Survey Index	2	2.7	3.3	3.1		3.03	0.2
Case with b=							
0.8	TAC = **(1+0.8*0.2)*24**			b*slope=	0.16		
TAC	27.84						
if b=1	28.8						

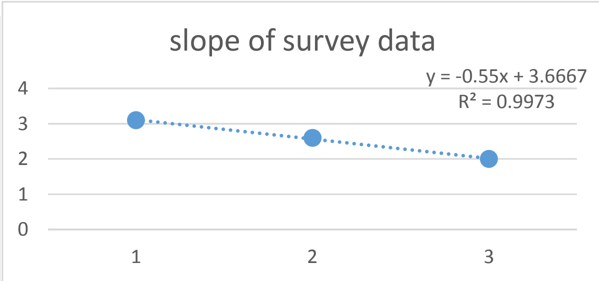
Example - decreasing resource:

	2013	2014	2015	2016		Average last 3 yrs	slope
Catch	20	29	25	32		28.7	
Survey Index	2	3.1	2.6	2		2.57	-0.55
Case with b=							

0.8	TAC = **(1+0.8*(-0.55))*28.7**	b*slope=	-0.44
TAC	16.1		
if b=1	12.9		

Increasing vs decreasing trend based on indicators





<u>Example - increasing resource - apply cap:</u>

<u>If b=1 cap=25% thus if b=0.8 cap=20% maximum increase per year</u>

	2013	2014	2015	2016	Average last 3 yrs	slope
Catch	10	15	25	32	24	
Survey Index	2	2.5	3.3	3.8	3.20	0.65
Case with b=						

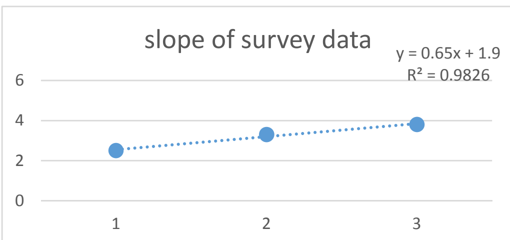
0.8	TAC = **(1+0.8*0.65)*24**	b*slope=	0.52
TAC	36.48		

But maximum increase capped at 20%, hence revise calculation:

TAC	28.8
if b=1	39.6
with cap	30

Very strongly increasing trend based on indicators

(B) **Multiple indicators (eg CPUE, size composition, spatial footprint) to adjust catches**



CPUE has not been demonstrated to be a reliable indicator on its own, but as more data are collected, the value of CPUE data as an index of abundance will increase, especially if used in combination with other indicators such as changes in average size of animals caught, catch composition and spatial footprint. Decision rules using a combination of these indicators were discussed at the workshop, but noting that decision rules of this form have not been tested using MSE (Management Strategy Evaluation) for Torres Strait.

If the catch of a species is declining and there are concerns that current catch levels are not sustainable, then (in the absence of survey data), the Method below could be used to adjust the TAC.

Conversely, if there is interest in increasing the catch of a species, then the following Method could be used to obtain a recommended increase, but this can only be considered for species for which the current TAC does not exceed an upper specified limit (based on surveys and other analyses).

If no survey data are available, then decisions to increase or decrease the TAC could be made based on a Recommended Biological Catch (RBC) calculated using 2 or more of the following primary indicators, where the weights assigned to each indicator are denoted w_1, w_2, w_3, w_4 for respective indicators CPUE, average Size, spatial footprint (Area) and changes in catch composition :

Multiple indicator adjustment:

$A = w_1 \times \text{CPUE} + w_2 \times \text{Size} + w_3 \times \text{Area} + w_4 \times \text{Catch proportion}$

The default weights are set at 0.25 (i.e. equal weighting), but renormalised if any of the indicators are missing and have associated zero weight.

The overall recommended adjustment in the RBC is computed by scaling the average of the adjustment factors by the average (3 yr) Catch, but with the constraints that the adjustment proportion not exceed the pre-specified cap A_{cap} and A<maximum increase permitted (MAX_{sp}):

$$RBC = \min(A, A_{cap}) \times C_{CUR} \qquad RBC \le MAX_{sp}$$
$$RBC = TAC \qquad \min(A, A_{cap}) \times C_{CUR} > MAX_{sp}$$

Individual indicator adjustment factors are computed as follows:

(i) CPUE (based on recent trend in CPUE)

$$I_{CPUE} = 1 + c_1 \times slope_{CPUE}$$

- Where "slope" is the slope in the trend in (standardised if available) CPUE index over the past 3 years for which data are available
- Parameter c_1 accounts for how reliable data are, with guidance provided on default settings

(ii) Average Size (based on recent average size relative to historic average)

$$I_{size} = 1 + c_2 \left(\frac{\sum_{y-2}^{y} s_y \big/ 3 - \overline{s}}{\overline{s}} \right)$$

- Where *s* is the average annual size of animals from a catch sample, with the average computed over the past 3 years and compared with the historical average size of caught animals $\overline{s}$
- Parameter c_2 accounts for how reliable data are (eg is the size sample representative), with guidance provided on default settings

(iii) Percentage of areas fished (based on recent average area fished relative to historic average)

$$I_{area} = 1 + c_3 \left(\frac{\overline{a}}{a} \right)$$

- Where *a* is the proportion of areas fished relative to the historical average proportion of area fished – note that an expansion of the area fished is assumed to indicate a decline in stock status (eg due to local depletion)
- Parameter c_3 accounts for how reliable data are (eg are there spatial references in the logbook used to compute the change in spatial footprint), with guidance provided on default settings

(iv) Catch proportion (based on recent average catch proportion of species being considered, relative to total catch of all TS BDM species)

$$I_{prop} = 1 + c_4 \left(\frac{\sum_{y-2}^{y} p_y \big/ 3 - \overline{p}}{\overline{p}} \right)$$

- Where *p* is the average annual catch proportion (of the species being considered) from a catch sample, with the average computed over the past 3 years and compared with the historical average catch proportion $\overline{p}$
- Parameter c_4 accounts for how reliable data are (eg were representative catch samples used, data form logbooks), with guidance provided on default settings

4.2.2 Example decision rules for lumped species category

The workshop discussed some considerations related to basket TACs and current trigger levels as summarised below:

Basket TACs

Species	Trigger (t)
Deepwater redfish	5
Blackfish	5
Stonefish	5
Pinkfish	5
Elephant trunkfish	15
Leopardfish	40
Greenfish	40
Curryfish	**40**
Curryfish vastus	**8**
Lollyfish	80

Individual TAC? Conservative as a start but know can catch more (restricted distribution so need more intensive surveys)

- Target species so should have TAC
- That also means get more data
- Note misidentification with surf redfish

need individual TAC

- Include size limits for all species.

Workshop participants noted that changes in market value and demand mean that several additional species need to have specific TACs or triggers (with associated actions). These include curryfish, greenfish, hairy blackfish and deepwater redfish.

The draft framework in Figure 1 also accommodates combined species groups, for which triggers need to be specified such that when the catch of a particular species reaches or exceeds a trigger, the reasons need to be established and appropriate management action implemented (Figure 4). This could include specifying the need for additional data to monitor the expansion of a fishery for a species, a good example being the recent growth in fishing effort on curryfish due to improved processing methods and market opportunities. Discussion is still underway as part of this project as to which species that are currently included as part of a joint TAC, should have their own TAC. Workshop participants supported a separate TAC for curryfish given the growing interest and expansion of the fishery for these species. Although there are several curryfish species, the focus is predominantly on two species (*Stichopus hermanni* and *S. vastus*). A draft plan for determining an initial curryfish TAC and trigger level was developed as follows:

1. Compute TAC for each of these species based on same methods as previously and add together = Joint curryfish TAC
2. As vastus lower abundance (based on survey), set trigger = 2 x vastus-specific TAC calculation

3. If trigger reached, implement decision rules for case where trigger exceeded

It was noted at the last workshop that the current Joint TAC = 80t including curryfish, The following was discussed regarding setting a revised TAC excluding curryfish:

(1) Subtract 60t curryfish, so new joint TAC = 20t – but this doesn't account for curryfish not historically having been a target;

(2) could subtract curryfish proportional allocation (ca. 20%) from original basket TAC trigger (i.e. subtract 20t) so new basket TAC = 60t?

(3) Other?

In addition, a suggested method for computing individual catch limits for curryfish is as below:

Joint-TAC for Curryfish based on survey data

S. herrmannii	Curryfish common	75% relative biomass	45t
S. vastus	Curryfish vastus	25% relative biomass	15t
TOTAL	Curryfish		60t

Vastus proportion in Catch Trigger = 33% (2x vastus-specific limit)
i.e. if one-third of curryfish average catch is vastus then need to review species –specific catch for both species

The draft joint (lumped) species groups decision rules are as follows:

- Compute the total catch of all species in the group
- Compute the estimated total catch of each species, either from direct species-specific catch data or from (representative) catch samples used to infer proportional abundance of different species
- If the catch of any species exceeds the species-specific trigger by more than **10%**, then use pre-specified rule (based on all available fishery data and survey data for

the species) to decide whether (1) a change to the joint TAC or (2) trigger level is required, or (3) a species-specific TAC is justified or (4) a closure deemed necessary or (5) recommend further data (eg in the form of a survey) be collected before any change to the joint TAC or trigger limit is allowed.

- The current TAC and trigger limit remain in place unless the above suggests a change.

Calculation for determining an initial curryfish TAC and trigger level is as follows:

4. Compute TAC for each of these species based on same methods as previously and add together = Joint curryfish TAC
5. As vastus lower abundance (based on survey), set trigger = 2 x vastus-specific TAC calculation
6. If trigger reached, implement decision rules for case where trigger exceeded

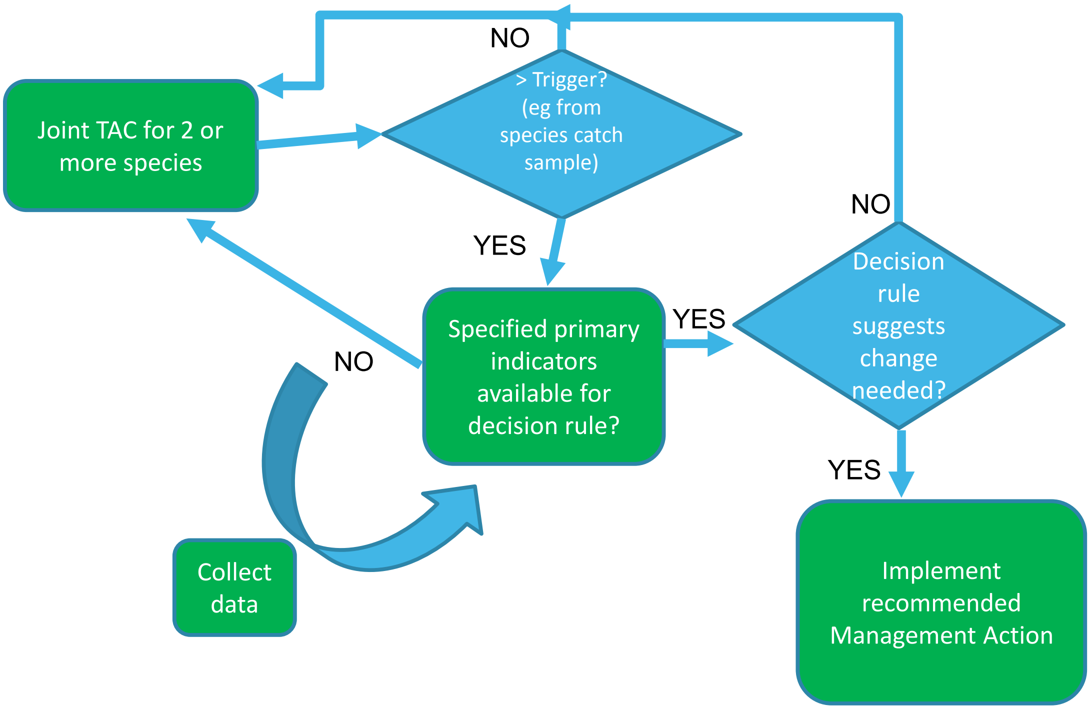


Figure 4. Flowchart summarising illustrative decision rule for reviewing whether a trigger is exceeded for any species caught as part of a lumped species allocation.

4.2.3 Example decision rules for re-opening a fishery or area

The draft harvest strategy framework (Figure 1) also specifies that in some instances decision rules are needed to inform decisions related to re-opening a closed fishery or closed area. Participants agreed that evidence of recovery was a necessary criterion and could be assessed based on data such as a biomass estimate from a survey. Consistent with the fishery objectives, a strategy for a gradual return was then needed, including a conservative initial TAC for example, and ongoing monitoring would be essential (Figure 4).

Flowchart diagrams as per the examples in Figures 1-3 are a useful way of summarising decision rules as clearly detail the action to be followed based on pre-agreed criteria. The Flowcharts 1-3 summarise broad agreement by participants at the workshop regarding potential decision rule structures, but the exact details, together with associated choices for the triggers and limits, still needs to be decided. Analyses will also be informed by existing data on the average density (per ha) of sea cucumbers sampled at 122 repeated sample sites in eastern Torres Strait during the 2002 and 2005 abundance surveys (from Skewes et al. 2010), as summarised in Table 2. Workshop participants also suggested additional rules be imposed such as summarised below:

Re-opening – additional rules

Suggestions raised during HCWG:

- If trial opening of species eg BTF, then only allowed to catch that species on boat
- Consider opening during June-July (during right tide) – TRL season so fairer for dedicated fishers working in East
- Ways to limit/control who can fish given cultural laws?

For recovering/re-opening species:

Establish effective warning system so everyone stops and pauses when approaching experimental TAC to allow extra data to come in
Rule: Experimental TAC cannot be exceeded by more than 5%

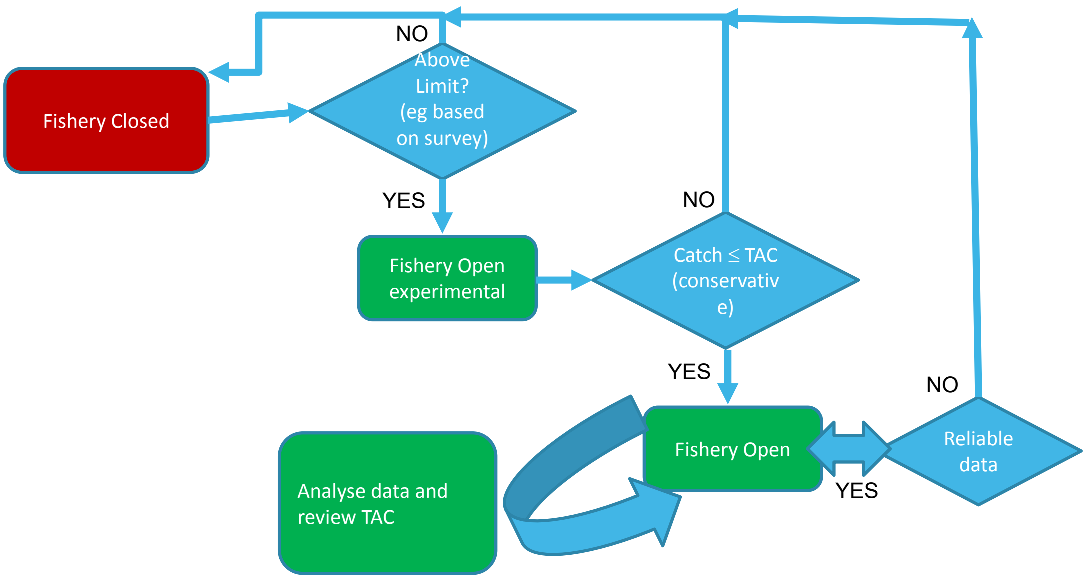


Figure 5. Flowchart summarising proposed process for re-opening a closed fishery.

Table 2. Average density (per ha) of sea cucumbers sampled at 122 repeated sample sites in eastern Torres Strait during the 2002 and 2005 abundance surveys (from Skewes et al. 2010)

Species	Common name	Average density (per ha)		% change
		2002	2005	
All sea cucumber		150.94	153.28	1.6
High value		18.03	14.74	-18.3
Med value		55.99	53.93	-3.7
H. whitmaei	Black teatfish	4.00	3.08	-22.8
H. fuscogilva	White teatfish	5.43	3.57	-34.1
T. ananas	Prickly redfish	8.61	8.09	-6.0
A. miliaris	Blackfish	1.64	3.79	131.3
A. lecanora	Stonefish	0.10	0.00	-100.0
A. mauritiana	Surf redfish	1.02	0.00	-100.0
A. echinites	Deep water redfish	1.43	0.51	-64.3
All Actinopyga		4.20	4.30	2.4
H. atra	Lollyfish	25.60	33.91	32.5
H. fuscopunctata	Elephant trunkfish	15.30	15.43	0.9
H. coluber	Snakefish	0.61	4.41	616.7
H. edulis	Pinkfish	30.79	27.97	-9.2
B. graeffei	Flowerfish	3.59	3.72	3.8
B. argus	Leopardfish	12.91	11.32	-12.3
S. chloronotus	Greenfish	23.16	24.71	6.7
T. anax	Amberfish	2.56	2.59	1.3
S. hermani	Curryfish	10.60	10.18	-4.0
H. leucospilota		1.54	2.56	66.7

4.3 Management controls – static

The draft harvest strategy framework (Figure 1) specifies a number of static controls that can be implemented to complement and strengthen other management actions. The key controls proposed by participants are briefly discussed below.

4.3.1 Size limits

Recent research on Australia’s sea cucumber fisheries recommended that for data-poor species in regions where more sophisticated management controls are difficult to implement (Plagányi et al. 2015) a minimum legal size (MLS) limit enhances benefits. Where data are available to inform as to the choice of this, it should be selected to protect at least the first age-at-maturity. Workshop participants endorsed that changes in some current size limits would be advisable to bring them in line with updated information on the age-at-first-maturity (Table 1 & Appendix 3) A secondary consideration in reviewing current size limits would be to better align them with comparable size limits from other fisheries such as the East Coast Bêche de Mer Fishery. Table 1 summarises this information for ongoing consideration by the HCWG. There was also discussion around providing tools, such as stickers with size measures on the side of boats. In addition, it was noted that it would be useful to apply conversion ratios to the MLS to facilitate cross-checking different product forms. A document summarising conversion ratios is being prepared for discussion at the next meeting.

4.3.2 Spatial and temporal closures

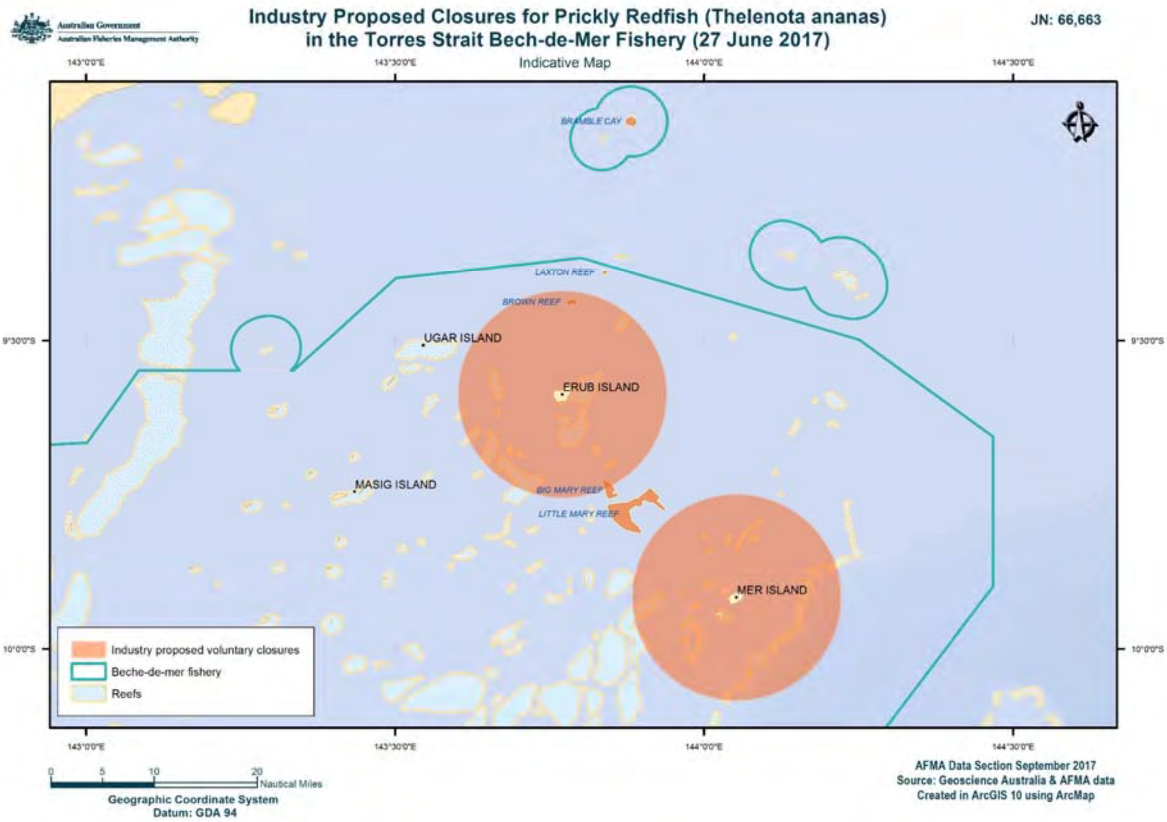
Several workshop participants expressed that there might be value in bans on fishing during part or all of the peak bêche de mer spawning time, which was identified from Appendix 4 as November to January. Moreover, it was felt that another advantage of banning fishing over this period was because it coincides with a closure and hookah-ban closure in place for the tropical lobster fishery (and hence prevents shifting effort from one fishery to another).

At the Working Group meeting held on 27 June 2017, Mer and Erub industry members and observers proposed voluntary spatial closures for Prickly Redfish, noting that further consultation with Ugar and Masig communities was required before such closures could be finalised and implemented. The proposed closures include:

a. 10 nautical mile radial closures from Mer and Erub communities

b. area closures on the following reefs: Big Mary Reef; Small Mary Reef; Bramble Cay; Brown Reef; Laxton Reef.

10. A map of these closures is provided below.



Workshop participants expressed that the management needs to account for native title and spatial structure, and fishers need to follow local rules as the preferred model is one where management is complemented by community ownership and people looking after their own areas. There was discussion as to the extent to which voluntary spatial closures would be adhered to. Some stakeholders expressed a preference for closing whole areas, say within 10nm, rather than specific reefs.

4.3.3 Processing restrictions

Workshop participants proposed that a new management control in the form of a restriction on allowing processing of BDM onboard fishing vessels.

4.4 Value Adding and economic considerations

The workshop included discussion on opportunities for value adding – such as improved processing and handling of curryfish. These initiatives were encouraged as ways to optimise utilisation of the resource form a biological, economic and social perspective as outlined in the objectives.

Workshop participants also suggested additional management measures to optimise biological, economic and social performance of the fishery, including a suggestion to close the BDM fishery in Dec/Jan. This gives all species a chance to rest and spawn. Allow free dive of TRL for TIB Dec/Jan, open BDM/black teatfish in Feb to coincide with TRL, no primary vessels.

Participants also noted that there may be ways to increase economic profit and value through industry awareness and co-ordination. This includes working as a cluster to attract higher prices, co-ordinating product/quality control.

4.5 Environmental Influences

Brief mention re some environmental indicators that could be included longer term; climate change considerations

- Link to SST etc data: Water temperature monitored daily at automated weather stations located at Thursday Island, Masig and Saibai – http://data.aims.gov.au/aimsrtds/

4.6 Operationalising Fishery Objectives

The Table below provides a preliminary overview of proposed components of the harvest strategy that will be used to operationalise the agreed fishery objectives:

Objective	How being operationalised
Consider Native Title Rights and customary and traditional laws and acknowledging and incorporating local knowledge and the ability to locally manage resources	• Community-controlled and enforced complementary management controls such as 10nm closures • Clearly identified pathway for incorporating local knowledge and building a platform to move to greater spatial and community management
To provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;	• Specification of monitoring and data needs, together with rules for adjusting management to ensure sustainability of stocks

	• Rules for closing or re-opening to ensure consistent with sustainability objectives
To develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;	• Transparent tier system for improving and growing monitoring and data collection to support increasing fishing on species/areas where appropriate • Measures to take economic considerations into account eg timing of harvest considered relative to East Coast BDM fishery, trigger limits to instigate action when there is increased focus on selected species
Acknowledging area-specific issues;	• Drawing on community systems to complement controls • Identified pathway for communities to self-regulate to avoid local depletion effects
Where possible, considering an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and	• Consider interactions with TRL fishery eg timing of closed seasons • Identify indicators that could be collected to start identifying impacts of different harvest levels on the ecosystem
Develop long-term recovery strategies for species where appropriate	• Include decision rules to guide recovery strategies

4.7 Formal evaluation of whether the harvest strategy options are likely to achieve the management objectives

The development of the harvest strategy draws extensively on testing done using a Management Strategy Evaluation (MSE) approach, during research on sea cucumber fisheries on the Queensland east coast (Plagányi et al. 2015) and in Torres Strait (Plagányi et al. 2013b; Skewes et al. 2010). These studies form part of the workshop discussions and aspects and key recommendations have also been summarised in the project milestone reports 1 and 2 (Plagányi et al. 2017a; Plagányi et al. 2017b). The section below provides a brief summary of the basis and justification for selection of different decision rules under different circumstances.

Basis for TS BDM decision rules

(I) No data = Zero fishing allowed

In order to manage a stock with at least some certainty of not overfishing, data (e.g. catches, CPUE, survey index of abundance) are needed to inform on stock status and trends. The minimum data requirement is to have catch data with a reasonable degree of reliability, and hence if no data are available, a fishery should be closed.

(II) Setting TAC with minimum size limit

Catch limits are based on previous biomass surveys, and using a conservative approach to estimate biomass and hence fishing mortality given uncertainty

Previous MSE testing suggested fishing mortality rate performs acceptably when used in combination with a minimum size limit as is proposed here

Previous MSE testing highlighted advantages of selecting MLS that is ≥ size at first spawning, and MLS are being reviewed accordingly

Previous MSE testing showed sensitivity to overly large catches and risk of stocks becoming locally and globally depleted, hence rules are needed to ensure that the catch doesn't exceed the TAC and that mitigating steps are implemented if Catch>TAC in any year (as per draft flowchart 2).

Trigger limits are also recommended to keep track of growing catches of a species that is part of a lumped TAC

(III) Spatial rotation strategies

Previous MSE testing suggests that spatial rotation strategies outperform non-rotation strategies and that the rotation cycle length should ideally be longer for slower-growing species. This approach is difficult to implement formally in Torres Strait but there are aspects included either explicitly or implicitly as follows:

- Some communities (eg Mer) self-manage using a form of spatial rotation and community-based approaches to manage the spatial effort on species is strongly encouraged

- Closing areas around communities for slower-growing species such as prickly redfish will have some equivalent benefits
- Closing specific areas for specified periods (as has been done eg or sandfish on Warrior Reef) will have a similar effect.

(IV) Adjusting TACs up or down

In order to motivate for a change in the TAC for a species, data are needed to inform on the stock status and trends in the resource to assess whether an increase is possible or a decrease is necessary. As it is difficult to obtain reliable data for BDM at an appropriate spatial and temporal scale, below are some suggested approaches considering different data sources. The proposed approaches also draw on the following findings from previous TS MSE testing:

- ➢ Higher profits (for the same risk levels) could only be achieved with strategies that included monitoring and hence adaptive management
- ➢ Spatial management approaches (such as spatial rotation and periodic closures) based on adaptive feedback performed best overall
- ➢ Harvest adjustments based on multi-species composition i.e. changes in proportions of species in the catch, was useful as an indicator to reduce risks to the resource

(A) Biomass survey data (also called fishery-independent data)

These data are considered a more reliable index of abundance than CPUE (Catch-Per-Unit-Effort) data and an approach has been suggested that could be used to adjust the TAC up or down at pre-specified intervals.

Justification: this is based on the recent average catch for each species. Previous TS BDM MSE testing suggested that the current catches and TACs perform acceptably in terms of maintaining the risk of depletion at an acceptable level, even when considering a range of potential environmental impacts on the stocks. The MSE testing did not explicitly represent all species but rather a range of species that reflected the typical nature and amplitude of sea cucumber population fluctuations and life history and hence was an appropriate basis for testing alternative harvest strategies. Over the period tested (up to 2010), the following fishing mortality rates *F* (and associated average catches) performed reasonably and hence there is support for setting catch limits up to this level, but the levels tested do not necessarily represent the maximum possible for all species:

Species		F value tested in TS MSE	catch based on model F x survey biomass estimate (t)	Current TAC
H. fuscogilva	White teatfish	0.1	15.6	15
H. whitmaei	Black teatfish	0.043	10.8	-
T. ananus	Prickly redfish	0.075	25.7	20
A. mauritiana	Surf redfish	0.01	0.2	joint 80t
A. echinites	Deepwater redfish	0.1	0.5	joint 80t
Based on testing for East Coast fishery:				
S. vastus	Curryfish	*0.04*	8.8	joint 80t
S. herrmannii	Curryfish	*0.104*	79.3	joint 80t

We won't have a formal stock assessment fitted to data to inform on targets and limits, but the set of decision rules will collectively aim to be consistent with the intent of the policy to avoid low (limit) biomass levels corresponding to overfishing and to aim for target levels that maximise sustainability and fishing opportunities. Choices of these goals and targets are predominantly guided by historical surveys.

For most species the current TAC is set based on a conservative estimate of historical biomass. The survey biomass estimates can be used to inform baseline target and limit densities – density is proposed as the reference measure because it is measurable locally rather than requiring a full survey across all spatial areas, but any density measure needs to be sufficiently representative of the broader area in which that species occurs.

For species with a recent sustainable catch history, where the TAC is set based as above, then the HS aims to maintain the stock at the level that yields that TAC by carrying over any over-catch (Catch Rule) as well as using complementary static measures such as closed areas, minimum size limits and spatial rotation.

The decision rules are tuned to the level of available data – hence if more data are available to inform indicators, then the survey or multiple indicator decision rule could be used to adjust catches. As TACs are mostly set at conservative levels, a higher target TAC can be defined based on a less conservative biomass survey estimate – this provides a pathway to maximise sustainable catch if sufficient data are collected to inform this process.

Conversely, if stock density falls below a lower limit (as defined from historical surveys) than the fishery is closed. To re-open the fishery, it is necessary to demonstrate that the stock density has increased above a trigger limit set at a pre-specified proportion greater than the limit reference density.

4.8 Implementation

The Harvest Strategy Workshops are focussing on developing a draft harvest strategy as a basis for obtaining further feedback from the HCWG and other stakeholders, as well as to guide any additional research and data collection needs before a final draft can be developed. Two further Harvest Strategy Workshops are being planned for the coming year. Additional communication outreach options are also being planned to complement this process. In order to ensure accurate catch information is recorded, materials are also being provided with regard to species identification (see e.g. Appendix 5).

Suggested approaches will acknowledge the challenges and limitations to harvest strategy development and implementation in the Torres Strait, as there is need to be cognisant of their ability to be implemented in the context of the fishery's operational and socio-economic issues.

5 Additional Summary of October Workshop sessions

Introduction and background: Overview of Harvest Strategies and recap from first workshop:

Harvest Strategy Basics

Harvest Strategies are tools to sustainably manage fish stocks to ensure the stock is available long-term and provides a good economic yield
Harvest Strategies set out the process on how to achieve this

COMPONENTS:

1. Indicator – something you can measure
2. Goal – measure success against this goal which is therefore a target
3. Critical limit – should never go below this point as too risky for resource
4. Specify how to move stock towards target and keep it there

How do we do this? Most important thing is to control fishing mortality so don't overfish (as this isn't sustainable) and don't unnecessarily waste resource, so on average want to aim for target level

How does it work for different stocks with more or less information and data

If we have less data then assessments need to be simpler and the harvest strategy needs to be more precautionary eg the aim might be to maintain catch rates at historical levels

With better information and data for a stock, a stock assessment model that uses all the information can be used

But stock assessments also differ – can be high quality vs more uncertainty in stock assessment:

- when more certain can approach more robustly
- but when less certain about stock status then need to be more precautionary as you have less certainty about stock status

Methods to manage a stock to be sustainable, profitable & socio-culturally supportable: BDM HS includes a mix of all three approaches:

1.
Effort Controls - limit fishers and limit times one can fish eg seasonal closures

2.
Spatial Management – limit where fish eg spatial rotation, closed areas

3.
TACs – limit total amount caught eg based on surveys

+ minimum size limit complements all approaches by allowing animals a chance to breed before being caught

Methods to manage a stock to be sustainable, profitable & socio-culturally supportable: BDM HS includes a mix of all three approaches for some of the reasons summarised

Effort Controls: limit fishers

- In theory good for data poor stocks where it is difficult to calculate catch and to assess stock status relative to reference levels
- BUT TS has open access so can't easily limit numbers participating (ie need to also satisfy social objective) and BDM are easy to catch so even a few operators or short season could still deplete resource – problem is that some species are highly valuable which makes the management harder
- Can complement management by considering temporal closures (eg spawning season), re-opening fisheries during times when participation more controlled (eg align TRL&BDM seasons) & consider culturally appropriate ways to restrict access for small biomass high value species

Spatial Management – limit where fish

- Research demonstrates spatial rotation strategies work well for BDM, but difficult to implement large scale across entire TS region – close 2/3rd of fishing area every year which limits access spatially by some fishers? But could work if community-controlled or even smaller reef scale
- Closed areas – closures around home reefs as proposed are beneficial to allow recovery – ideally need series of small closed areas around TS but participants have queried how compliance could work
- Need equity re closures

TACs – limit total amount caught

- TACs work well for fisheries with good reliable data collection so that is the major challenge, but for the more valuable target species there's no reason it can't be done, and less valuable species can be lumped into a joint category and revised if demand increases for a species
- If adhered to, TAC limits total take and there is a sound basis from surveys for computing conservative sustainable levels – especially for high value species eg BTF – only other option is to close fishing area for 3-5 yrs between fishing but would still be risky if no limit on catch as stock could drop too low for re-seeding of area in nonfished yrs
- But for data poor stocks it is hard (& can't be done with too few data) to evaluate stock status relative to reference levels and adjust TACs accordingly, so TACs need to be more conservative

+ minimum size limit complements all approaches by allowing animals a chance to breed before being caught

6 Next Steps

The June 2017 workshop concluded by outlining the following next steps, many of which are ongoing post the October 2017 workshop, with regard to filling in detail on the Harvest Strategy Framework:

Indicators:

- Support and strengthen data recording and collation

Monitoring:

- develop plan for biomass surveys

Assessment:

- Quantify reference levels used for assessing stock status e.g. limit level that is to be avoided and target to aim for
- Quantify recovery criteria for closed species

Decision Rules:

- Develop decision rules for adjusting TACs up or down based on multiple indicators (weighted or not) with pre-specified constraints such as maximum annual permissible change (eg 20%)
- Agree on how frequently (annual, every 2^{nd} or 3^{rd} year etc) assessments performed and TAC adjustments recommended

The following overarching action items were also identified:

- Refine Framework
- Agree separate TAC for curryfish (other species?)
- Refine development and support implementation of community multiple indicator scoring framework
- Static Controls:
    - Revise and recirculate size limit summary information for consideration and comment
    - Action items re size measures (eg sticker on side of boat); table showing conversions between different product forms
    - Consider seasonal closure recommendation Nov-Jan
    - Add restriction to prevent allowing processing of BDM onboard fishing vessels
- Circulate link to East Coast BDMF quota tracking website
- Circulate web links to sea surface temperature & environmental information

The October 2017 workshop noted the following additional next steps:

- Communication of Harvest Strategy and feedback from communities
- If possible, formally evaluate whether the harvest strategy options are likely to achieve the management objectives: use previous work or additional testing/justification as appropriate
- Review choices for limits, triggers and targets as well as settings for all decision rules
- Once adopted, review every 3-5 years

- Stretch objectives:
    - Validate use of CPUE data for target species and jointly caught species (eg compare survey and CPUE trends)
    - Methods for analysing multispecies CPUE
    - Consider additional indicators

Finally, the workshop discussed that the Harvest Strategy would be drafted over the next few months with the next workshop preferably being held within 6 months. Broader industry representation and broader consultation would form part of the process. Any policy would ultimately need to be approved by the PZJA.

7 Acknowledgements

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8 Glossary of technical terms

Assessment:	A mathematical population model coupled to a statistical estimation process that integrates data from a variety of sources to provide estimates of past and present abundance, fishing mortality and productivity of a resource
BDM:	bêche de mer or sea cucumber
CPUE:	Catch Per Unit Effort
Harvest Strategy HS:	Harvest Strategy: a framework that specifies the pre-determined management actions in a fishery necessary to achieve the agreed ecological, economic and/or social management objectives
Limit reference points:	highlight conditions to be avoided
Management objectives:	Broad objectives pertaining to the management of a resource as set by decision makers and stakeholders

<u>MSE</u>: Management Strategy Evaluation – the process of testing alternative decision rules by simulation, in particular for robust performance in the presence of uncertainty

<u>MSY</u>: Maximum Sustainable Yield – the maximum yield/catch that can be taken from a resource on an ongoing sustainable basis

<u>Reference Point</u>: particular levels that reflect stock status (eg spawning Biomass *Bsp* or fishing mortality rate *F)*

<u>TAC</u>: Total Allowable Catch to be taken from a resource within a specified period

<u>Target reference points</u>: specify where management should aim, which stakeholders usually decide

Note that several of these definitions are taken from (Rademeyer et al. 2007).

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Appendix 1 Agenda and Background questions for bêche de mer Harvest Strategy Workshop, 25-26 October 2017

AGENDA

CSIRO HARVEST STRATEGY WORKSHOP

Dates: 25-26 Oct 2017

Following Torres Strait Hand Collectables Working Group (24 Oct)

Venue: Thursday Island – Port Kennedy Association hall, 64-66 Douglas Street

Workshop Chair: Anne Clarke

Workshop Co-ordinators: Éva Plagányi & Nicole Murphy, assisted by Tim Skewes

Wednesday 25 October

8:30-9:00	Opening prayer and acknowledgement of traditional owners Introduction and outline of workshop objectives (Éva)
9-11am	• Recap of progress to date on developing a Harvest Strategy for Torres Strait bêche der mer BDM (with reference to June 2017 workshop report) • Short report back regarding CSIRO/TIB science capacity workshop, 16-20 October, Brisbane (CSIRO & TS reps) • Communication strategies to explain what harvest strategies are and why they are needed • Progress on action items (size measures, conversion ratios) – presentations later in the day (or earlier if time permits)
11-11:30am	Morning tea
11:30-12	Summary of size limit information (Nicole)
12-1pm	Outline of Harvest Strategy framework and details and decision rules that need to be agreed on (Éva)
1-2pm	Lunch

2-3 pm	SMALL GROUP BREAKOUT SESSION 1 – Harvest Strategy Components: participants to discuss and provide their feedback on questions in background document provided, to inform on settings in the Harvest Strategy
3 -3:30	Afternoon tea
3:30-4:30pm	Small group report back, opportunity for questions, further discussion and synopsis of participant inputs
4:30 – 5pm	Conversion ratios – the latest (Nicole & Tim) End of Day 1

Thursday 26 October

8:30-9:30am	Summary of progress previous day and objectives for Day 2 and breakout session
9:30-10am	SMALL GROUP BREAKOUT SESSION 2 – Process for monitoring and re-opening a fishery: participants to discuss and provide their feedback on questions provided – focus on monitoring, surveys, roadmap for re-opening fisheries
10-10:30am	Small group report back, opportunity for questions, further discussion and synopsis of participant inputs
10:30-11am	Morning tea
11-12 pm	Summary presentation on HS framework, decision rules and any outstanding issues Discussion of next steps
12 pm	Meeting close (lunch or depart for flights)

Background questions for bêche de mer Harvest Strategy Workshop, 25-26 October 2017

The workshop on 25-26 October will build on the previous workshop during which a draft harvest strategy (HS) framework was developed with participants (Fig. 4 – at end of this document). Below are some of the discussion items that input will be sought from participants (both in small-group and plenary sessions) in order to refine the specific details of the HS.

SMALL GROUP BREAKOUT SESSION 1 – Harvest Strategy Components:

Indicators:

- Are necessary improvements in data recording and collation on track? As explained in the last workshop report, the HS can be updated and refined as more and better quality data become available. During Stage 1, which of the following data will definitely be available as inputs to the HS:
  - Catch per species
  - Catch and Effort i.e. CPUE; what are the units effort will be measured in (eg dive time, no. tubs etc)
  - Size samples of selected species (who will collect)
  - Species composition sample (from logbooks and/or sample collected by whom?)
  - Spatial footprint (sample) – if sufficient information recorded in logbooks could be obtained from that source
  - Discard mortality – how to get an estimate?

Monitoring:

- What is the most cost-effective way to get survey data that is needed to re-open a fishery on a species or to monitor several BDM species in the fishery?

Assessment:

- Are there any issues that need to be considered in moving to a separate TAC for curryfish? Also will it be possible to monitor roughly what proportion of the total curryfish catch is comprised of common curryfish (hermanni) vs vastus curryfish (vastus)?
- Is there support and are there any issues if a separate TAC is set for (A) Deepwater redfish and (B) Hairy blackfish?
- How soon after the end of the fishing season will data be available?
- Are there existing CPUE data or do we need to wait 3 years before one can start using CPUE to provide a reliable index of abundance?

Decision Rules:

- Is there agreement that increasingly stringent penalties should be applied where total catch exceeds the recommended biological catch in a year (eg the additional catch to be subtracted from next year's catch)
- Please consider draft decision Rules (summarised also in flowchart form) in decision Rule section below – comments or suggested changes to these.
- Please also consider Tier Flowchart (Fig. 5) – any comments?

SMALL GROUP BREAKOUT SESSION 2 – Monitoring and process for re-opening a fishery:

Monitoring and Rules for Re-opening a fishery:

- Sandfish – a full scale stock survey of Warrior Reef, potentially in collaboration with Papua New Guinea was recommended. Are there suggestions for how and by whom a survey could be run to assess the extent to which this species has recovered and whether the fishery could be re-opened

- There has been some discussion around the need for and use of biomass surveys (fishery-independent surveys), particularly for key species such as sandfish, but what are the most cost-effective ways of collecting data needed to inform management?
- Trial re-openings for a species – are you happy with the suggested rules below or suggest changes or additions (see also Fig. 5 below)?
  - Biomass survey is needed
  - Stock needs to be demonstrated to be above pre-specified limit reference level
  - Condition for re-opening is a commitment to data recording – could specify a compliance catch reporting limit of eg (A) 80%; (B) 90% OR (C) 100%
  - There needs to be no overshoot of the experimental TAC – an overshoot of more than 5% results in continued closure the following year
  - The catch and effort (diving time) must be recorded during experimental trial for use in evaluating the stock
  - A conservative initial TAC should be set

SMALL GROUP BREAKOUT SESSIONS – Additional questions to be considered in session 1 or 2 time-permitting

- **Static Controls:**
  - Revise and recirculate size limit summary information for consideration and comment
  - Previously strong support was expressed for communities self-regulating and overseeing spatial exclusions such as the proposed 10 nm exclusion zone around home reefs for fishing prickly redfish – should this be considered for any other species?
  - Is there support for seasonal closure recommendation Nov-Jan
  - How much support is there for a new management control in the form of a restriction on allowing processing of BDM onboard fishing vessels

- **Other indicators**: Is there support and suggestions for advancing the community multiple indicator scoring framework to complement primary indicators?

Summary of local data could be collected for use as indicators:

LOCAL:	Size composition - small: large ratios
	Condition index of animals
	Surveys of dead individuals on beach
	Distance travelled to fish
	Local CPUE
	Perceived extent of illegal fishing
	Environmental conditions favourable or not, in terms of temperature, state of habitat (algae), predators
	Density estimates (e.g. by diver cameras)

Appendix 2 Summary discussion points from Small Group Breakout Sessions

 

SMALL GROUP BREAKOUT SESSION 1 – Harvest Strategy Components:

GROUP 1

Indicators:

- Are necessary improvements in data recording and collation on track? As explained in the last workshop report, the HS can be updated and refined as more and better quality data become available. During Stage 1, which of the following data will definitely be available as inputs to the HS:
  - Catch per species
  - Catch and Effort i.e. CPUE; what are the units effort will be measured in (eg dive time, no. tubs etc)
  - Size samples of selected species (who will collect)
  - Species composition sample (from logbooks and/or sample collected by whom?)
  - Spatial footprint (sample) – if sufficient information recorded in logbooks could be obtained from that source
  - Discard mortality – how to get an estimate?

Log books – species, Lat/Long, effort – how many divers, hours worked, size (undersize returned), discard mortality (not currently recorded)

Blackteat, catch data texted back. Real time reporting, logbook sent later.

Monitoring:

- What is the most cost-effective way to get survey data that is needed to re-open a fishery on a species or to monitor several BDM species in the fishery?

Survey data – working with scientists/fishers undertake survey eg. scallop. TIB operators. Independent: scientists.

Assessment:

- Are there any issues that need to be considered in moving to a separate TAC for curryfish? Also will it be possible to monitor roughly what proportion of the total curryfish catch is comprised of common curryfish (hermanni) vs vastus curryfish (vastus)?
- Is there support and are there any issues if a separate TAC is set for (A) Deepwater redfish and (B) Hairy blackfish?
- How soon after the end of the fishing season will data be available?
- Are there existing CPUE data or do we need to wait 3 years before one can start using CPUE to provide a reliable index of abundance?

Setting TAC properly/sustainable

herrmanni/vastus easy to distinguish, separate. herrmanni bigger

Already separated when fished, use same processing method

Same prices

Support for separate TAC, easier for one

Deepwater redfish – set own TAC, remove from basket – Yes

Hairy Blackfish – set own TAC, remove from basket – Yes

How soon after the end of the fishing season will data be available?

Fish Receiver – 3 days, other (docket?) 2-3 weeks

CPUE Data – Docket book/ 1st year transition; logbooks. Yes, existing data from full time fishers and buyers

Q. How do you deal with part time fishermen? Fish receiver?

Decision Rules:

- Is there agreement that increasingly stringent penalties should be applied where total catch exceeds the recommended biological catch in a year (eg the additional catch to be subtracted from next year's catch)
- Please consider draft decision Rules (summarised also in flowchart form) in decision Rule section below – comments or suggested changes to these.
- Please also consider Tier Flowchart (Fig. 5) – any comments?

Penalties for exceeding catch? Over catch TAC, what happening with stock unknown.

One rule easier to control/don't close

Overfish 5 tonne – Take 5 tonne from following year

Large overcatch – Rest/pause for one year, depends on species/size limits (growth) and depends on what species being paused – high value, decrease TAC, don't pasue

(III) Catch-Based Decision Rule (see Figure 1)

- Hierarchical: First Apply Catch Decision Rule (operational fishery):
    - If no data then TAC = 0

If no data close fishery – Currently do not have to provide data; Will be different with the fish receiver system.

- If exceed by >5% and <20% then carry over catch and subtract from following year's total
- if exceed by >20% and <50% then pause fishing on that species following year
- If exceed by >50% and <100% (double) pause fishing 2 years
- If exceed by more than double, close fishery 4 years

Total catch exceeds/Over – reduce TAC the following year

Don't exceed catch but exceed trigger level eg. Curryfish – Action to review

Other indicators? (not triggered) – two indicators, effort and size (going back to same area

If have indicators – catch, size, effort

5%, 10%, 20% - Need to define, >10% positive, <10% adjust eg TAC

What if in between – Keep fishing, review following year

Who decides where line is drawn – depends on the indicator

Indicators Good, fishing > 10% - positive, can increase TAC. How much/too large eg. 20 tonne to 50 tonne in one year – No, support for a CAP. Upper limit on changing TAC

To increase TAC (capped) – Do you undertake survey? Some support for one and others/TSRA support to focus on catch data

Support for a biomass survey from workshop participants

Pre-specified rule to increase catch – yes, if data, not overfishing & positive indicators (not much algae Uncle William).

Q – Increase TAC, undertake survey – Yes

III Indicators – Abundance, increase or decrease in numbers

CPUE – Logbook, more hours fishing, going further

GROUP 2

Indictors – DATA

Catch – monthly catch, compare tonnage/reef

CPUE – hrs/day, depends on weather/tides

Catch composition; Spatial footprint – Daily log, send book annually, lat/long, species, habitat dived

Size of animals - ?rangers or industry – small monitoring program

Discard mortality – up to individual fishers:

Post capture Bad product, heat, discolour, soggy, moist; drying final stage, moisture.

Live – 5 tubs/boat, 4-5 prickly throw back before or after gutting (soft) some days lose none. Curryfish & Greenfish – handling, worst, use ice?

Deepwater habitat tougher than shallow water habitat

Decision Rules

Catch based: Distinguish

Rebuilding fishery – experimental, TAC vs TAC in place

BTF eg. 15t – over fish 500 kg, flexibility

Communication – alarm at 10t when closer to TAC (stop and wait)

25t – non sustainable

Prolonged and sustained over catch, then ACTION - too risky

12t – pause and wait for data to come in

Normal species

Data – TAC (close fishery), extra data =

	Year 1	Year 2	Year 3	3yr
*	15	15	15	45
x	45	0	0	45
x	20	10	15	45
10% x	25	10	10	45

If fish 17 (overfish by 2t) *50% over = closure

18 – 3t extra

Penalty 2x3t = 6t

Next year TAC 15.6 = 9t

Return to 15t

Sustainability – Alarm, If >10% over TAC, penalty applies; take off tonnage or on notice for a 3yr period/if exceed total then close

Example Curryfish

Separate TAC

60t – discount/discard factor (5%) down from 20%? Yes, live tank on board

Curryfish on processing vessel?

Some places - both abundant (vastus/herrmanni), can be more vastus some places, Dungeness herrmanni/common currfyish. Easy to tell apart, more vastus in deep than shallow

Photos of catch composition – can distinguish dry product

10-15m water depth more vastus – was survey shallower? BDM? (Depends on location)

Deepwater Redfish – 5t, Hairy Blackfish – 5t, not that much 10t?

Hairy blackfish – night time when come out

Revised basket TAC – 60t? 50t?

Curryfish – weigh after boiling, conversion ratios/some data. Time large re data – Ugar, complete every day but getting back? Fax? Sent within 3 days but mail less reliable ?10 days. No live figures, but regular reports – out to industry, phone. 2 weeks.

Workshop notes/working group 3

<u>10nm Exclusion zone</u> – Prickly redfish

Curryfish after boiling - <100kg; 2 dinghies – not appropriate

Deepwater blackfish sit in pockets

Murray – deepwater black, white teat, prickly – can fish outside

Ugar & Erub – different as need to fish closer

Closures?

New areas with large animals – could be breeding ground? Needs to be analysed. Might be idea to set up protection for certain areas.

Need care in managing data so doesn't lead to more exploitation, native title stakeholders to decide how to protect.

Set total catch limits and devolve responsibility to native title stakeholders re allocation including spatial

<u>Species combined TAC</u>

Split curryfish – separate TAC, trigger for species

How many of each species? Skippers with training to look at catch composition once per month? All scientific observers could be used.

Sea Rangers – TSRA/AFMA, scientific observers for Torres Strait, catch composition

Agreement at meeting – voluntary closures, need survey to look at biomass. Detailed account of how much is there and then again in 6 months. Need now for Prickly red. Other operators can provide data.

Monitoring – survey

1. Logbook

2. Docket book

3. Scientific survey

4. On board observers (sea rangers)

5. Change in product size monitored by camera – review which species, area, size – from dives, scientific survey. Could use cameras eg. specified dives, specific dives to record information (bus stop), routine monitoring, same spot take photo at set time periods, compare photo at different depth, could see changes in aggregation (breeding). Need resources eg. s130 go-pix /pro has GPS co-ordinates

Indicators

Black teatfish – compare time frame for catch, but also licences

Good data – TIB, take responsibility, good decision, needs awareness, education

Identify committed divers/industry- ongoing fishing dependant on reporting (note, high value species); also up to communities = > no. active fishers.

Don't reveal individual information buy whether recording

Logbook page demo

No information – close fisheries

Need data from buyers and logbooks

Challenge: getting data from docket books – AFMA, fax, mailing – risk if lost ?electronic, Stephen Is? Murray – poor reception, need allowances, resources

How to get information recorded in timely period?

?Average catch over 3 years

Buyers important for data collection

Logbook has spatial co-ordinates

Reefs, number around TI so know area

Which species listed – prickly, curryfish, deepwater, etc. 5 species

Effort – fishers daily catch

Depth? Number, 10nm-12nm

Rules to re-open fishery

East coast – check CPUE trends to adjust TAC up or down – need logbook information, in future regionalise, ownership

Torres Strait – understand native title, spatial structure

1. survey – up or down, or stable

2. conservative – TAC

Region/management

Need to follow local rules

Ownership/people look after their areas

10 nautical miles

Prefer whole areas eg. within 10nm rather than specific reefs (voluntary)

Voluntary more likely to be supported. May not be respected if voluntary, especially if not from adjacent island community

There may be ways to increase economic profit and value through industry awareness and co-ordination

Working as a cluster to attract higher prices, co-ordinating product/quality control

Example for community TAC eg. 5-7 tonnes each, if you overfish it comes off your allocation/TAC following year. With a built in review

Short term actions – Compulsory catch monitoring, better understanding and specific actions per species, size limit triggers

Long term – Ability for real time management

Community plans important to inform Harvest Strategy eg. Indicators, evidence

Tier approach – all about risk, Yes/supported

Impediments to data recording

Not compulsory

Lack of education/awareness

Sporadic fishing

Records not going to AFMA

Concern about confidentiality

Concern about reaching TAC

Doesn't capture damaged/lost/discarded catches

Require specific quota – Curryfish, prickly redfish, greenfish

Changes with market demand/value aim to have TAC or triggers (with actions) for each species

Minimum requirement to reopen fishery/species: reliable catch reporting, monitoring, assessment knowledge of current stock level, a conservative TAC, consideration of harvest strategy

Definite minimum sizes and maximum where science convinces

Spatial closures difficult to manage/compliance conflict

Suggestion: Close BDM fishery Dec/Jan, gives all species a chance to rest and spawn. Allow free dive of TRL for TIB Dec/Jan, open BDM/black teatfish in Feb to coincide with TRL, no primary vessels

Appendix 3 – Revised size limit information

Common name	Species	Maximum length cm (guide)	Size at maturity (Female) cm	Size at maturity (Male) cm	Size at maturity (unknown) cm	Size limit TS	Proposed size limit TS*	Size limit EC (DAFF report)	Size limit CS (AFMA report)	Age at maturity TS yrs (model)	Weight or age (unknown sex)	TAC TS t
Sandfish	*Holothuria scabra*	32	16.9[11], 21[6], 19.9[6]	17.7[11], 21.3[6], 13.6[6]	16.8, 15[10], 21[7], 25[7], 16[2,7], 14[6], 20-23[6]	18	25 (2,3)	20	16	2 (16.5)	184gr[6] (total wt), 22.6gr[3]gr (total wt), 18 mths[6]	No take
Surf Redfish	*Actintopyga mauritiana*	38	-	-	23[7], 22[2], 22[10], 23	22	25 (1,2)	25	15	3 (13.8)	125-350gr[7], 153gr[9]	Part of 80t limit
Black Teatfish	*Holothuria whitmaei*	30	-	-	26[2], 26[10], 22.7[9], 23[12]	25	30 (1,2)	30	25	4 (24)	580gr[9]	No take
White Teatfish	*Holothuria fuscogilva*	55	-	-	32.4[9,10], 32[2]	32	35 (1) 40?	40	32	4 (30.4)	1167[3]gr (total wt), 1100gr[7](total wt) 900gr[9], 1500gr[12]	15
Prickly Redfish	*Thelenota ananas*	70	-	-	34.5[10], 30[9], 30[2]	30	40 (2)	50	30	4 (30.4)	1150gr[9], 1200gr[7] (total wt)	20
Hairy Blackfish	*Actinopyga miliaris*	35	-	-	12[10]	22	-	20	15	3 (19.2)	-	Part of 80t limit
Curryfish (common)	*Stichopus herrmanni*	55	-	-	27[2], 27[10], 31[7], 31[12]	27	30 (1,2)	35	15	-	-	Part of 80t limit
Elephants Trunkfish	*Holothuria fuscopunctata*	66	-	-	35[2], 35[10]	24	40 (1,2)	40	15	-	1200gr[7] (total wt)	Part of 80t limit

Lollyfish	*Holothuria atra*	*65*	*14.8[11], 15.5[4]*	*16.5[4], 14.8[11]*	*12[10], 16.5[2], 19[1], 15.2[4],16[4]*	*15*	20 (1,2)	*20*	*15*	-	*80gr[7](drained wt), 18gr[1] (gutted wt)*	*Part of 80t limit*
Deepwater Redfish	*Actinopyga echinites*	*35*	-	*9.3[11]*	*12[2], 12[7], 12[10]*	*12*	20 (2,3)	*20*	*15*	*3 (19.5)*	*65gr[3,5] (total wt), 46-55gr[3] (gutted wt), 45-90gr[7], 45gr[12]*	*Part of 80t limit*
Curryfish (vastus)	*Stichopus vastus*	*35*	-	-	-	*nil*	*5t trigger*	*15*	*15*	-	-	*Part of 80t limit*
Burrowing blackfish	*Actinopyga spinea*	*40*	-	-	-	*22*	-	*20*	*15*	-	-	*Part of 80t limit*
Deepwater blackfish	*Actinopyga palauensis*	*35*	-	-	-	*22*	-	*20*	*15*	-	-	*Part of 80t limit*
Golden sandfish	*Holothuria lessoni*	*46*	-	-	*22[2], 22[6]*	*18*	25 (2)	*15*	*15*	-	*490gr[6] (total wt), 480gr[7]*	*Part of 80t limit*
Brown sandfish	*Bohadschia vitiensis*	*40*	*26.1[8]*	*24.5[8]*	*15[10]*	*nil*	25 (1)	*25*	*15*	-	-	*Part of 80t limit*
Leopardfish	*Bohadschia argus*	*60*	-	-	*30[10]*	*nil*	35 (1)	*35*	*15*	*3 (size)*	-	*Part of 80t limit*
Greenfish	*Stichopus chloronatus*	*38*	-	-	*14[10]*	*nil*	20 (1)	*20*	*15*	-	*50gr[5]*	*Part of 80t limit*
Stonefish	*Actinopyga lecanora*	*24*	-	-	-	*nil*	15 (1)	*15*	*15*	-	-	*Part of 80t limit*

*Proposed size limit (Torres Strait): 1= Better align with EC (East Coast BDM fishery); 2 = too small relative to age at maturity and 3= based on model simulation recommendation (TS BDM Milestone Report, Appendix/Summary).

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Appendix 4 – Sea cucumber Spawning Information

Common name	Species	Spawning time	Country
Sandfish	*Holothuria scabra*	*October to January**	*Australia**
		March to May, November to December	*India*
		December, January, August, September	*New Caledonia*
		November to December	*Papua New Guinea*
Surf Redfish	*Actintopyga mauritiana*	*June to April*	*Guam*
		December, January	*New Caledonia*
Black Teatfish	*Holothuria whitmaei*	*June, July*	*New Caledonia*
		April	*Aldabra, Seychelles*
		*December**	*GBR, Australia**
White Teatfish	*Holothuria fuscogilva*	*Part of November, December, January*	*New Caledonia*
Prickly Redfish	*Thelenota ananas*	*January, February, March*	*New Caledonia*
		*December**	*John Brewer Reef, GBR, Australia**
Hairy Blackfish	*Actinopyga miliaris*	*July (new moon)*	*Japan*
		May, November to December	*New Caledonia*
		*November**	*Orpheus Island, Australia**
Curryfish (common)	*Stichopus herrmanni*	*December, January*	*New Caledonia*
		June to July	*Straits of Malacca, Malaysia*
		*November, December, January**	*Little Broadhurst Reef, GBR, Australia**
Elephants Trunkfish	*Holothuria fuscopunctata*	*December, January, part of February*	*New Caledonia*
		*December**	*Lizard Island, Australia**
		*December**	*John Brewer, GBR, Australia**
Lollyfish	*Holothuria atra*	*November*	*Solomon Islands*
		August	*Peninsular Malaysia*
		*October**	*Davies Reef, GBR, Australia**
Deepwater Redfish	*Actinopyga echinites*	*January, February*	*New Caledonia*
Curryfish (*vastus*)	*Stichopus vastus*	-	-
Burrowing blackfish	*Actinopyga spinea*	-	-
Deepwater blackfish	*Actinopyga palauensis*	-	-
Golden sandfish	*Holothuria lessoni*	*November, December, January, part of February*	*New Caledonia*
		November	*New Caledonia*
Brown sandfish	*Bohadschia vitiensis*	*November, December*	*New Caledonia*
Leopardfish	*Bohadschia argus*	*October to January**	*GBR, Australia**

		*October , November, December, January**	*GBR, Australia**
Greenfish	*Stichopus chloronatus*	*April to June, December to February*	*Straits of Malacca, Malaysia*
		*November, January**	*Myrmidon Reef, Davies Reef, GBR, Australia**
Stonefish	*Actinopyga lecanora*	*July*	*Peninsular Malaysia*
		*December**	*GBR, Australia**

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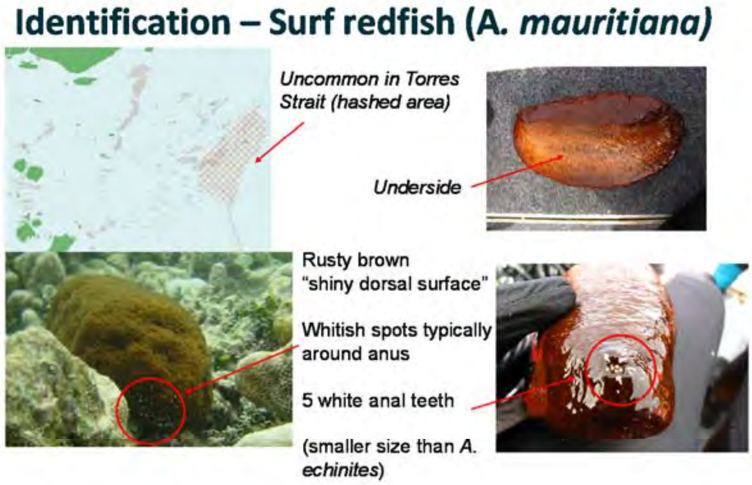
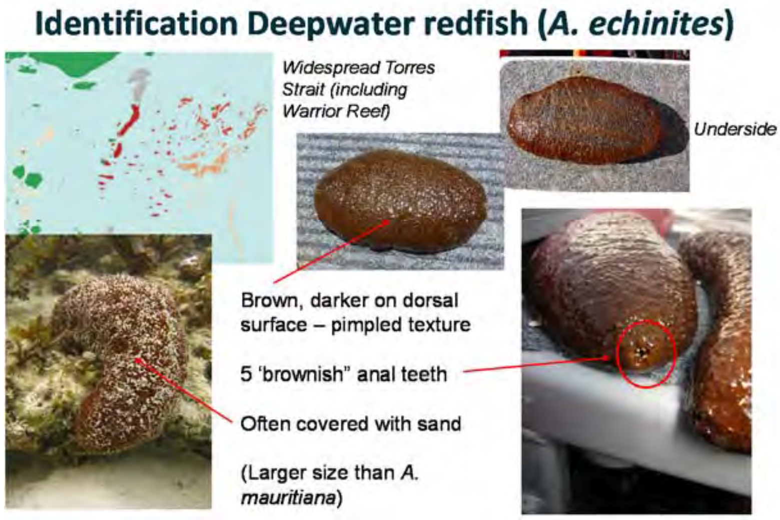
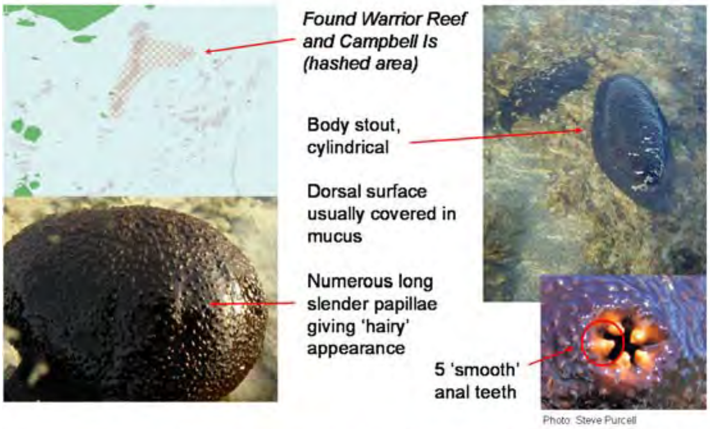
Appendix 5 - Species identification support materials



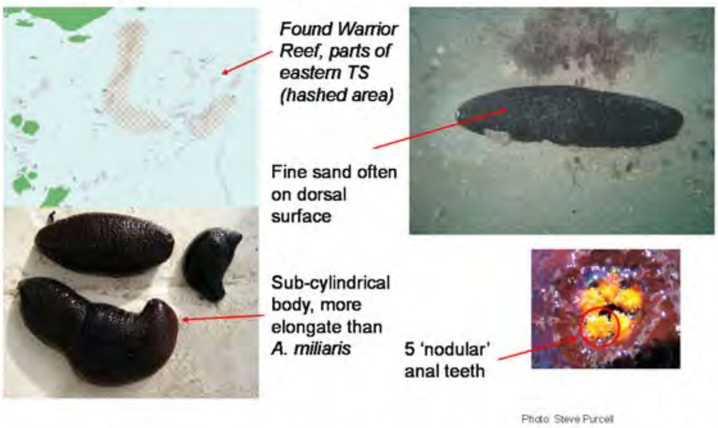


Blackfish

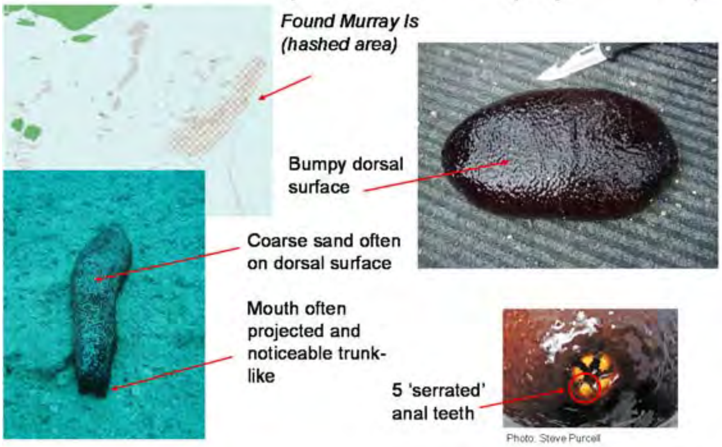
Identification – Hairy blackfish *(A. miliaris)*



Identification – Burrowing blackfish *(A. spinea)*



Identification – Deepwater blackfish *(A. palauensis)*



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Harvest Strategies for the Torres Strait Bêche-de-mer (sea cucumber) fishery – Milestone Report - July 2018 Workshop

AFMA project no. 2016/0823

Éva Plagányi, Nicole Murphy, Leo Dutra

25-26 July 2018

Summary Milestone Report

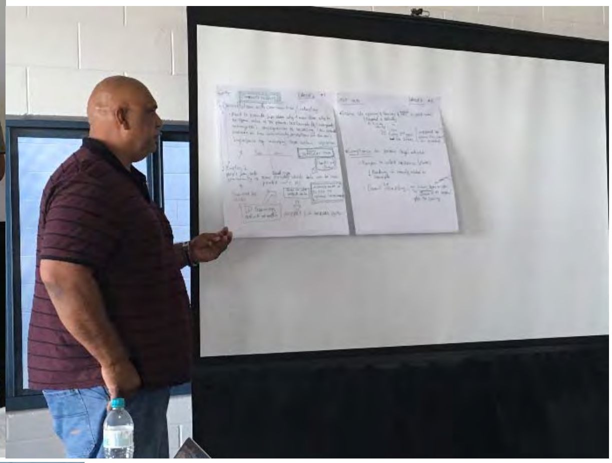

Table of Contents

1 Non-Technical Summary

- This report summarises the 3rd Harvest Strategy Development Workshop held on Thursday Island, 25-26 July 2018, immediately following the Hand Collectable Working Group Meeting held on 24 July 2018.
- The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been discussed at management forums (e.g. HCWG) for some time. In consultation with the HCWG, AFMA, TSRA, Malu Lamar and other stakeholders, CSIRO have been drafting a scientifically-sound harvest strategy.
- The harvest strategy describes clearly how to manage the fishery. It provides a transparent protocol, agreed on by stakeholders, for monitoring, information gathering, assessment and management into the foreseeable future.
- The harvest strategy depends critically on the new Fish Receiver System and also fisher logbook data. It specifies the data that are needed to effectively manage the fishery and how these data will be used to adjust catches and manage the fishery to meet the biological, social and economic objectives.
- The most important data are accurate total catch per species, and this needs to be provided in a timely fashion. Catch records per day and per spatial location are needed to support scientific assessments of the fishery (lumped and stockpiled data are less useful). It is important to record discards also as these need to be included in the total catch record (with product type also specified). Other very useful data to support scientific assessment include fishing effort (eg hours fished) and size of animals caught. Detailed logbook information including areas and depth fished can be submitted confidentially and if sufficient detailed data are provided by the fishery, this can support ongoing growth of the fishery. Without these data it is difficult for scientists to assess the potential of the fishery to support continued and ongoing growth. Correct species identification is also important and tools are available to support correct species identification.
- The future growth and successful management of the BDM fishery will be greatly strengthened by a combination of reliable data collection and an agreed harvest strategy to guide the sustainable and optimal use of bêche-de-mer in line with agreed objectives for the fishery.
- The harvest strategy provides clear and practical guidance for future sustainable fishing, including the data requirements, procedures and other requirements for potential fishery expansion.
- The framework also includes some static controls such as size limits and spatial closures to complement management measures, for example, a proposed 10 nm ban on fishing for prickly redfish around home reefs, with devolved responsibility to native title holders

- The draft framework is a tier system which accounts for understanding that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management. This means higher catches are possible if there is more and better data.
- The harvest strategy includes different rules for the following cases:
    - Monitoring and adjusting catches annually, with agreement that a fishery will be closed if no data are provided
    - Rules for managing mixed species/basket catches. To support future growth of the fishery, careful monitoring is necessary and hence as many target species as possible will be monitored as individual species. By starting to collect data on all species now, this means it will be easier to support future development of selected species in response to growing market demands.
    - Rules for how to re-open a fishery that has been closed. For example, there are very strict rules being developed to support re-opening the black teatfish fishery. This includes the need to very accurately report catches on a daily basis as if total catch exceeds the Total Allowable Catch (TAC) or data are not accurately recorded this could put at risk future fishery openings. For overfished species such as sandfish, there are guidelines for supporting recovery as well as how surveys (either full scale scientific surveys or smaller experimental surveys with fisher participation) can be used to inform whether or not the fishery could be re-opened.
    - Rules for how to increase catches (TACs) if good quality fishery data are available and indicate an increase is possible
    - Rules for how to further increase catches (TACs) if high quality survey data become available.
- Australia's Commonwealth Harvest Strategy Policy defines a harvest strategy 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 success and recommendations given updates of data and/or model outputs.

The rapid progress made in developing a harvest strategy is due to the collaborative and enthusiastic participation and inputs from all stakeholders, all of whom recognised that demonstrating that the Fish Receiver System is working well and having a formal harvest strategy are key building blocks for the future of the Torres Strait bêche-de-mer fishery. The draft harvest strategy will be available for stakeholder comment in the next few months.

2 Introduction

The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been the subject of some discussion at management forums (e.g. the Hand Collectable Working Group (HCWG)) and community meetings for some time. 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.

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).

This report summarises further progress made in developing a harvest strategy framework at a workshop held in conjunction with a Hand Collectable Working Group meeting, 24-26 July 2018, Thursday Island, Torres Strait, to collaboratively progress the development of a harvest strategy. The workshop included relevant stakeholders in addition to the HCWG members. The CSIRO project team – Éva Plagányi and Leo Dutra (and including inputs from Nicole Murphy) – supported by independent scientific expert Tim Skewes, facilitated discussions with participants in plenary and in small group discussions.

The Workshop Agenda and background questions for participants is provided in Appendix 1.

Project Objectives

The project will develop and ratify a single harvest strategy for the Torres Strait bêche-de-mer (TS BDM) 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 sea cucumbers in Torres Strait, and establishing first order harvest strategy approaches such as global fishery TACs, size limits and temporal closures. It will include clear 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.

3 Progress on Harvest Strategy Development

3.1 Specify Management Objectives:

The Protected Zone Joint Authority (PZJA) is responsible for management of commercial and traditional fishing in the Australian area of the Torres Strait. The PZJA objectives adopted for the Torres Strait Bêche-de-mer Fishery are:

- to provide for the sustainable use of all bêche-de-mer stocks in Torres Strait;
- to develop bêche-de-mer stocks for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty); and
- to develop an appropriate long-term management strategy for sandfish.

The workshop discussed modifying and extending these objectives as follows:

- To acknowledge, empower and operationalise Native Title Rights and interests including customary and traditional laws of individual nation groups : Malo ra GELAR (Malo's Law) of Kemer Kemer Meriam Nation, Saabi law of Maluilgal Nation, Saabi law of Gudamalulgal Nation, Kulkalgal Nation and Saabi law of Kaurareg Nation. This also includes acknowledging and incorporating local knowledge and the ability to locally manage resources. The operational objectives include the following:
- to provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;
- to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;
- to acknowledge area-specific issues;
- where possible, to consider an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and
- to develop long-term recovery strategies for species, where appropriate.

3.2 Harvest Strategy Development

A harvest strategy for the Torres Strait bêche-de-mer fishery needs to apply to all bêche-de-mer species (Table 1) and set out the management actions necessary to achieve the objectives outlined above. It will be a formal framework for guiding the overall management of a fishery rather than dictating day-to-day fishing activities or decisions. Hence there are pre-agreed transparent set of rules for making tactical management decisions, including specifications for:

(i) a monitoring program
(ii) the indicators to be calculated from monitoring data (usually via a stock assessment but this can be a relatively simple assessment for fisheries with limited data)
(iii) the use of those indicators and their associated reference points in management decisions, through application of decision (or control) rules.

The progress made at the July 2018 workshop is summarised in the powerpoint summary (available on request) as well as the notes from the workshop small group sessions. This information is being compiled into a full draft of the harvest strategy, for consideration by stakeholders. The draft framework encapsulates the principles of a tier system whereby it is acknowledged that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management such that higher catches are possible. The framework overall structure is shown in Fig. 1 and acknowledges that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order adjustments needed. Simultaneously the framework clearly maps pathways for ongoing improvements and refinements, such as through further data collection as well as a clear role to contribute community-level data and local knowledge. The details of the framework are described in the previous June 2017 and October 2017 progress reports, and additional refinements discussed at the July 2018 workshop will be included in the draft harvest strategy document.

There is also parallel work being done to review the proposed new size limits (see Plagányi et al. 2018), conversion ratios and to revise the bêche de mer species identification guide. Workshop participants provided further feedback with regard to requested updates to the identification guide. Feedback was also obtained with regard to suggestions for effective communication and outreach activities.

It was noted that to manage the TS BDM stocks to be sustainable, profitable, and socio-culturally supportable, a mix of approaches is being proposed:

1. Effort controls to limit fishers and limit times one can fish; (e.g. seasonal closures)
2. Spatial management (limit where to fish (e.g. spatial rotation, closed areas)
3. TACs: limit total amount caught, e.g. based on surveys
4. <u>PLUS</u> minimum size limit complements all approaches by allowing animals a chance to breed before being caught.

A summary of the harvest strategy framework is provided below, and includes the following elements:

- Management controls – static
    - Size limits

    - Temporal closure
    - Processing Restrictions
- Monitoring and data collection to determine indicators
- Management controls – dynamic - Decision Rules Needed:

Low tier:

1. Catch-based Decision rule: for species-specific recommended biological catch
2. Joint TAC trigger-limit Decision rule: for lumped species category
3. Re-opening Decision rule: for re-opening a fishery or area (see Fig 2)

Middle tier:

1. Multiple Indicator Decision Rule: for adjusting species-specific TACs (see Fig. 3)

High tier:

1. Survey-based Decision Rule

- **Monitoring and data collection to determine indicators**
    - Annually – need minimum amount of data to make changes
    - When will annual data summaries be available to inform decisions for following season?
- **Management controls – dynamic - Decision Rules Needed:**

Low tier:

1. Catch-based Decision rule: annually – simple accounting system & rules
2. Joint TAC trigger-limit Decision rule: for lumped species category - annually
3. Re-opening Decision rule: for re-opening a fishery or area – as needed

Middle tier:

1. Multiple Indicator Decision Rule: for adjusting species-specific TACs – every 3 years? Review species with sufficient data or concern. Could add exceptional circumstances rule to low tier that triggers review for species of concern or in response to marketing opportunities

High tier:

1. Survey-based Decision Rule – as needed and survey data become available

Table 1. Summary of key bêche de mer species in Torres Strait, together with their minimum size limit and Total Allowable Catch (TAC) in tonnes (from (Murphy et al. 2014))

Common name	Scientific name	Commercial value	Minimum size limit (mm)	TAC (t)
Sandfish	*Holothuria scabra*	High	180	Closed
Surf redfish	*Actintopyga mauritiana*	Medium	220	Closed
Black teatfish	*Holothuria whitmaei*	High	250	Closed[#]
White teatfish	*Holothuria fuscogilva*	High	320	15[$]
Prickly redfish	*Thelenota ananas*	High	300	20
Hairy blackfish	*Actinopyga miliaris*	Medium	220	Part of 80t limit
Curryfish common	*Stichopus herrmanni*	Medium	270	Part of 80t limit
Elephant trunkfish	*Holothuria fuscopunctata*	Low	240	Part of 80t limit
Lollyfish	*Holothuria atra*	Low	150	Part of 80t limit
Deepwater redfish	*Actintopyga echinites*	Medium	120	Part of 80t limit
Curryfish vastus	*Stichopus vastus*	Medium	270	Part of 80t limit
Burrowing blackfish	*Actinopyga spinea*	Medium	220	Part of 80t limit
Deepwater blackfish	*Actinopyga palauensis*	Medium	220	Part of 80t limit
Golden sandfish	*Holothuria lessoni*	High	180	Part of 80t limit
Brown sandfish	*Bohadschia vitiensis*	Medium	nil	Part of 80t limit
Leopardfish	*Bohadschia argus*	Medium	nil	Part of 80t limit
Greenfish	*Stichopus chloronotus*	Medium	nil	Part of 80t limit
Stonefish	*Actinopyga lecanora*	Medium	nil	Part of 80t limit

***Size limits off PZ JA website –** http://pzja.gov.au/the-fisheries/torres-strait-beche-de-mer-fishery/

[#]WG agreed Black teatfish has had some trial re-openings already but that it will not be re-opened again until the compulsory catch reporting is in place.

[$] WG discussed considerations for proposed allowance for hookah to use on White teatfish

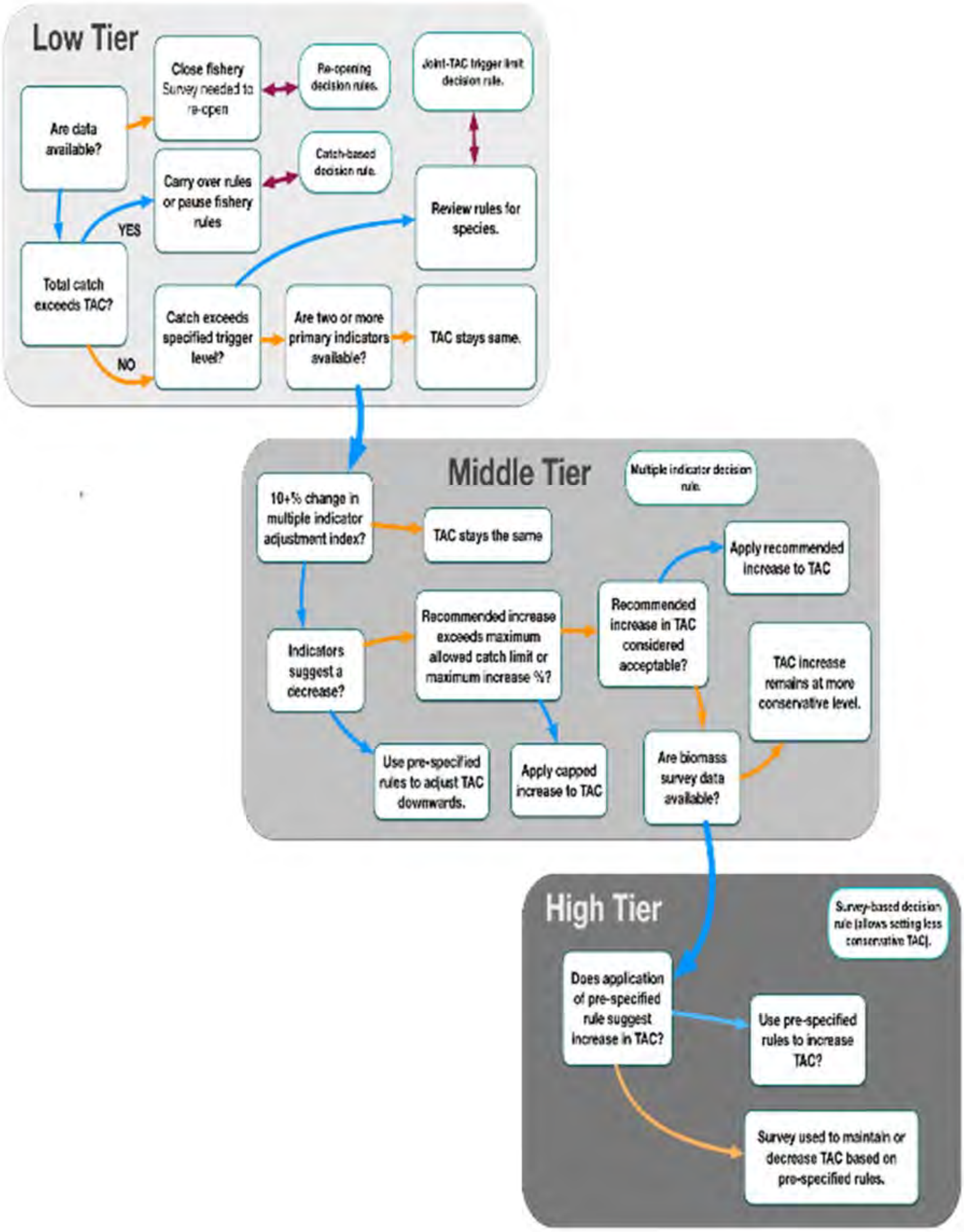


Figure 1. Schematic summary of draft harvest strategy rules and framework being developed for Torres Strait bêche de mer

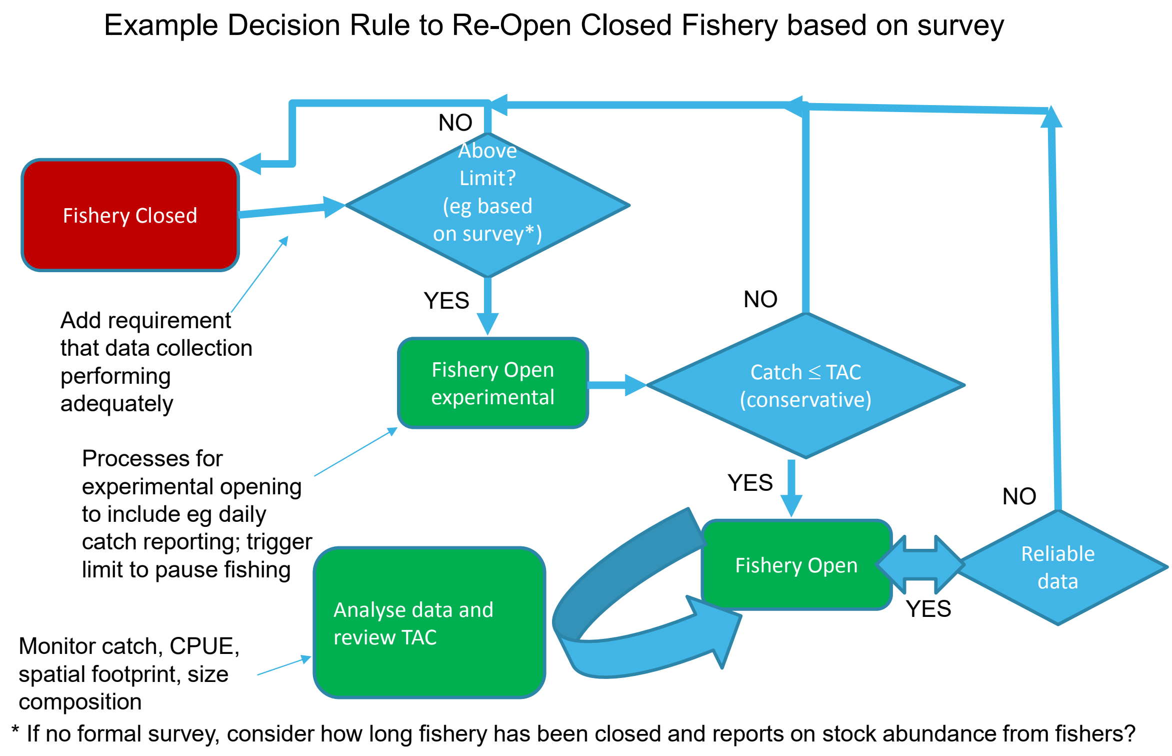


Fig. 2. Re-opening decision rule schematic

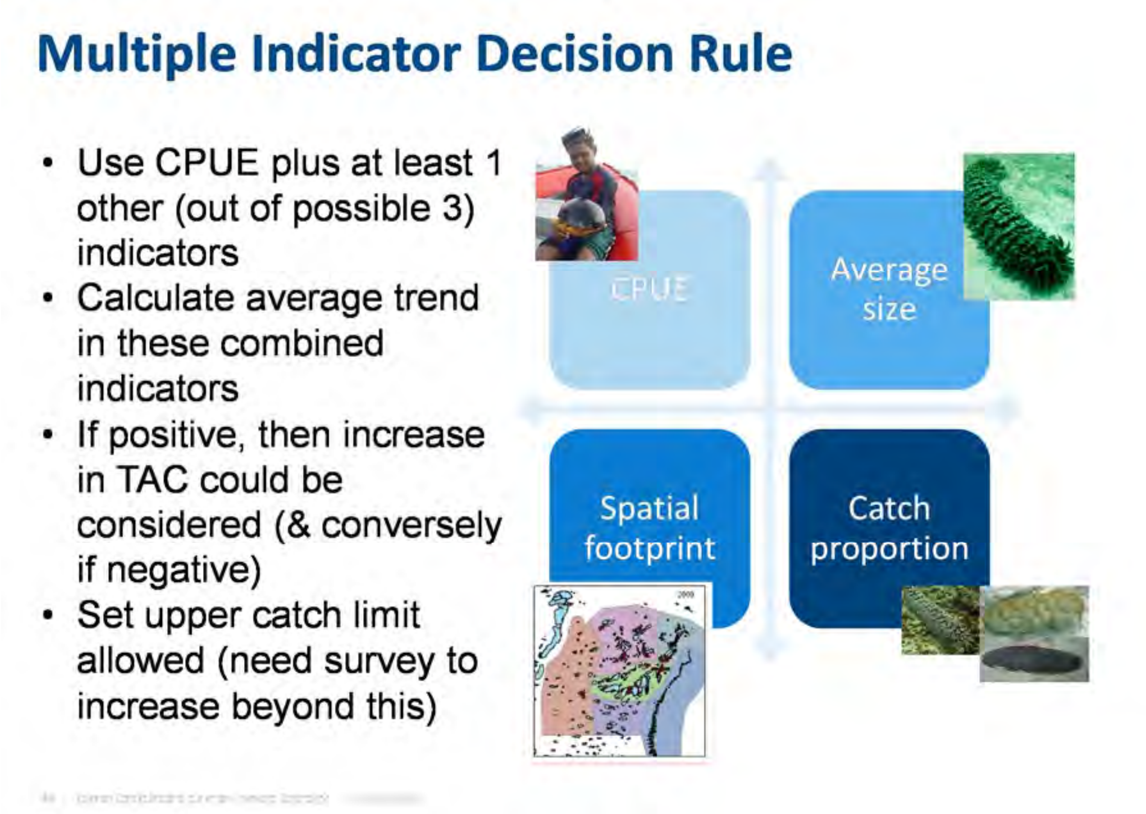


Fig. 3. Summary of multiple indicator decision rule

4 Small Group Summaries

There was a lot of useful information provided and shared during the 3 small group breakout sessions. A summary of some of the points raised is provided in detail in Appendix 2. Several of these provide broader insights than simply to inform a harvest strategy. Below follows a very brief summary of some of the key feedback regarding the questions posed and hence to assist in refining aspects of the harvest strategy.

SMALL GROUP BREAKOUT SESSION 1 – Questions posed and summary responses below

Harvest Strategy Components: Obtaining useful Catch and Effort indicators

- How well can we separate catch data for individual species e.g. curryfish (vastus and hermanni)?
- For shallower water species and mixed species assemblages, do fishers collect all suitable animals as they are encountered, or optimise time in the water to focus on specific species. If the former, then for a fixed diving time, we should be able to use the catch per species divided by total combined dive time as an index of abundance of that species. If the latter, we need information on relative preferences for species.
- For deeper water or target species (eg white teatfish, prickly redfish), how can we get an index of abundance? For example, if the stock is highly aggregated, then CPUE will stay high until the aggregation is close to being depleted. Can we get information on the spatial extent and depth of fishing? What difference are different fishing methods likely to have?

Can we use a single combined CPUE index for each species, or do we need to consider separate indices for different fishing areas? If so, for which species and what is the minimum number of separate indices we would need?

Summary of Responses:

- All curryfish species easy to separate alive, boiled or dry
- Notes on discards: If slug is still alive then it is not counted as discard as it will regenerate (but not good for boiling). If slug is dead it is counted as discard.
- Discards must be counted towards TAC
- Curryfish and Greenfish are very fragile and cannot weigh wet due to risk of losses
- Please consider additional effort for small-scale fishers for fishing processing: fishing full day and processing full night, then reporting. We understand reporting is important and very beneficial for the long-term sustainability of the fishery
- When fishing fishers normally target 1-2 species depending on order from buyers. They collect high-value opportunistic species (white teatfish, golden sandfish, etc.) if found.

- Target species depend on preferences from buyers and availability in reefs. At the moment preferences from some buyers are (but preferences vary during the year): Curryfish, Blackfish. Others currently want curryfish, white teatfish, prickly red and black teatfish. Would be best if they buy other species eg leopardfish. Buyers have a big say. Some only buy 1-2 species
- Greenfish, leopardfish, white teat: very fragile, better when kept in ice or water exchange every 20 minutes
- Can record all depths and species in daily logbook reports but not able to do the same in the fish receiver form. Best to fill in fish receiver and logbook to support businesses and operation.
- Local practices: use all divers working in certain areas/reef for a month or so and leave that reef for re-supplying for a period of 3 months. That's when you get the stocks coming back up. Working well using local knowledge
- Ugar: rotate between the fisheries. At the moment a couple of the fishers are doing coral trout and TRL fishing. They stopped doing curryfish and are targeting finfish and TRL at the moment to give time to re-stock and re-supply BDM on the reef. They fish for periods of 1 week and then swap
- Location of fishing grounds can be sensitive information
- Deepwater species – need hookah – changes in depth and spatial extent of fishing are useful indicators
- White teatfish – limited by freediving so catch rates are not a good indicator of stock. In 1997, catch rates were 80-100kg/day getting the ones on top but now reduced to 8-20 kg/day (but can see them in deeper water)
- Prickly redfish : good catch rates are 150-200 kg/day versus bad 50-80 kg/day. But will move on before and also stop when get to 150kg.
- Deepwater redfish: over 6 months drop form 20 kg/day but very patchy
- Curryfish: over 6 months, good catch rate = 200 kg/day but only when focussed on curryfish; bad = 50 kg/day, but will rotate earlier. Also fish harder to get 200 kg/day.
- Deepwater: without hookah can't use CPUE as stock indicator – suggested to get historical hookah catch rate to compare with as well as East Coast rates as comparison
- For species such as curryfish, some fishers limit daily take to reduce wastage as processing is challenging
- Prickly redfish – similarly stop collecting over processing limit amount
- Training and resourcing for fish receivers needs to be provided

SMALL GROUP BREAKOUT SESSION 2 – Questions and Summary Responses below

Harvest Strategy Rules for Re-opening a fishery

Decision rules are needed to inform decisions related to re-opening a closed fishery or closed area. Participants at previous workshops agreed that evidence of recovery was a necessary criterion and could be assessed based on data such as a biomass estimate from a survey. Consistent with the fishery objectives, a strategy for a gradual return was then needed, including a conservative initial TAC for example, and ongoing monitoring would be essential (Figure 5).

- Is it feasible that surveys of key species could be done to inform whether to re-open the fishery for a species? Will these be done by the community or outsourced to researchers?
- Are there alternative ways to get adequate information to inform potential re-opening?
- Is it sufficiently conservative to set the starting TAC as half the target value for the first year?
- Based on discussions at previous workshop, can we set a trigger at 75% (three quarters) of the TAC at which point all fishers need to pause activity to wait for data to be submitted and analysed to ensure no overshoot of the TAC. As per suggestion from stakeholders, the system could also include rapid sms/text (other?) of catch even before formal records submitted to help keep track of catch?

Summary of Responses:

- Difficult to compare scientific surveys with fishers surveys because fishers know where to look for things and scientists randomise transects

Re-opening fishery requires:

<u>Community support</u>

Consultations with communities and industry: Need to provide information about why the fishery was closed, why re-open, value of the fishery, sustainability (safeguards; tonnage TAC), consequences of exceeding TAC (external pressure on how community perceptions are driven). Importance of managing stocks sustainably: reputation

<u>Plenty/sufficient stocks</u>

We need to show stocks are there

Employ 2 locals at each community and providing training for them so they can carry out surveys which data can be incorporated into HS.

Show we can collect the data (support fish receiver system) and manage the fishery:

<u>Management in place to ensure sustainability</u>

Define temporal and spatial opening & closures (based on TAC and catch rates).

E.g. 5-10 days openings

Open every 2nd year using 2xTAC [safeguard to ensure TAC would not be exceeded]

Compliance – using rangers. They don't have full authority to apprehend but they can collect evidence so compliance officers can act.

Prevent live stock piling. No fishing before the opening or after the closure or before/after the opening.

- Surf redfish – very deep water. Need to educate people in a way that fishermen knows about where most of the fish stays. We need to have a community talk with fishermen to get this idea through.
- Training on species identification is needed
- Experimental quota -> 5 tons and assess risk and trial this TAC to re-open surf redfish. Fishermen will fill out special data sheet and select full-time fishermen to do this. They will also support analysis of data.
- Sandfish (Warrior): Experimental quota 4-5 tons. (same as before).
- Black Teatfish opening suggestions:
    - Ownership for industry. A fee to get into the industry. Money that goes into industry goes back into research. High-value species
    - Split into 3 short catches (e.g. 3 x 5 tons separated by a closure) to show we can manage the fishery. It will encourage people not to rush in and give the opportunity to do it right.
    - Any catch reporting is a must (daily catch reporting from Fish Receivers System) land-based only.
    - TSRA technological apps iPad: ID guide, photos, reporting. Each fish receiver will get an iPad and will be trained on how to use the app.
    - Length measures data sheets and rulers
- If we have to re-open the fishery again we need to ensure the fish receiver system is working well. Accurate and timely reporting about catches. Fishers need to be encouraged to fill out daily fish logs as well.
- Sandfish: suggest locals do surveys (locally)
- Golden sandfish seen at Mer. Need consultation with Iama and Warrior reef area to identify the right people on the process.
- Mer: seeing a comeback of surf redfish -> could be trialled; use surveys.
- Ugar: very few seen; some evidence on smaller ones.
- Black teatfish: no survey needed as we know there is plenty out there.
- Trial in the 5 Island communities in the East to trial openings.

- Community discussions with TIB reps, TSRA, Malu Lamar (as native title body), and AFMA for community consultations.

SMALL GROUP BREAKOUT SESSION 3 – Questions and Summary Responses

Review of overall Harvest Strategy Framework (Fig. 1-5): what's missing? Suggested changes etc

- Is the distinction between the 3 tiers clear?
- Does the flowchart in Fig. 1 (see also Fig. 2) cover most scenarios? Anything missing?
- Does the Harvest Strategy Framework (as per Fig. 1) make sense in terms of allowing increases in TAC as more data become available?
- Which rules need changing or refining or do you think will be difficult to implement?
- Any further comments on suggestions raised during previous HCWG:
- If trial opening of species eg BTF, then only allow to catch that species on boat
- Consider opening during June-July (during right tide) – TRL season so fairer for dedicated fishers working in East
- Ways to limit/control who can fish given cultural laws?
- System to submit sample photos of mixed species catches to inform on species composition and validate species identification? There were mixed views as to whether scientific observers might be available to assist in looking at catch samples eg once per month – any further thoughts?

Summary of Responses:

- Several suggestions to improve presentation of overall framework were noted and will be included in revised version of the tier diagram.
- Curryfish joint TAC: Several species but focus predominantly on 2 spp (*S. hermannii* and *S. vastus*). People are talking about similar abundances for both species so will look further into this given it's not what was recorded during surveys. Agreed to include *S. oscellatus* in the same basket as well even though they are not as abundant as the other two. Discarded species must be recorded if we want to accurately monitor the stock. It is a fragile species and it is important that the discarded weight is captured too because at the end of the day we want to ensure the fishery is sustainable
- Each species need to be managed separately and we need to be careful that we don't fish them down and we don't have weird interactions between the three species. Combined TAC is a bit risky in this regard. Trigger is not a cap. A trigger is a way to check what is happening and get more information about what is going on.
- Hairy blackfish – there is high demand at the time for this species. 5 tons may be small for this species. But 5 tons is the trigger and maximum (based on indicators) is 10t, as survey data is uncertain. If we can see some CPUE or other data that people

are fishing + information from fishers which indicates the stocks are better and there is more certainty about the stock then it is easy to adjust TAC – data supports TAC and that's how HS starts to work

- If logbooks are filled in correctly these will provide valuable information to manage the stocks
- Any future surveys need to benefit and involve Torres Strait Islanders
- Might be good to know how reliable survey data is (current survey is about 9 years old).
- People paid (fish receivers) as an incentive to make sure the data is filled in accurately.
- Logbook and fish receiver book are two separate books. Daily fishing log has the old style catch disposal data combined. But new system separate this. Fish receiver is mandatory, old logbook is voluntary. It is really important to have the voluntary logbook filled in in conjunction with the fish receiver logbook. Suggested this should be compulsory
- Ways of limiting who can fish given cultural laws in different communities -> should be trialled in the black teatfish. Needs to be discussed in next workshops as to how to do this.
- 3 tiers make sense but it should be interpreted in plain language because when you look at this you can understand but it is very important to understand the details. Who makes the decision about going into the 3 tiers. It needs to come back to the HCWG for making these decisions.
- Black teatfish: used in the first tier at the moment where we want to see it happen next year (1st December). Effort, size limits to be investigated. During the opening time the trial should be opened at the same time as TRL. Daily catch report is very important. We didn't go much into cultural protocols as it needs to be discussed between TS islanders.
- Very excited about potential for technology. We need to keep up with technology. The example about IPad app is a very good idea to help send data quickly, especially in Ugar. This will definitely improve getting catch data report through. Mark gave an example that TS rangers are using this method now, which is very good. But who is going to do it? AFMA/TSRA should take this on.
- New survey techniques are coming. ROVs, drones. These can detect the presence of sea cucumber.
- The current harvest strategy and the 3 tier process is quite detailed and in terms of people understanding how this flow it will take time. Not only fishers, but people in the communities. This will be a bit more difficult for part-timers and recreationals to understand the process. We mentioned that in terms of interpretation of the 3 tiers

and the language used will be quite difficult for our people to understand. We highlighted clearly that having this translated isn't necessarily a good idea because English is easier to read. A simplified version could be developed.

- We need to ensure the right policies are in place to support data collection. For example, daily fish logbook. The current diagram needs to be rearranged from low to high. It is easier to read high is high and low is low. Each tier can be broken down into one A4 size instead of having all in one page and expect people to read.
- Flexibility needs to be built into the rules to allow a double TAC in one year and a break in the second year. This could work for species such as black teatfish with regulated openings but not for all species where the TAC is important to observe. Use AFMA catch watch to alert fishers when approaching the TAC. Also recommended that revised species identification guide include a larger map of the species distribution and native title boundaries clearly identified.
- Whenever there is a survey, first consideration should be given to locals for boat and human resources

5 Next Steps

The June 2017 workshop concluded by outlining the following next steps, many of which are ongoing post the October 2017 workshop, with regard to filling in detail on the Harvest Strategy Framework:

Indicators:

- Support and strengthen data recording and collation

Monitoring:

- develop plan for biomass surveys

Assessment:

- Quantify reference levels used for assessing stock status e.g. limit level that is to be avoided and target to aim for
- Quantify recovery criteria for closed species

Decision Rules:

- Develop decision rules for adjusting TACs up or down based on multiple indicators (weighted or not) with pre-specified constraints such as maximum annual permissible change (eg 20%)
- Agree on how frequently (annual, every 2nd or 3rd year etc) assessments performed and TAC adjustments recommended

Analysing historical Data:

- Historical survey data will be reanalysed and complemented by Tropical Rock Lobster survey data (particularly for deepwater blackfish, greenfish and stonefish) to provide updated distribution and population density estimates for commercially important species, especially those recognised as increasing in commercial importance.

- Information gaps in population surveys will be summarised. Survey information on deepwater blackfish is also being reviewed to inform the feasibility of a separate TAC for this species.

Proposed Schedule of Activities

- Provide summary of talking points to seek suggestions on suggested wording and to support workshop representatives in preliminary communications
- Short presentation on BDM by EP at TSRA Fisheries Summit (Aug)
- Circulation of draft harvest strategy (by early October) to workshop participants out of session
- Science communication visit to outer island/s in October
- Plan videoconference as appropriate with other interested stakeholders, and/or as follow up to visit
- Communication aids made available, including presentation for AFMA
- Final harvest strategy report deadline is May 2019
- Final harvest strategy to be tabled at next HCWG meeting (date not currently decided) for consideration

Finally, the workshop discussed that the Harvest Strategy would be drafted over the next few months. Broader industry representation and broader consultation would form part of the process. This includes a proposal for a scientific outreach visit to the outer islands tentatively proposed 22-26 October 2018 (Ugar, Masig, or Erub?). Any policy would ultimately need to be approved by the PZJA.

6 Acknowledgements

We are grateful to Tim Skewes for sharing his extensive knowledge and insights on this fishery and supporting all aspects of the work detailed in this report. We thank AFMA, TSRA and all stakeholders for their inputs and participation. Thanks to Natalie Dowling and Mick Haywood (CSIRO) for earlier contributions to the project. Funding for this project has been provided jointly by AFMA and CSIRO Oceans and Atmosphere. Catch data provided by AFMA.

7 References

Murphy N, Fischer M, Skewes T (2014) Torres Strait beceh-de-mer (sea cucumber) species ID guide

Plagányi, É., Murphy, N. & N. Dowling. 2018. Harvest Strategies for the Torres Strait Beche-de-mer (sea cucumber) fishery – Progress Report from October 2017 Workshop. 59 pp.

Appendix 1 Agenda and Background questions for bêche de mer Harvest Strategy Workshop, 25-26 July 2018

DRAFT AGENDA

CSIRO HARVEST STRATEGY WORKSHOP

Dates: 25-26 July 2018

Following Torres Strait Hand Collectables Working Group (24 July)

Venue: Thursday Island – TSRA Boardroom on 24th and 26th and Thursday Island Boat Shed on the 25th

Workshop Chair: Anne Clarke

Workshop Co-ordinators: Éva Plagányi & Leo Dutra, assisted by Tim Skewes (apologies Nicole Murphy)

WORKSHOP AIMS AND OUTLINE

There are many components to a Harvest Strategy, and a summary of some of the key components of the TS BDM strategy being developed with stakeholders is summarised below. The details of each component are described in previous workshop reports and presentations, and are being updated and refined in consultation with stakeholders, taking into account feedback from plenary sessions and small breakout discussion groups.

The July 2018 workshop will provide an opportunity to comment on all aspects of the harvest strategy, but given limited time, a few key areas have been selected for more in-depth discussion to assist with refining specification of these components in the harvest strategy. There are 3 related categories that have been discussed at the ongoing workshops, and this workshop will focus on the second of these:

1. Management structures (e.g. the issue of allocation/control of the fishery to island clusters)
2. **Decision Rules (also called harvest control rules) for adjusting catches (including how to get useful indicators of stock status and how to obtain and analyse these indicators)**

3. Static controls (eg size limits which provide additional support for achieving the biological, economic and socio-cultural aims of the harvest strategy)

Background questions to guide discussions during the breakout sessions are provided in a separate document.

Draft Torres Strait Bêche-de-mer Harvest Strategy Framework Components

- Monitoring and data collection to determine indicators
- Reference points, Method of Assessment and Decision Rules
  - Decision rules for species-specific recommended biological catches
  - Decision rules for lumped species category
  - Decision rules for re-opening a fishery or area
- Management controls – static
  - Size limits
  - Temporal closure
  - Processing Restrictions
- Value Adding and economic considerations
- Environmental Influences
- Operationalising Fishery Objectives
- Formal evaluation of whether the harvest strategy options are likely to achieve the management objectives
- Implementation

Wednesday 25 July

8:30-9:00	Opening prayer and acknowledgement of traditional owners Introduction and outline of workshop objectives (Éva)
9-11am	• Recap of progress to date on developing a Harvest Strategy for Torres Strait bêche der mer BDM (with reference to October 2017 workshop & framework summarised in Fig. 1, and summary at end of Agenda) • Progress on action items (size measures, conversion ratios, 10 nautical mile radial closures from Mer and Erub communities)
11-11:30am	Morning tea
11:30-12:30	SMALL GROUP BREAKOUT SESSION 1 – Harvest Strategy Components: Obtaining useful Catch and Effort indicators (see Background questions in Appendix)
12:30-1pm	Small group report back, opportunity for questions, further discussion and synopsis of participant inputs
1-2pm	Lunch

2-2:15 pm	Short overview of previous BDM surveys: choosing representative sites, obtaining density estimates and trend information to support management (Tim Skewes)
2:15-3:15pm	SMALL GROUP BREAKOUT SESSION 2 – Harvest Strategy Rules for Re-opening a fishery and use of survey data in setting TACs (see Background questions in Appendix)
3:15 -3:45	Afternoon tea
3:45-4:30pm	Small group report back, opportunity for questions, further discussion and synopsis of participant inputs
4:30 – 5pm	Planning for next workshop on Eastern Island/s and including community consultation – suggestions, communication strategies, planning, comments on draft HS Tentative dates: 22-26 October 2018? End of Day 1

Thursday 26 July

8:30-9:30am	Summary of progress previous day and objectives for Day 2 and breakout session
9:30-10:30 am	SMALL GROUP BREAKOUT SESSION 3 – Review of overall Harvest Strategy Framework: what's missing? Suggested changes etc
10:30-11am	Small group report back, opportunity for questions, further discussion and synopsis of participant inputs
11am	Morning tea
11:15-12 pm	Summary presentation on HS framework, decision rules and any outstanding issues Discussion of next steps
12 pm	Meeting close (lunch or depart for flights)

Summary of Workshop Planning

The July 2018 workshop will be run in a similar dynamic format to previous ones, which allows for a high level of interaction from members. Topics previously discussed will be touched on with regard to obtaining members desire to cover again, and in what detail. In addition, prior meeting transcripts are reviewed and comments and questions prepared for, such as:

Request for example scenarios that can be simulated and run through at the next meeting.

Question - How is discard rate accounted for?

Question – How is TAC allocated for other species? If Prickly Redfish and Curryfish fished heavily, other species then fished instead. Concern no one knows what is being taken. How can this be captured.

Comment – Note or mark out reefs where know species have been declining eg. Curryfish and Prickly Redfish. Used as a red flag for managers, can record in comments on docket books, or add a map.

The workshops will include both small group discussion sessions and plenary sessions aimed at filling knowledge gaps and reviewing and seeking endorsement of the draft harvest strategy. Inputs from stakeholders will be used to refine details of the harvest strategy, with basic elements as summarised in Fig. 1. The harvest strategy will focus in the main on rules that can currently be implemented based on current data availability, but will also include options for moving to higher tiers in future (eg if survey data become available) and these options could be further refined in future. As with the previous workshops, they have been planned to involve the HCWG members and observers, plus additional key stakeholders are invited to try and ensure broad representation of stakeholders who in turn represent the many communities.

The workshop will also provide an opportunity to refine the details of some of the rules being considered for incorporation in the harvest strategy. This includes:

1. Defining a decision rule and trigger limits for the 2 curryfish species
2. decision rules based on survey information
3. the proposed multiple indicator decision rule based on CPUE, size composition, spatial footprint and catch proportion

CSIRO HARVEST STRATEGY WORKSHOP

APPENDIX: Background questions for participants

Dates: 25-26 July 2018

SMALL GROUP BREAKOUT SESSION 1 – Wednesday 11:30-12:30

Harvest Strategy Components: Obtaining useful Catch and Effort indicators

- How well can we separate catch data for individual species e.g. curryfish (vastus and hermanni)?
- For shallower water species and mixed species assemblages, do fishers collect all suitable animals as they are encountered, or optimise time in the water to focus on specific species. If the former, then for a fixed diving time, we should be able to use the catch per species divided by total combined dive time as an index of abundance of that species. If the latter, we need information on relative preferences for species.
- For deeper water or target species (eg white teatfish, prickly redfish), how can we get an index of abundance? For example, if the stock is highly aggregated, then CPUE will stay high until the aggregation is close to being depleted. Can we get information on the spatial extent and depth of fishing? What difference are different fishing methods likely to have?
- Can we use a single combined CPUE index for each species, or do we need to consider separate indices for different fishing areas? If so, for which species and what is the minimum number of separate indices we would need?

SMALL GROUP BREAKOUT SESSION 2 – Wednesday 2:15-3:15pm

Harvest Strategy Rules for Re-opening a fishery

Decision rules are needed to inform decisions related to re-opening a closed fishery or closed area. Participants at previous workshops agreed that evidence of recovery was a necessary criterion and could be assessed based on data such as a biomass estimate from a survey. Consistent with the fishery objectives, a strategy for a gradual return was then needed, including a conservative initial TAC for example, and ongoing monitoring would be essential (Figure 5).

- Is it feasible that surveys of key species could be done to inform whether to re-open the fishery for a species? Will these be done by the community or outsourced to researchers?
- Are there alternative ways to get adequate information to inform potential re-opening?
- Is it sufficiently conservative to set the starting TAC as half the target value for the first year?

- Based on discussions at previous workshop, can we set a trigger at 75% (three quarters) of the TAC at which point all fishers need to pause activity to wait for data to be submitted and analysed to ensure no overshoot of the TAC. As per suggestion from stakeholders, the system could also include rapid sms/text (other?) of catch even before formal records submitted to help keep track of catch?

SMALL GROUP BREAKOUT SESSION 3 – Thursday 9:30-10:30am

Review of overall Harvest Strategy Framework (Fig. 1-5): what's missing? Suggested changes etc

- Is the distinction between the 3 tiers clear?
- Does the flowchart in Fig. 1 (see also Fig. 2) cover most scenarios? Anything missing?
- Does the Harvest Strategy Framework (as per Fig. 1) make sense in terms of allowing increases in TAC as more data become available?
- Which rules need changing or refining or do you think will be difficult to implement?
- **Any further comments on suggestions raised during previous HCWG:**
- If trial opening of species eg BTF, then only allow to catch that species on boat
- Consider opening during June-July (during right tide) – TRL season so fairer for dedicated fishers working in East
- Ways to limit/control who can fish given cultural laws?
- System to submit sample photos of mixed species catches to inform on species composition and validate species identification? There were mixed views as to whether scientific observers might be available to assist in looking at catch samples eg once per month – any further thoughts?

For recovering/re-opening species:
Establish effective warning system so everyone stops and pauses when approaching experimental TAC to allow extra data to come in
Rule: Experimental TAC cannot be exceeded by more than 5%

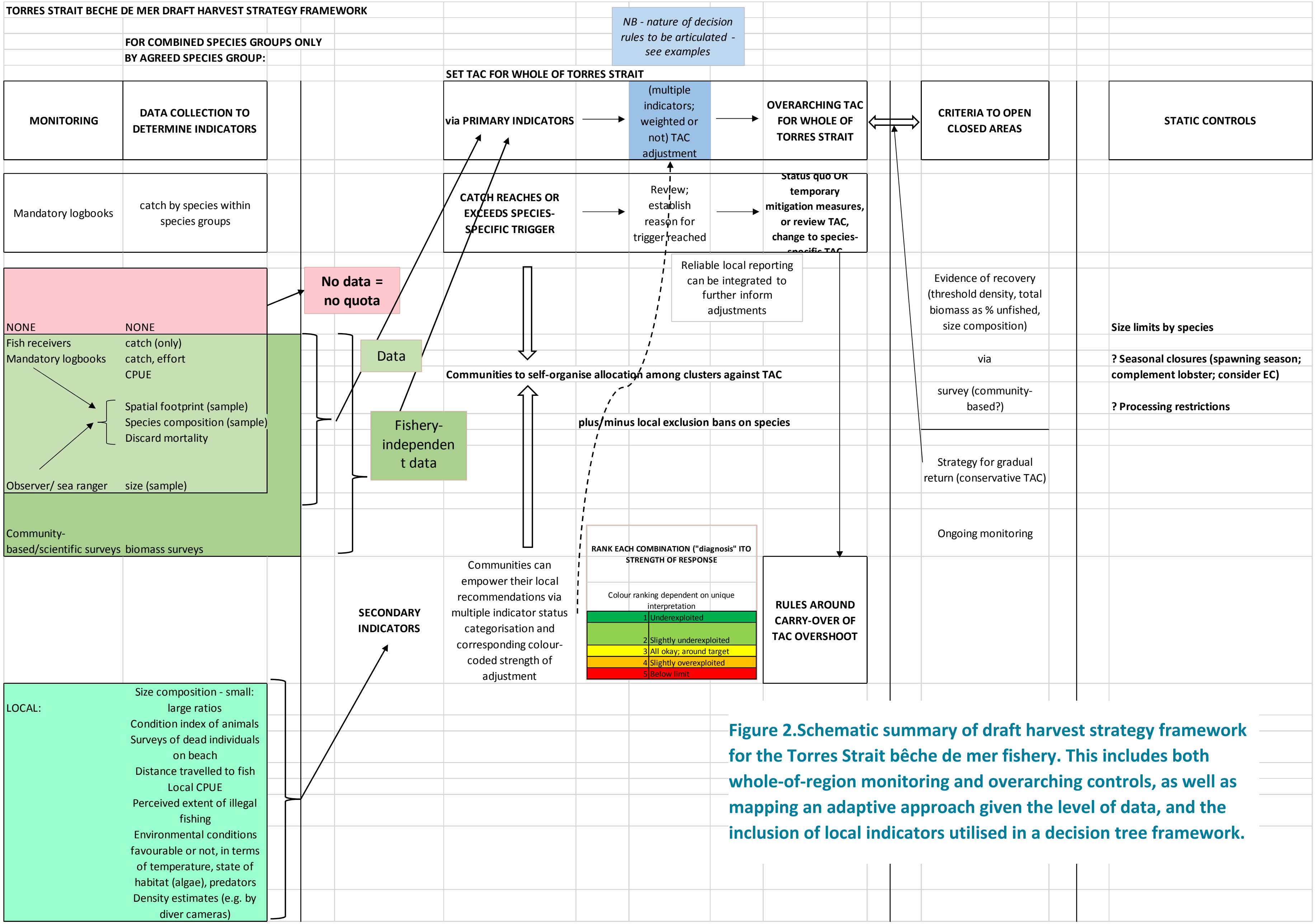


Figure 2.Schematic summary of draft harvest strategy framework for the Torres Strait bêche de mer fishery. This includes both whole-of-region monitoring and overarching controls, as well as mapping an adaptive approach given the level of data, and the inclusion of local indicators utilised in a decision tree framework.

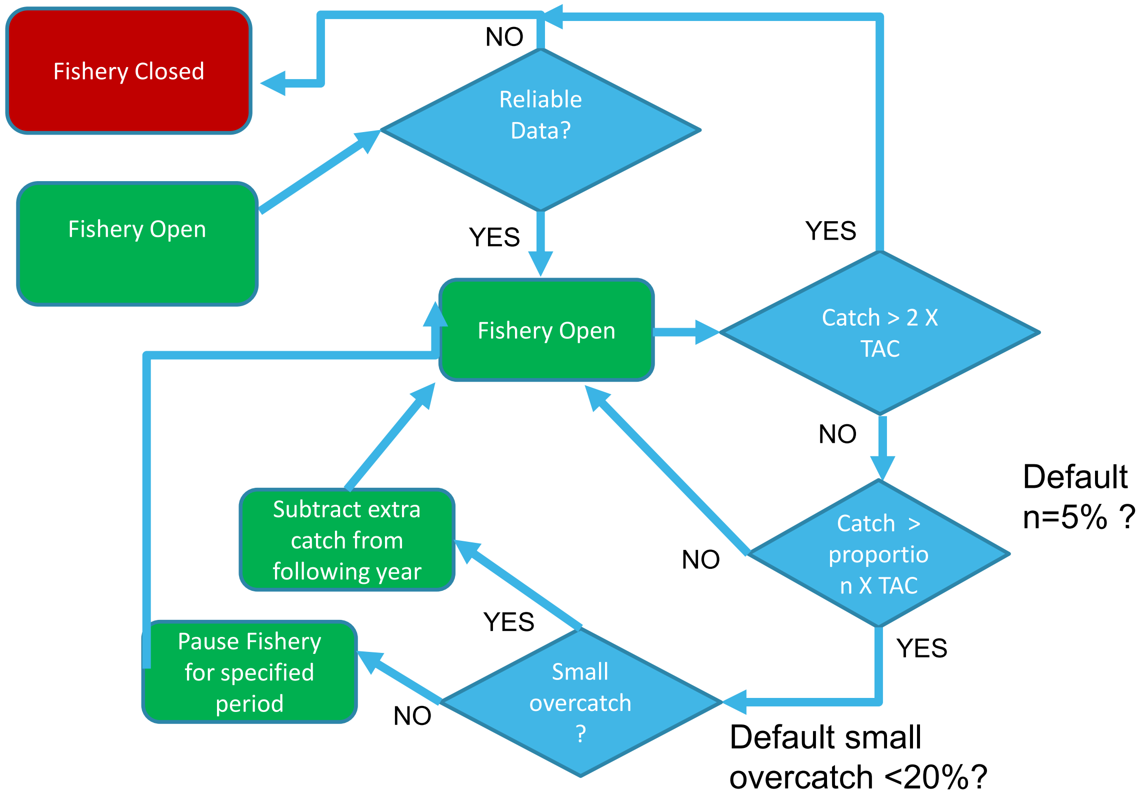


Figure 3. Flowchart summarising illustrative decision rule based on catch

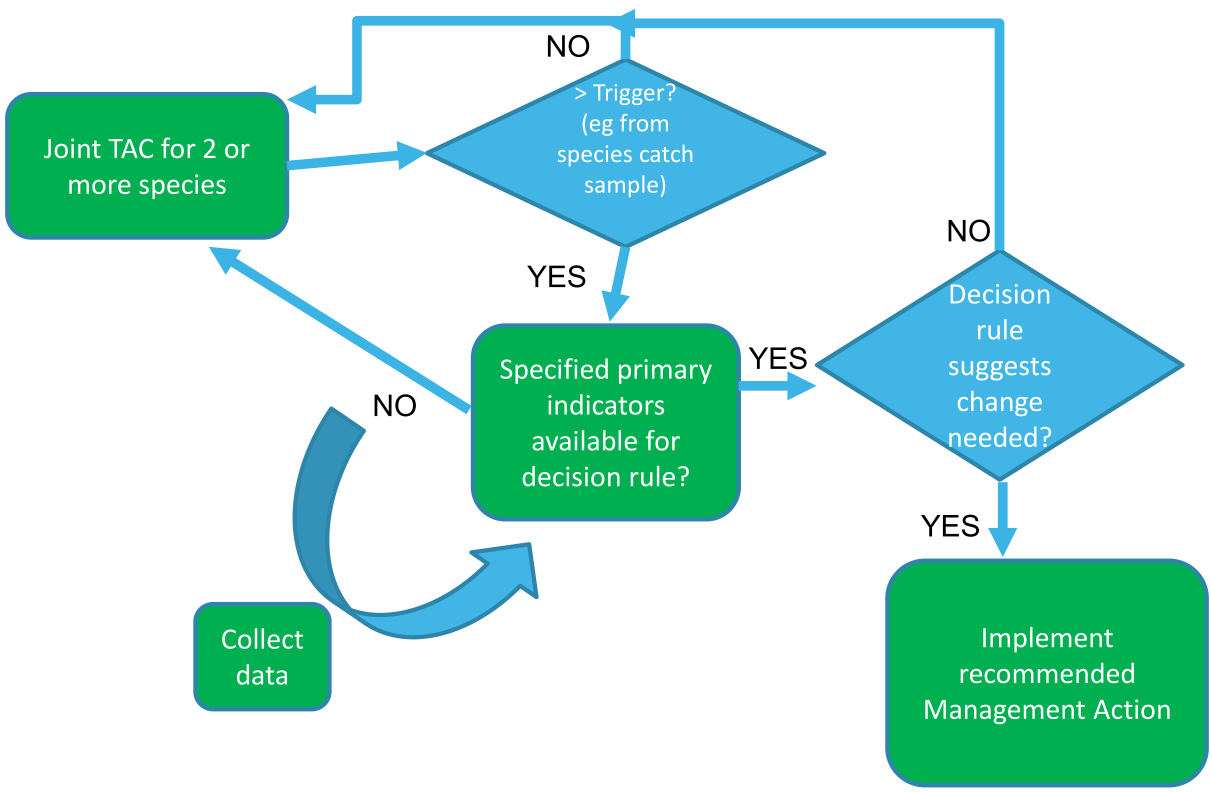


Figure 4. Flowchart summarising illustrative decision rule for reviewing whether a trigger is exceeded for any species caught as part of a lumped species allocation.

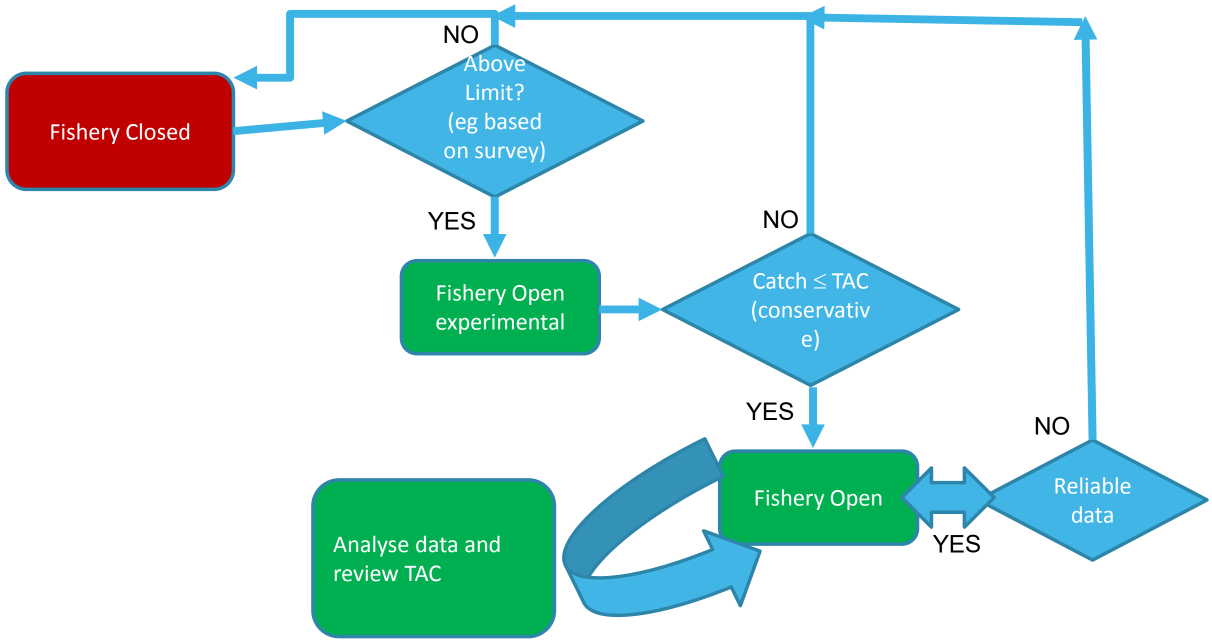
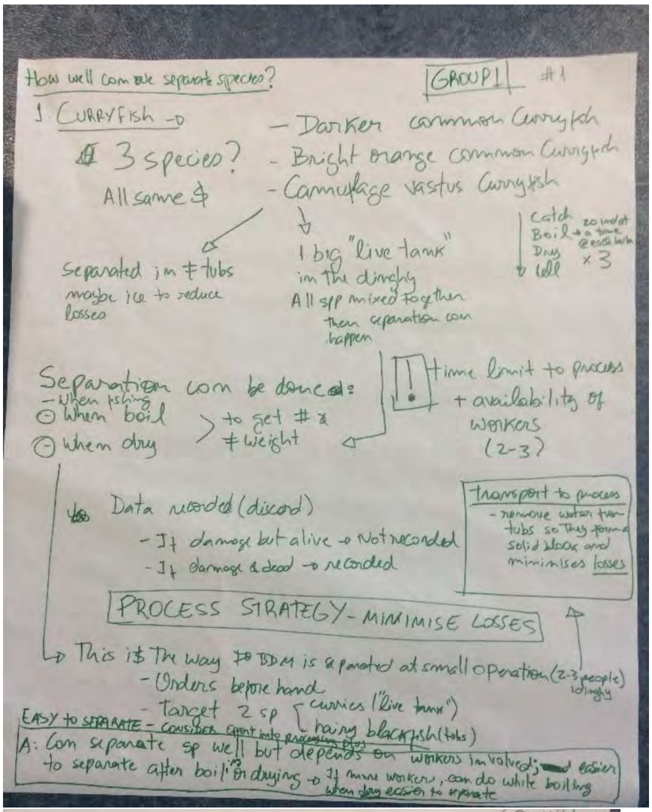


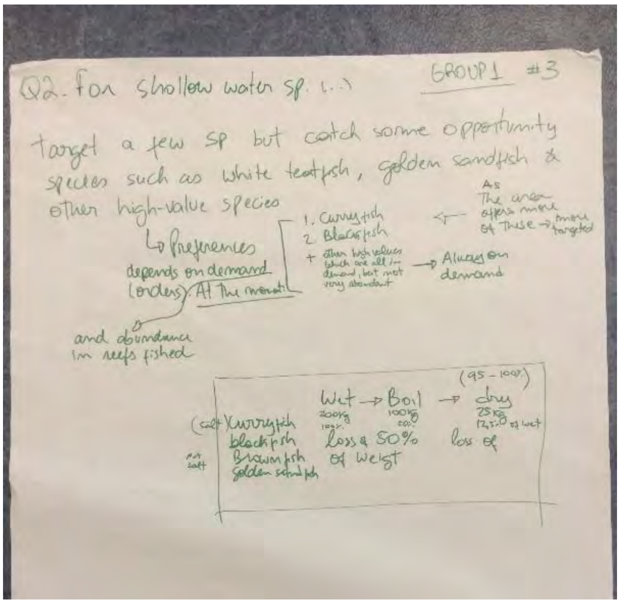
Figure 5. Flowchart summarising proposed process for re-opening a closed fishery.

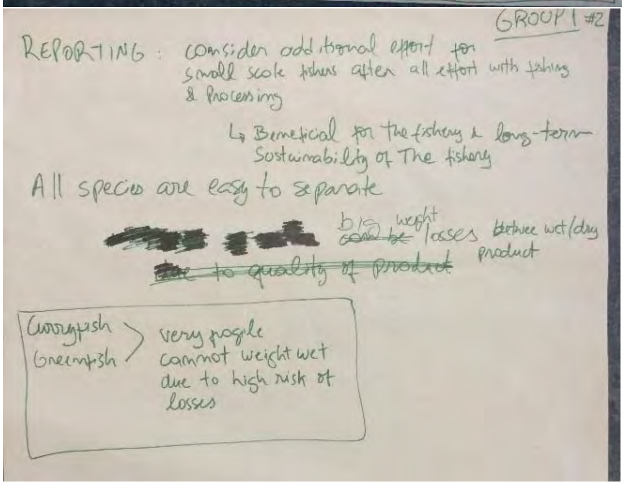
Appendix 2 Summary discussion points from Small Group Breakout Sessions

SMALL GROUP BREAKOUT SESSION 1

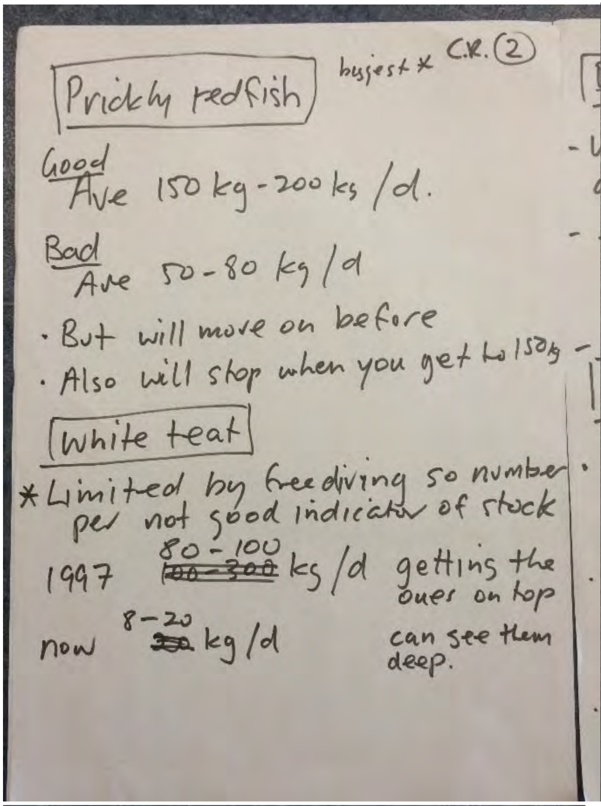
Group 1







Group 2:



C.R. (2)

Prickly redfish   biggest *

Good
Ave 150 kg - 200 kg /d.

Bad
Ave 50 - 80 kg /d

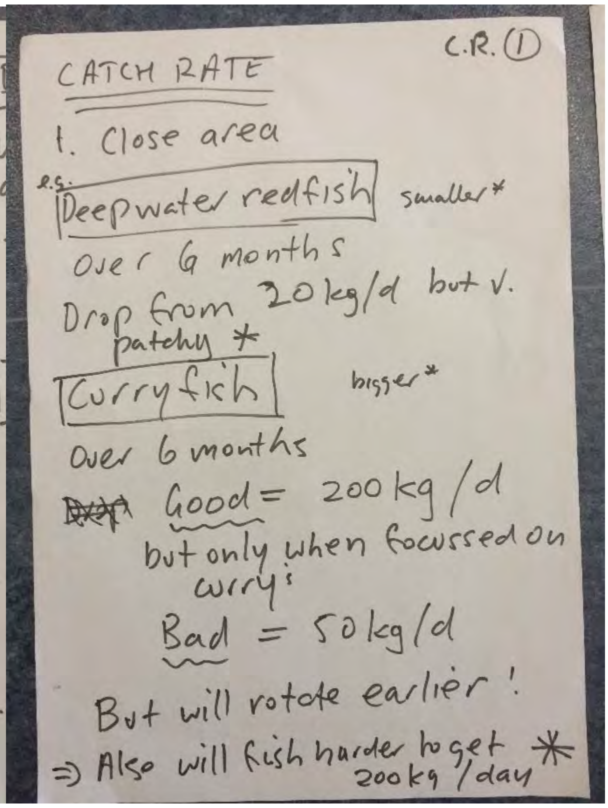
- But will move on before
- Also will stop when you get to 150kg

White teat

* Limited by freediving so number per not good indicator of stock

1997   80 - 100 ~~100 - 300~~ kg /d   getting the ones on top

now   8 - 20 ~~30~~ kg /d   can see them deep.



C.R. (1)

CATCH RATE

1. Close area

e.g. Deepwater redfish   smaller *

Over 6 months

Drop from 20 kg/d but v. patchy *

Curryfish   bigger *

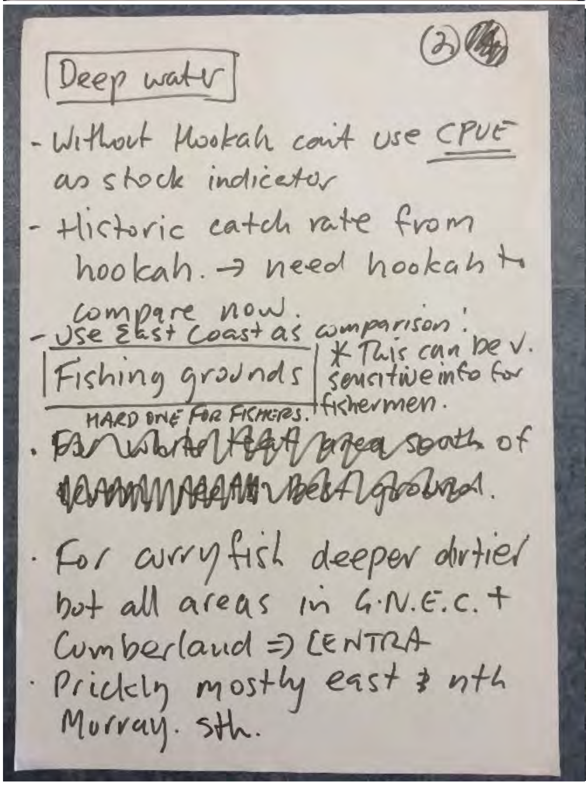
Over 6 months

Good = 200 kg /d
but only when focussed on curry!

Bad = 50 kg/d

But will rotate earlier!

=> Also will fish harder to get 200 kg /day *



(2)

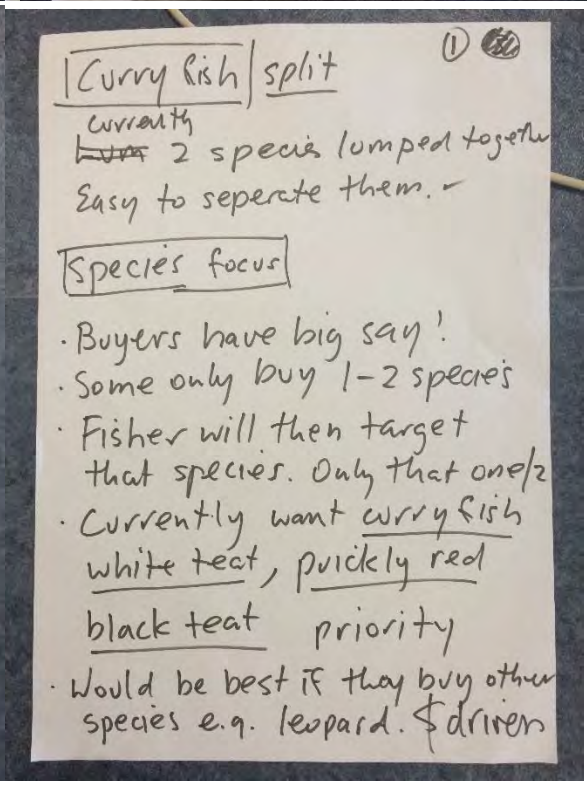
Deep water

- Without Hookah can't use CPUE as stock indicator
- Historic catch rate from hookah. → need hookah to compare now.
- Use East Coast as comparison!

Fishing grounds   * This can be v. sensitive info for fishermen.

HARD ONE FOR FISHERS.

- For white teat area south of [illegible] best ground.
- For curryfish deeper dirtier but all areas in G.N.E.C. + Cumberland => CENTRA
- Prickly mostly east & nth Murray. sth.



(1)

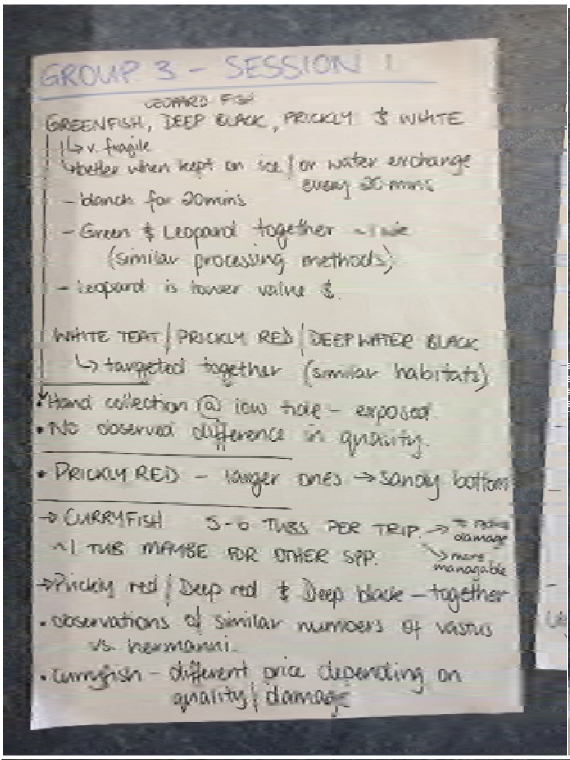
Curry fish | split

currently 2 species lumped together
Easy to seperate them.

Species focus

- Buyers have big say!
- Some only buy 1-2 species
- Fisher will then target that species. Only that one/2
- Currently want curryfish white teat, prickly red black teat priority
- Would be best if they buy other species e.g. leopard. $ driven

Group 3:



GROUP 3 – SESSION 1

LEOPARD FISH

GREENFISH, DEEP BLACK, PRICKLY & WHITE

↳ v. fragile

↳ better when kept on ice / or water exchange every 20 mins

- blanch for 20min's
- Green & Leopard together ~ [illegible]
(similar processing methods)
- Leopard is lower value $.

WHITE TEAT / PRICKLY RED / DEEP WATER BLACK

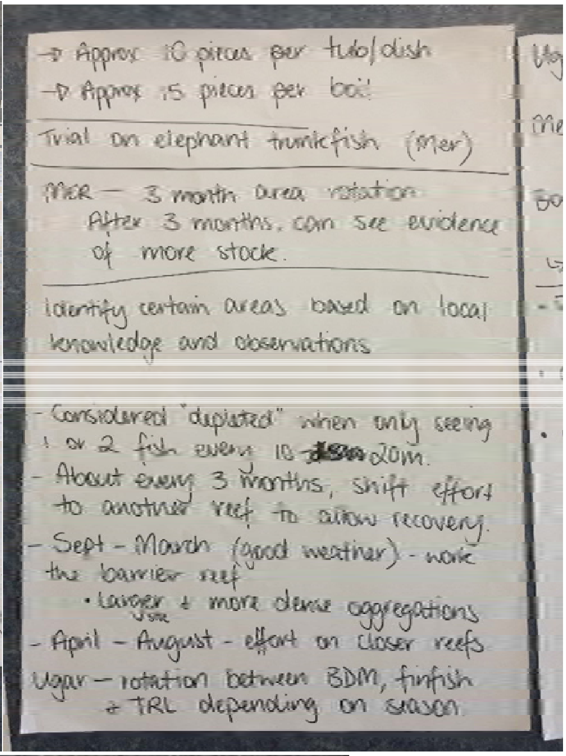
↳ targeted together (similar habitats)

- Hand collection @ low tide – exposed
- No observed difference in quantity.

- PRICKLY RED – larger ones → sandy bottom

→ CURRYFISH 5-6 TUBS PER TRIP → [illegible] damage
~1 TUB MAYBE FOR OTHER SPP. ↳ more managable

→ Prickly red / Deep red & Deep black – together
- observations of similar numbers of vastus vs. hermanni.
- Curryfish – different price depending on quality / damage



→ Approx 10 pieces per tub / dish
→ Approx 15 pieces per boil

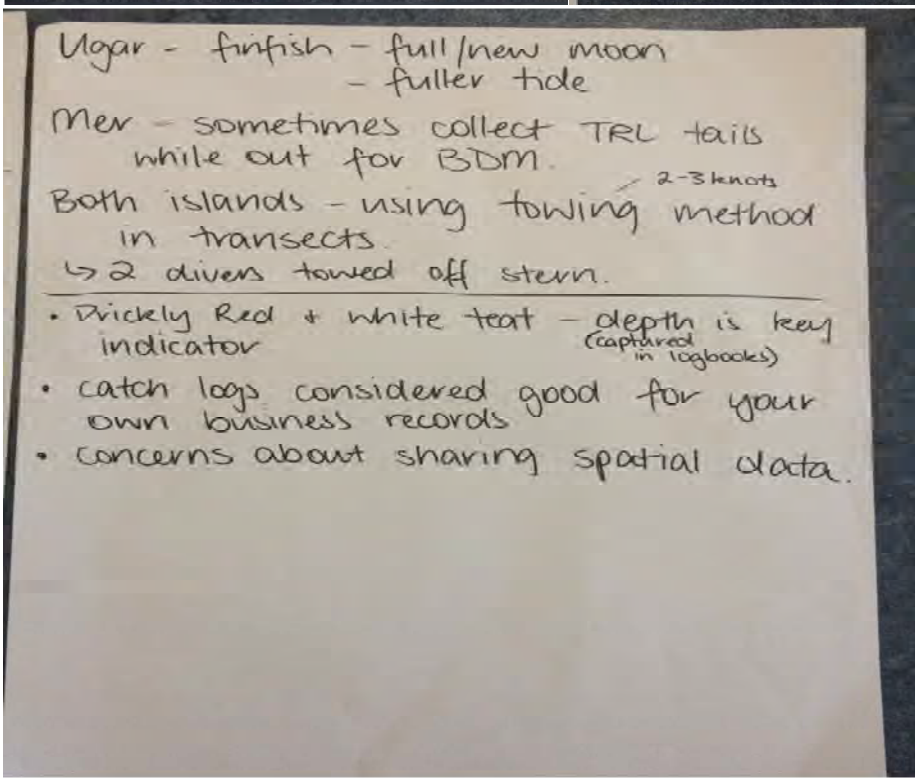
Trial on elephant trunkfish (Mer)

MER – 3 month area rotation
After 3 months, can see evidence of more stock.

Identify certain areas based on local knowledge and observations

- Considered "depleted" when only seeing 1 or 2 fish every 10 ~~[illegible]~~ 20m.
- About every 3 months, shift effort to another reef to allow recovery.
- Sept – March (good weather) – work the barrier reef
  - Larger & more dense aggregations
- April – August – effort on closer reefs

Ugar – rotation between BDM, finfish & TRL depending on season.



Ugar – finfish – full / new moon
– fuller tide

Mer – sometimes collect TRL tails while out for BDM.

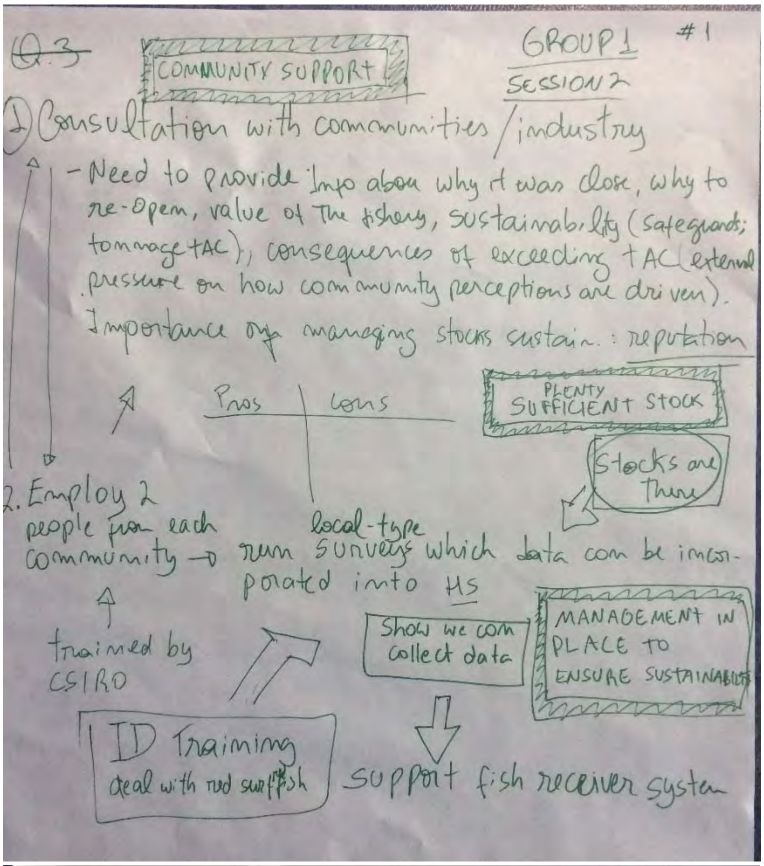
Both islands – using towing method (2-3 knots) in transects.

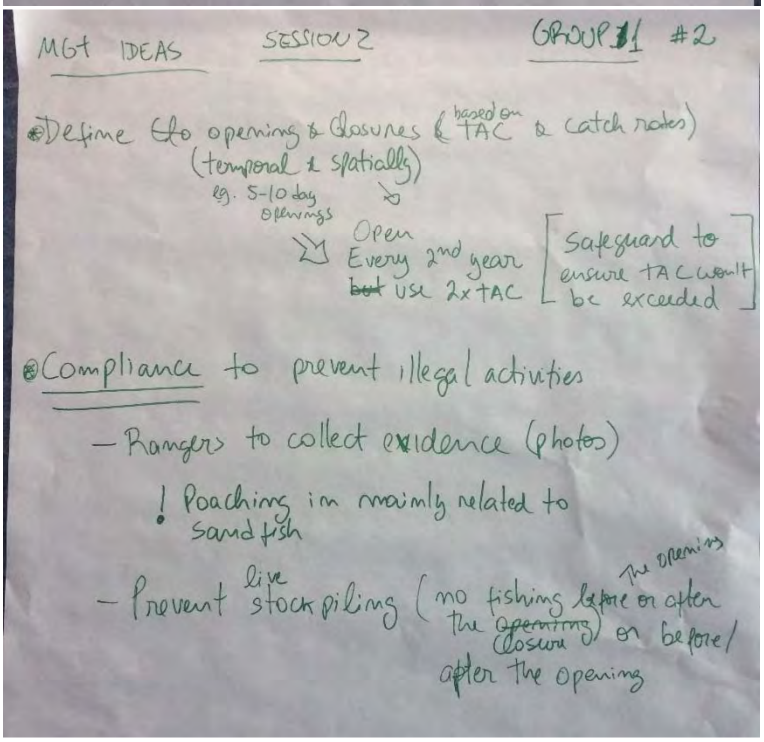
↳ 2 divers towed off stern.

- Prickly Red + white teat – depth is key indicator (captured in logbooks)
- catch logs considered good for your own business records
- Concerns about sharing spatial data.

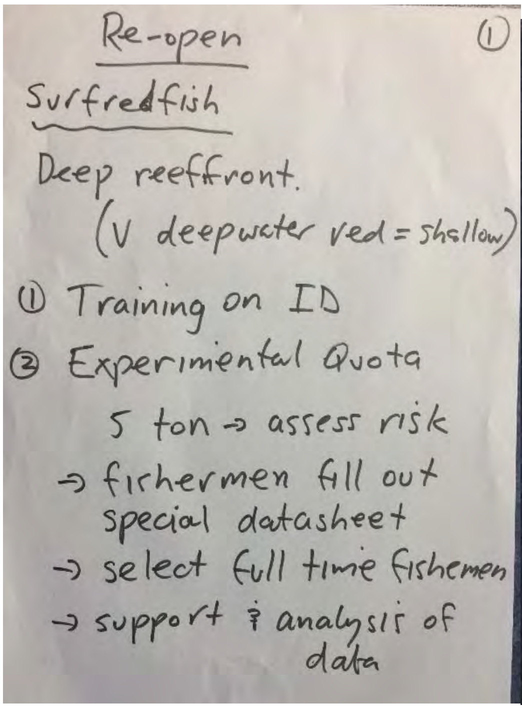
BREAKOUT SESSION 2

Group 1:


Q.3
COMMUNITY SUPPORT
GROUP 1 #1
SESSION 2
1) Consultation with communities / industry
- Need to provide info about why it was close, why to re-open, value of the fishery, sustainability (safeguards; tonnage TAC), consequences of exceeding TAC (external pressure on how community perceptions are driven).
Importance of managing stocks sustain. : reputation
Pros | Cons
PLENTY SUFFICIENT STOCK
Stocks are there
2. Employ 2 people from each community → run local-type surveys which data can be incorporated into HS
trained by CSIRO
Show we can collect data
MANAGEMENT IN PLACE TO ENSURE SUSTAINABILITY
ID Training
deal with red surffish
support fish receiver system


MGT IDEAS
SESSION 2
GROUP 1 #2
• Define ~~to~~ openings & closures (based on TAC & catch rates)
(temporal & spatially)
eg. 5-10 day openings
Open every 2nd year ~~but~~ use 2x TAC
[Safeguard to ensure TAC won't be exceeded]
• Compliance to prevent illegal activities
- Rangers to collect evidence (photos)
! Poaching in mainly related to sand fish
- Prevent live stockpiling (no fishing before or after the ~~openings~~ closure) or before/after the opening

Group 2:


Re-open

Surfredfish ①

Deep reeffront.

(V deepwater red = shallow)

① Training on ID

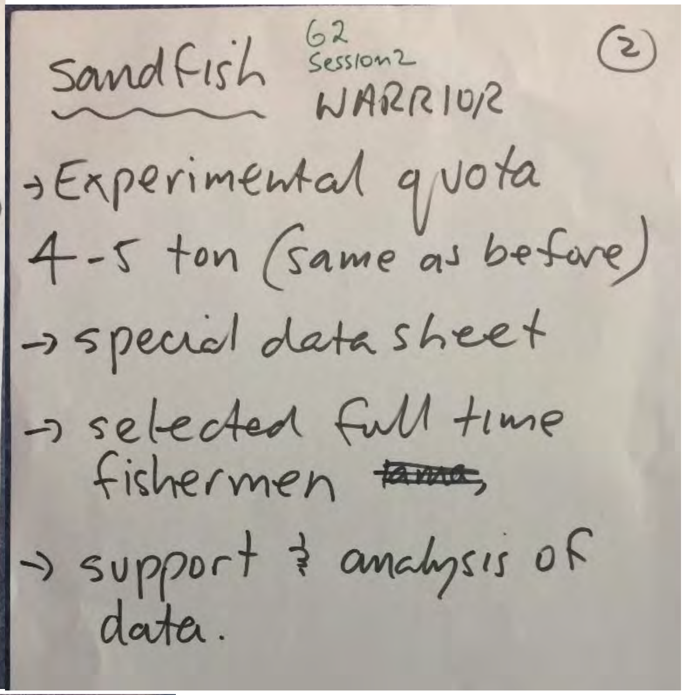
② Experimental Quota

5 ton → assess risk

→ fishermen fill out special datasheet

→ select full time fishermen

→ support & analysis of data


Sandfish G2 Session2 WARRIOR ②

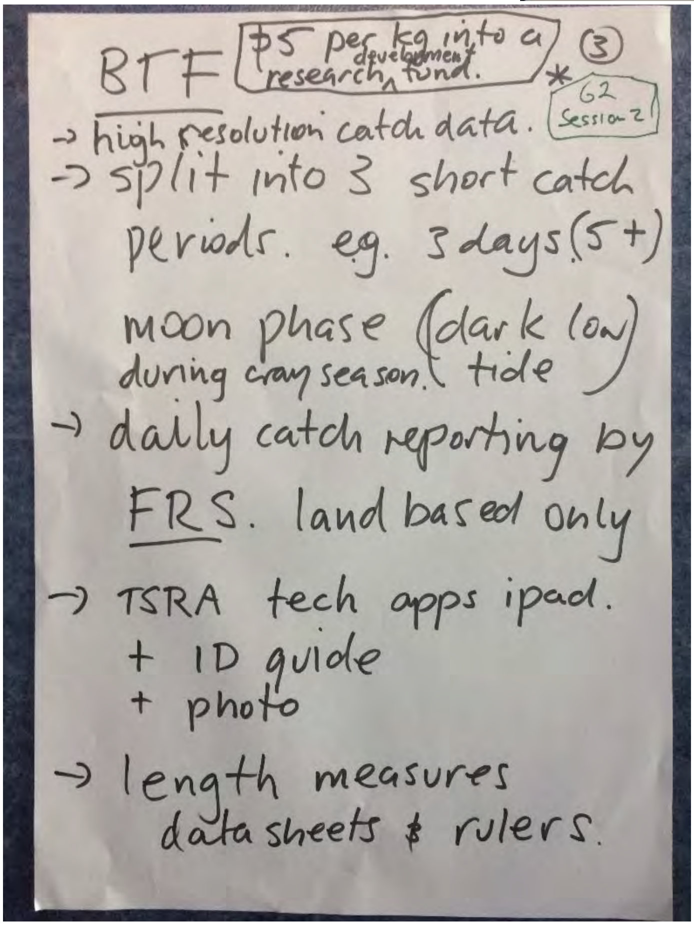
→ Experimental quota

4-5 ton (same as before)

→ special data sheet

→ selected full time fishermen,

→ support & analysis of data.


BTF $5 per kg into a research development fund. ③ * G2 Session 2

→ high resolution catch data.

→ split into 3 short catch periods. eg. 3 days (5+)

moon phase during cray season (dark (low) tide)

→ daily catch reporting by FRS. land based only

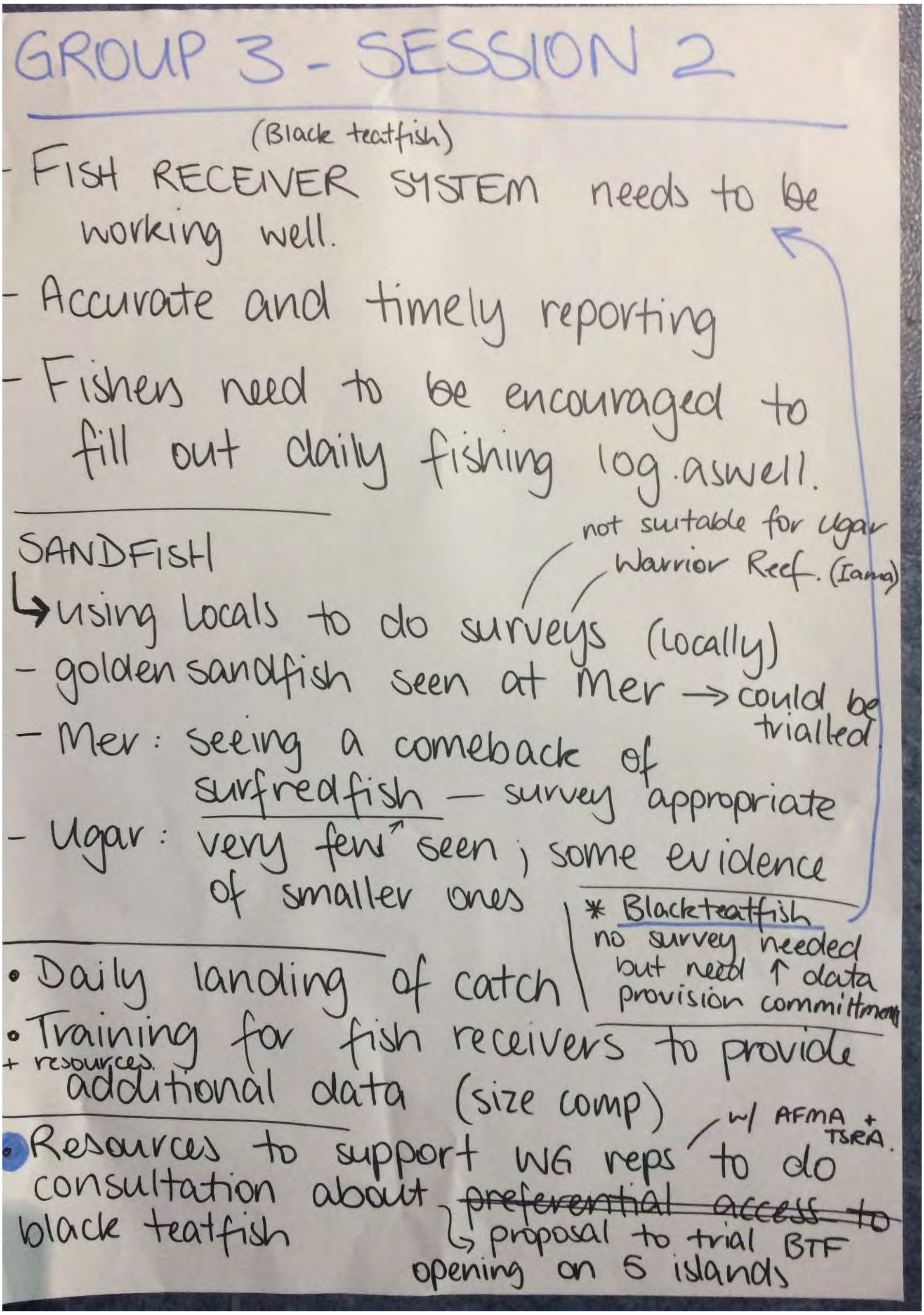
→ TSRA tech apps ipad.

+ ID guide

+ photo

→ length measures data sheets & rulers.

Group 3:



GROUP 3 - SESSION 2

(Black teatfish)

- FISH RECEIVER SYSTEM needs to be working well.
- Accurate and timely reporting
- Fishers need to be encouraged to fill out daily fishing log aswell.

SANDFISH

↳ using locals to do surveys (locally) — not suitable for Ugar — Warrior Reef. (Iama)

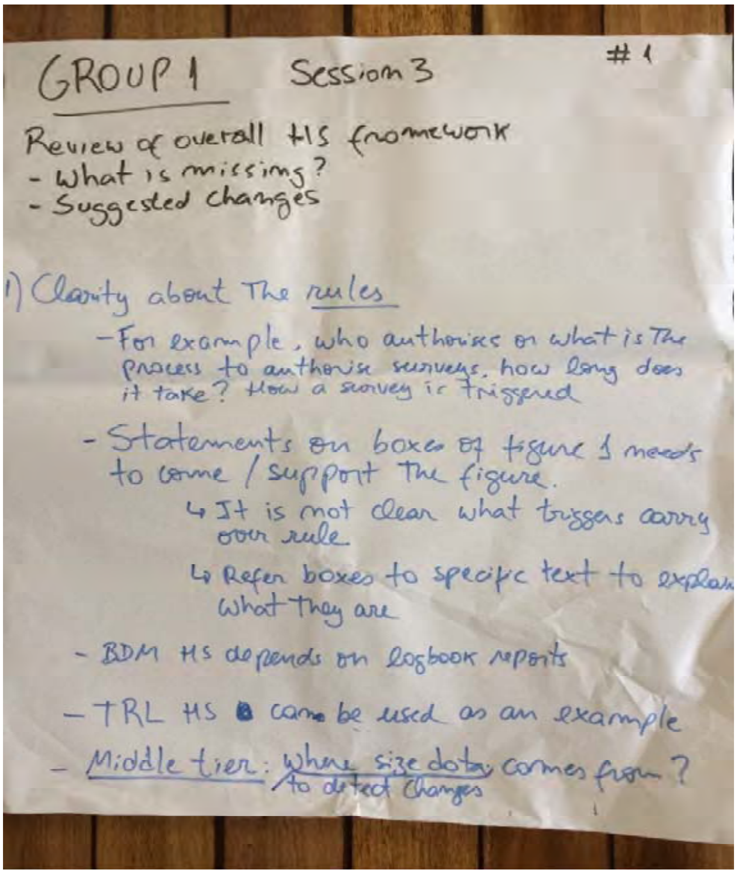
- golden sandfish seen at Mer → could be trialled
- Mer: seeing a comeback of surfredfish — survey appropriate
- Ugar: very few seen; some evidence of smaller ones

* Blackteatfish no survey needed but need ↑ data provision commitment

- Daily landing of catch
- Training + resources for fish receivers to provide additional data (size comp)
- Resources to support WG reps w/ AFMA + TSRA. to do consultation about ~~preferential access to~~ black teatfish
  ↳ proposal to trial BTF opening on 5 islands

BREAKOUT SESSION 3:

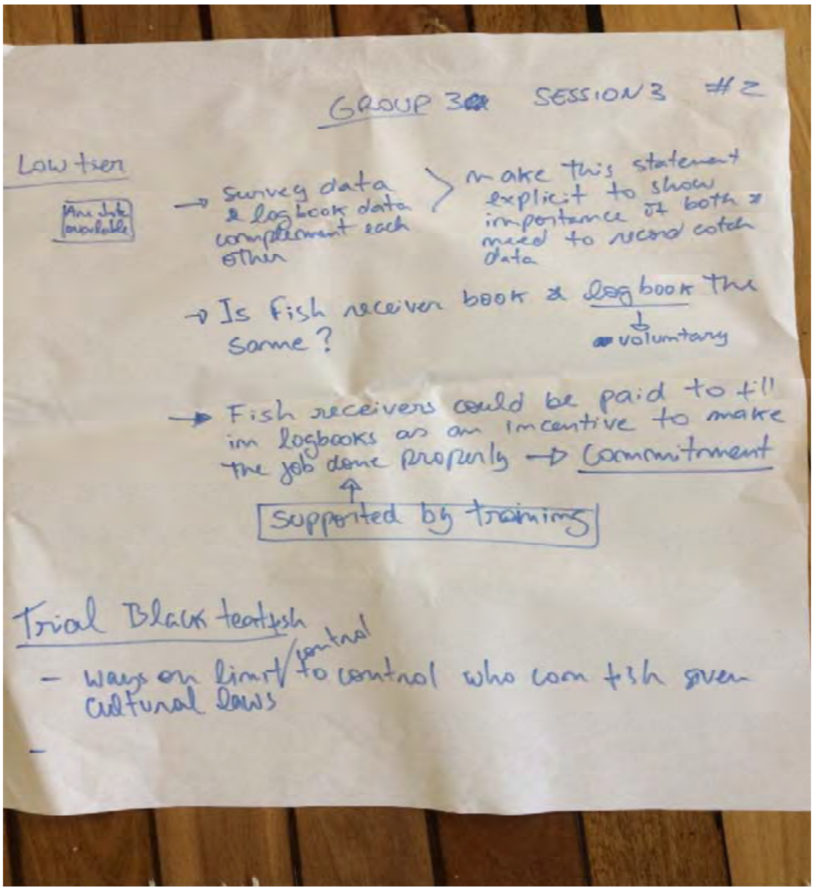
Group 1:



GROUP 1 Session 3 #1

Review of overall HS framework
- What is missing?
- Suggested changes

1) Clarity about the rules
- For example, who authorises or what is the process to authorise surveys, how long does it take? How a survey is triggered
- Statements on boxes of figure 1 needs to come / support the figure.
↳ It is not clear what triggers carry over rule
↳ Refer boxes to specific text to explain what they are
- BDM HS depends on logbook reports
- TRL HS can be used as an example
- Middle tier: where size data comes from? / to detect changes



GROUP 3 SESSION 3 #2

Low tier

Are data available

→ Survey data & logbook data compliment each other > make this statement explicit to show importance of both & need to record catch data

→ Is fish receiver book & logbook the same? voluntary

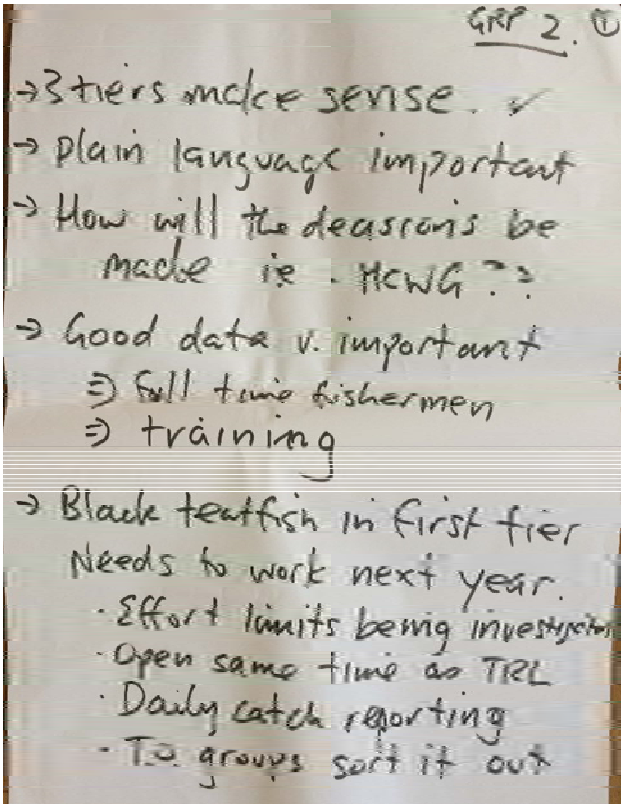
→ Fish receivers could be paid to fill in logbooks as an incentive to make the job done properly → Commitment

Supported by training

Trial Black teatfish
- ways on limit/control to control who can fish given cultural laws

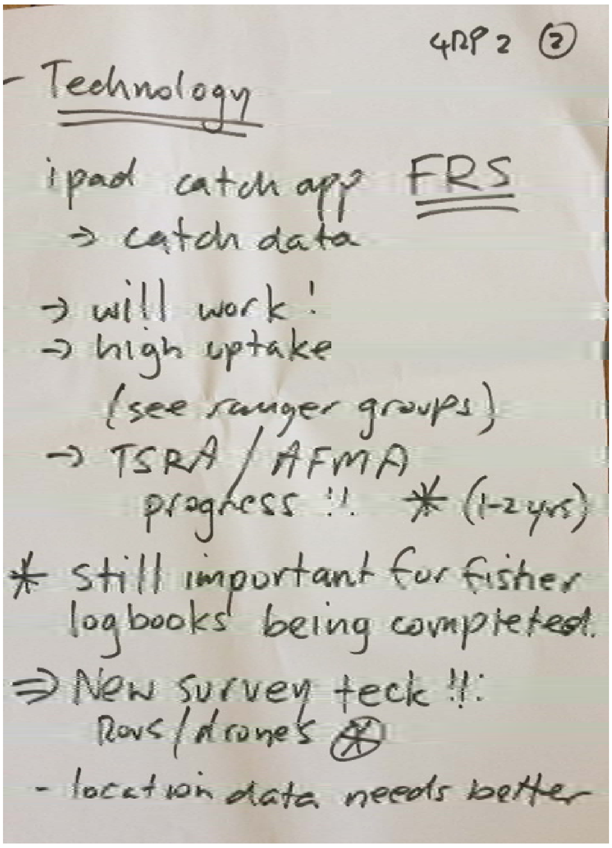
-

Group 2:



GRP 2. ①

→ 3 tiers make sense. ✓
→ plain language important
→ How will the deasions be made ie. HCWG ? ?
→ Good data v. important
⇒ full time fishermen
⇒ training
→ Black teatfish in first tier
Needs to work next year.
· Effort limits being investigated
· Open same time as TRL
· Daily catch reporting
· T.I. groups sort it out

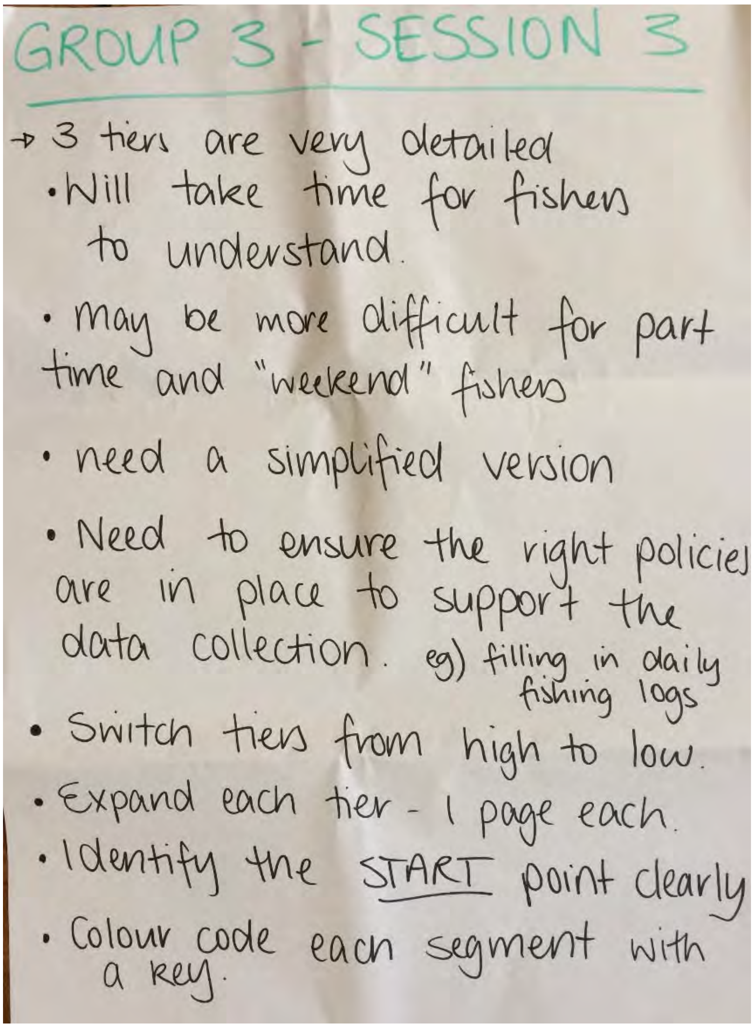


GRP 2 ②

- Technology

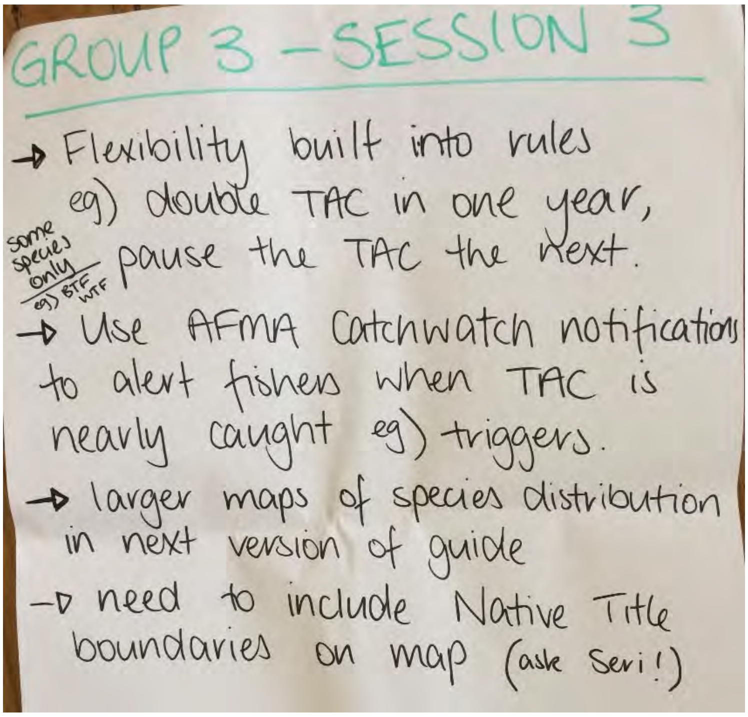
ipad catch app FRS
→ catch data
→ will work!
→ high uptake
(see ranger groups)
→ TSRA / AFMA
progress !! * (1-2 yrs)
* still important for fisher
logbooks being completed.
⇒ New survey teck !!:
Rovs / drones *
- location data needs better

Group 3:



GROUP 3 - SESSION 3

- 3 tiers are very detailed
  - Will take time for fishers to understand.
  - may be more difficult for part time and "weekend" fishers
  - need a simplified version
  - Need to ensure the right policies are in place to support the data collection. eg) filling in daily fishing logs
  - Switch tiers from high to low.
  - Expand each tier - 1 page each.
  - Identify the START point clearly
  - Colour code each segment with a key.



GROUP 3 - SESSION 3

- Flexibility built into rules eg) double TAC in one year, pause the TAC the next.

  some species only eg) BTF WTF
- Use AFMA Catchwatch notifications to alert fishers when TAC is nearly caught eg) triggers.
- larger maps of species distribution in next version of guide
- need to include Native Title boundaries on map (ask Seri!)

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Australian Government

Australian Fisheries Management Authority

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1 List of Tables

2 List of Figures

GLOSSARY

Types of reference points:

Reference Point	Description
Target	Relates to a target reference point as per the HSP. Expressed in terms of biomass
Limit	Relates to a limit reference point as per the HSP. Fishing stops if this reference point is exceeded a specified number of times. Expressed in terms of biomass
MEY	Maximum economic yield occurs when the total profit from the Fishery is maximised
MSY	Maximum sustainable yield is the maximum that can be taken from a stock in perpetuity

Notation:

Notation	Description
B	Spawning biomass level
B_0	The unfished spawning biomass (determined from an appropriate reference point)
F	Fishing mortality rate

Other acronyms:

Acronym	Description
BDM	Bêche de Mer
CPUE	Catch per unit effort
HCWG	Hand Collectible Working Group
HSP	Commonwealth Harvest Strategy Policy and Guidelines 2007
HS	Harvest Strategy
HSF	Harvest Strategy Framework
HCR	Harvest Control Rule
RBC	Recommended Biological Catch
TAC	Total Allowable Catch
Tiered approach	A framework that uses different control rules to cater for different levels of uncertainty about a stock
TSRA	Torres Strait Regional Authority

OVERVIEW

The Torres Strait Sea Cucumber or Bêche de mer Fishery (the Fishery) Harvest Strategy (HS) sets out the management actions needed to achieve the agreed Fishery objectives. The Fishery HS describes the performance indicators used for monitoring the condition of the stock, the analytical procedures and the rules applied to determine the recommended biological catch each fishing season.

The need to formalise a harvest strategy for the Torres Strait bêche-de-mer (sea cucumber) fishery has been discussed at management forums (e.g. Hand Collectables Working Group HCWG) for some time. In consultation with the HCWG, AFMA, TSRA, QDAF, Malu Lamar (Torres Strait Islander) Corporation RNTBC and other stakeholders, CSIRO have led drafting a scientifically-sound harvest strategy. The harvest strategy describes a clear and transparent protocol, agreed on by stakeholders, for monitoring, information gathering, assessment and management into the foreseeable future.

The harvest strategy depends critically on fishery data provided through the Torres Strait Fish Receiver System that was implemented on 1 December 2017. It specifies the data that are needed to effectively manage the fishery and how these data will be used to adjust catch limits and manage the fishery to meet the biological, social and economic objectives. The most important data are accurate total catch per species, and this needs to be provided in a timely fashion. Catch records per day and per spatial location are needed to support scientific assessments of the fishery (lumped and stockpiled data are less useful). It is important to record discards also as these need to be included in the total catch record (with product type also specified). Other very useful data to support scientific assessment include fishing effort (e.g. hours fished) and size of animals caught. Detailed logbook information including areas and depth fished can be submitted confidentially and if sufficient detailed data are provided by the fishery, this can support ongoing growth of the fishery. As this is a multispecies fishery, correct species identification is also important and tools are available to support this.

The harvest strategy provides clear and practical guidance for future sustainable fishing, including the data requirements and conditions for potential fishery expansion. The framework also includes some static controls such as size limits and spatial closures to complement fishery management measures and other traditional community management initiatives (e.g. a proposed 10 nautical mile voluntary ban on fishing for prickly redfish around home reefs).

The draft framework is a tier system which accounts for understanding that more data and more information reduce the risk to a resource and hence reduce the need for precautionary management. This means higher catches are possible if there is more, better quality data available.

The harvest strategy includes different rules for the following cases:

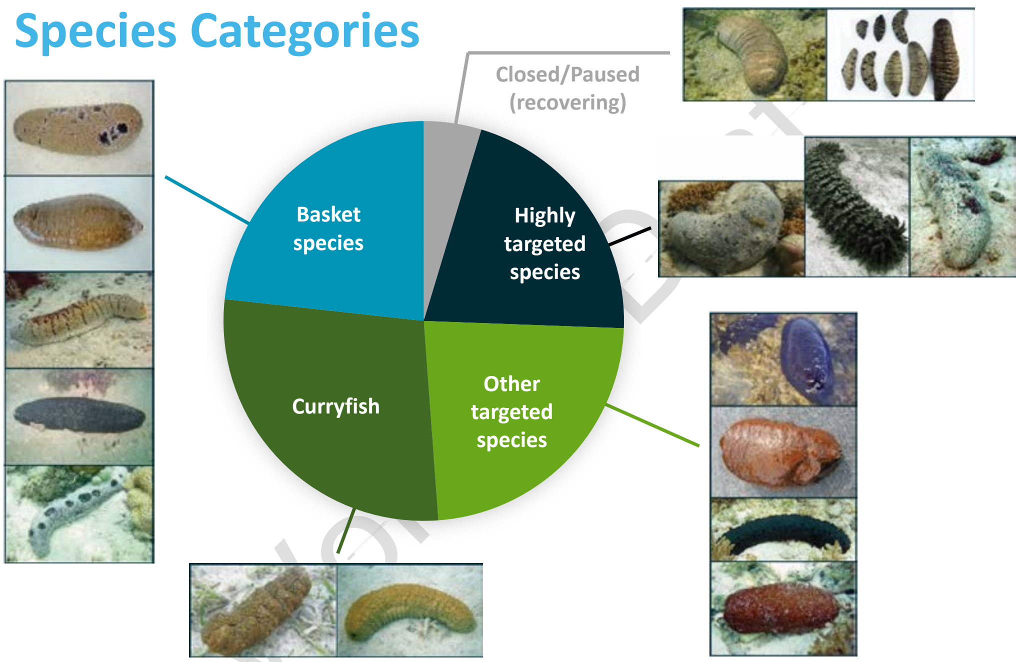
1. Monitoring and adjusting TACs annually, with agreement that a fishery will be closed if no data are provided.
2. Rules for managing mixed species/basket catch limits. To support future growth of the fishery, species specific monitoring is necessary and hence as many target species as possible will be monitored as individual species. Species specific data collection will help support future development of selected species in response to growing market demands.
3. Rules for how to re-open a fishery that has been closed. For example, the need to accurately report catches on a daily basis to support re-opening the black teatfish fishery. For species that were overfished such as sandfish, there are guidelines for supporting species recovery as well as how surveys (either full scale scientific surveys or smaller experimental surveys with fisher participation) can be used to inform whether the fishery could be re-opened.
4. Rules for how to increase TACs if good quality fishery data are available and indicate an increase is possible
5. Rules for how to further increase TACs if high quality survey data become available.

Australia's Commonwealth Harvest Strategy Policy defines a harvest strategy 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 success and recommendations given updates of data and/or model outputs. The HS meets the requirements of the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2007 (*HSP) by applying a precautionary approach as well as a tiered approach that applies different rules to cater for different amounts of data available and to account for changes to uncertainty on stock status. A tiered approach adopts increased levels of precaution that correspond to increasing levels of uncertainty about the stock status, in order to maintain the same level of risk across the different tiers.

3 SUMMARY OF HARVEST STRATEGY

1. The HS has been developed in close consultation with stakeholders, incorporates local knowledge and has been designed to have regard to traditional knowledge and the ability for communities to manage fishery resources locally (e.g. voluntary spatial closures), through acknowledging and incorporating customary and traditional laws.

2. Applies to all Torres Strait BDM species, with these classified into groups as follows:



3. The HS includes voluntary compliance with revised Minimum Size Limits

4. The HS depends critically on fishery data provided through the Torres Strait Fish Receiver System that was implemented on 1 December 2017. It specifies the data that are needed to effectively manage the fishery and how these data will be used to adjust catch limits and manage the fishery to meet the biological, social and economic objectives.

5. The HS uses data from fishers and surveys (where available). Primary Indicators (in order of importance) from fisher data are:
   (i) Catch per species per day (including discards) converted to landed weight (using revised conversion ratios compiled as part of the HS)

(ii) Catch Per Unit Effort (CPUE) – requires Effort (e.g. hours fished) to be recorded
(iii) Proportional composition of different species in catch if individual species mass not recorded
(iv) Size composition (per species) of representative catch sample
(v) Area (and depth) each species caught (preferably fine-scale information)

6. Surveys can be used to produce an index of relative stock abundance or to estimate total standing stock biomass. Surveys need to be conducted in an adequately representative manner and underpinned by scientific principles. Survey data can be used both to quantify trend sin resource status as well as assess resource status relative to reference levels, such as a lower density limit that triggers fishery closure or a threshold level above which a fishery can be re-opened.

7. Decision Rules for each species are specified based on an overall Tier Structure as shown in Figure below which uses one of 5 Decision Rules depending on the species category and data availability. The low tier maintains or reduces TACs, the middle tier allows small increases in TACs and the high tier allows the largest increases in TAC. The re-opening Decision rule has a number of additional conditions attached.

   Low tier (Catch data only):

   1. Catch-based Decision rule: for species-specific recommended biological catch
   2. Joint TAC trigger-limit Decision rule: for lumped species category
   3. Re-opening Decision rule: for re-opening a fishery or area

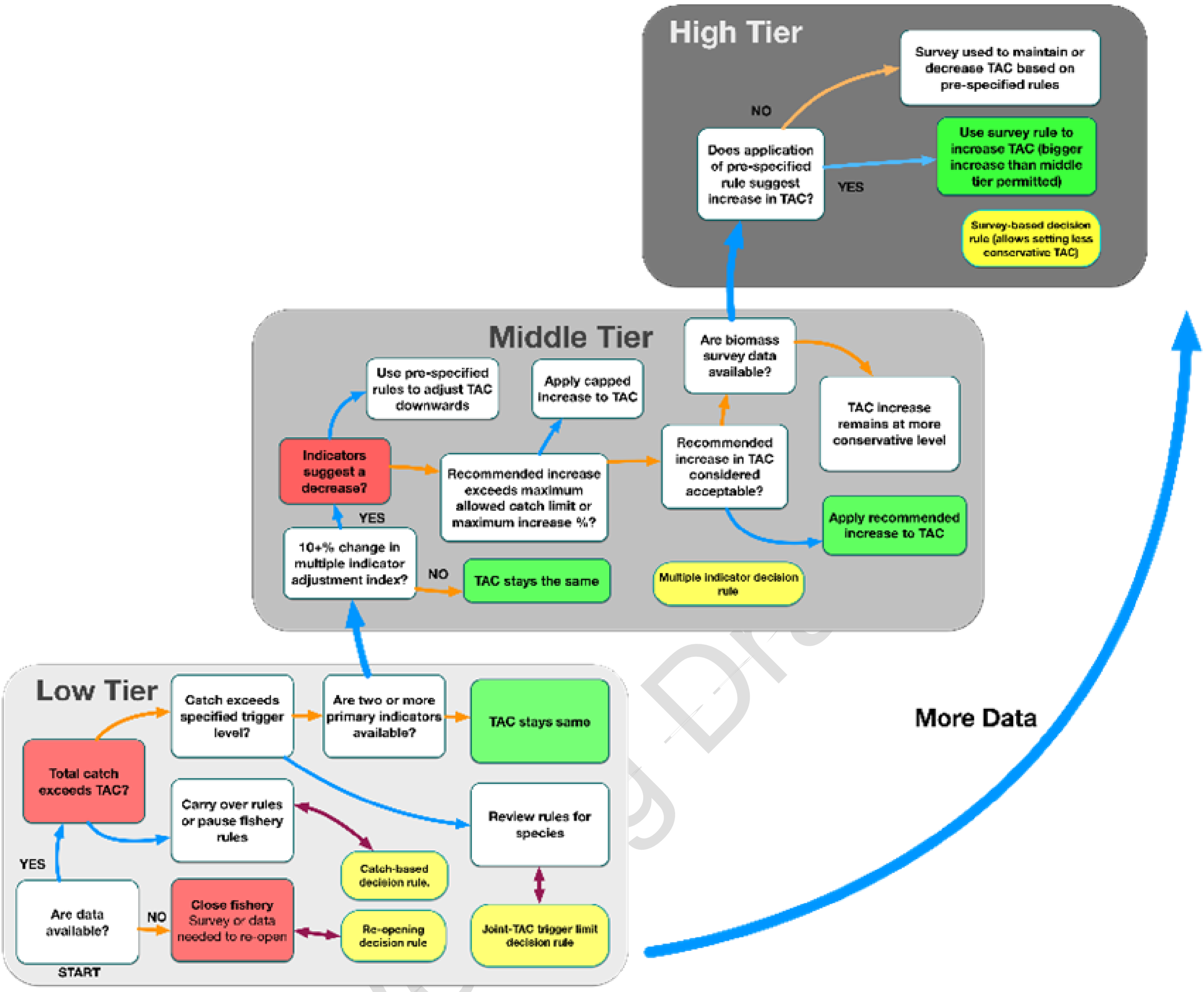
   Middle tier (at least 3 primary indicators):

   4. Multiple Indicator Decision Rule: for adjusting species-specific TACs

   High tier (high quality survey data):

   5. Survey-based Decision Rule

8. The HS development is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order decisions. Simultaneously the framework maps a pathway for ongoing improvements and refinements, such as through further data collection as well as a clear role for community-level data and local knowledge.



4 BACKGROUND

This Torres Strait Bêche de mer Fishery (the Fishery) Harvest Strategy (HS) has been developed in accordance with the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2007* (HSP) and consistent with objectives of the *Torres Strait Fisheries Act 1984* (the Act).

The Protected Zone Joint Authority (PZJA) is responsible for management of commercial and traditional fishing in the Australian waters of the Torres Strait Protected Zone. The PZJA objectives adopted for the Torres Strait Bêche-de-mer Fishery are:

- to provide for the sustainable use of all bêche-de-mer stocks in Torres Strait;

- to develop bêche-de-mer stocks for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty); and
- to develop an appropriate long term management strategy for sandfish.

The HS has been designed to have regard to traditional knowledge and the ability for communities to manage fishery resources locally (e.g. voluntary spatial closures), through acknowledging and incorporating customary and traditional laws. It is recognised that there are differing cultural laws for individual nation groups which may be applied by communities to supplement fishery management measures. These include Malo ra GELAR (Malo's Law) of Kemer Kemer Meriam Nation, Saabi law of Maluilgal Nation, Saabi law of Gudumalulgal Nation, Kulkalgal Nation and Saabi law of Kaurareg Nation.

1.1 COMMONWEALTH FISHERIES HARVEST STRATEGY POLICY

The objective of the HSP is the sustainable and profitable use of Australia's Commonwealth fisheries in perpetuity through the implementation of harvest strategies that maintain key commercial stocks at ecologically sustainable levels, and within this context, maximise the economic returns to the Australian community.

To meet the HSP objective, harvest strategies are designed to pursue an exploitation rate that keeps fish stocks at a level required to produce maximum economic yield (MEY) and ensure stocks remain above a limit biomass level (B_{LIM}) at least 90 per cent of the time. Alternative reference points may be adopted for some stocks to better pursue the objective of maximising economic returns across the Fishery as a whole or other fishery specific objectives.

The HSP provides for the use of proxy settings for reference points to cater for different levels of information available and unique fishery circumstances. This balance between prescription and flexibility encourages the development of innovative and cost effective strategies to meet key policy objectives. Proxies must ensure stock conservation and economic performance as envisaged by the HSP. Such proxies, including those that exceed these minimum standards, must be clearly justified.

With a harvest strategy in place, fishery managers and stakeholders are able to operate with pre-defined rules, management decisions are more transparent, and there are likely fewer unanticipated outcomes necessitating hasty management responses.

1.2 DEVELOPMENT OF THE BDM HARVEST STRATEGY

The HS has been developed in consultation with the HCWG (and as part of HS development workshops led by CSIRO and involving a broader group of stakeholders (3 November 2016; 27-29 June 2017; 25-26 October 2017; 24-26 July 2018; 23-24 October 2018). This document is a first draft HS for consideration by the HCWG, with a subsequent revised version to be considered for endorsement by the HCWG.

5 BDM FISHERY HARVEST STRATEGY

5.1 SCOPE

This HS applies to the whole Torres Strait bêche de mer fishery but not broader species such as trochus that are generally managed as part of the Hand Collectable Fishery complex (Table 1).

The HS outlines the control rules used to develop advice on the recommended biological catch (RBC) and recommend Total Allowable Catches (an enforced limit on total catches). The HS sets the criteria that pre-agreed management decisions will be based on in order to achieve the Fishery objectives.

The HS uses a tiered approach to cater for different amounts of data available and different species groups and types of assessments (for example target species with species-specific Catch-Per-Unit-Effort (CPUE) and surveys). Underpinning a tiered HS is increased levels of precaution with increasing levels of uncertainty about the stock status. Each tier has its own harvest control rule (HCR) and associated rules that are used to determine a RBC.

Table 1. Summary of key bêche de mer species in Torres Strait, together with their minimum size limit and Total Allowable Catch (TAC) in tonnes (from (Murphy et al. 2014))

Common name	Scientific name
Sandfish	*Holothuria scabra*
Surf redfish	*Actintopyga mauritiana*
Black teatfish	*Holothuria whitmaei*
White teatfish	*Holothuria fuscogilva*
Prickly redfish	*Thelenota ananas*
Hairy blackfish	*Actinopyga miliaris*
Curryfish common	*Stichopus herrmanni*
Elephant trunkfish	*Holothuria fuscopunctata*
Lollyfish	*Holothuria atra*
Deepwater redfish	*Actintopyga echinites*
Curryfish vastus	*Stichopus vastus*
Burrowing blackfish	*Actinopyga spinea*
Deepwater blackfish	*Actinopyga palauensis*
Golden sandfish	*Holothuria lessoni*
Brown sandfish	*Bohadschia vitiensis*
Leopardfish	*Bohadschia argus*
Greenfish	*Stichopus chloronotus*
Stonefish	*Actinopyga lecanora*

5.2 OBJECTIVES

The objectives of the Harvest Strategy are as follows:

- to provide for the sustainable use of all bêche-de-mer in Torres Strait to take account of long-term sustainability for future generations;

- to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations;
- to acknowledge area-specific issues;
- where possible, to consider an ecosystem approach to management that reduces impacts on, or optimises interactions with, other harvested and dependent species; and
- to develop long-term recovery strategies for species, where appropriate.

5.3 RECOMMENDING TACs FROM RBCs

The Recommended Biological Catch (RBC) is the recommended total catch of BDM (both retained and discarded) that can be taken from throughout the Torres Strait region in a calendar year. The HSP states that when setting the TAC for the next fishing season the HS should take into account all sources of fishing mortality.

5.4 MONITORING

The Fishery is monitored by a range of methods listed below. Currently there is no ongoing monitoring strategy in place to collect economic information. In addition, very limited historical fishery-dependent monitoring data are available because catch reporting was only made compulsory in December 2017, and it is anticipated that there will be a time lag before reliable catch and effort data is available for analysis. Hence the HS outlines a starting point in terms of data collection, analysis and use to inform decision making, but this may need to be revised as more data and data needs arise. Hence it is acknowledged that development of a harvest strategy is an ongoing process, with the immediate requirement for some basic primary indicators which can be used in setting rules to inform first order decisions. Simultaneously the framework will clearly map a pathway for ongoing improvements and refinements, such as through further data collection as well as a clear role for community-level data and local knowledge.

Fishery independent surveys

There are a considerable number of surveys and other biological studies (Long et al. 1996; Skewes et al. 2000; Skewes et al. 2002; Skewes et al. 2010) conducted in Torres Strait which have been used to inform aspects of harvest strategy development. Fishery-independent surveys are not a compulsory component of the HS but are highly recommended where appropriate to inform decisions related to whether increases or decreases in TACs may be warranted. Considering the costs of surveys relative to the value of the fishery, its multispecies nature and spatial heterogeneity, there are a range of different survey types that could be used as inputs to the HS. These include:

(i) Small-scale experimental fishing surveys with local fisher participation and possible cost-recovery via fishers being permitted to sell animals surveyed (e.g. Warrior Reef sandfish experimental fishing survey, 2012);

(ii) Species-specific dedicated surveys (which could be conducted by fishers and/or scientists) and are tailored to effectively survey stocks that are not otherwise easily included in more general surveys, e.g. white teatfish (due to depth), black teatfish (due to high value and sensitivity to overexploitation), deepwater redfish (restricted distribution)

(iii) Full-scale scientific surveys conducted over a large representative area and surveying multiple species.

There are a number of existing protocols for survey design based on previous surveys and it is recommended that these be adhered to in designing future surveys for use as inputs to the HS (see also Supporting Information). This is also to ensure that new data are consistent with and comparable to historical information and can therefore be used as an index of relative abundance (see decision rules). Most surveys will yield an index of relative stock abundance, but some of the above survey designs could also be used to estimate total standing stock biomass. To be useful for management, surveys need to demonstrate that they are conducted in an adequately representative manner and underpinned by scientific principles, and hence all references to survey data in the HS assume that the survey design and execution have been approved by qualified scientific expertise.

Catch and effort information

Fishers are required to record catch information as part of the mandatory Fish Receiver System. This includes reporting the total mass of each species landed, as well as the processed stage so that conversion ratios (see Appendix Table A.1) can be used to convert all catch measures to landed (gutted) weight which is (as the latter is the measure used to assess the biological impact on the stock). It is essential that these records also include an accurate estimate of the total discards (which includes product lost due to processing losses). It is important to separate total catch into the different species and record species names as accurately as possible. Where there is uncertainty regarding accurate species identification, it is recommended that a couple of representative photos of the catch be taken for later identification (e.g. with the assistance of scientists or experienced industry persons) and the catch record reference needs to be stored with the photos. For species such as curryfish with a mixed bag of similar species (and in instances where it isn't practical to separate the species due to handling and processing constraints), the proportion of each individual species (in particular *Stichopus hermanni* and *S. vastus*) should be estimated (noting that several fishers have indicated they are able to distinguish these species in a variety of product forms – alternatively, representative photos of the catch should be provided).

As part of the data recording process, the area where the sea cucumbers were caught needs to be recorded as accurately as possible. Although it is important to know where catch is landed and by whom, for scientific assessments, information about the location (e.g. even if within say 5km) where the sea cucumber were caught is extremely valuable. If high quality area-specific and depth information are recorded, these data could be used as inputs to the decision rules described below.

Although it is not currently compulsory to record fishing effort, this is a key measure that is used to calculate the Catch-Per-Unit-Effort (CPUE) which can serve as an index of abundance and hence inform on stock status and trends. High quality CPUE data are needed as inputs to decision rules that can be used to adjust TACs upwards or downwards. If no regular fishery-independent (survey) data are available, high quality CPUE provide a valuable input that can be used to support decision making. The default unit of effort is assumed to be one day, but data quality can be improved by recording the total number of hours per trip (corresponding to the catch landed), and number of fishers in the vessel. For these reasons, it is also required that total catch be recorded on a daily basis, rather than accumulating catch and completing a single data entry for more than one day's fishing.

For some high value target species or species with a restricted distribution, the CPUE data are expected to index a single species only, and this should be obvious from the data entries submitted. For catches comprised of mixed species, the total catch and effort information are still useful provided an accurate breakdown of the component species is provided. If a fishing trip involved targeting different species or areas, data would be most useful for analyses if an estimate is provided of the total time spent on different activities.

Note also that for high value species such as black teatfish, there are additional constraints imposed on the recording of catch information as detailed in this HS document.

Catch sub-sampling information

Additional data that are required as inputs to decision rules for use in adjusting TACs include estimates of the size distribution of individual species caught. It isn't necessary to measure every animal caught, but accurate measures of the length and mass of a representative (by area and species) sub-sample is important as an input to the decision rules. Size frequency sub-sample information could be collected by volunteers, nominated fishers or trained fish receivers. These data could also be completed by additional detailed information such as the proportion of each species comprising a mixed bag catch.

Environmental Indicators

As a stretch objective for the fishery, some fishers indicated as part of the HS workshops that they were eager to undertake local reporting and to take responsibility for local management. As such, a draft framework was developed to operationalise these indicators in a decision framework to provide a defensible basis on which to make recommendations for cluster catch allocations and for other local management measures. The draft hierarchical decision tree framework considered two groups of local indicators: "primary" local indicators (those felt to be most reliable/important, and thus invoking the greatest change in management), and "secondary" local indicators (used to make further, more minor adjustments to management recommendations). Examples of indicators include condition of feeding grounds (algae etc), density estimated from diver camera surveys, surveys of dead individuals on the beach and perceived extent of illegal fishing. This framework is described in Supporting Information as no such data are currently available for evaluation, but if these data are collected on a regular basis in future, then it might be possible to more formally incorporate them in the HS given that it is anticipated the HS will regularly be revised and updated in future years.

Information based on local knowledge and the ability to locally manage resources

The stated objective of acknowledging and incorporating local knowledge and the ability to locally manage resources has been achieved to some extent as all elements of the HS, developed in close consultation with Traditional Owners, have been informed by local indigenous knowledge:

- For example, species targeted, processing challenges, discard rates, areas fished, species distribution
- Local knowledge has informed which strategies are likely to be successful and implementable
- Local knowledge being used to propose additional management measures, such as voluntary spatial closures for sensitive species

In addition, customary practices are being acknowledged and included as "voluntary" (i.e. self-managed) components of the HS.

The HS will be subject to periodic reviews and updates, and hence there will be ongoing opportunities to refine and improve the HS in future. Summaries of local knowledge, observations, preferences, outcomes of local management practices such as community-specific closures and spatial rotations as to where fishing takes place should all be recorded (e.g. via the HCWG) and could be used in an iterative manner to continually improve the HS and ensure customary practices receive appropriate acknowledgement.

5.5 Management controls – static

The overarching harvest strategy framework (Appendix Fig. A.1) specifies a number of static controls that can be implemented to complement and strengthen other management actions. The key static controls used to strengthen the HS are as described below, with dynamic (i.e. changing over time) controls outlined in later sections of this document.

5.5.1 Size limits

Recent research on Australia's sea cucumber fisheries recommended that for data-poor species in regions where more sophisticated management controls are difficult to implement (Plagányi et al. 2015) a minimum legal size (MLS) limit enhances benefits. Where data are available to inform as to the choice of this, it should be selected to protect at least the first age-at-maturity. This HS includes recommended changes in some current size limits to bring them in line with updated information on the age-at-first-maturity as well as to better align them with comparable size limits from other fisheries such as the East Coast Bêche de Mer Fishery. Appendix Table A.2 summarises the revised HS size limit recommendations.

5.5.2 Spatial and temporal closures

Workshop participants expressed that there might be value in bans on fishing during part or all of the peak bêche de mer spawning time, which was identified from Appendix Table A.3 as November to January. Moreover, it was felt that another advantage of banning fishing over this period was because it coincides with a closure and hookah-ban closure in place for the tropical lobster fishery (and hence prevents shifting effort from one fishery to another). Temporal/seasonal closures are not currently implemented as a compulsory component of this HS but could be used as an additional management measure by local communities and may be more formally incorporated in future versions depending on level of support and need.

In addition, local communities may choose to complement this HS with voluntary spatial closures, which could also potentially be formally recognised as compulsory closures in future HS revisions. For example, at the Working Group meeting held on 27 June 2017, Mer and Erub industry members and observers proposed voluntary spatial closures for Prickly

Redfish, noting that further consultation with Ugar and Masig communities was required before such closures could be finalised and implemented. The proposed closures include:

a. 10 nautical mile radial closures from Mer and Erub communities

b. area closures on the following reefs: Big Mary Reef; Small Mary Reef; Bramble Cay; Brown Reef; Laxton Reef.

A map of these closures is provided in Appendix Figure A.2.

The HS therefore recognises that management needs to account for local knowledge, and spatial structure, and fishers need to follow local rules as the preferred model is one where management is complemented by community ownership and people looking after their own areas.

5.6 SPECIES CLASSIFICATION

The HS recognises that the TS BDM fishery is a multispecies fishery comprising species with different life histories, economic value, distributions and fishing pressure. All species have therefore been assigned to one of 5 species categories as described in Table 2 and Fig. 1.

Table 2. TS BDM species category definitions (see Table 1 for list of scientific species names)

	Species in category	Category definition
Closed/Paused (recovering)	sandfish, surf redfish	Overfished species on recovery plan; need survey to evaluate if recovered sufficiently to reopen
Highly targeted species	black teatfish, white teatfish, prickly redfish	High value species that require specialised assessment and monitoring methods
Other target species	hairy blackfish, deepwater redfish, greenfish	Target species with own individual TAC
Curryfish	3 curryfish species	Increasingly targeted curryfish species
Basket species	all other species	Remaining species lumped but with trigger to identify species of growing commercial interest

5.7 Total Allowable Catch (TAC)

A critical requirement for the HS is that the right policies are in place to support data collection. The Fish Ree4iver system is therefore an integral part of the HS. The HS therefore assumes that there is accurate data collection and compliance with pre-agreed decision rules as outlined in this document. As this is an advance on previous practises, adoption of the HS means that it is possible to set slightly less conservative TACs for stocks, consistent with the underlying philosophy of the tier system. The HS includes recommendations for changes to the current TACs (Table 3), with these changes also reflecting the revised classification of the component fishery species into categories as shown in Fig. 1. Changes in market value and demand mean that several additional species were identified as needing to have specific TACs or triggers (with associated actions). These include curryfish, greenfish, hairy blackfish and deepwater redfish (Table 3). Systems such as the AFMA catch watch need to be used to alert fishers when approaching the TAC.

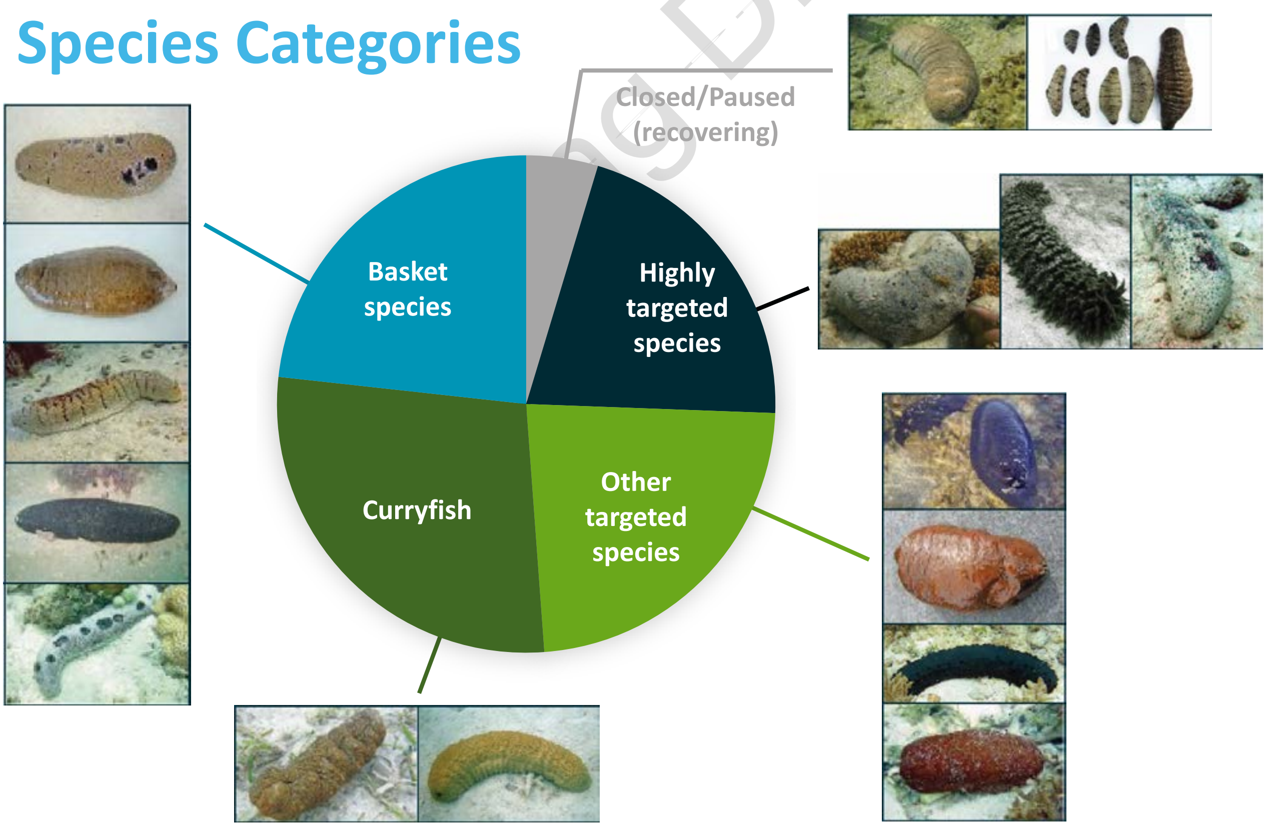


Figure 1. Schematic showing 5 BDM species categories used in the HS

Table 3. HS Revised TAC recommendations

Common name	TAC (t)	Proposed changes	Trigger for basket TACs	Maximum (based on indicators)	Max recorded historical catch and year
Sandfish	Closed	Closed		5	200t (1994)
Surf redfish	Closed	Closed		5	60.2t (1998)*
Black teatfish	Closed	rial (1 Dec 2019) 15t		25	52.7t (1996)
White teatfish	15	15		20	16.3t (2014)
Prickly redfish	l5 (reduced from 20	5 (reduced from 20)		20	28.1t (2015)
Hairy blackfish	Part of 80t limit	5		10 (lower CI survey as uncertain)	28.5t (2001)
Curryfish common	Part of 80t limit	60t curryfish		60 (hermanni)	6.1t (2015); 15t (mid-2018)
Elephant trunkfish	Part of 80t limit	Part of 50t limit	15	15	0.4t (2004)
Lollyfish	Part of 80t limit	Part of 50t limit	40?	80	0?
Deepwater redfish	Part of 80t limit	5#		40? (80t based on surveys?)	5.5t (2015)*
Curryfish vastus	Part of 80t limit	60t curryfish	15	20 (vastus)	see curryfish
Burrowing blackfish	Part of 80t limit	Part of 50t limit	5?	10 (survey suggested could be high around Warrior etc)	0
Deepwater blackfish	Part of 80t limit	Part of 50t limit	0.5?	10	0.5t (2001)*
Golden sandfish	Part of 80t limit	Part of 50t limit	0.35?	5	0.35t (2014)
Brown sandfish	Part of 80t limit	Part of 50t limit	3	5	3.4t (2002)
Leopardfish	Part of 80t limit	Part of 50t limit	40	40	9.6t (2003)
Greenfish	Part of 80t limit	? 40t		40	1.2t (2002)
Stonefish	Part of 80t limit	Part of 50t limit	5	5	0.5t (2010)

5.8 REFERENCE POINTS

There are no adopted proxies consistent with the Commonwealth Fisheries Harvest Strategy Policy and Guidelines (HSP) for the Torres Strait BDM fishery, and it isn't necessarily sensible to derive these because of the highly variable nature of the fishery as well as the cost-benefit relationship when considering the large spatial area that would need to be reliably assessed for relatively small catches of some species. However, the current TACs are set conservatively and in that respect reflect an intention to meet the HSP. Moreover, some of the proxies used in the HS are fairly conservative and consistent with the HSP.

Nonetheless, where required, proxies for reference points were based on Plaganyi et al. (2015) as follows:

The unfished biomass B_0 – defined as the pristine or survey-based spawning biomass estimate, noting however that with large recruitment variability, it is possible for populations to exceed B_0 in some years, or conversely appear severely depleted in other years, even in the absence of fishing.

The limit biomass B_{LIM} – a more conservative value (than the default harvest strategy limit reference point) of 0.4**K* is used. Where available, survey data are used to select a lower limit reference level below which stock density is considered unacceptably low and the fishery should be closed – see example in Figure A.3. A threshold limit can also be specified as the level above which the fishery is allowed to re-open.

The target biomass B_{TARG} – it's difficult to define a proxy for the HSP target because of the large natural variability (both in time and space) and insufficient data. For some species such as sandfish an estimate can be obtained based on historical survey data and/or comparison with densities in less fished areas (see Fig. A.3).

F_{TARG} F_{LIM} and F_{MSY} – as above, it is difficult to derive sensible estimates of these quantities, and none currently exist. It is also difficult to estimate fishing mortality in practice because accurate catch records are needed, as well as regular assessments of resource status. Some of the TAC estimates are based on applying default fishing mortalities to conservative biomass estimates (see Supporting Information).

HS analyses are also informed by existing data on the average density (per ha) of sea cucumbers sampled at 122 repeated sample sites in eastern Torres Strait during the 2002 and 2005 abundance surveys (from Skewes et al. 2010), as summarised in the Supporting Information.

The HS is tailored to the specific data available for this fishery, and a range of indicators are used to inform on the status of each species. Whether or not the status is considered good, bad or average for example, depends on comparison with agreed Reference Points as specified below – for example if total catch exceeds a pre-specified limit or CPUE is below a pre-specified limit reference level then it may mean that species is being fished too heavily. An assessment process is therefore needed to assess the current status and trends in the biomass of each species. A decision rule is then used to describe what action is needed to adjust catches to achieve desired targets and satisfy the overall fishery objectives.

5.9 STOCK ASSESSMENT CYCLE

The HCWG meets at least once annually to review all available catch data as well as primary indicators data, and decides on analyses needed as well as any future monitoring needs and revisions to the HS.

5.10 DATA SUMMARY

The annual data summary reviews the catch and catch per unit effort (CPUE) from the fishery as well as all other information, such as the size-frequency information provided from sub-samples of commercially caught BDM. The data summary is used as an indicator to identify if catches correspond to the RBC, and to monitor CPUE.

5.11 DECISION RULES

To manage the TS BDM stocks to be sustainable, profitable, and socio-culturally supportable, the HS includes a mix of approaches as described above:

1. Effort controls to limit fishers and limit times one can fish;
2. Spatial management (limit where to fish (e.g. spatial rotation, closed areas)
3. TACs: limit total amount caught, e.g. based on surveys
4. <u>PLUS</u> minimum size limit complements all approaches by allowing animals a chance to breed before being caught.

A summary of the harvest strategy framework is provided below, and includes Decision Rules specified based on an overall Tier Structure (Fig 2) as well as tailored for different species categories as shown in Fig. 3.

Low tier:

1. Catch-based Decision rule: for species-specific recommended biological catch
2. Joint TAC trigger-limit Decision rule: for lumped species category
3. Re-opening Decision rule: for re-opening a fishery or area

Middle tier:

4. Multiple Indicator Decision Rule: for adjusting species-specific TACs

High tier:

5. Survey-based Decision Rule

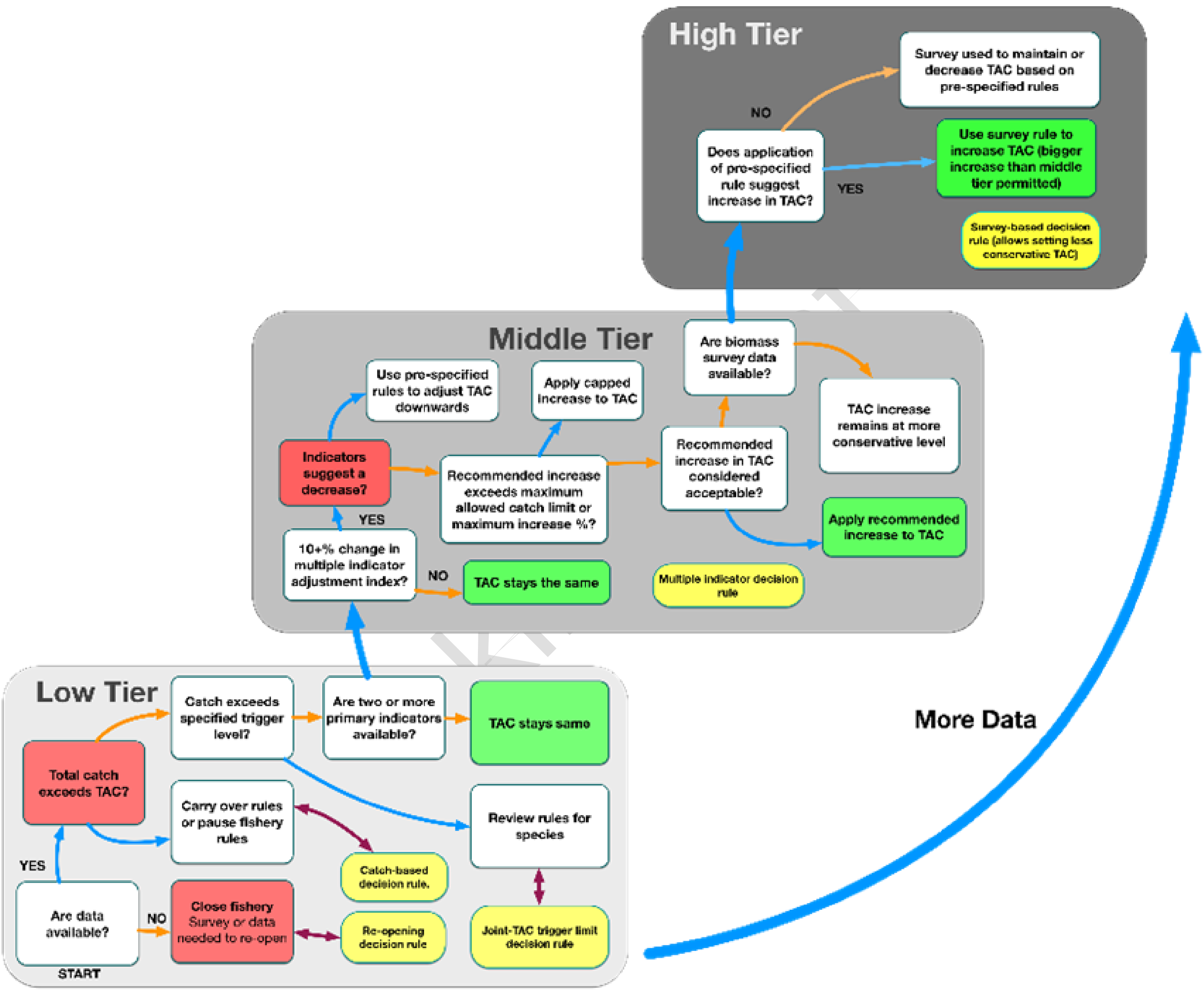


Figure 2 Schematic summary of Tier framework for Torres Strait bêche de mer Harvest Strategy showing starting point with limited data at bottom left hand corner and pathways to move to higher tiers for cases with more data, thereby allowing greater increases in TACs.

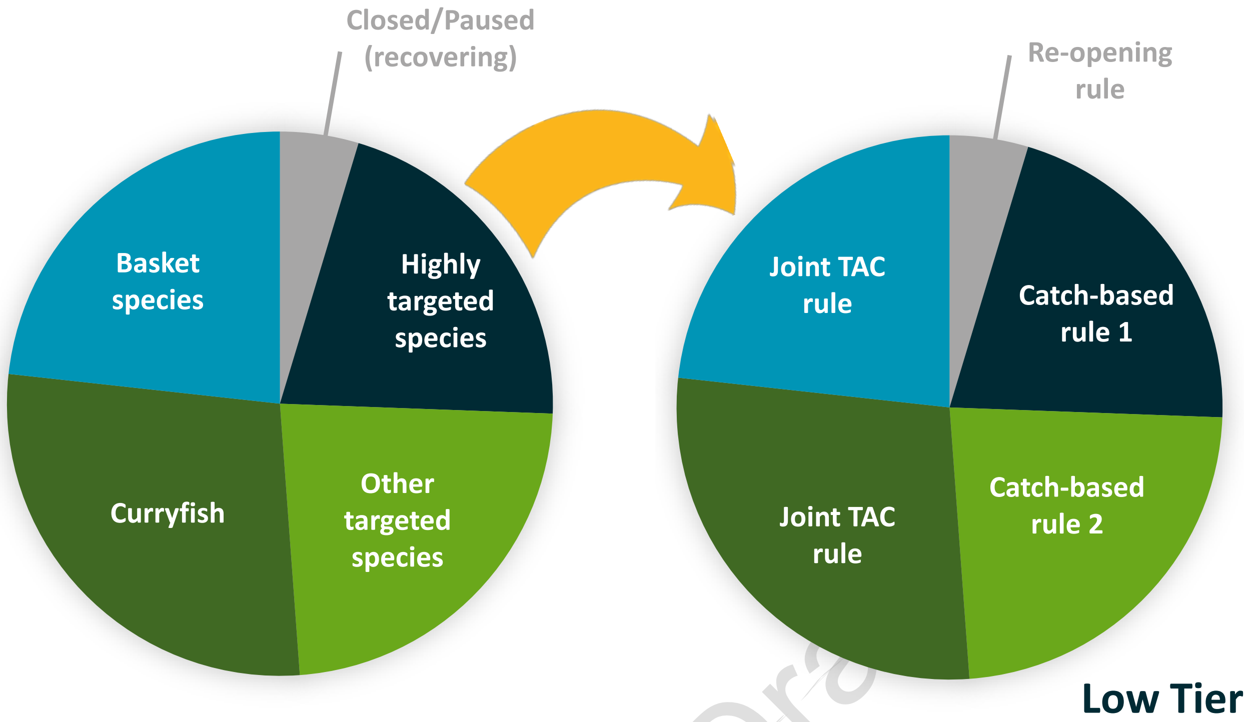


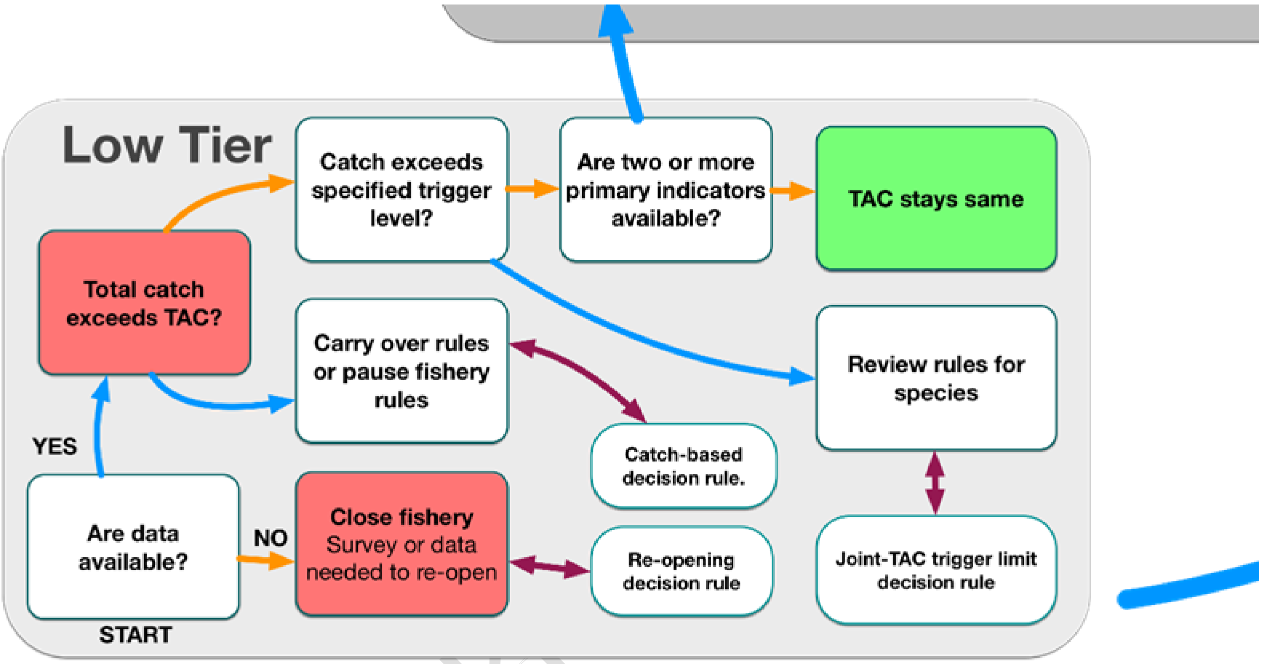
Figure 3. Schematic summary of HS species categories and corresponding decision rules under the Low Tier scenario.

Table 4. Summary of HS BDM species categories, corresponding total current TAC for that species category (see also Table 3) and corresponding Decision Rules that apply at each of the tiers as indicated.

	TAC (t)	Species in category	Decision Rule (Tier 3)	Decision Rule (Tier 2)	Decision Rule (Tier 1)
Closed/Paused (recovering)	10	sandfish, surf redfish	Re-opening rule	Multiple indicator rule	Re-opening rule
Highly targeted species	45	black teatfish, white teatfish, prickly redfish	Catch-based rule1	Multiple indicator rule	Survey-based rule
Other target species	50	hairy blackfish,deepwater redfish, greenfish	Catch-based rule2	Multiple indicator rule	Survey-based rule
Curryfish	60	3 curryfish species	Joint TAC rule	Multiple indicator rule	Survey-based rule
Basket species	50	all other species	Joint TAC rule	Joint TAC rule	Survey-based rule

Below the different decision rules for the Fishery Harvest Strategy are described in more detail (and accompanied where relevant with graphical representations). The decision rules are presented sequentially from the lowest tier to the top tier, and the mapping between rules and species categories is also summarised in Table 4.

5.12 Low Tier Decision Rules



5.12.1 Catch-Based Decision Rule (see also Figure 4)

- This is a low tier rule that is applied to all species in the absence of data other than total annual catch per species:
  - If no data then TAC = 0
  - If exceed by >10% and <20% then carry over catch and subtract from following year's total
  - if exceed by >20% and <50% then pause fishing on that species following year
  - If exceed by >50% and <100% (double) pause fishing 2 years
  - If exceed by more than double, close fishery 4 years

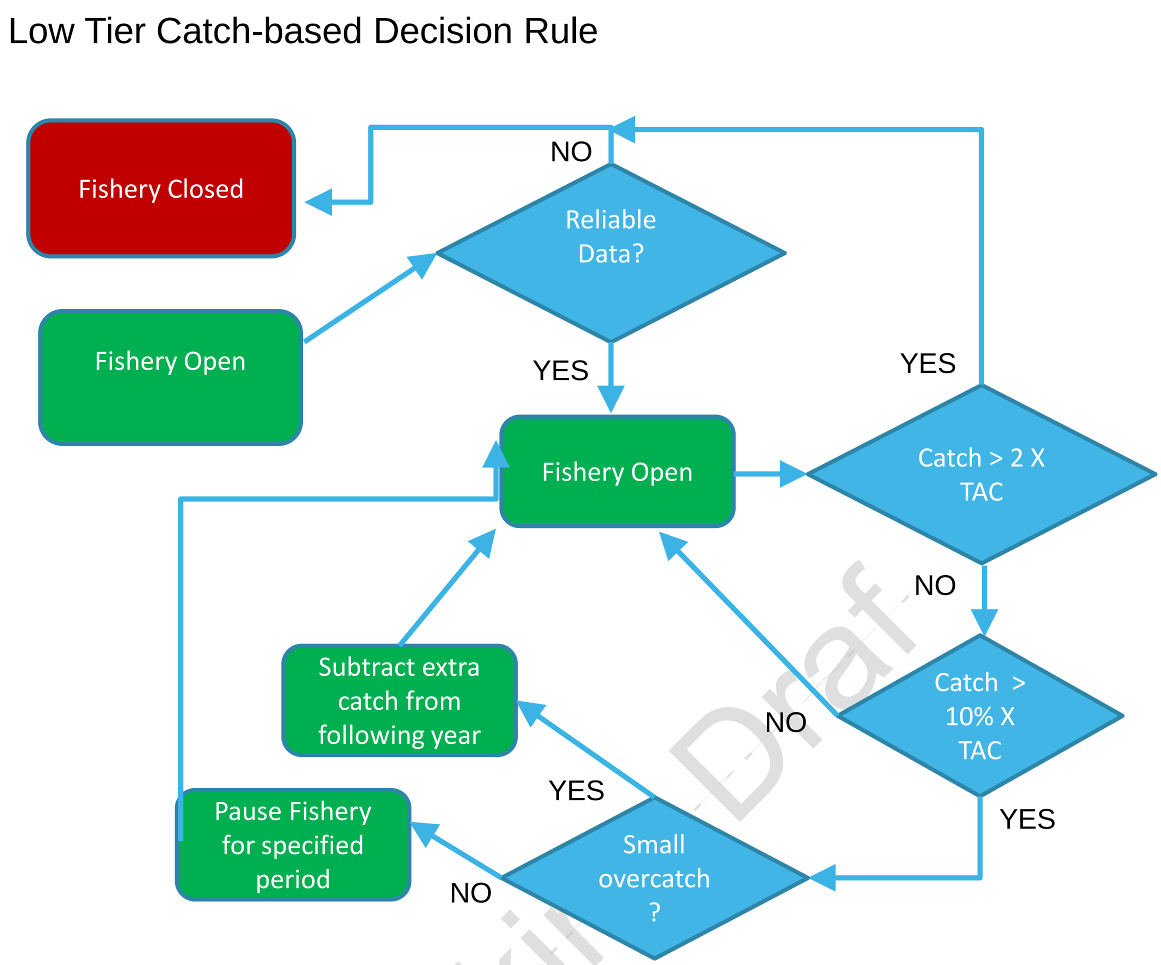


Figure 4. Flowchart summarising low tier catch-based decision rule

5.12.2 Joint TAC trigger-limit Decision rule: for lumped species category (see also Fig. 5)

- This is a low tier rule that is applied to combined and basket species:
    - Compute the total catch (including discards) of all species in the group
    - Compute the estimated total catch of each species, either from direct species-specific catch data or from (representative) catch samples used to infer proportional abundance of different species
    - If the catch of any species exceeds the species-specific trigger (Table 3) by more than **10%**, then collect data and information to decide whether (1) a change to the joint TAC or (2) trigger level is required, or (3) a species-

specific TAC is justified or (4) a closure deemed necessary or (5) recommend further data (eg in the form of a survey) be collected before any change to the joint TAC or trigger limit is allowed.

- The current TAC and trigger limit remain in place unless the above suggests a change.

For combined (curryfish) and basket species groups, triggers are specified such that when the catch of a particular species reaches or exceeds a trigger, the reasons need to be established and appropriate management action implemented (Figure 5). This could include specifying the need for additional data to monitor the expansion of a fishery for a species, a good example being the recent growth in fishing effort on curryfish (*Stichopus hermanni* and *S. vastus*) due to improved processing methods and market opportunities (Purcell 2014). The trigger levels for individual species are as shown in Table 3.

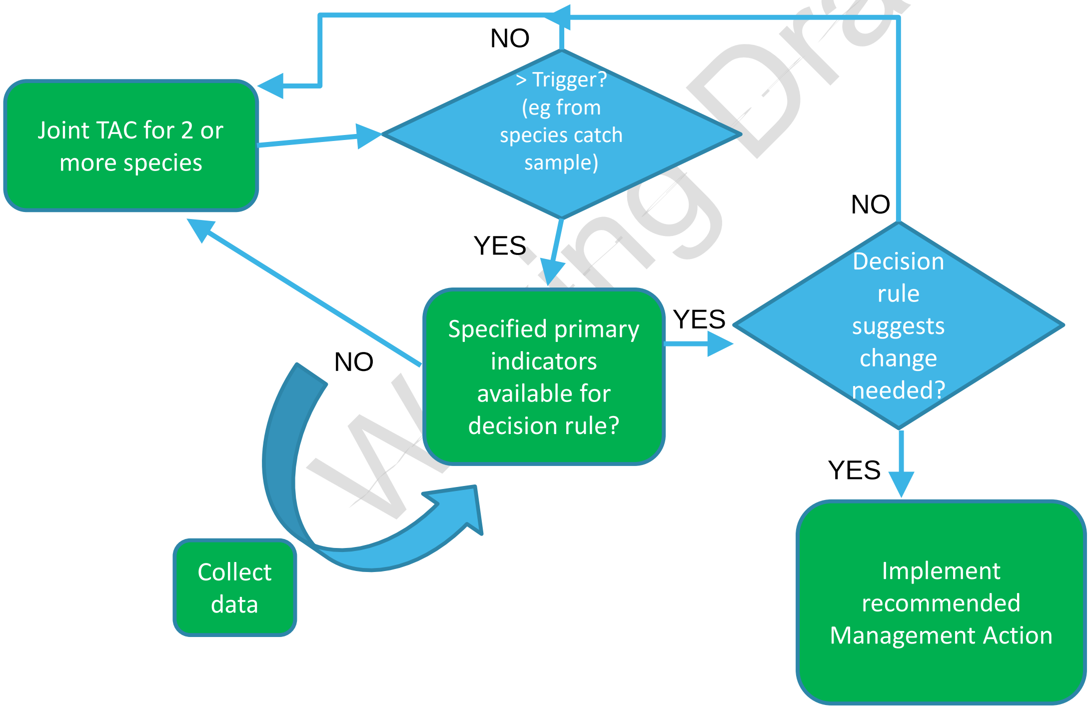


Figure 5. Flowchart summarising decision rule for reviewing whether a trigger is exceeded for any species caught as part of a lumped species allocation.

5.12.3 Re-opening Decision rule: for re-opening a fishery or area

- This is a low tier rule that is applied to re-open a fishery (where the term “fishery” here refers to a specific BDM species in Torres Strait) that has been closed, paused or is recovering. A species may have been closed due to concerns around stock status and depletion or (temporarily) closed/paused to fishing for reasons such as needing to first ensure adequately precautionary measures are in place so that overfishing does not occur. A decision that the fishery may potentially be re-opened should also take into account previous survey information as well as recent catch history (both legal and illegal) and periods over which the fishery has been closed – the black teatfish provides an example. Note this also takes into account findings from testing spatial rotation strategies for bêche de mer (Plaganyi et al. 2015) which suggest that larger annual catches need to be followed by rest periods (with no fishing for 2-3 years) to keep risks to the fishery the same as lower but constant annual average catches. This notion is also consistent with, and underpins, the catch-based rule which prescribes a pause in fishing following instances of heavy fishing (Fig. 4).
    - Given stock status concerns, first establish that the stock is above a limit reference point level or conduct a survey and compare with limit reference point (see survey-based reference levels section of this document), only proceeding to next step in potential opening if the survey or available information suggests the stock is above a limit reference point.
    - The next step involves evaluating whether monitoring and management are adequate. This involves ensuring data collection and monitoring are clearly specified and in place before proceeding to next step in potential opening.
    - If the above conditions are met, then a Trial opening is possible with the following conditions attached:
        - Accurate daily catch reporting is a compulsory requirement
        - A trigger limit may be set to temporarily pause fishing while catch records are collated to ensure that overfishing does not inadvertently occur.
        - An effective warning system needs to be put in place to ensure everyone stops and waits while approaching the experimental TAC to allow all data to be entered and processed.

- A condition of the experimental opening is that no other species may be harvested at the same time as the trial re-opened species (e.g. no other caught species permitted on fishing boat during trial)

- Trial opening dates need to be set taking into account seasonal fishing dates for tropical lobster (TRL) in particular, with the BDM opening preferably during the same time that the TRL fishery is open to hookah fishing to reduce pressure on the BDM resource and also account for equity considerations for dedicated fishers working in eastern areas where the BDM stocks are mostly located. Trial opening dates also need to take into account favourable weather and tides to ensure safe and efficient fishing can occur.

- Consideration should also be given to cultural laws and community agreements with respect to who can fish where.

- The Trail opening TAC needs to be set at a demonstrably conservative level with reference to values as shown in Table 3.
- If the Trial TAC is exceeded by more than 5%, then the fishery is automatically paused (i.e. no fishing allowed) for the following year.
- If data collection during the Trial opening was not conducted satisfactorily, then the fishery is closed again.
- If the TAC wasn't exceeded and reliable data were collected, these data need to be analysed to review the TAC and potential for the fishery to stay open in future, or be re-opened periodically after a pre-specified interval.
- An ongoing condition of the fishery remaining open is that reliable data collection continues, and preferably includes additional data such as CPUE, spatial footprint and size composition (see multiple indicator section).

Re-opening Decision Rule

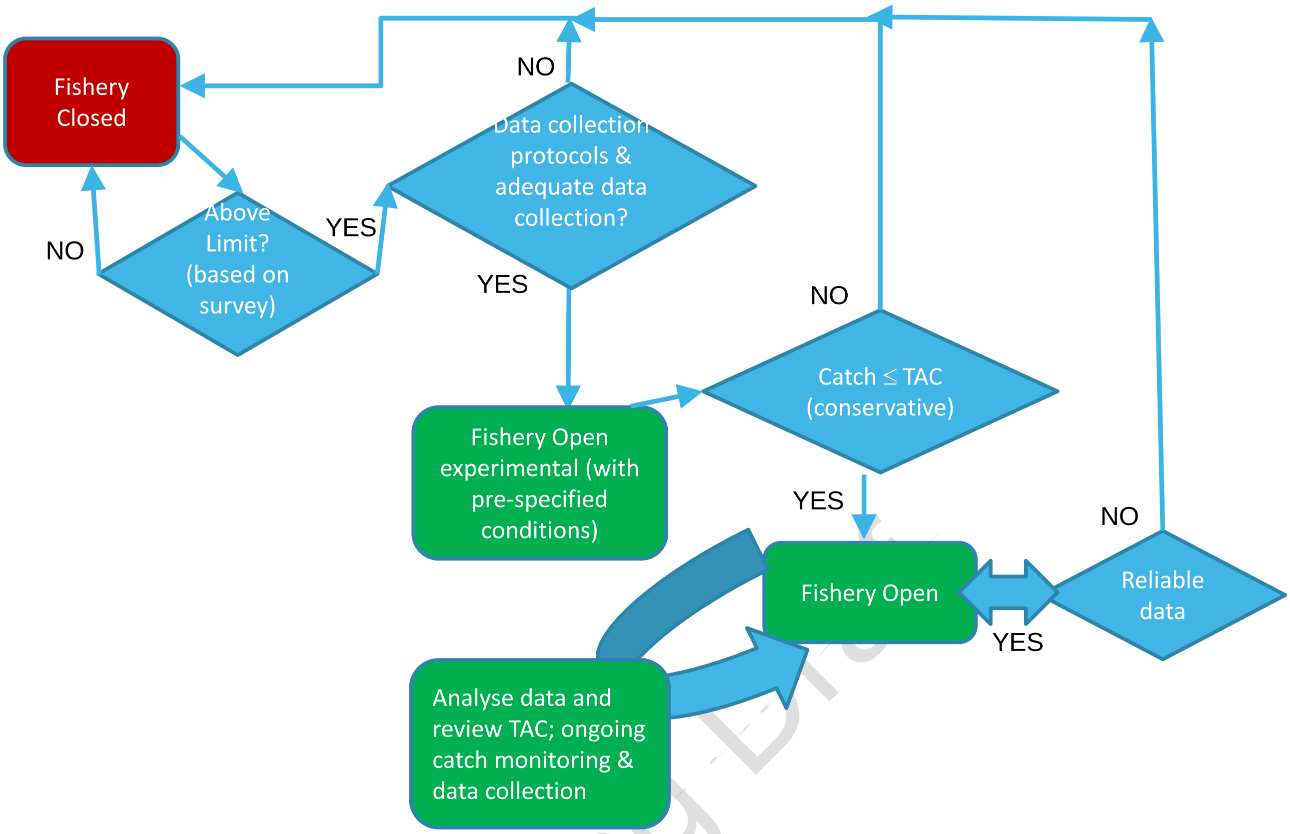
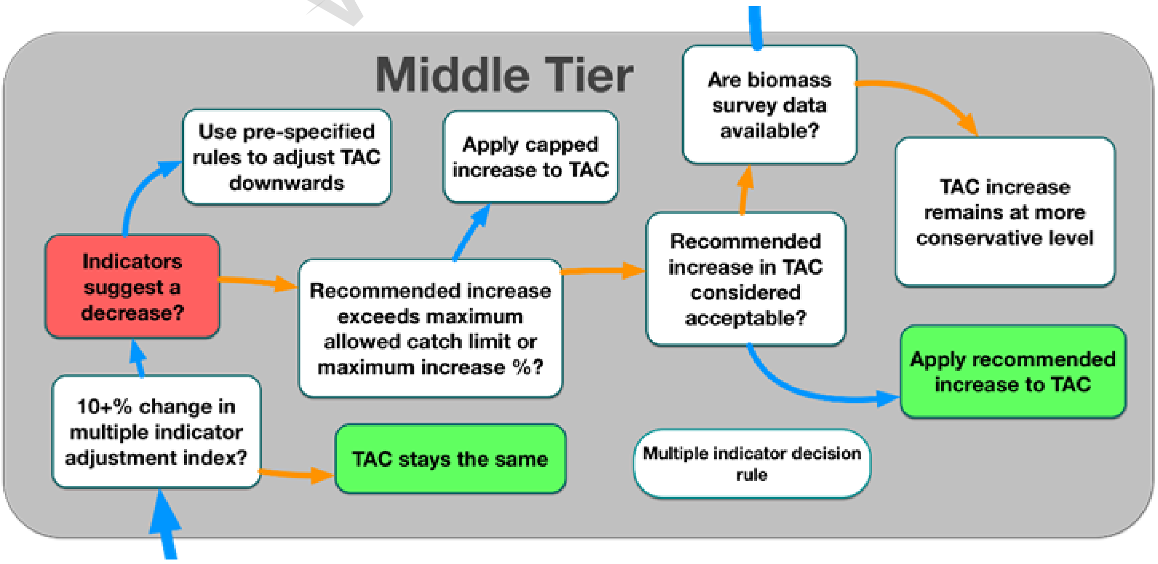


Figure 6. Flowchart summarising process for re-opening a closed fishery.

5.13 Middle Tier Decision Rules



The Middle tier applies when high quality data are available from several primary indicators in addition to total catch per species. The Middle Tier Decision Rules specify how to increase catches (TACs) if good quality fishery data are available and indicate an increase is possible. The Tier System is hierarchical such that Tier 1 rules must first be met (e.g. catch data recorded, TAC not exceeded) before it is possible to progress to the middle tier. This is because the lower tier is informed by less data and hence decisions need to be more conservative (i.e. maintain or reduce the TAC only) whereas the Middle Tier provides an incentive to collect additional high quality data to reduce uncertainty as to stock status and therefore potentially allow increases in TAC. The Middle Tier is not immediately applicable as no detailed historical fishery data are available, but it provides a pathway for improving and growing the fishery to address the objective “to develop bêche-de-mer populations for the benefit of Australian Traditional Inhabitants (as defined by the Torres Strait Treaty) and accommodating commercial considerations”. This acknowledges also that the HS is part of an ongoing process of improving the fishery, and that improvements to these preliminary decision rule guidelines could be made in future, for example, after testing using Management Strategy Evaluation (MSE) (Plaganyi et al. 2015; Plagányi et al. 2013).

The Middle Tier uses the Multiple Indicator Decision Rule, with the condition that high quality data are required from at least two of the additional primary indicators (Fig 7).

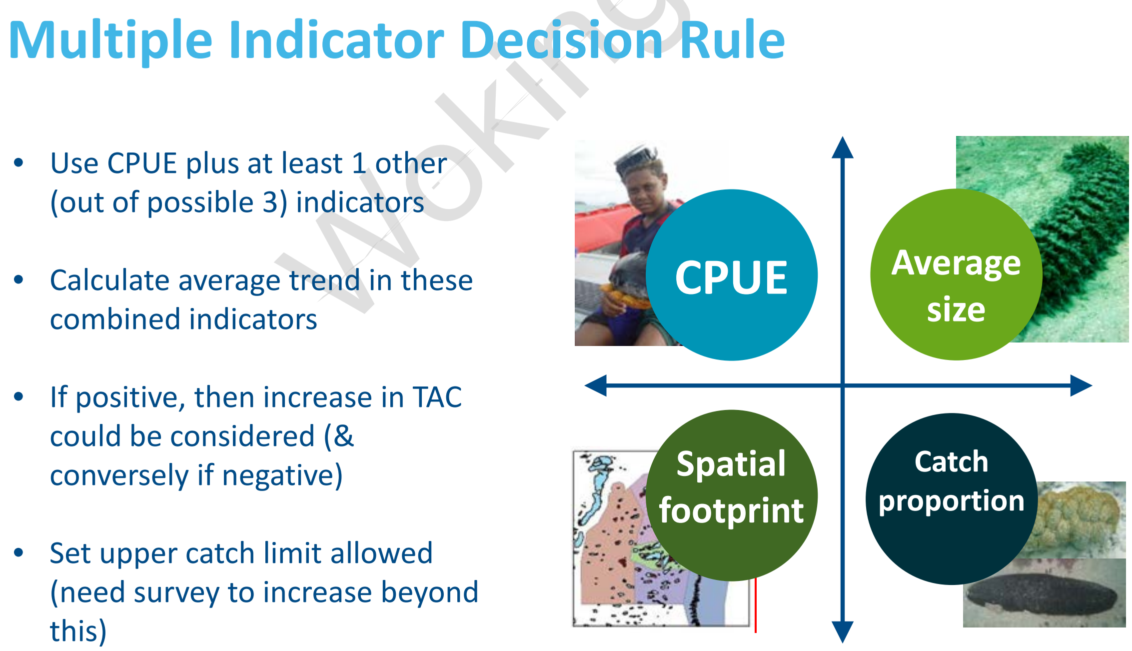


Figure 7. Schematic summary of Middle Tier Multiple Indicator Rule and its components.

5.13.1 Multiple indicator rule

Catch-Per-Unit-Effort (CPUE) has not been demonstrated to be a reliable indicator on its own, but as more data are collected, the value of CPUE data as an index of abundance will increase, especially if used in combination with other indicators such as changes in average size of animals caught, catch composition and spatial footprint. Decision rules using a combination of these indicators could be used to increase or decrease the TAC could be made based on a Recommended Biological Catch (RBC) calculated using 2 or more of the following primary indicators, where the weights assigned to each indicator are denoted w_1, w_2, w_3, w_4 for respective indicators CPUE, average Size, spatial footprint (Area) and changes in catch composition (Fig. 7):

$$A = w_1 \times \text{CPUE} + w_2 \times \text{Size} + w_3 \times \text{Area} + w_4 \times \text{Catch proportion}$$

The default weights are set at 0.25 (i.e. equal weighting), but renormalised if any of the indicators are missing and have associated zero weight.

The overall recommended adjustment in the RBC is computed by scaling the average of the adjustment factors by the average (3 yr) Catch, but with the constraints that the adjustment proportion not exceed the pre-specified cap A_{cap} and A<maximum increase permitted (MAX_{sp}):

$$\begin{array}{ll} RBC = \min(A, A_{cap}) \times C_{CUR} & RBC \le MAX_{sp} \\ RBC = TAC & \min(A, A_{cap}) \times C_{CUR} > MAX_{sp} \end{array}$$

The **Multiple indicator rule** can be summarised as follows:

- Calculate 2 or more of the individual Indicator adjustment factors described below
- Work out the average *A* of these values or a weighted average if assigning different weights to different contributions
- Calculate the average recent catch (past 3 years)
- If the average *A* exceeds a pre-specified maximum increase proportion (default value 0.10) then use the maximum capped value rather than calculated value
- Multiply the average recent catch by the indicator average to obtain the new Recommended Biological Catch (RBC)
- Check that the RBC does not exceed a pre-specified maximum catch limit (see Table 3).

The multiple indicator rule will typically be applied to species which are highly targeted and hence the rules below assume that available data and information are largely species-specific. Additional considerations are necessary if the target species is typically caught together with one or more other species, and this is discussed elsewhere. The middle tier also recognises that the use of CPUE is problematic as an index of abundance of sea cucumbers (noting potential for hyperstability in particular for highly aggregated species) as well as the limitations of the other primary indicators used here, and for this reason, increases based on these data are more conservative than possible if using survey data based on sound scientific methods.

Individual indicator adjustment factors are computed as described below, with a mathematical formulation first specified followed by plain English summary of the rule.

5.13.2 CPUE indicator (based on recent trend in CPUE)

$$I_{CPUE} = 1 + c_1 \times slope_{CPUE}$$

- Where “slope” is the slope in the trend in (standardised if available) CPUE index over the past 3 years for which data are available
- Parameter c_1 accounts for how reliable data are, with guidance provided on default settings

CPUE Indicator Rule

- Use all available reliable data converted to consistent units (e.g. kg/hour fishing) to compute the annual average CPUE (preferably standardised to the extent possible) for a target species (and/or area)
- Use the past series of comparable CPUE data (at least 3 years’ data required) and compute the slope of a regression line fitted through the data (i.e. quantify the trend in the data to determine whether CPUE is increasing, decreasing or stable over time) (e.g. a population increasing at 10% per year would have an average slope value of 0.1).
- Select a value for the scaling parameter which downweights the empirical slope estimate to take into account that the CPUE data do not provide a very reliable index of stock abundance. The default setting is 0.5 (see also comparison with survey factor below). Hence for example this downweights a perceived stock increase of 0.1 to 0.05, as a basis for recommending a 5% increase in the TAC).
- The CPUE Index contribution to the multiple indicator rule is then 1 plus the slope factor.

5.13.3 Average Size Indicator (based on recent average size relative to historic average)

$$I_{size} = 1 + c_2 \left(\frac{\sum_{y-2}^{y} s_y \big/ 3 - \bar{s}}{\bar{s}} \right)$$

- Where s is the average annual size of animals from a catch sample, with the average computed over the past 3 years and compared with the historical average size of caught animals $\bar{s}$
- Parameter c_2 accounts for how reliable data are (eg is the size sample representative), with guidance provided on default settings

Average Size Indicator Rule

- Use all available representative size data converted to consistent units (e.g. length of live animal in cm or average individual mass of boiled individual animal in kg) to compute the average size of the catch of a target species (and/or species in a particular area) over the past 3 years
- Use data from past observations (see Supporting Information and noting that these data should be reviewed and updated over time) to compute an average historical size of the fished population
- Calculate the ratio of the recent measured size compared with the base estimate to determine whether average size has been increasing or decreasing over time.
- Select a value for the scaling parameter which downweights the empirical size ratio to account for potential errors and biases in this measurement. The default setting is 0.5.
- The Size Indicator Index contribution to the multiple indicator rule is then 1 plus the scaled size ratio.

5.13.4 Percentage of areas fished Indicator (based on recent average area fished relative to historic average)

$$I_{area} = 1 + c_3 \left(\frac{\overline{a}}{a} \right)$$

- Where *a* is the proportion of areas fished relative to the historical average proportion of area fished – note that an expansion of the area fished is assumed to indicate a decline in stock status (eg due to local depletion)
- Parameter c_3 accounts for how reliable data are (eg are there spatial references in the logbook used to compute the change in spatial footprint), with guidance provided on default settings

Area Fished Indicator Rule

- Use all available data on the area fished for a target species, converted to consistent units (e.g. square kilometres of fished area; number of reefs fished; depth range fishing occurred), to compute the average recent fished area of a target species
- Use data from past observations to compute an average historical fishing area for the fished population
- Calculate the ratio of the recent fished area compared with the base estimate to determine whether average fished area has been increasing or decreasing over time.
- Select a value for the scaling parameter which downweights the empirical area fished ratio to account for potential errors and biases in this measurement. The default setting is 0.5.
- The Area Fished Indicator Index contribution to the multiple indicator rule is then 1 plus the scaled area ratio.

5.13.5 Catch proportion Indicator (based on recent average catch proportion of species being considered, relative to total catch of all TS BDM species)

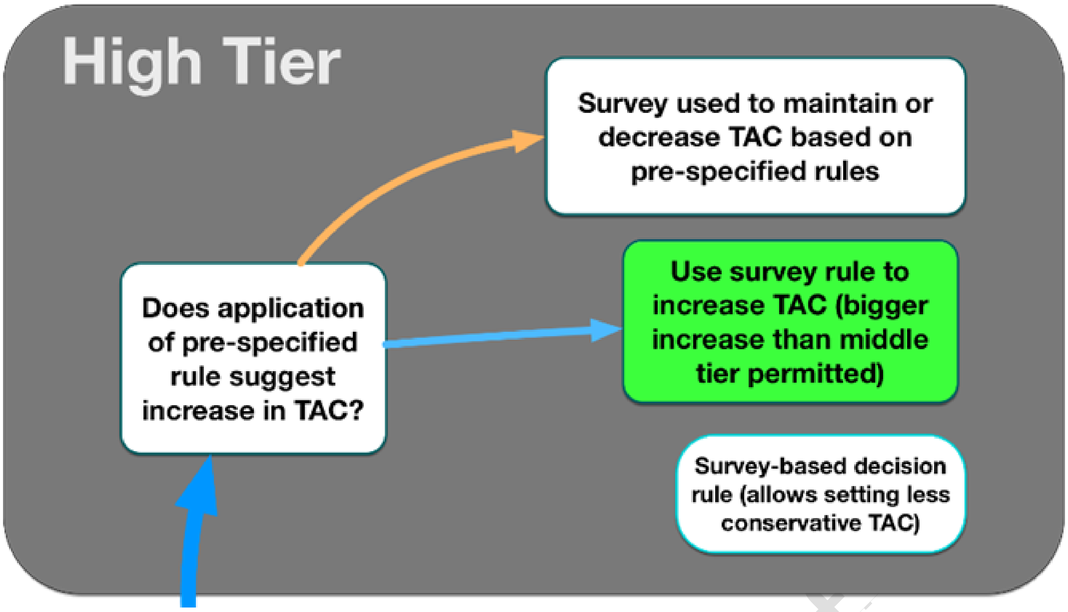
$$I_{prop} = 1 + c_4 \left(\frac{\sum_{y-2}^{y} p_y \big/ 3 - \overline{p}}{\overline{p}} \right)$$

- Where p is the average annual catch proportion (of the species being considered) from a catch sample, with the average computed over the past 3 years and compared with the historical average catch proportion $\overline{p}$
- Parameter c_4 accounts for how reliable data are (eg were representative catch samples used, data from logbooks), with guidance provided on default settings

Catch Proportion Indicator Rule

- Use all available reliable data (but excluding data from highly targeted single-species catches such as for black teatfish) to compute the average (past 3 years) catch proportion for a target species
- Use data from past observations (including survey data) to compute the average expected catch proportion of the fished population
- Calculate the ratio of the recent measured catch proportion compared with the base estimate to determine whether the proportional representation of a species in a mixed basket catch has been increasing or decreasing over time.
- Select a value for the scaling parameter which downweights the empirical catch proportion ratio to account for potential errors and biases in this measurement. The default setting is 0.5.
- The Catch Proportion Indicator Index contribution to the multiple indicator rule is then 1 plus the scaled catch proportion ratio.
- Before using this index, information (such as from market prices and fisher local knowledge pertaining to drivers to target particular species) should be considered to determine whether the change in catch proportion is likely due to fisher targeting behaviours or reflects changes in the relative abundance of the target species relative to other species. This indicator therefore needs to be used with caution, but may be particularly useful for species such as curryfish where data on component species are required.

5.14 High Tier Decision Rules



The high tier utilises high quality survey data (see earlier section outlining requirements for survey data to meet the criterion of being adequately high quality and representative).

5.14.1 Survey-based Decision Rule for adjusting TACs

This section describes first the use of survey data as relative indices of abundance and second use of surveys to estimate total standing stock. There are a number of extensive historical surveys which can be used as a baseline for comparison with future survey data to quantify trends in abundance of key species. Before comparing new and old survey data, it is critical that an evaluation is made of the extent to which the data are comparable (e.g. were they collected from comparable areas and habitats; how extensive was the survey) and where necessary, data should be reconfigured to ensure optimal comparability. In evaluating the quality of a trend based on survey data, the inter-survey interval also needs to be considered as long gaps between surveys mean that data may be less informative. Additional considerations (such as survey timing – season and time of day) are outlined in the Supporting Information document. As fishery-independent or dedicated surveys conducted by fishers are generally considered more reliable than CPUE data, survey trends can be used to adjust TACs upwards (in cases where there is evidence of scope to increase TACs) or downwards (in cases where there are concerns about the status of a fished species). This is usually only necessary is total catch of a species is close to the current TAC.

Whenever there is a survey, first consideration should be given to locals for boat and human resources.

5.14.2 Survey-Based Decision Rule based on trends

- If Average (3 yr) Catch between 80% and total TAC, use index of abundance (survey) to adjust:
    - TAC = $(1+b*slope)*C_{CUR}$ and maximum increase pre-specified
- where C_{CUR} is average catch over the past three years, and includes landings plus discards;
- "slope" is the slope in the trend in standardised biomass survey index over the past 3 years for which data are available, noting that it isn't necessary for past data to be available on an annual basis
- Parameter *b* differs based on how reliable data are (eg survey extent, intensity and standard error). Deafult settings are shown below.

Settings:

If excellent survey data available, set ***b* = 1**

If survey less comprehensive and lag since last survey, set ***b* = 0.8**

Lower *b* adjusts for data being less reliable

Slope:

If slope is positive it suggests resource is increasing and TAC can be increased

Conversely, if slope is negative, it suggests resource is decreasing and TAC should be decreased

If slope is large positive i.e. fast increase, a cap (limit) on the maximum permissible increase in TAC should be implemented. Default setting is 10% for fixed period of 2 years.

5.14.3 Survey-Based Decision Rule based on total biomass estimate

Given that the BDM Fishery includes very many species occupying different habitats, the HS recognises that the same survey design isn't appropriate for all species. The HS also recognises that technologies and hence survey techniques are changing fast and hence that innovative new survey methods may need to be included in future revisions of the HS. For species such as sandfish which is concentrated in a specific area (Warrior Reef), a dedicated survey design can be used to estimate the local density and this can then be compared with limit reference points (see Reference Points section) to determine whether or not the fishery can be re-opened (see Re-opening Decision Rules). Once open, future surveys can be sued to obtain an estimate of relative abundance as described above. On the other hand, for species such as white teatfish which occur mostly in deeper waters, a survey with representative sites could be used to estimate the total standing stock occupying previously unsurveyed areas or depths (in this case, depths in excess of 20m). This new information informs on total stock standing biomass and can be used to make adjustments to existing TACs using the same process that was used previously to estimate conservative initial TACs for species (see Supporting Information). Similarly, for species of concern, such as prickly redfish, surveys could be used to either assess trends in abundance or to evaluate standing stock biomass for the purpose of comparing with estimates of sustainable catch. Surveys are also less straightforward for prickly redfish but it is possible to select reference sites for use in obtaining a trend from future surveys.

In summary:

- For most species the current TAC is set based on a conservative estimate of historical biomass (Fig. 8).
- The survey biomass estimates can be used to inform baseline target and limit densities for species such as sandfish, but challenges need to be recognised in obtaining comparable and representative estimates for species such as black teatfish. Other species such as surf redfish are also difficult to survey reliably
- Density standardised by habitat type and reference sites is proposed as the reference measure because it is measurable locally rather than requiring a full survey across all spatial areas, but any density measure needs to be sufficiently representative of the broader area in which that species occurs.

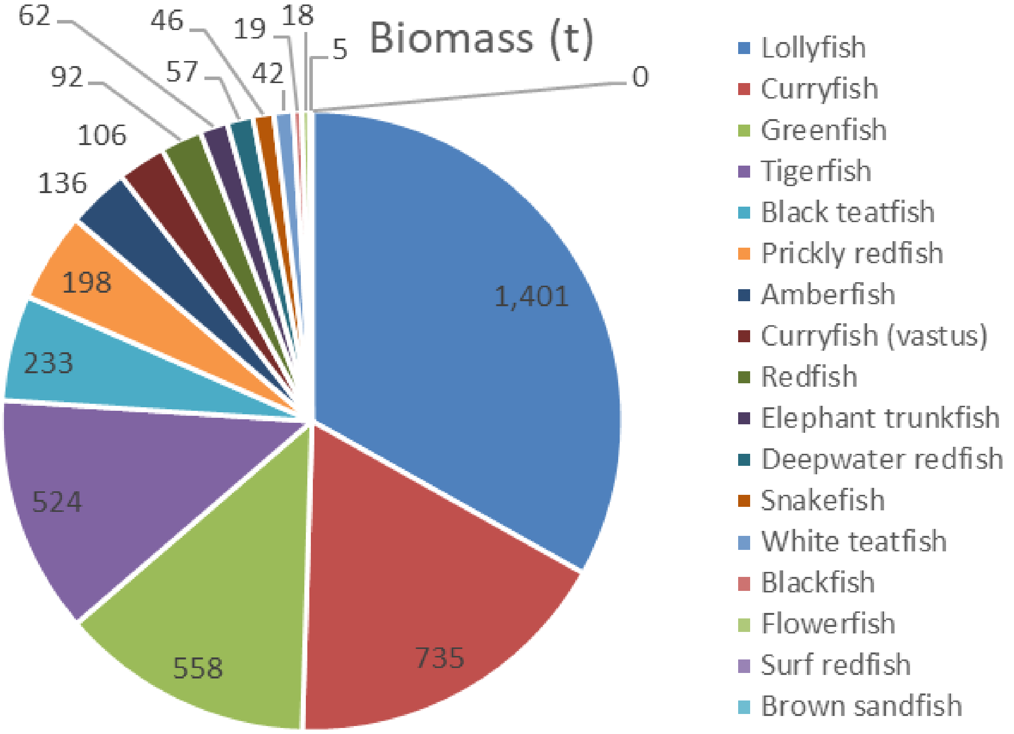


Figure 8. Schematic showing average survey-based Torres Strait biomass estimates (t) for species as shown for use in comparing with future survey-based biomass estimates.

5.15 GOVERNANCE

The status of the Fishery and how it is tracking against the HS is reported to the Working Group and the PZJA as part of the yearly management process.

5.16 REVIEW

Under certain circumstances, it may be necessary to amend the harvest strategy. For example if:

- there is new information that substantially changes the status of a fishery, leading to improved estimates of indicators relative to reference points; or
- drivers external to management of the fishery increase the risk to fish stock/s; or
- it is clear the strategy is not working effectively and the intent of the HSP is not being met; or

- alternative techniques are developed (or a more expensive but potentially more cost-effective harvest strategy that includes surveys and annual assessments is agreed) for assessing the Fishery. The HSF may be amended to incorporate decision rules appropriate for those assessments.

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7 Appendix Table A.1. Conversion ratios

Common name	Species	Live to Gutted	Live to Salted	Live to Dried	Gutted to Salted	Gutted to Dried	Salted to Dried	Salted to Gutted	Dried to Gutted
Sandfish	*Holothuria scabra*	0.496[4]	0.355[4]	AVE=0.049[a14]	0.758[4]	0.094[4]	0.125[4]	1.319[d]	10.638[e4]
Surf Redfish	*Actintopyga mauritiana*	0.684[2*]	-	AVE=0.084[a12*]	0.873[4]	AVE=0.187[2*4]	0.286[4]	1.145[d]	AVE=5.930[2*e4g]
Black Teatfish	*Holothuria whitmaei*	AVE=0.677[2*34]	0.529[3]	AVE=0.108[a12*3]	0.824[f,4]	AVE=0.177[2*f3]	0.220[f]	1.213[f,4]	AVE=5.663[2*f3g]
White Teatfish	*Holothuria fuscogilva*	AVE=0.627[2*c4]	0.593[c]	AVE: 0.137[1ab2*]	0.775[1]	AVE=0.237[12*]	0.309[1]	1.290[1]	AVE=4.219[12*g]
Prickly Redfish	*Thelenota ananas*	AVE=0.667[c4]	0.481[c]	AVE=0.055[1ab4]	AVE=0.736[14]	AVE=0.088[14]	AVE=0.118[14]	AVE=1.382[1d4]	AVE=12.502[1e4]
Hairy Blackfish	*Actinopyga miliaris*	0.480[4]	-	AVE=0.067[a14]	0.964[4]	0.209[4]	0.217[4]	1.037[d]	4.785[e]
Curryfish (common)	*Stichopus herrmanni*	0.651[2]	-	AVE=0.036[a1]	-	0.114[2]	-	-	8.772[2g]
Elephants Trunkfish	*Holothuria fuscopunctata*	0.519[4]	-	AVE=0.133[a1b4]	0.911[4]	0.242[4]	0.263[4]	1.097[d4]	8.772[e4]
Lollyfish	*Holothuria atra*	AVE=0.436[c12*]	0.236[c1]	AVE=0.063[a1bc2*]	0.586[1]	0.150[12*]	0.256[1]	1.706[1]	5.917[12*g]
Deepwater redfish	*Actinopyga echinites*	0.692	-	AVE=0.088[a13]	-	0.152[f3]	-	-	6.600[f3]
Curryfish (vastus)	*Stichopus vastus*	-	-	-	-	-	-	-	-
Burrowing blackfish	*Actinopyga spinea*	0.544[3]	0.375[3]	0.073[1a]	0.689[f3]	0.135[f3]	0.195[f3]	1.449[f3]	7.424[f3]
Deepwater blackfish	*Actinopyga palauensis*	AVE=0.818[c13]	AVE=0.593[c13]	AVE=0.175[a1b]	AVE=0.728[1f3]	AVE=0.190[1f3]	AVE=0.262[1f3]	AVE=1.374[1f3]	AVE=5.335[1f3]
Golden sandfish	*Holothuria lessoni*	0.645[3]	0.526[3]	0.098[a]	0.815[f3]	0.152[f3]	0.186[f3]	1.226[f3]	6.588[f]
Brown sandfish	*Bohadschia vitiensis*	0.735[c,1]	0.612[c1]	0.116[c1]	0.834[1]	0.157[1]	0.189[1]	1.199[1]	6.337[1]
Leopardfish	*Bohadschia argus*	AVE=0.665[c12]	0.572[c1]	AVE=0.115[c12]	0.777[1]	AVE=0.171[12]	0.233[1]	1.286[1]	AVE=5.841[12g]
Greenfish	*Stichopus chloronatus*	-	-	-	-	-	-	-	-

Stonefish	*Actinopyga lecanora*	0.894[c1]	0.652[c1]	AVE=0.154 [c12*]	0.729[1]	AVE=0.158[12*]	0.253[1]	1.372[1]	5.418[1]

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[a]Ngaluafe & Lee, 2013. Table 3; percent conversion ratios, total whole/fresh weight, from wet to dry product including values from other studies.

[b]Ngaluafe & Lee, 2013. Table 1; wet-to-dry conversion ratios.

[c]Whole fresh weights noted in Purcell et al., 2009.

[d]Derived: Inverse gutted to salted value Skewes et al. 2004.

[e]Derived: Inverse dried to gutted value Skewes et al. 2004.

[e]Empirical: Values calculated from Purcell et al. 2009.

[g]Inverse: Values calculated from Prescott et al., 2015.

Common name	Species	Live to Gutted	Live to Salted	Live to Dried	Gutted to Salted	Gutted to Dried	Salted to Gutted	Salted to Dried	Dried to ~~Gutted~~ Boiled	Wet to Boiled	Wet to Boiled to Salted	Wet to Boiled to Salted to Dry
Curryfish (common)	*Stichopus herrmanni*	0.651[2] *0.5 estimate*	-	0.033[f,3] 0.039 [a,1] AVE=0.036	-	0.114[2]	-	-	2.66[h]	0.375[h]	-	*0.25 estimate*
Curryfish (vastus)	*Stichopus vastus*	-	-	-	-	-	-	-	-	-	-	-

References - curryfish

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Footnote

[a]Ngaluafe & Lee, 2013. Table 3, percent conversion ratios, total whole/fresh weight, from wet to dry product including values from other studies.

[f]Empirical: Values calculated from Purcell et al. 2009.

Data

[h]Data from Ugar Island: Curryfish processing example (Provided by Rocky Stephens)

Curryfish x9
Boil & then weigh 8kg (800gr each, conversion ration boiled to dry = 0.375)
Wet to dry – 2.4kg (300gr each, 0.375 conversion ration dry to boiled = 2.66)

8 Appendix A.2 – HS size limit information

Common name	Species	Maximum length cm (guide)	Size at maturity cm	Size limit TS	Proposed size limit TS*	Size limit EC	Age at maturity TS yrs (size, cm) (model)	TAC TS t
Sandfish	*Holothuria scabra*	*32*	*13-25*	*18*	*Leave[4]*	*20*	*2 (16.5)*	*No take*
Surf Redfish	*Actintopyga mauritiana*	*38*	*22-23*	22	*Leave*	*25*	*3 (13.8)*	*Part of 80t limit*
Black Teatfish	*Holothuria whitmaei*	*30*	*22-26*	*25*	*Leave*	*30*	*4 (24)*	*No take*
White Teatfish	*Holothuria fuscogilva*	*55*	*32*	*32*	*Leave*	*40*	*4 (30.4)*	*15*
Prickly Redfish	*Thelenota ananas*	*70*	*30-35*	*35*	*Leave*	*50*	*4 (30.4)*	*20*
Hairy Blackfish	*Actinopyga miliaris*	*35*	*12*	22	*Leave*	*20*	*3 (19.2)*	*Part of 80t limit*
Curryfish (common)	*Stichopus herrmanni*	55	*27-31*	27	*31[2]*	*35*	-	*Part of 80t limit*
Elephants Trunkfish	*Holothuria fuscopunctata*	*66*	*35*	24	*Leave[5]*	*40*	-	*Part of 80t limit*
Lollyfish	*Holothuria atra*	*65*	*12-19*	*15*	*Leave[5]*	*20*	-	*Part of 80t limit*
Deepwater Redfish	*Actinopyga echinites*	*35*	*9-12*	*12*	*20[3]*	*20*	*3 (19.5)*	*Part of 80t limit*
Curryfish (*vastus*)	*Stichopus vastus*	*35*	-	*nil*	*15[1]* *5t trigger*	*15*	-	*Part of 80t limit*
Burrowing blackfish	*Actinopyga spinea*	*40*	-	*22*	*Leave*	*20*	-	*Part of 80t limit*
Deepwater blackfish	*Actinopyga palauensis*	*35*	-	*22*	*Leave*	*20*	-	*Part of 80t limit*
Golden sandfish	*Holothuria lessoni*	*46*	*22*	*18*	*22[2]*	*15*	-	*Part of 80t limit*
Brown sandfish	*Bohadschia vitiensis*	*40*	*15-26*	*nil*	*25[1,2]*	*25*	-	*Part of 80t limit*
Leopardfish	*Bohadschia argus*	*60*	*30*	*nil*	*30[1]*	*35*	*3*	*Part of 80t limit*
Greenfish	*Stichopus chloronatus*	*38*	*14*	*nil*	*Leave*	*20*	-	*Part of 80t limit*
Stonefish	*Actinopyga lecanora*	*24*	-	*nil*	*Leave*	*15*	-	*Part of 80t limit*

*Proposed size limit (Torres Strait):

1 = Better align with EC (East Coast BDM fishery)

2 = Too small relative to age at maturity

3 = Based on model simulation recommendation (TS BDM Milestone Report, Appendix/Summary)

4 = Species closed to fishing

5 = Low value species (medium and high value considered for new size limits)

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9 Appendix A.3 – Sea cucumber Spawning Information

Common name	Species	Spawning time	Country
Sandfish	*Holothuria scabra*	*October to January**	*Australia**
		March to May, November to December	*India*
		December, January, August, September	*New Caledonia*
		November to December	*Papua New Guinea*
Surf Redfish	*Actintopyga mauritiana*	*June to April*	*Guam*
		December, January	*New Caledonia*
Black Teatfish	*Holothuria whitmaei*	*June, July*	*New Caledonia*
		April	*Aldabra, Seychelles*
		*December**	*GBR, Australia**
White Teatfish	*Holothuria fuscogilva*	*Part of November, December, January*	*New Caledonia*
Prickly Redfish	*Thelenota ananas*	*January, February, March*	*New Caledonia*
		*December**	*John Brewer Reef, GBR, Australia**
Hairy Blackfish	*Actinopyga miliaris*	*July (new moon)*	*Japan*
		May, November to December	*New Caledonia*
		*November**	*Orpheus Island, Australia**
Curryfish (common)	*Stichopus herrmanni*	*December, January*	*New Caledonia*
		June to July	*Straits of Malacca, Malaysia*
		*November, December, January**	*Little Broadhurst Reef, GBR, Australia**
Elephants Trunkfish	*Holothuria fuscopunctata*	*December, January, part of February*	*New Caledonia*
		*December**	*Lizard Island, Australia**
		*December**	*John Brewer, GBR, Australia**
Lollyfish	*Holothuria atra*	*November*	*Solomon Islands*
		August	*Peninsular Malaysia*
		*October**	*Davies Reef, GBR, Australia**
Deepwater Redfish	*Actinopyga echinites*	*January, February*	*New Caledonia*
Curryfish (*vastus*)	*Stichopus vastus*	-	-
Burrowing blackfish	*Actinopyga spinea*	-	-
Deepwater blackfish	*Actinopyga palauensis*	-	-

Golden sandfish	*Holothuria lessoni*	*November, December, January, part of February*	*New Caledonia*
		November	*New Caledonia*
Brown sandfish	*Bohadschia vitiensis*	*November, December*	*New Caledonia*
Leopardfish	*Bohadschia argus*	*October to January**	*GBR, Australia**
		*October , November, December, January**	*GBR, Australia**
Greenfish	*Stichopus chloronatus*	*April to June, December to February*	*Straits of Malacca, Malaysia*
		*November, January**	*Myrmidon Reef, Davies Reef, GBR, Australia**
Stonefish	*Actinopyga lecanora*	*July*	*Peninsular Malaysia*
		*December**	*GBR, Australia**

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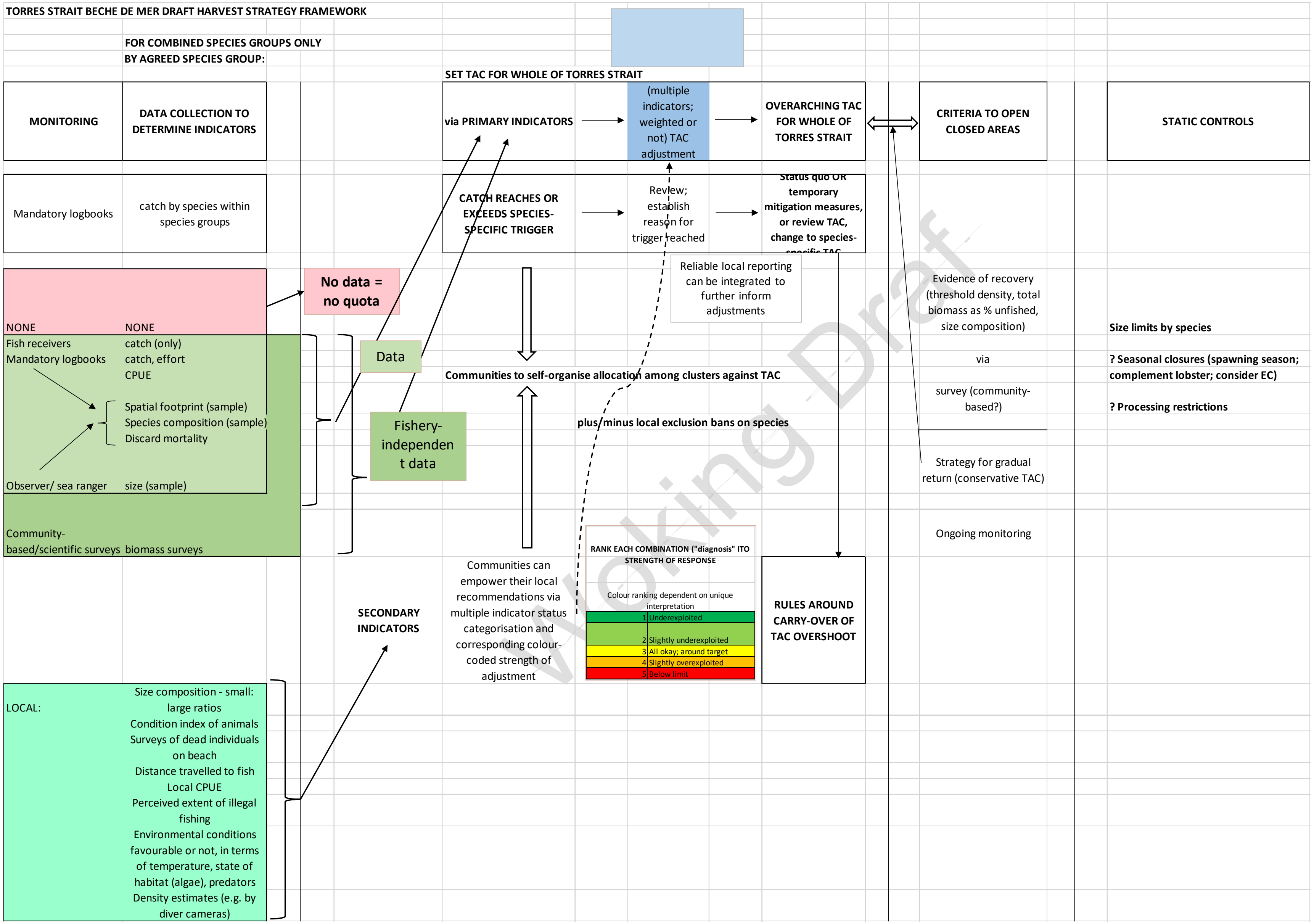
Table A.4. Average density (per ha) of sea cucumbers sampled at 122 repeated sample sites in eastern Torres Strait during the 2002 and 2005 abundance surveys (from Skewes et al. 2010)

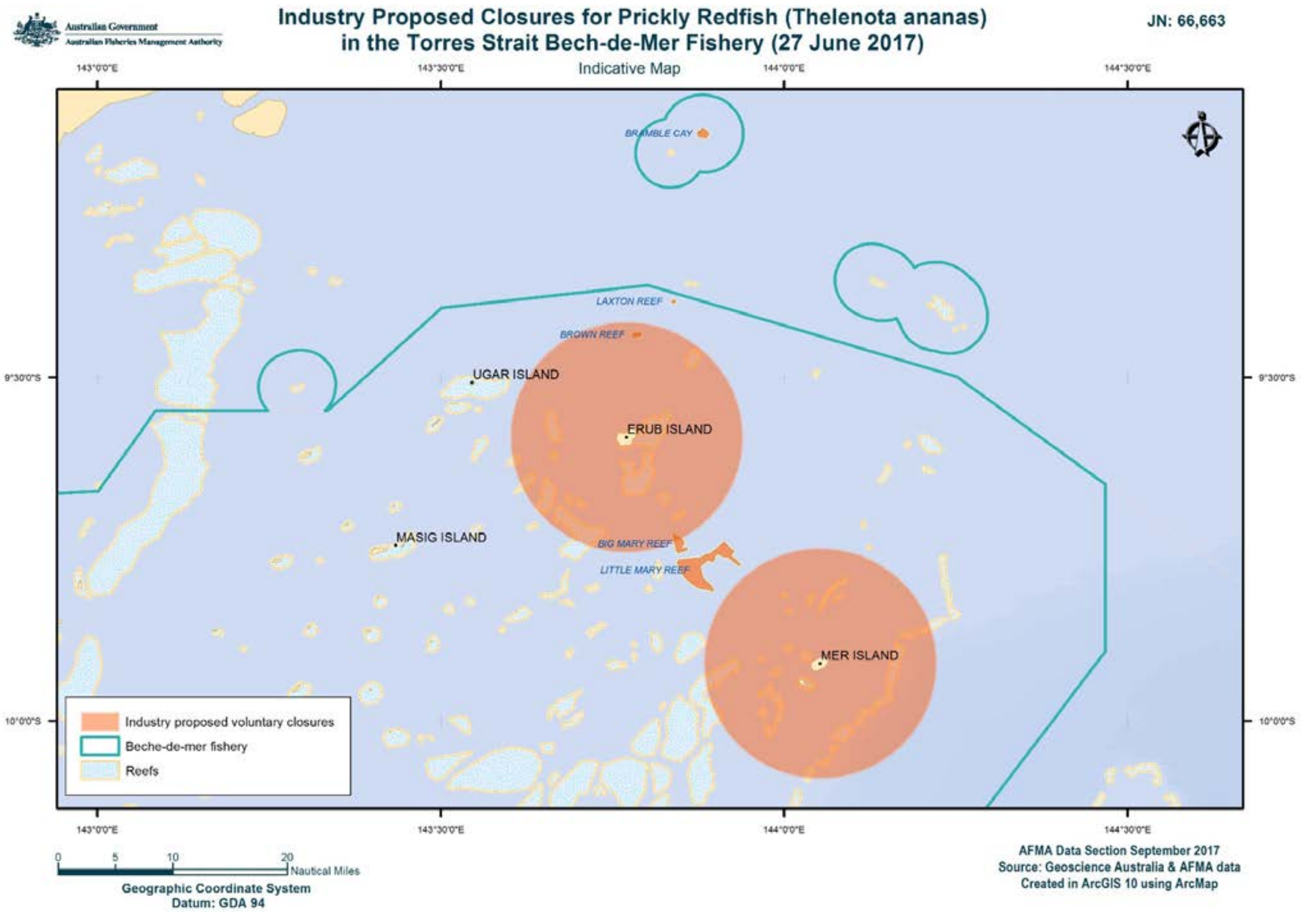
Species	Common name	Average density (per ha)		% change
		2002	2005	
All sea cucumber		150.94	153.28	**1.6**
High value		18.03	14.74	**-18.3**
Med value		55.99	53.93	**-3.7**
H. whitmaei	Black teatfish	4.00	3.08	**-22.8**
H. fuscogilva	White teatfish	5.43	3.57	**-34.1**
T. ananas	Prickly redfish	8.61	8.09	**-6.0**
A. miliaris	Blackfish	1.64	3.79	**131.3**
A. lecanora	Stonefish	0.10	0.00	**-100.0**
A. mauritiana	Surf redfish	1.02	0.00	**-100.0**
A. echinites	Deep water redfish	1.43	0.51	**-64.3**
All Actinopyga		4.20	4.30	**2.4**
H. atra	Lollyfish	25.60	33.91	**32.5**
H. fuscopunctata	Elephant trunkfish	15.30	15.43	**0.9**
H. coluber	Snakefish	0.61	4.41	**616.7**
H. edulis	Pinkfish	30.79	27.97	**-9.2**
B. graeffei	Flowerfish	3.59	3.72	**3.8**
B. argus	Leopardfish	12.91	11.32	**-12.3**
S. chloronotus	Greenfish	23.16	24.71	**6.7**

T. anax	Amberfish	2.56	2.59	**1.3**
S. hermani	Curryfish	10.60	10.18	**-4.0**
H. leucospilota		**1.54**	**2.56**	**66.7**

Appendix Fig. A.1.



Appendix Figure A.2.



Warrior Reef sandfish example

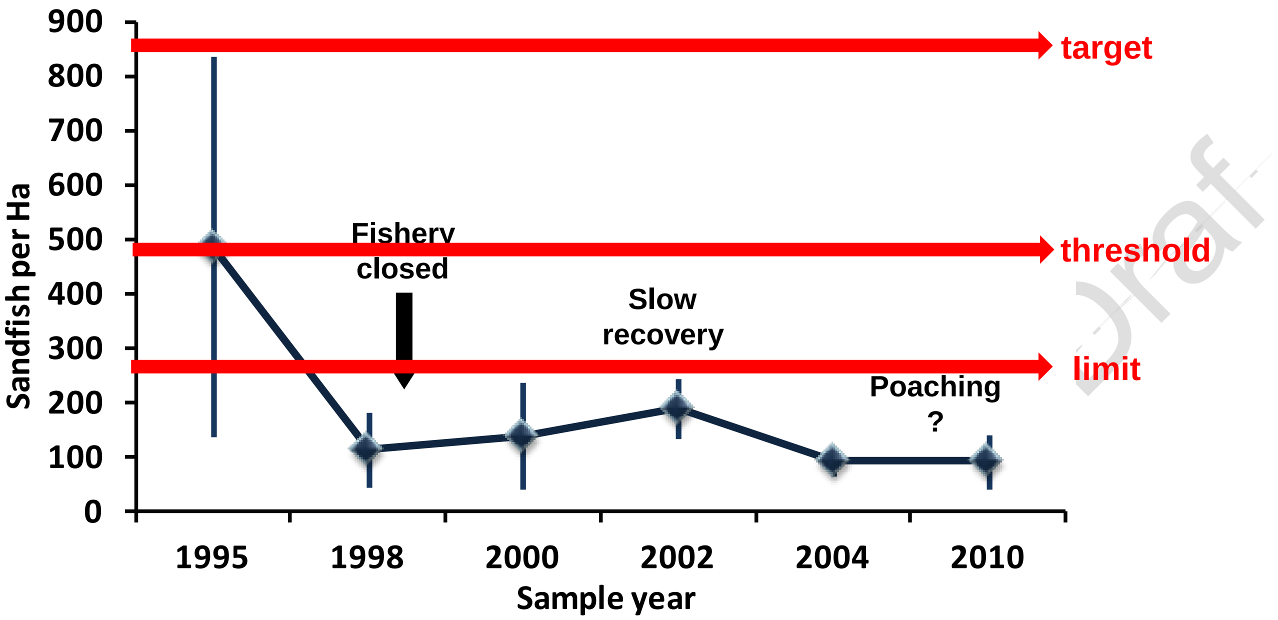


Figure A.3. Example using Warrior Reef historical survey data for sandfish and comparison with sandfish density estimates from other locations, to inform choice of a limit reference point (below which the fishery should be closed), a threshold reference point (which is set higher than the limit reference point and serves as a trigger to re-open a fishery) and a target level that should ideally be aimed for.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT Catch Reporting & Fish Receiver System update	Agenda Item 3.2 For DISCUSSION and ADVICE

RECOMMENDATIONS

1. That the Working Group:
   a. **NOTE** the overview of catch and effort reporting for hand collection fisheries, as reported in catch disposal records (TDB02) by licenced fish receivers this season (1 Jan 2018 until 26 September 2018); and
   b. **DISCUSS** and **PROVIDE ADVICE** on the likely accuracy of available data in reflecting true catch and effort for the Fishery noting in particular;
      i. the numbers of licenced fishers and fish receivers versus those reporting;
      ii. the decline in the completion and submission of CDRs since the start of the season; and
      iii. the timeliness of submission of CDRs to AFMA.

KEY ISSUES

Beche-de-mer catch and effort

2. <u>How much?</u>
   a. In total 34.3 tonnes has been taken in the Beche-de-mer Fishery for this season as of 26 September and as reported in CDRs.
   b. This is 4% more reported catch (1.5 tonnes) compared to the last fishing season reported through a range of sources including voluntary AFMA docket books (TDB01), mandatory Catch Disposal Records (TDB02) and voluntary Daily Fishing Logs (HC01) (**Table 1**).
   c. Highest reported catches this season to date are for curryfish (24.1 tonnes) (**Figure** 1).
   d. Prickly redfish catches (reported 8.2 tonnes) are below the TAC which was reduced from 20t to 15t this season and are less than catches reported for the last fishing season (12.1 tonnes) (**Table 1**).
3. <u>Where?</u>
   a. Approximately 80% of all CDRs returned (individual CDR sheets) reported information on Area Fished as per the map in **Figure 7**.
      i. Of the reports received containing information on Area Fished, only 4 areas were reportedly fished; Warraber (Area 12) (3%), Darnley (Area 16) (93%), Cumberland (Area 17) (3%) and Don Cay (Area 19).
   b. For a significant amount of catch landed (45% of all reported catch landed) area fished has not been reported. This data is voluntary but very important understanding changes to effort which is used as an indicated for the health of stocks and to assess the performance of the fishery.

c. The largest amount of catch (45%) was reportedly taken from Area 16 (Darnley), 2% was reported from 12 Warraber, 45% reported from 16 Darnley, 6% reported from 17 Cumberland, 2% from 19 Don Cay (**Figure 2**). It should be noted that these areas are very broad. Reported area data may reflect landing location as opposed to the actual area fished. AFMA is seeking HCWG advice to clarify this.

d. Approximately 65% of reported curryfish catches included information on area fished, while 35% did not.

e. Contrastingly, around 71% of reported prickly redfish catches and 63% of white teatfish catches did not include information on area fished.

4. When?

a. Peak monthly reported catches were Jan (5.9 tonnes), Feb (8.9 tonnes) and April (7.1 tonnes) (**Figure 3**).

b. Curryfish is the only species consistently reported each month.

5. By how many TIB licence holders and fish receivers?

a. In total 25 licences (or 20%) of a total of 126 licences authorised to take BDM have been reportedly active (catch reported under a TIB licence that has been landed to a fish receiver).

b. Of these reportedly active TIB licence holders, 68% have been recorded on less than 5 CDRs this year (**Figure 4**) i.e. 17 fishers have reportedly conducted less than 5 fishing trips in 2018.

c. Reported catches have been landed to a total of 9 out of 78 licenced fish receivers (**Table 2**).

d. Of the 9 different fish receivers submitting data, 5 receivers (56%) have only returned less than 5 CDRs this year (**Figure 5**).

Beche-de-mer catch reporting

6. Reporting has improved since the introduction of the mandatory fish receiver system on 1 December 2017. It is clear however that further improvement can be made.

7. Key findings on reporting performance to date are:

a. Overall levels of reporting have improved. A total of 144 Catch Disposal Records were received this season with reported beche-de-mer catch. This is a significant increase from 2017, with only 59 voluntary docket book records submitted to AFMA. A summary of the number of records received each year is outlined in **Figure 6**. The two highest years for record submissions are 2014 and 2015, when a Black Teatfish opening occurred.

b. 65% of CDRs reported information about the number of days fished.

c. 80% of CDRs reported information about the Area Fished.

d. No catch has been reported in the daily Hand Collectable logbook (HC01) this season. In 2017 only 2 fishers submitted 156 HC01 records on a voluntary basis. This provides more detailed catch and effort information.

e. Failure to submit CDR records in a timely manner. Only 49% of the CDRs completed and returned to AFMA were received within 24 days. 24 days accounts for the maximum 3 day limit to send the white copy CDR to AFMA after the product is weighed, plus a conservative estimate of time (21 days) needed for CDRs to reach AFMA in the post.

   f. AFMA suspects some catches are not being landed to and recorded by a fish receiver.

8. The Working Group is being asked to the review the available data and provide advice on its likely accuracy in reflecting true catch and effort for the Fishery.

9. AFMA is planning to conduct a further education and awareness campaign this financial year for the new fish receiver system. Advice from members is welcome on possible key issues to be addressed.

OTHER UPDATES

Licencing

10. A summary of licences for the hand collectable fisheries is provided in **Table 3.**

11. As of 2 October 2018, there were 126 Traditional Inhabitant Boat (TIB) licences authorised to catch beche-de-mer (BD) and 78 fish receiver licence holders. This season, a total of 9 different fish receivers have submitted CDRs with reported catch of beche-de-mer from 25 different fishers.

12. TSRA hold one TVH BDM licence package (1 Primary and 2 tenders). This licence is subject to future Protected Zone Joint Authority (PZJA) fisheries management arrangements consistent with achieving the objectives of the *Torres Strait Fisheries Act 1984* and Torres Strait Treaty. Any future decisions relating to the transfer and/or use of this beche de mer (BDM) licence, once held by the Commonwealth, will be referred to the PZJA.

Pearl Shell and Trochus Fisheries

13. Fishing activity in both the Pearl Shell and Trochus Fisheries remains negligible. The low level of catch and effort in the Pearl Shell and Trochus Fisheries is thought to be due to low market demand rather than a decline in stock availability.

    a. There have been no reports through Catch Disposal Records (TDB02) of trochus and only one report of pearl shell being harvested in the 2018 fishing season (**Table 4**).

    b. Limited activity has been reported in the Pearl Shell Fishery reported since 1 December 2017. During a review of developmental permits issued for the taking of undersized pearl shell in 2015 and 2016, AFMA received verbal reports that approximately 800 pearl shell was collected during the permit period, with roughly 15-20% comprised of shell between 100-130 mm. It was also reported that this low level of take has continued with pearl shell collected on an opportunistic basis largely by TIB licence holders whilst targeting TRL or in TRL closure periods.

BACKGROUND

14. On 1 December 2017 the Fish Receiver system was implemented. It became mandatory for all Torres Strait Fisheries licence holders (excluding Torres Prawn) to land their catch to a licenced fish receiver as soon as the catch either came onto land or was landed to a Carrier vessel (excluding onto freight ships (i.e. Seaswift). When catches are unloaded directly to a freight ship the catch must be received by a Fish receiver when landed in port).

15. An analysis comparing the date of landing recorded on a CDR, with the date of receipt by AFMA indicates that approximately half (49 per cent) of the CDRs have been received within 24 days of landing. This is accounting for the three day requirement to send the white copy to AFMA and conservatively allowing for three weeks (21 days) in the mail. AFMA considers a turnaround time of 24 days to be reasonable. Any CDRs received more than 24 days after the reported date of landing is considered to not meet Condition 8 of a Fish Receiver Licence.

16. Fish receivers are reminded that it is a condition of their fish receiver licence to complete a Torres Strait Fisheries Catch Disposal Record (TDB02) immediately after receiving product and return the completed TDB02 pages to AFMA within 3 business days. Any CDRs received more than 24 days after the reported date of landing (3 days to send, plus 21 days in the post) is considered to be a breach of the licence conditions of a Fish Receiver Licence.

No-take species

17. Enquires are being made in to reports of prohibited species of Beche-de-mer being taken and processed within the Torres Strait Protected Zone.

Table 1. Torres Strait Beche-de-mer Fishery historical catch records from 2005 to 2018.
Sources: AFMA docket book (TDB01) database, verbal reports obtained from industry during the 2015 Black Teatfish opening, Daily Fishing Logs (HC01), other correspondance and AFMA Catch Disposal Records (TDB02) for 2018 only. *This data does not include discarded or unreported catch.*

Common Name	TAC (t)	Recorded catch (kg)[1]										
		2005	2007	2010	2011	2012	2013	2014	2015	2016	2017[2]	2018[3]
Black Teatfish	**0 (15[4])**				75	2,001	138	16,624	23,303			
Prickly Redfish	**15 (20[5])**	5,564	128	146	11,056	1,255	5,888	9,173	28,110	11,211	12,185	8,202
Sandfish	**0**			5	31	2152	26	6				18
Surf Redfish	**0**						52	1				57
White Teatfish	**15**	734			3,179	13,294	12,633	16,341	4,200	990	747	850
Blackfish		186	128		507	73	216	1,960	3,596	1,098		843
Curryfish					1,118				6,099	1,085	11,118	24,136
Deepwater Redfish				7			5,024	4,229	5,546		597	6
Elephant Trunkfish					4	28	2		133			70
Golden Sandfish							52	351	55		160	5
Greenfish	**80 t 'basket'**						1	1	14			35
Stonefish				459								0
Leopardfish											63	
Brown sandfish											6	
Unidentified BDM											6,876	40
'Basket' total		**186**	**128**	**466**	**1,629**	**101**	**5,295**	**6,541**	**15,443**	**2,183**	**19,831**	**25,135**
Grand Total		**6,484**	**2,56**	**6,17**	**15,970**	**18,803**	**24,032**	**48,686**	**71,056**	**14,384**	**32,764**	**34,261**

[1] There was no catch reported in 2006, 2008, 2009.
[2] Catch data for 2017 is converted weights where processed form is known (47kg unknown), based on catch reported through tax invoices, HC01, TDB01 & TDB02. Verification was conducted to remove possible duplicates between records.
[3] Data is reported through TDB02 Catch Disposal Records only
[4] The 15t TAC was available during 2014 and 2015 only.
[5] The 20t TAC was available until the end of 2017.
Yellow highlighted cells indicate an exceeded TAC

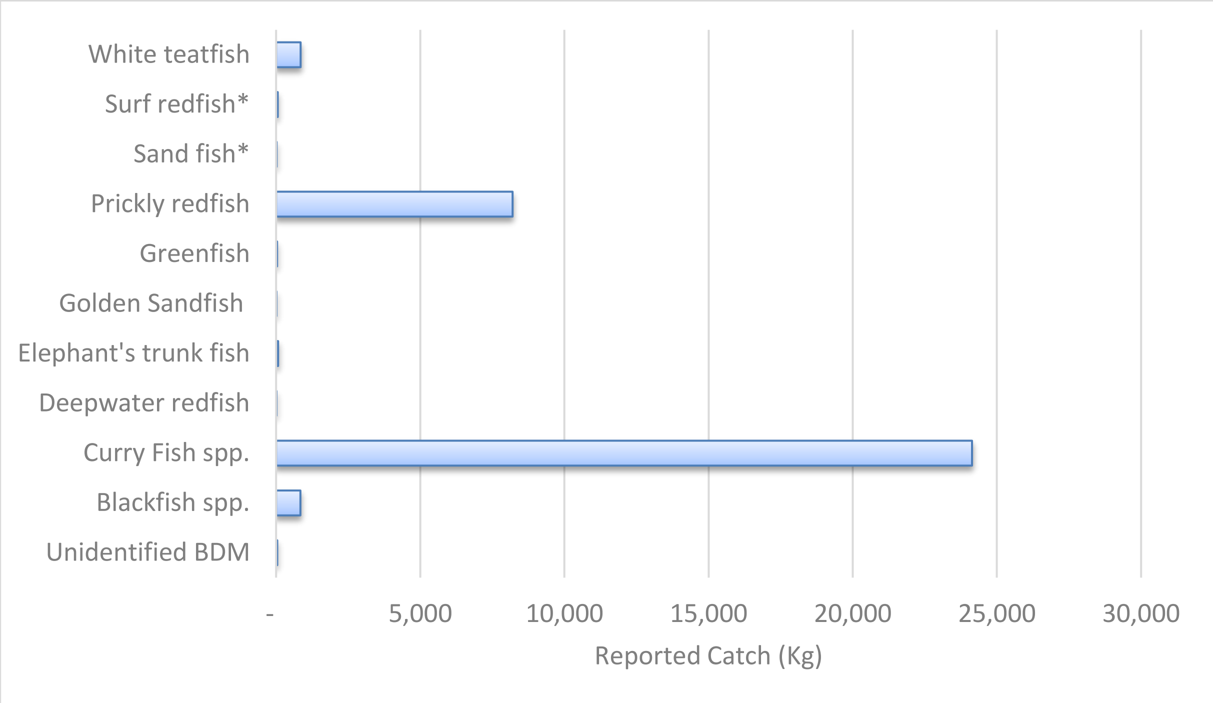


Figure 1. Total reported catch by species group in 2018. Reported catches have conversion factors applied.
Source: TDB02 Catch Disposal Records.

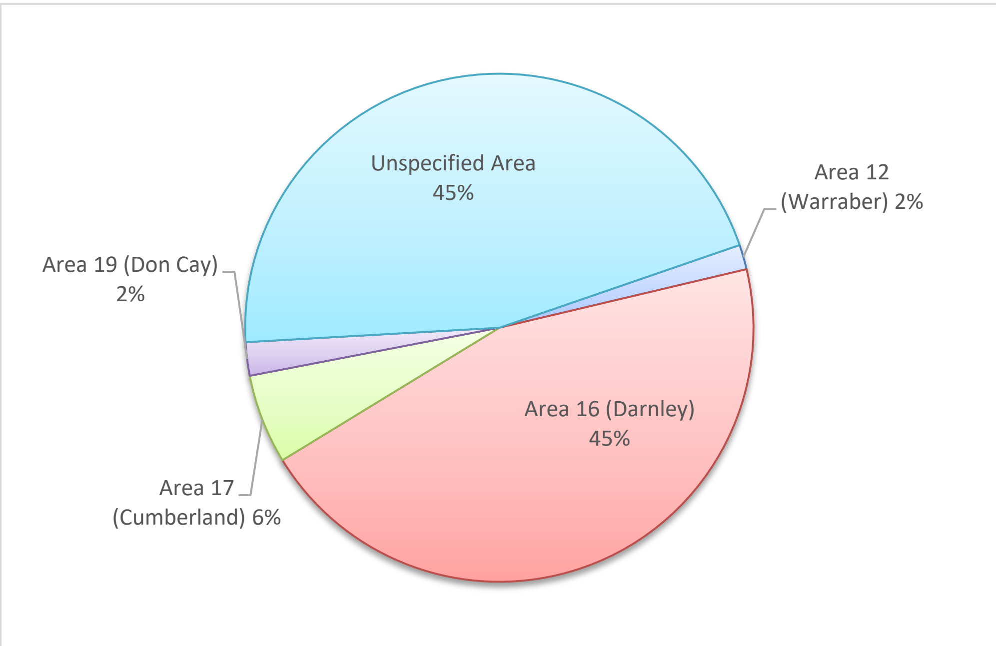


Figure 2. Proportion of total catch based on reported Area Fished.
Source: TDB02 Catch Disposal Records Voluntary Part B section

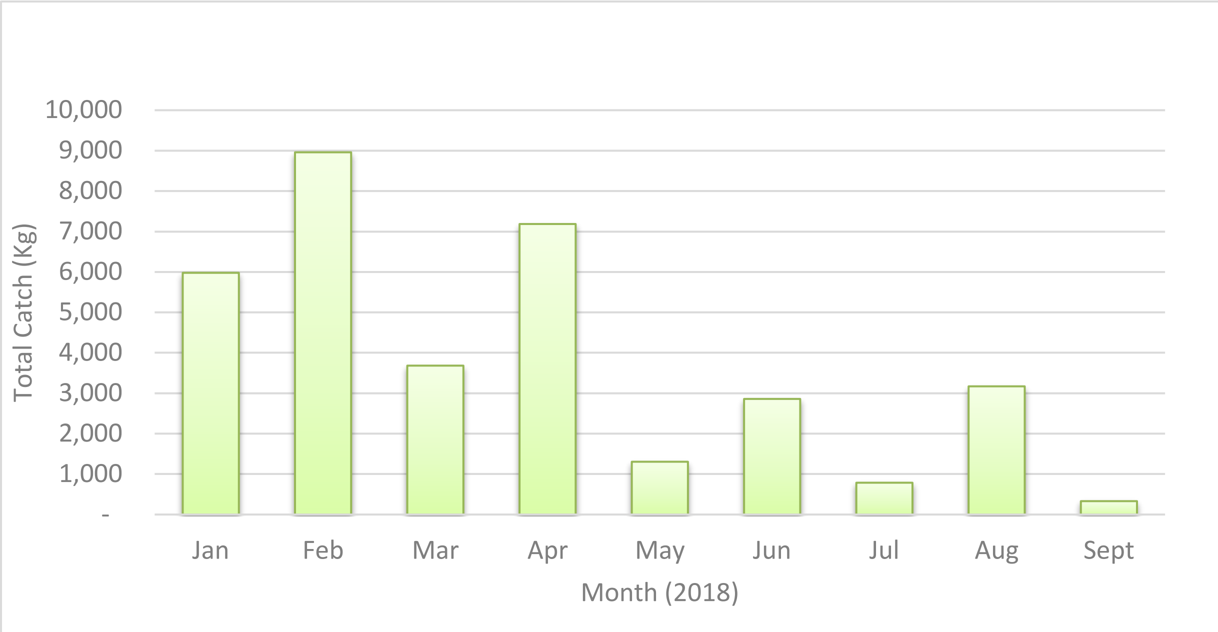


Figure 3. Reported catches by month. Reported catches have conversion factors applied.
Source: TDB02 Catch Disposal Records

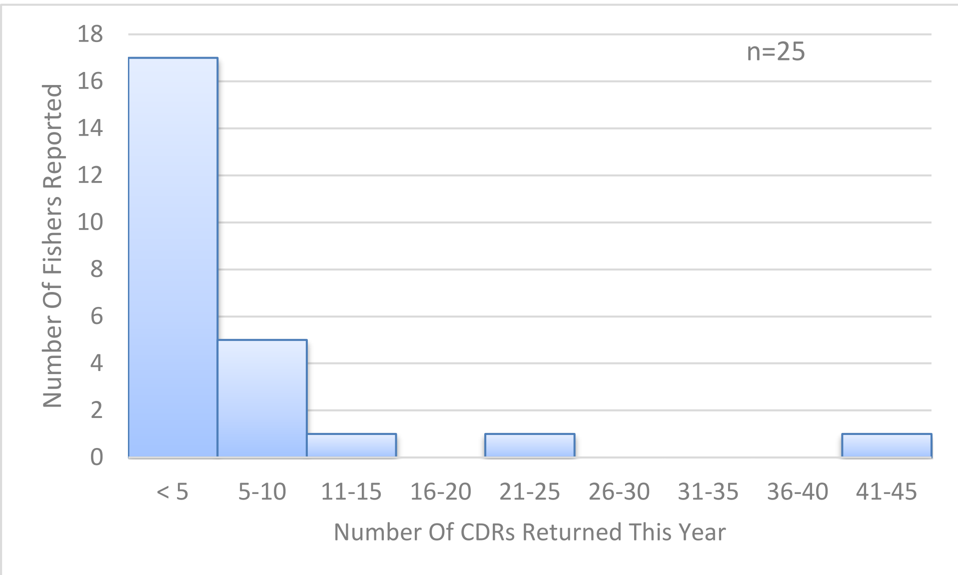


Figure 4. Frequency of Fishers reported on CDRs

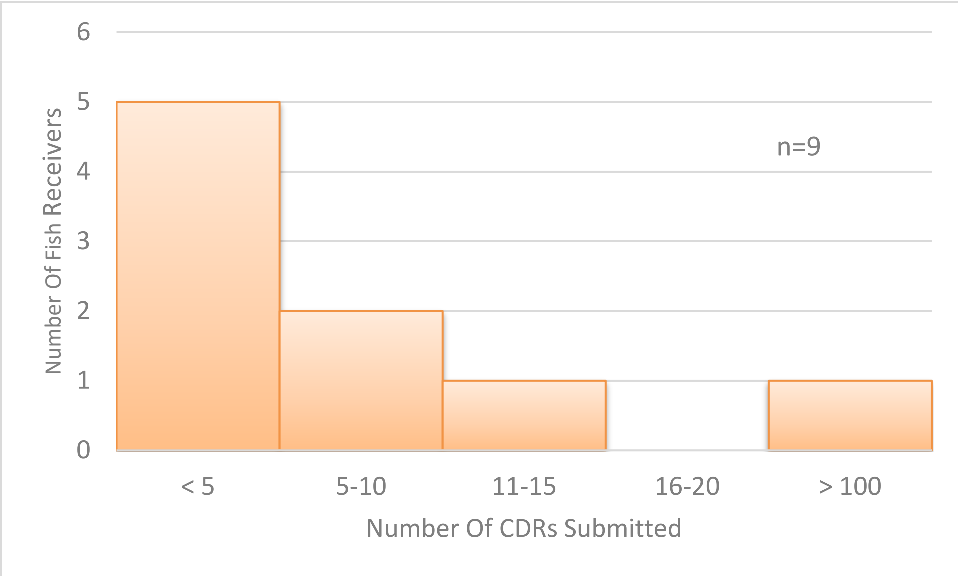


Figure 5. Frequency of Fish Receivers submitting CDRs this year.

Table 2. Comparison of the number of fishers and fish receivers reporting catches of beche-de-mer through CDRs with the number of licenced fishers authorised to catch beche-de-mer and fish receivers those that are licenced as of 4 September 2018.

No. of fishers reporting beche-de-mer catch on CDRs	No. of current beche-de-mer licence holders	No. of fish receivers submitting CDRs with beche-de-mer catch	No. of licenced fish receivers
25	126	9	78

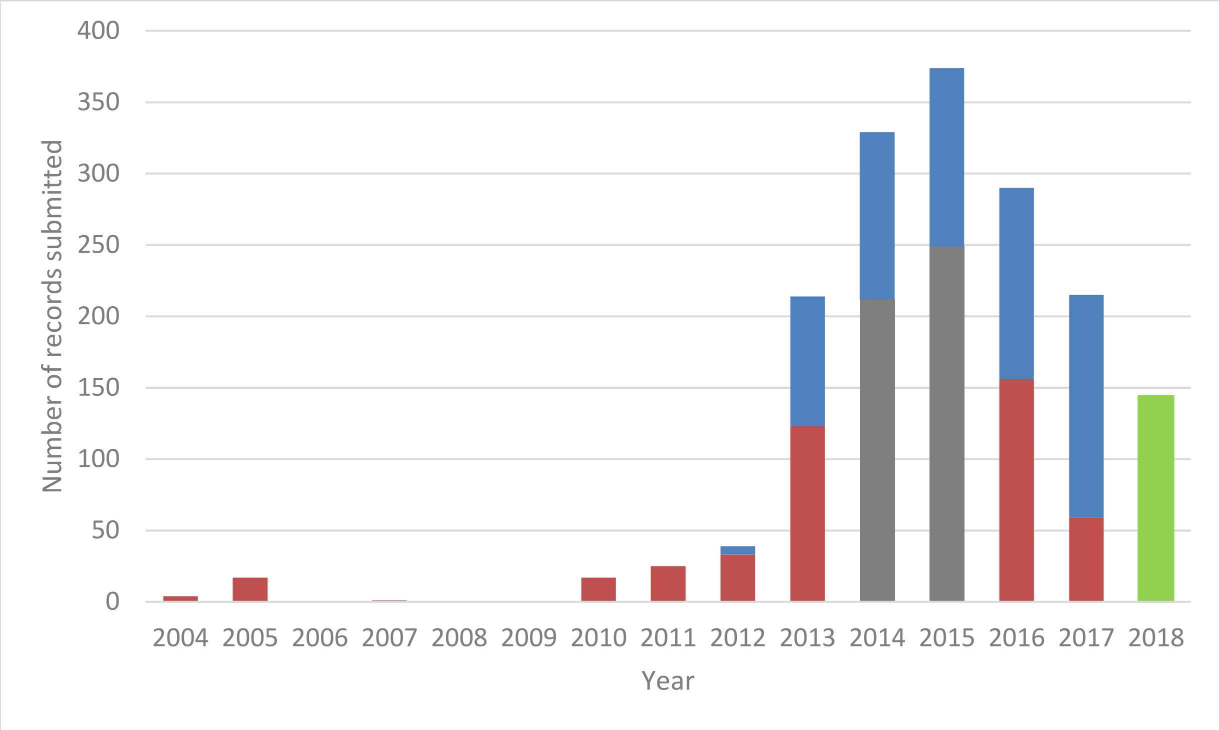


Figure 6. Number of catch records submitted each year. The red bars indicate voluntary TDB01 docket book data, the grey bars indicate years with Black Teatfish openings, blue bars indicate voluntary Hand Collection Daily Fishing Logs (HC01) and green bars indicate mandatory TDB02 Catch Disposal Records

Table 3. Summary of licences for all Hand Collectables fisheries.

	TIB licences	TVH licences	Carrier Boat licences	Fish Receiver licences
Beche-de-mer	126	1 package (held in trust by TSRA)	12 (B and C)	78
Pearl shell	44	7 total (5 primary/tender packages; 2 primary's)	11 (A, B and C)	
Trochus	30	-	5 (A, B and C)	

Table 4. Total catch by species group versus total allowable catch limits for the 2018 season (as of 26 September).
Reported catch has been converted to wet weight-gutted using CSIRO conversion ratios. Where no formal conversion ratio is available for a particular species, the most conservative (or highest) ratio has been applied. Catch figures are preliminary and are subject to change as AFMA receives additional catch reports.

Species	Total Allowable Catch (kg) 2018	Total Reported Catch (kg)
Pearl Shell [6]	n/a	-
Trochus	150,000	0
Sand fish	0	18[7]
Surf redfish	0	57[7]
Black teatfish	0	0
White teatfish	15,000	850
Prickly redfish	15,000	8,202
'Basket' species	**Total Allowable Catch (kg) 2018**	**Total catch (kg)**
Unidentified BDM	80,000	40
Blackfish		843
Curryfish		24,136
Deepwater redfish		6
Elephant's trunk fish		70
Golden Sandfish		5
Greenfish		35
	Basket Total Catch (kg)	**25,135**
	Grand Total Catch (kg)	**34,261**

[6] Unable to report due to there being less than 5 fishers

7 Reported catch of no take species is being followed up with AFMA Compliance.

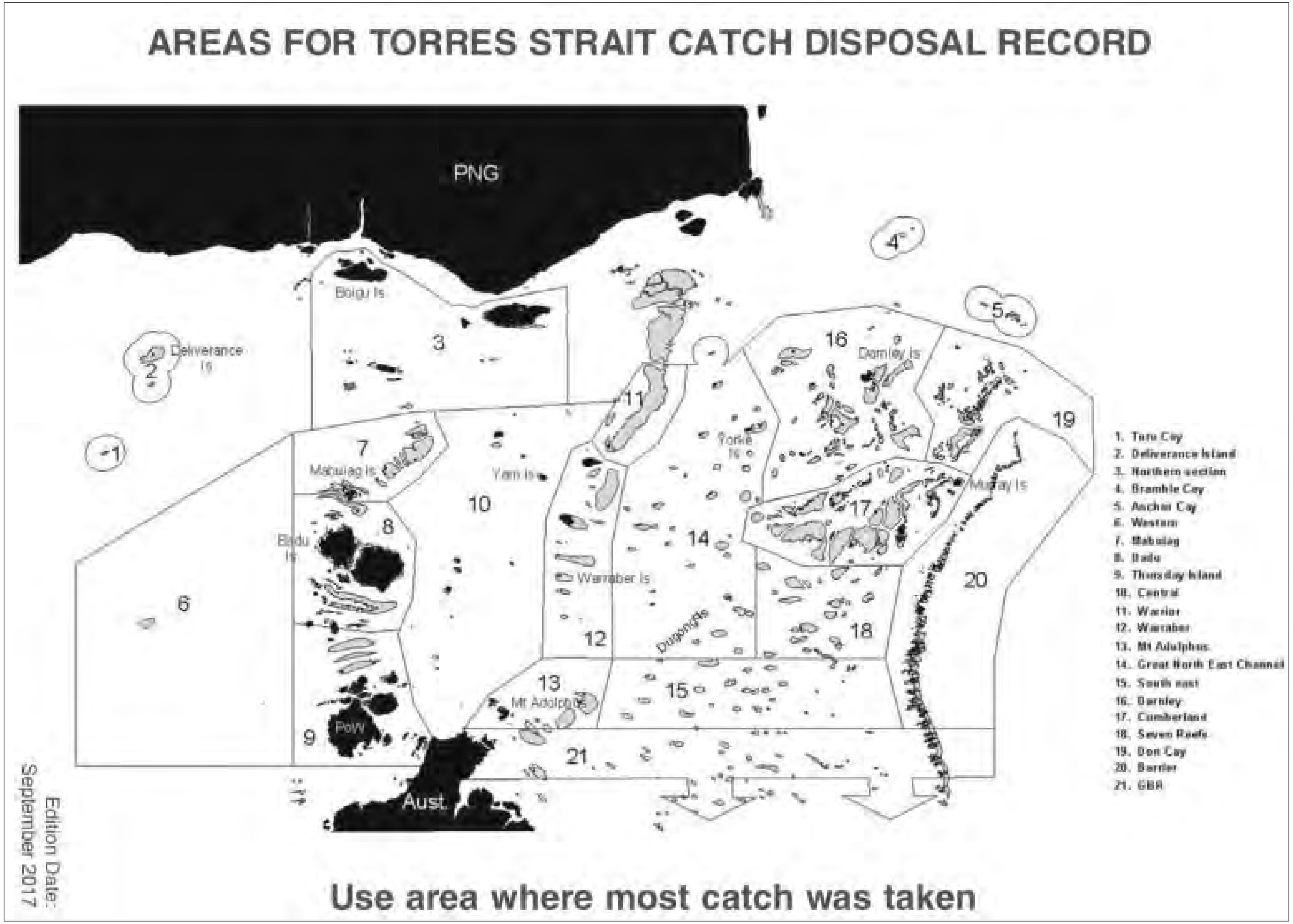


Figure 7. Areas for Torres Strait Catch Disposal Record (TDB02).

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT **Black Teatfish**	**Agenda Item 3.3** **For DISCUSSION & ADVICE**

RECOMMENDATIONS

1. That the Working Group:
   a. **NOTE** the history of the Black teatfish fishery and associated discussions;
   b. **NOTE** that the PZJA has agreed (out of session, February 2017) that fishing for Black Teatfish (*Holothuria whitmaei*) will remain closed until the risk of exceeding the total allowable catch (TAC) set for the species is substantially reduced through cost-effective management tools;
   c. **NOTE** the approximate timeline for PZJA out of session decision making and other relevant notifications required to support a Black Teatfish opening in December 2019;
   d. **DISCUSS** and **ADVISE** on industry catch reporting targets over the coming months to demonstrate improved catch reporting.
   e. **DISCUSS** and **ADVISE** on preferred management arrangements needed to support a successful opening of Black Teatfish fishing, noting:
      i. the previous management arrangements that have been considered (Table 2) to date by the 2016 Erub Industry Workshop, Working Group and AFMA.
      ii. the identified risks, benefits and additional considerations of each possible management tool.

KEY ISSUES

2. The PZJA has agreed (out of session, February 2017) that fishing for Black Teatfish will remain closed until the risk of exceeding the TAC set for the species is substantially reduced through cost-effective management tools.
3. Any recommendations to allow fishing for Black Teatfish will need to clearly explain how the risk of exceeding the TAC will be reduced compared to the arrangements from the previous trial openings in 2014 and 2015 where the TAC was exceeded both times.
4. Significant lags in catch reporting during both trials was a key issue that undermined the ability to manage the fishery within the TAC. As part of a range of management arrangements discussed at the Industry Workshop on Improving Black Teatfish Catch Reporting held on Erub in October 2016, AFMA has since implemented a mandatory fish receiver system (FRS).
5. At the July 2018 meeting, HCWG13 acknowledged that another Black Teatfish opening is largely contingent on improved catch reporting through the fish receiver system and industry demonstrating accurate and timely reporting of other beche-de-mer species.
6. In the ten months the FRS has been in place, catch reporting in the beche-de-mer fishery has progressed substantially (refer to Agenda Item 3.2), however it is likely that greater improvements will be required to satisfy the PZJA that the risk of over harvesting Black Teatfish can be reduced. Specifically around the timeliness of reporting.
7. As discussed previously by the HCWG, additional management measures will likely be required for a further the black teatfish opening.

8. In preparation of putting a proposal to the PZJA for a Black Teatfish opening, AFMA is seeking HCWG advice on:
    a) Adopting performance targets for improved catch reporting (e.g. improved timeliness of submission of CDRs);
    b) Advice on the Recommended Biological Catch/Total Allowable Catch;
    c) The management arrangements required to support a Black Teatfish opening.
9. It is open to the working group to raise additional considerations.

Performance targets for improved catch reporting

10. Having agreed performance targets is one way to encourage reporting and target AFMA support for industry. AFMA can provide monthly updates to remind and inform industry of how well they are tracking to meet the agreed reporting targets.

11. AFMA is planning to conduct a further education and awareness campaign this financial year for the new fish receiver system. Advice from members is welcome on possible key issues to be addressed.

12. AFMA has given some consideration to the reporting standards (detailed below) required for industry to meet in order to demonstrate a commitment to providing timely and accurate data. Given these requirements above, AFMA is seeking HCWG advice on a range of reporting targets to achieve over the coming months (**Table 1**).

Minimum Requirements

a) Adhering to licence conditions:
    i. Licenced fishers landing all commercial product to a licenced fish receiver.
    ii. Licenced fish receivers only receiving commercial product from a licenced fisher.
    iii. Fish receivers must ensure all fish are accurately weighed upon receipt from a fisher
    iv. Fish receivers must complete a Torres Strait Catch Disposal Record (TDB02) immediately after receiving fish
    v. Fish receivers must return the white copies to AFMA within 3 business days of receiving the fish.

    This requirement applies to all fisheries in the Torres Strait Protected Zone and the Commonwealth.

    Consistently sending CDRs and/or Logbooks to AFMA. Stockpiling CDRs and sending several months' worth at one time is not acceptable.
b) Ensuring the correct fisher/fish receiver and/or authorised agent names and licence holder details are accurate

Additional Requirements

a) Reporting to species level where possible. Recording "slugs" is not sufficient. Other examples include, differentiating between common curryfish, and curryfish vastus.
b) Filling in the Part B Voluntary section of the CDR regarding Fishing Effort and Area. This includes details about area fished, number of days fished and number of fishers.
c) Fishers voluntarily filling in and submitting non-mandatory Hand Collection Daily Fishing Logs (HC01). These logs include more detailed information about where and

when fishing is occurring. This data is important to support the Harvest Strategy and future management decisions for the Beche-de-mer Fishery.

Advice on the Recommended Biological Catch/Total Allowable Catch.

13. The HCWG can finalise its TAC advice at its next meeting allowing time for AFMA to seek inter-sessional advice from the Scientific member.

14. Members should note there is no new information available on the stock status of Black Teatfish. The last BDM survey to inform on black teatfish stocks was conducted in 2009. Catch data collected during the two previous openings is not informative of stock status due to the lack of effort information.

15. As previously done, the HCWG will need to consider whether or not a discount factor needs to apply to take into account aging of the stock assessment. The HCWG could consider the risk-catch-cost trade–off of collecting additional data to update the stock assessment however available funding and timing is likely to mean this could not be completed next year.

Management arrangements required to support a black teatfish opening

16. In addition to improved catch reporting, additional recommendations to reopen the Black Teatfish fishery will need to clearly explain how the risk of exceeding the TAC will be reduced compared to the arrangements from the previous trial openings. **Table 2** summarises a compilation of arrangements that have been discussed at previous HCWG meetings and the 2016 Erub industry workshops.
17. AFMA has summarised the risks and benefits of each strategy, and the Working Group is asked to discuss and provide advice on the prioritisation of which of these strategies (or combination thereof) is preferred to effectively control, monitor and enforce a future opening.

Administrative Process and Next Steps

18. Subject to the proposed management arrangements, a December 2019 opening would require the following:
    a) an out of session decision by the PZJA (three months),
    b) Native Title Notification (one month),
    c) Adequate industry notification prior to an opening (one month)
19. This leaves approximately 8-9 months (until July 2019) for industry to demonstrate improved catch reporting.

For Industry

a) Continue to report catches through the Fish Receiver System and aim to meet or exceed agreed reporting benchmarks over the coming months.
b) Encourage fishers and fish receivers to provide information on the Voluntary Part B section of the catch disposal records.
c) Encourage fishers to complete voluntary Hand Collection Daily Fishing Logs (HC01).

For AFMA

a) Develop appropriate administrative measures to regulate the opening;

b) Develop a Compliance Plan to monitor and enforce proposed arrangements.

c) Regularly report back to industry on their progress against agreed reporting targets.

d) Provide an updated overview of catch reporting and overall performance against agreed targets at the next Hand Collectables Working Group meeting.

Table 1. Potential catch reporting targets and performance measures. Green = minimum standard to demonstrate compliance with existing rules. Yellow = voluntary but demonstrates comprehensive reporting.

What do we want to achieve?	**What's the current situation?**	**Target 1**	**Timeline**	**Target 2**	**Timeline**	**Final Target**	**Timeline**
		What are we aiming for?	**When do we need to achieve this by?**	**What are we aiming for**	**When do we need to achieve this by?**	**What are we aiming for**	**When do we need to achieve this by?**
Improved timeliness of submission of CDRs	49% of CDRs are received within 24 days of the reported date of landing	60% returned within the appropriate timeframe (24 days)	January 2019	80% returned within the appropriate timeframe (24 days)	April 2019	90% returned within the appropriate timeframe (24 days)	July 2019
Increase in the provision of data regarding Areas Fished in Part B of TDB02	80% of CDRs include information on Area Fished	90%	January 2019	95%	April 2019	100%	July 2019
Voluntary submission of HC01 Daily Fishing Log	No HC01 logs have been received this year	At least each fisher having access to a HC01 Daily Fishing Log	December 2018	At least each fisher reported on CDRs also submitting some Daily Fishing Logs			
Reporting curryfish to species level where possible	Almost all reported curryfish is recorded as "CUC"	50% of reported curryfish is split out between species (e.g. curryfish common, curryfish vastus)	January 2019				

Table 2. Summary of risks and benefits of previously discussed management tools required to support a Black Teatfish opening.

KEY MANAGEMENT OBJECTIVE: Reduce the risk of exceeding the total allowable catch for Black Teatfish (Source: PZJA decision Jan 2017)

Legislative Objectives *(Torres Strait Fisheries Act 1984)***:**

(b) *to protect and preserve the marine environment and indigenous fauna and flora in and in the vicinity of the Protected Zone*

(e) *to manage commercial fisheries for optimum utilisation*

(g) *to have regard, in developing and implementing licencing policy, to the desirability of promoting economic development in the Torres Strait area and employment opportunities for traditional inhabitants.*

Management tool		Details	Benefits	Risks
Catch Reporting	Mandatory Fish Receiver System	Reporting frequency to be increased to daily submission of CDRs. AFMA will need to implement a system that allows for submission of CDRs by electronic means.	The system is already in place and industry have the next 8-9 months to continue to demonstrate improvements in catch reporting.	Fishers and fish receivers will need to ensure they have means (eg reception to email, sms) to submit reports daily to AFMA. Some fishers undertake multi-day fishing trips camped on remote islands. Previously, carrier vessels have operated in remote areas. Product is considered landed when brought to shore or transhipped to a carrier vessel.
	Daily logbook reporting	Fishers voluntarily fill in and submit Hand Collection Daily Fishing Logs (HC01).	The provision of detailed catch and effort information captured through HC01 logs will provide useful data for the fishery. Will be an added element industry can use to demonstrate their commitment to providing accurate and timely data on the fishery, despite not being mandatory.	Until the necessary legislative amendments are made to support mandatory daily fishing log reporting, there is a risk that no fishers will voluntarily complete them.
Catch Limits	Closure Trigger	Set a TAC trigger at which point the fishery will be declared closed to allow for all outstanding catch reports to be submitted. During the 2015 trial opening, there was a lag in catch reports being received by AFMA, as many fishers reported previous	Will mitigate the risk of over catching the TAC by having less reliance on accurate catch reporting.	May reduce the incentive for fishers and fish receivers to report their catch immediately and accurately. If reporting is effective fishers will forego catch.

		days' catches a number of days after they were caught.		
	Precautionary TAC	Set a precautionary TAC that takes into account the risk of over catch. From the last Erub Workshop participants discussed setting the TAC at 10t rather than 15t.	Would mitigate potential stock impacts from of over-catching.	If reporting is effective fishers will forego catch (income).
Time and length of opening	Limited opening period	Instead of opening the fishery for 1 month or until the TAC is reached, set the opening for 3-4 days. The maximum daily recorded catch during the 2015 trial opening was 4.341 tonnes. Allowing for a 10% increase in fishers participating in the trial opening, the total catch expected over a 3 day period would be approximately 14 tonnes.	May mitigate the risk of over-catching by having less reliance on accurate catch reporting.	The pre-selected 3-4 day time frame for an opening may be impacted by weather variability (poor tides) and may be more difficult for fishers to participate given other commitments. It may not be possible administratively, alter the dates within a short-timeframe.
	Timing of opening	At the Erub Workshop participants discussed changing the season date to coincide with the opening of the TRL Fishery to reduce the number of fishers participating in the fishery. HCWG13 advised that any future trial opening should be in December.	At the HCWG13 members advised that a December opening allows people to earn an income before the Christmas period. This was identified as an important economic/social benefit consideration.	TRL fishers will have less opportunity to access the Fishery.
Improved Compliance Monitoring	Restricted Entry	a) Access to the opening is provided through developmental permits (discussed at the ERUB workshop) b) b) "Opt-in" – Subject to further consideration by AFMA - Fishers could be required to apply to AFMA to access the opening up until a particular date. After this time, no more applications for access are granted. A fishers application could require the fishers to advise on fish receivers they are likely to land they catch to. AFMA would produce a public list of 'black teat' fishers ahead of opening.	Could provide more accurate information on likely fishers and therefore assist in more effective compliance operations. May reduce the risk of a sudden increase in the number of fishers fishing in the Fishery. This can increase compliance risks but also has been raised as a concern for fishers who fish more regularly fishers. Noting, the size of the available catch, limiting the number of fishers may be consistent with the objective to manage for optimum utilisation. When there	a) The developmental permit process is lengthy (can take at least 4-5 months to process) and subject to further AFMA consideration may not be an appropriate administrative mechanism. b) Restricting Traditional Inhabitants access to Torres Strait Fisheries is inconsistent with current PZJA licencing policy. Any departures from this approach may not be supported by the PZJA and/or would require additional consultation and therefore time to progress.

			are too many fishers compared to the available TAC, the risk of overcapitalisation and negative economic returns increases.	
	Restricted Landings	a) Restrict landings to specified communities or landing sites (e.g. criteria may be based on historic fishing areas and landings.). Discussed at the Erub Workshop. b) Restrict landings to specific fish receivers who meet specific criteria. Discussed at the Erub Workshop to be part of community-level plans.	Limiting landing locations assist compliance monitoring.	It is not clear that the Act supports restricting fishers to land to specific fish receivers or locations. Subject to further AFMA consideration. If the power clearly exists it may be difficult, therefore requiring more time to consider, to agree on fair and equitable criteria for determining who may be a fish receiver and the limited landing sites.
	Closure of Beche-de-mer Fishery after a Black Teatfish opening	Close the entire Torres Strait Beche-de-mer Fishery (i.e. all species) for one month once fishing for Black Teatfish is closed. This would assist compliance but not necessarily address catch reporting issues. Discussed at the Erub Workshop.	May assist with compliance in mitigating the further take of Black Teatfish after the agreed opening period.	Would limit ongoing economic opportunity for industry if entire fishery is closed.
	Prohibition on carrier boats	Carrier boats should not be permitted to receive Black Teatfish. The Fishery should instead be a small boat fishery with fishers working from the community. Discussed at Erub Workshop. **Note**: Carrier vessels are subject to VMS (exemption available for carrier vessels under 6m) if receiving product must comply with the fish receiving reporting requirements.	Would reduce competition for fishing operations that do work with a carrier operation.	Limits operational flexibility for fishers. Some fishers advise that carrier vessels allow timely processing of product therefore is value adding.

BACKGROUND

2014 trial opening

1. In 2014, the PZJA reopened fishing for black teatfish for the first time since the closure in 2003 (PZJA out of session decision, November 2002). Fishing was limited to a one month period (November) or until the TAC of 15 tonnes was caught. Key results of the trial were:
   a. the TAC was exceeded within two weeks of the one month trial. The total catch was estimated to be 16.624 tonnes;
   b. it was necessary for AFMA to make daily contact with fishers, buyers, processors and freight companies to properly monitor catches; and
   c. although there appeared to be good support from industry for the use of catch data forms prior to the season opening, only 17.3% of reported catch was reported by individual fishers. AFMA consulted widely with fishers, buyers and processors to determine the total catch. This was an inefficient use and drain on resources.

2015 trial opening

2. In 2015, the PZJA again reopened fishing for Black Teatfish. Fishing was again limited to a one month period (November) or until the TAC of 15 tonnes was caught. Key results of the trial were:
   a. catch was not kept within the 15 tonne TAC limit. The fishery was closed after only eight days of fishing and fishers reported a total catch of 23.303 tonnes, 8.303 tonnes over the TAC;
   b. interest by fishers in participating in the fishery increased. AFMA estimates that 64 fishers participated in the fishery in 2015 compared to 29 in 2014;
   c. catch reporting rates by fishers and local community-based shore managers improved significantly from the 2014 trial opening. However, a significant lag between reporting and capture undermined the ability to manage the fishery within the TAC limit;
   d. Approximately 68% of the product was collected by fishers working cooperatively with a central person reporting catch on behalf of a fishing operation;
   e. There is a strong industry-held perception that significant levels of illegal fishing occurred. Allegations included fishing before the season commenced, using illegal fishing gear, and breaching both boat length limits and carrier vessel operating conditions.
3. A timeline of the history of Black Teatfish openings and closures is outlined in **Table 3.**

Recent Working Group recommendations and PZJA decisions

4. Since the 2015 trial opening the Working Group has been working to develop advice on the future management arrangements for Black Teatfish – this process is ongoing.
5. At its meeting in November 2016, the Working Group recommended the following minimum requirements for allowing further fishing for Black Teatfish:
   a. development and implementation of community-based catch monitoring arrangements (noting that in the short term these systems would be voluntary), starting with Community Monitoring Plans to be submitted to AFMA by 30 November 2016; and
   b. implementation of a regulatory-based catch monitoring/reporting tool. The preferred tool being a mandatory FRS.
6. In February 2017, the PZJA agreed out of session that fishing for Black Teatfish will remain closed until the risk of exceeding the TAC set for the species is substantially reduced through cost-effective management tools.
7. At the last meeting of the Working Group (HCWG13) in July 2018, it was recommended that AFMA prepare a proposal for the PZJA, for a Black Teatfish trial opening in December 2019, following consultation with communities about potential limited access for the five key eastern islands and to include a basis for scientific data to support the proposal after the finalisation of the harvest strategy.

Table 3. Timeline of the Black teatfish fishery closures and openings.

Year	Meeting	Fishery status	Comments
2003	Pre-HCWG	Closed	Black teatfish found to be overexploited. PZJA agreed to shut the fishery.
2009	HCWG3	Closed	CSIRO presented early results of a survey of stock abundance of Hand Collectables fisheries in the eastern Torres Strait. Results indicated that the Black teatfish stock has recovered to near unfished biomass. CSIRO recommended a conservative TAC of 25 tonnes. This recommendation was contingent on appropriate management strategies being in place to reduce the risk of over fishing and localised depletion.
2011	HCWG5	Closed	HCWG recommended to TS Fisheries Management Advisory Committee a 15 tonne TAC for Black teatfish to be available for one month. The opening was recommended to occur during the Tropical Rock Lobster hookah season to limit the transfer of fishing effort, and was contingent on mandatory catch reporting being agreed to by the PZJA.
Nov 2014	NA	Open	The fishery was opened for the first trial in November 2014. The fishery was set to close either after a month or when the 15 tonne TAC was reached, which ever came first.
Apr 2015	HCWG8	Closed	Following the 2014 trial, the HCWG recommended that the trial arrangements be maintained as part of the re-development of the fishery. A second opening in November 2015 was agreed to under the same conditions of 15t TAC or one month. A further recommendation was that catch reporting levels needed to improve significantly (from 17.3%) for further trials to be considered. The number of fishers reporting their catches increased, however there was still issues with the timeliness of reporting.
Nov 2015	NA	Open	The second Black teatfish trial opening was conducted. The catch was not kept within the 15 tonne TAC and the fishery was closed after eight days. The reported total catch was 23 tonnes; which was 8 tonnes over the TAC.
Jun 2016	HCWG9	Closed	Recommended not to open the fishery again until measures were in place to significantly reduce the risk of overshooting the TAC. An action item from the meeting was to hold a workshop, with the support of AFMA and the TSRA, with industry representatives to consider immediate options to improve catch reporting, short, medium and long term management options.
Oct 2016	Industry workshop	Closed	Following the recommendation from the HCWG, an industry workshop was conducted on Erub Island. The workshop involved industry members, fishers and buyers, from the eastern islands. A range of views were put forward by industry at the meeting, with some fishers wanting the fishery to be opened against as soon as possible (1 December 2016 was suggested) and others who wished to develop better catch

Year	Meeting	Fishery status	Comments
			reporting and community-based management arrangements. Advice from the meeting included: 1. The development of community management plans; 2. A desire to move towards catch share allocations for the five communities. This allocation would be further restricted to operators from those communities to be decided by the PBC, cultural protocols to be adhered to; 3. Improved catch monitoring, possibly via mandatory logbooks. <u>Recommendation: </u>a) each community develop their community catch monitoring arrangements in details, b) proposals include other community based management arrangements (ie catch allocations, control over who can fish, cultural protocols) be developed and adopted by industry agreement, and c) that these proposals be submitted to the Hand Collectables Working Group and PZJA.
Nov 2016	HCWG10	Closed	The outcomes from the Industry Workshop were considered. The HCWG noted its previous recommendation that the fishery remain closed until measures are in place to improve reporting. <u>Recommendation:</u> Minimum requirements for allowing further fishing for black teatfish - Development and implementation of community based catch monitoring arrangements (noting that in the short-term these systems would be voluntary) to be submitted by 30 November 2016; and - Implementation of a regulatory-based catch monitoring/reporting tool. The preferred tool being a mandatory fish receiver system.
Feb 2017	PZJA	Closed	The PZJA formally agreed to keep the black teatfish fishery closed until the risk of exceeding the TAC set for the species is substantially reduced through cost-effective management tools.
June 2017	HCWG11	Closed	HCWG noted the out of session agreement that the Black teatfish fishery would remain closed until cost-effective management arrangements were in place that would reduce the risk of over catching the TAC.
Oct 2017	HCWG12	Closed	No formal recommendations were made. The HCWG reiterated the need to obtain reliable catch data and limit fishing effort to support a future opening.
July 2018	HCWG13	Closed	The WG recommended that AFMA prepare a proposal for the PZJA, for a Black Teatfish trial opening in December 2019, following consultation with communities about potential limited access for the five key eastern islands and to include a basis for scientific data to support the proposal after the finalisation of the harvest strategy.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT Research Update	Agenda Item 3.4.1 FOR NOTING

RECOMMENDATIONS

1. That the Working Group **NOTE** the update provided by the Scientific member on research relating to bech de mer fisheries in Australia and internationally.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT Five Year Fishery Research Plan 2019/20 – 2022/23	Agenda Item 3.4.2 For DISCUSSION & ADVICE

RECOMMENDATIONS

1. That the Working Group:
   a) **NOTE** that a rolling five-year research plan for the Hand Collection Fisheries 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 Hand Collectable Fisheries (**Attachment 3.4.2a**).

KEY ISSUES

2. Research needs for Hand Collectable Fisheries identified 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 is provided at **Table 1**.
3. In summary the key focus of research investment and management resources in the hand collectable fisheries has been to develop a harvest strategy for the active Beche-de-mer Fishery and improve catch and effort data. Both are fundamental to guiding cost-effective research investment in the future and having the most basic information available in which to monitor the status of the Fishery.
4. Outside of the fishery specific 2015 AOP research needs, AFMA co-funded with FRDC the production of a sea cucumber product processing training video for Torres Strait Communities, titled: *Sea Cucumbers in the Torres Strait – A practical guide to sustainable fishing and building the Torres Strait beche-de-mer brand.*
5. Whilst the beche-de-mer Harvest Strategy is likely to inform much of the future research needs in the BDM Fishery, the HCWG has provided advice on research and data needs over the last few years. This advice is summarised in **Attachment 3.4.2b**.
6. Based on HCWG advice received to date, AFMA has drafted a Rolling Five Year Fishery Research Plan 2019/20 – 2022/23 for Hand Collectable Fisheries (**Attachment 3.4.2a**). This has been prepared as a starting point for HCWG discussion.
7. Research priorities proposed align with the new TSSAC Strategic Research Plan (SRP) Theme 1, Strategy 1a – Fishery stocks, biology and marine environment and Theme 3, Strategy 3a – Develop technology to support the management of Torres Strait fisheries. It is open to the HCWG to provide advice on broader priorities.

Climate Change

8. Understanding the impacts of climate change and having adaptable management arrangements is a priority for fisheries management.

9. 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 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
10. Whilst AFMA adaption project and 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.
11. 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 BDM 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) (**Attachment 3.4.2c**).
        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*).
12. 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.
13. The quantitative assessment conducted by Welch and Johnson (2013) concluded that black teatfish was highly vulnerable to climate change while sandfish are moderately vulnerable. At the TSRA and NESPs workshop in June 2018, participants identified that in general there is a limited understanding of species responses to changes environmental variables, with bech de mer high-lighted as an example.

Table 1. Summary of research needs identified in the last TSSAC Annual Operating Plan (AOP) 2015.

AOP 2015		
Research Area	**Research need**	**AOP 2015 Research need pursued**
Stock abundance/ assessment for TAC setting	a. Complete stock assessment and estimate TAC for target species.	AFMA project 2016/0823 – Harvest Strategies for the Torres Strait Beche-de-mer (sea cucumber) fishery. Funded to develop a harvest strategy for the Beche-de-mer Fishery. The harvest strategy will guide future stock assessment options and data needs for the Fishery. Project due for completion in 2019.
	b. Improved monitoring of catch and effort in all sectors of the fishery.	Mandatory reporting of catch landings via catch disposal records under the Fish Receiver System was implemented on 1 December 2017. AFMA is progressing this with continued education and awareness programs. This is also to be supported by legislative amendments to the *Torres Strait Fisheries Act* 1984 and *Regulations* 1985 to enable mandatory logbook reporting. More broadly, AFMA is looking to utilise opportunities to improve monitoring of catch and effort particularly in the areas of electronic reporting and catch disposal records.
Efficacy of management arrangements	a. Impact of overfishing on PNG Warrior Reef.	Not undertaken. Note deterring IUU fishing on Warrior Reef remains a key focus for AFMA Foreign Compliance.
	b. MSE looking at the use of hookah for white teatfish.	Not undertaken. Matter remains a high priority for some fishers. • AFMA circulated a written survey to all Beche-de-mer licence holders in March 2017 to canvass industry views on convening a trial designed to provide an economic opportunity for a select number of fishers to fish for white teatfish using hookah gear. Only one formal reply to the survey was received. • HCWG13 developed an action item for the TSRA to assist TIB licence holders to develop a proposal to lift the hookah ban when fishing for White Teatfish, to be put up to the PZJA for consideration.

	c. A study to look at the possibility of reducing the minimum size limit of the gold-lipped pearl oyster	• In 2015, AFMA undertook a desktop study to look at the possibility of reducing the minimum size limit of the gold-lipped pearl oyster. Having regard to HCWG advice, the PZJA granted developmental permits to eight licence holders to allow commercial assessment of the viability of using smaller pearl shell in pearl farming. Development Permits were granted to existing licence holders with no more than 2,000 pearl shell sized between 100 – 130 mm to be taken in the fishery. • A consideration by the PZJA in granting the developmental permits was that any permanent changes to the minimum size limit for the TSPSF should also consider the results of the implementation of a similar reduction in size limits in the Western Australian Pearl Oyster Fishery. • No catch was reported to AFMA and advice from industry at the time suggested that no fishing activity had taken place. • AFMA has since undertaken a review of the 2015 developmental permits to understand why participation rates were so low. The report of this review is due to be finalised in 2019. • Given the low level of interest, this issue remains a low management priority.
Knowledge of biology, ecology and distribution of target species	Assessment of trochus habitat using Indigenous knowledge or remote sensing to inform stock assessment[1.]	No undertaken. Fishery remains inactive.

[1] Trochus is a small fishery with low effort so research in this area is not seen as urgent.

BACKGROUND

14. 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 3.4.2d.**

15. 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

16. 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.

17. There are 3 research themes, under which the HCWG could identify research priorities for the Beche-de-mer, trochus and pearl shell fisheries (**Attachment 3.4.2e**). 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

18. 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.

19. 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

20. 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.

21. 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.

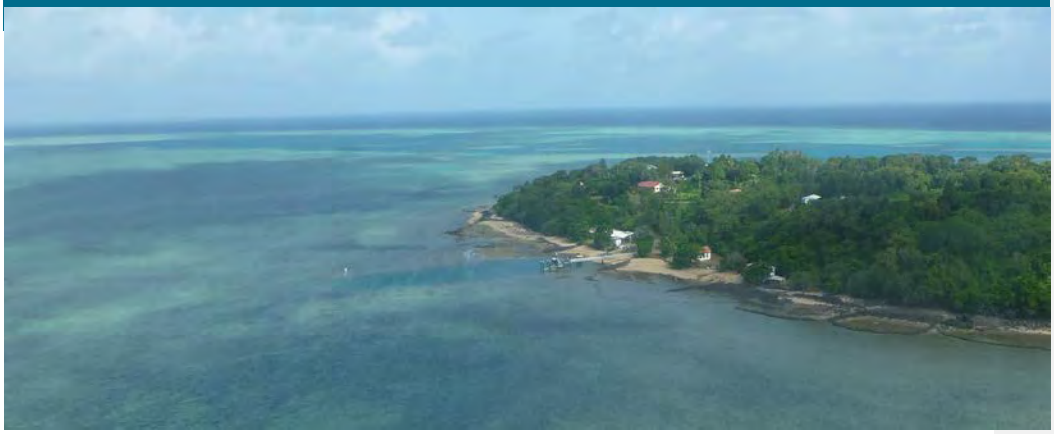
22. The TSSAC has an annual research cycle, which with the AFMA budgeting cycle (**Attachment 3.4.2f**).

Attachment 3.4.2a

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

Torres Strait Hand Collectable Fisheries

Beche-de-mer
Pearl shell
Trochus



Compiled by the Hand Collectables Working Group (HCWG14)
October 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.

TROCHUS

There have been no reports of trochus being harvested since 2010. The low level of catch and effort is thought to be due to low market demand rather than a decline in stocks. While there is no activity in the fishery, 77 trochus endorsements are currently issued to traditional inhabitant boat licence holders.

The Torres Strait Trochus Fishery was granted World Trade Organisation (WTO) export approval under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) until 9 October 2026. No conditions were imposed on the fishery do to its inactive status.

No research priorities are currently identified.

Table 1. Research priorities for Torres Strait Hand Collectable Fisheries 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
Beche-de-mer Harvest Strategy Project No. 2016/0823	To develop a single harvest strategy for the Torres Strait beche-de-mer fishery as per the design criteria in the Commonwealth Fisheries Harvest Strategy Policy and Guidelines. Will include update of existing species identification guide and further development of sea cucumber conversion ratios and revised size limits It is expected that additional research priorities will be identified once the Harvest Strategy has been finalised.	$86,470					Project established in 2016/17. To be completed by May 2019	CSIRO (in-kind)	Essential	1	1
Understanding critical uncertainties for Torres Strait species and processing methods for all species	Undertake field sampling of BDM species to develop conversion ratios for boiled and salted weight to gutted weight.								Essential	1	1
Stock Status Survey	To undertake an Eastern Torres Strait sea cucumber population survey with a focus on white teatfish to understand potential expansion of the fishery; black teatfish to understand recovery rates; and prickly redfish and			$200,000			Subject to finalisation of Harvest Strategy and availability of other sources of funding, noting likely	Torres Strait Regional Authority (primary) Papua New Guinea National Fisheries Authority	Desirable	2	1

	curryfish species in response to recent increased targeting and increased uncertainty of stock status. To also include an updated survey on Warrior Reef to understand recovery rates and stock status of sandfish. To include provision of training and materials to Traditional Inhabitant fishers to assist with the survey and data collection field work where possible.						level of available AFMA funding across all Torres Strait Fisheries.	(sandfish) Third party research provider			
Ecological Risk Assessment (ERA)	Conduct an ERA for the TSBDM Fishery		$20,400				Nil	CSIRO (in-kind)	Desirable	3	1
Improving best practice processing methods of beche-de-mer	Understanding and improving industry processing methods to achieve higher market prices (particularly for lower value species)	Not costed - advice pending					Subject to broader collaborative funding		Desirable	3	3
Understanding biological parameters of BDM species, including growth, mortality, size and breeding seasonality.	Identifying gaps in knowledge of biological parameters of BDM species and investigating options for collaborative research	Difficult to cost due to lack in feasible methodologies.					Contingent on finalisation of BDM Harvest Strategy with identification of data uncertainties in the Torres Strait.		Desirable	3	1
Climate Change impacts and vulnerability	Understanding species responses to combinations of changing environmental variables						Subject to broader collaborative funding		Desirable	3	1
Management Strategy Evaluation (MSE) of the use of hookah	.	Not costed							Desirable		

Commented [LG1]: Whilst this work was previously identified at HCWG12, preliminary out-of-session advice from the Scientific member is that there is a lack of feasible methodologies.

AFMA is seeking HCWG advice on the prioritisation of this work and availability of other funding.

Commented [LG2]: This work was previously identified through the 2015 Annual Operating Plan.
AFMA is seeking HCWG advice on the prioritisation of this work and availability of other funding.

whilst fishing for beche-de-mer species											
Ecological Risk Assessment (ERA)	Conduct an ERA for the Torres Strait Pearl Shell (TSPF) Fishery			$20,400			Nil	CSIRO (in-kind)	Desirable	5	1

Attachment 3.4.2b

Advice from the Hand Collectables Working Group (HCWG) on research and data needs

Meeting	Description	HCWG Discussion
HCWG9 (June 2016)	**Harvest Strategy**	The HCWG agreed that future research priorities would be guided by the Harvest Strategy to be developed over the coming 18 months.
HCWG11 (June 2017)	**Stock status of sandfish and the feasibility of a re-seeding program**	• Concern from industry that the status of the sandfish stock on Warrior Reef was not currently known with the last survey being carried out in 2010. • Members and observers noted advice from the AFMA member that as part of the harvest strategy project, agreed minimum information requirements together with supporting management measures could be developed to guide any resumption of fishing. Fishery independent surveys may be one way to obtain an understanding of stock status. • Advice was sought on the potential benefit and feasibility of a re-seeding program to facilitate stock rebuilding. The Research Member advised that while there may be some benefit, any re-seeding program would need to be well designed to ensure that moving stock around the strait did not disrupt the natural spawning potential of this recovering species.
	Harvesting larvae for ranching	Some industry members and observers queried whether juvenile beche-de-mer that washes up on the shoreline from time-to-time in large numbers, could be harvested and be grown-out for ranching and potentially used to restore depleted stocks. The research member advised that: • this would be a challenging project. • samples and juveniles should ideally be collected for research and identification; and • the only grow-out in hatcheries at the moment is for sandfish and that small beche-de mer could potentially be used to seed reefs.
HCWG12 (October 2017)	**General**	The HCWG noted a presentation by the research member and acknowledged the following future research needs identified: • Stock status (density, size, catch, areas fished, collaboration with PNG on shared stocks). • Conversion ratios (Curryfish boiled and salted). • Biology (growth, mortality, size and seasonality of breeding). • Value adding, best practice processing and drying (particularly for lower value species).

		• Requirements for harvest strategy implementation.
HCWG13 (July 2018)	**Harvest Strategy**	The HCWG agreed that progressing work on the Harvest Strategy would help to identify additional research priorities including: a) Standardising conversion ratios b) Understanding biological parameters (growth, mortality, breeding)

Attachment 3.4.2c

Risk management tools for sustainable fisheries management under changing climate: A sea cucumber example

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Risk management tools for sustainable fisheries management under changing climate: a sea cucumber example

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Abstract Sustainable fisheries management into the future will require both understanding of and adaptation to climate change. A risk management approach is appropriate due to uncertainty in climate projections and the responses of target species. Management strategy evaluation (MSE) can underpin and support effective risk management. Climate change impacts are likely to differ by species and spatially. We use a spatial MSE applied to a multi-species data-poor sea cucumber/béche-de-mer fishery to demonstrate the utility of MSE to test the performance of alternative harvest strategies in meeting fishery objectives; this includes the ability to manage through climate variability and change, and meeting management objectives pertaining to resource status and fishery economic performance. The impacts of fishing relative to the impacts of climate change are distinguished by comparing future projection distributions relative to equivalent no-fishing no-climate-change trials. The 8 modelled species exhibit different responses to environmental variability and have different economic value. Status quo management would result in half the species falling below target levels, moderate risks of overall and local depletion, and significant changes in species composition. The three simple strategies with no monitoring (spatial rotation, closed areas, multi-species composition) were all successful in reducing these risks, but with fairly substantial decreases in the average profit. Higher profits (for the same risk levels) could only be achieved with strategies that included monitoring and hence adaptive management. Spatial management approaches based on adaptive feedback performed best overall.

Electronic supplementary material The online version of this article (doi:10.1007/s10584-012-0596-0) contains supplementary material, which is available to authorized users.

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1 Introduction

Climate change is likely to have a significant impact on both target and non-target marine populations worldwide, with the concomitant need for management strategies capable of sustaining fishing into the future. There is a need to bridge the gap between short-term individual stock forecasts and longer term assessments of community production and resilience (Steele and Gifford 2010). A wide range of methods, ranging from single-species assessment models to ecosystem models, are currently under development to model the effects of climate change on fish and fisheries (Hollowed et al. 2011; Plagányi et al. 2011a, b). Improvements in understanding the functional relationships between climate variability and fish production are increasingly enabling their explicit incorporation in fisheries models (Hollowed et al. 2009; Holt and Punt 2009; Ianelli et al. 2011).

Uncertainty pervades all aspects of fisheries management, with a paucity of data and understanding similarly hindering moves to ecosystem-based fisheries management as well as incorporation of climate impacts. This has motivated the adoption of risk-based assessment methods such as ecological risk assessment (Hobday et al. 2011) and Management Strategy Evaluation (MSE) (Smith et al. 2007). Several risk assessment approaches have been developed to identify, analyse and evaluate the ecological effects of fishing under changing climate and to prioritize management responses (Fletcher 2005; Chin et al. 2010; Hobday et al. 2011). MSE frameworks (also known as an operational management procedure) 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). Briefly however, it involves modelling each step of the formal adaptive-management approach (Walters 1986) 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 tradeoffs in performance across a range of management objectives, it provides advice on the performance of different management measures and whether they are robust to inherent uncertainties in all inputs and assumptions used (Cooke 1999).

The simulation-testing frameworks used in MSE consist of operating models that simulate alternative plausible scenarios for the "true" dynamics of the resource. They are also used to generate simulated fisheries data that are used when fitting assessment models. The outputs from these assessment models are used by decision or control rules to determine what management actions are taken. In turn, these management actions are implemented inside the operating models with error or filtered by the industry's social and economic drivers. The active feedback, which is a part of MSE testing, can simulate how well the different management strategies can detect and control changes in fishery production or profitability (Plagányi et al. 2011b). For example, MSE has been used to evaluate the performance of fishery management control rules for walleye Pollock (*Theragra chalcogramma*) under climate change and the assumption of temperature-induced changes in recruitment pattern (A'mar et al. 2009; Ianelli et al. 2011).

In this paper we provide an example of the use of MSE to assess both the effects of projected climate change impacts and the relative performance of alternative harvest strategies in adapting to those changes and meeting management objectives pertaining to resource status and fishery economic performance. Our MSE risk management framework simultaneously accounts for uncertainty in biological understanding as well as projected climate change impacts.

The case study used is the Australian Torres Strait (Fig. 1) bêche-de-mer (sea cucumber) fishery. Though it has a small Gross Value of Production ($321,000 in 2005), it is an important source of income for local Islander communities, especially in east Torres Strait. Historically, the fishery has been characterised by boom and bust cycles as the result of resource depletion and/or price fluctuations (Wilson et al. 2010). The open access rights for all Torres Strait Islanders and the artisanal nature of fishing makes regulatory control very difficult (Wilson et al. 2010). The underlying Operating Model (OM) (Plagányi et al. 2011c) is both spatial (27 reefs) and multi-species (8 bêche–de-mer species) to enable assessment of the performance of different management strategies from a spatial and multi-species perspective. Furthermore, there are substantial differences in the value of the different species and hence we compare the overall profit arising from alternative fishing strategies.

2 Methods

2.1 The Torres Strait Sea cucumber fishery

The Torres Strait bêche-de-mer fishery began in the late 1800s up until about 1939, and restarted in about 1990. Sandfish (*Holothuria scabra*) on Warrior Reef (Fig. 1) provided the bulk of the early catches in the fishery, which peaked at over 1200 t (wet gutted weight) in 1995. A survey in 1998 (Skewes et al. 1998) found that the population was severely depleted and the sandfish fishery was closed. Subsequent surveys found a small recovery in the

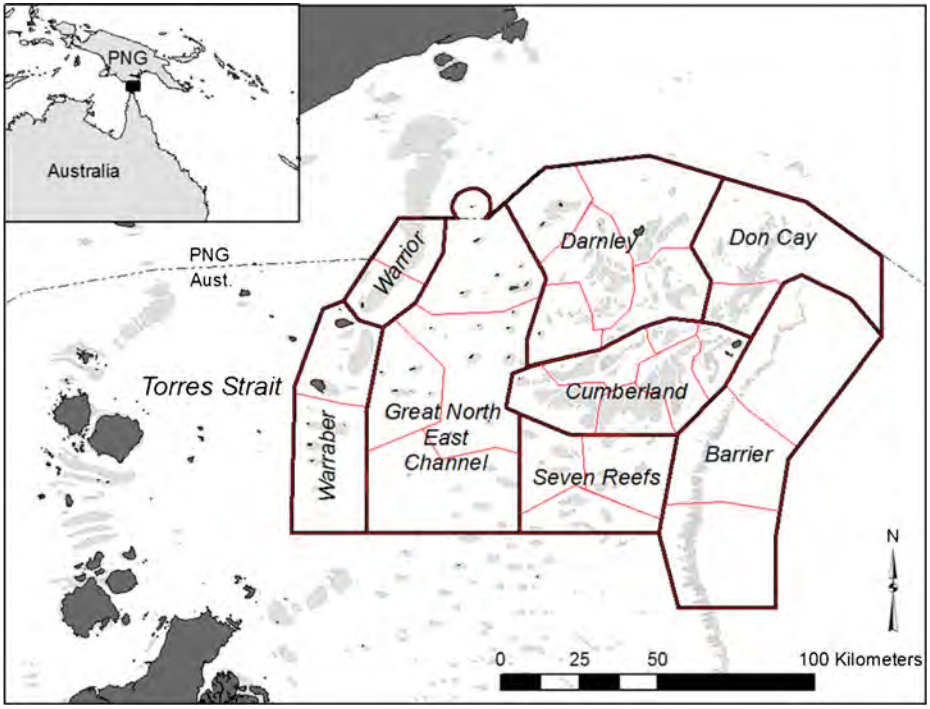

Fig. 1 Spatial zones for the Torres Strait sea cucumber MSE analysis. There are 27 spatial subzones that are explicitly differentiated in the operating model, with these in turn grouped into 8 zones as shown

population, especially of the breeding cohort, but it is still considered heavily depleted (Murphy et al. 2011).

After the closure of sandfish in 1998, the fishery mostly targeted black teatfish (*H. whitmaei*), deepwater redfish (*Actinopyga echinites*), surf redfish (*A. mauritiana*), blackfish (mostly *A. miliaris*) and white teatfish (*Holothuria fuscogilva*). However, a survey in March 2002 found that black teatfish and surf redfish were probably overexploited (Skewes et al. 2003), and a prohibition on the harvest of these species was introduced in January 2003. A survey in 2009 found that the density of black teatfish had recovered to near natural (unfished) densities (Skewes et al. 2010) and it was recommended that this species be reopened to fishing but with a modest TAC of 25 t and community-based harvest strategies to manage the spatial effort of this species (Skewes et al. 2010).

2.2 Climate change in the Torres Straits

We used existing reviews and analyses of climate change in Torres Strait to summarise the related changes to several environmental variables: sea surface temperature, sea level rise, changes to current systems, storms and cyclones, rainfall, and ocean acidification; two critical habitats: seagrass and coral reefs; and an important survival parameter for larval holothurians: phytoplankton productivity (Online Resource 1). The projections were considered only to 2030 as this has higher management relevance than longer term projections, for which there would be increasing uncertainty. Projections of global warming were considered only for the mid-high range greenhouse gas emissions scenario, A1B (IPCC 2007)—in any case there is little deviation by 2030 among different emission scenarios.

2.3 Assessing and classifying risks

The potential impacts of the projected changes to physical variables and critical habitats were assessed for a range of life history variables (growth, mortality, movement and distribution and reproduction) separately for three sea cucumber life history stages (larvae, juvenile and adult) in Torres Strait. Each potential impact was described and quantified to the fullest extent possible using information from literature reviews, unpublished experimental studies and expert consultation, based on the approach of Norman-López et al. (2012). Considerable uncertainty exists for most combinations of physical and biological variables. We took the view, in this case, of using all available information to outline likely potential impacts for use in our model.

Following the Australian national risk assessment approach, risk rankings for potential impacts on sea cucumber biological variables from climate-change-related changes in environmental variables were formulated from the likelihood of the climate-related change occurring and the consequences, or severity of impact, of such changes to sea cucumber biology (Table 1). Likelihood scores of the physical variable changing were assigned based on confidence ratings by experts in the field (Poloczanska et al. 2009); where >70 % likelihood was considered as high, <30 % low and in between these values medium (Table 1). The relative consequence of the potential impacts was a subjective assessment based on expert opinion—generally impacts that resulted in greater than a 5 % change in a biological property were considered as a high consequence, and greater than 2 % as a medium consequence. Less than 2 % was considered as low consequence. The ratings criteria used were arbitrary, but acknowledged that relatively small changes in biological rates could potentially have a large effect on overall population productivity (Norman-López et al. 2012).

Table 1 Risk matrix for assigning risk categories to impacts based on likelihood and consequence of the impact

	Risk	Consequence		
		L	M	H
Likelihood	L,<30 %	L	L	M
	M, 30–70 %	L	M	H
	H, >70 %	M	H	H

Risk for potential impacts for all combinations of climate change variable and life history parameter were then formulated (see Online Resource 1, Table 2). Interactions between multiple impacts (e.g. temperature and acidification on mortality) were considered by taking an iterative approach to formulating potential impacts: all potential impacts were assessed in a cyclical fashion several times and potential interactions between them were accounted for in the final assessment.

2.4 MSE simulations

We used a modified form of the spatial MSE developed by Plagányi et al. (2011c) for 8 bêche-de-mer species inhabiting 27 reef groupings (hereafter called subzones) in the Torres Straits. The model was conditioned over the historic period 1995–2010 using all available survey data (Skewes et al. 2010). A Reference Set (see Rademeyer et al. 2007) of alternative model parameterisations was used to collectively capture some of the key biological uncertainties (e.g. alternative natural mortality estimates and steepness of the stock-recruitment relationship), as well as uncertainty as to the likelihood (using high risk scenarios only versus assuming both high and medium risk scenarios occur) and consequence (accounting for a doubling of the severity of each postulated effect) of climate-change effects. By using a Reference Set (rather than a single base-case operating model) (see Rademeyer et al. 2007) we were able to integrate across this range of biological and climate-impact uncertainties. Finally we tested a range of alternative harvest strategies to evaluate their performance under changing climate.

2.5 Spatial Operating Model (OM)

The OM used is that developed by Plagányi et al. (2011c) for the Torres Strait region, with a full description of the spatial age-structured population model described therein. The model includes 8 bêche-de-mer species, with populations distributed across 27 subzones, in turn grouped into 8 zones (Fig. 1) (see Online Resource 2). Species modelled are sandfish, black teatfish, surf redfish, white teatfish, deepwater redfish, hairy blackfish (*Actinopyga miliaris*), prickly redfish (*Thelenota ananas*), and leopardfish (*Bohadschia argus*).

The time period covered in the model was 1995 to 2010, with a 20 year future projection time period. Selected key equations are reproduced below.

The resource dynamics are modelled by the following set of population dynamics equations:

$$N_{s,y+1,0,r} = \rho_{s,r} \cdot R^{Z}_{s,y+1} \quad a = 0 \tag{1}$$

$$N_{s,y+1,a+1,r} = \left(N_{s,y,a,r}\, e^{-3M_s/4} - C_{s,y,a,r}\right) e^{-M_s/4} \quad 1 \le a \le m-1 \tag{2}$$

Table 2 Risk scores for impacts on sea cucumber life history variables from climate change related variables

Life stage	Life history variable	Sea Temperature	Acidification	Sea level	Currents, Torres Strait	Storms and Cyclones	Rainfall	Phytoplankton productivity	Seagrass	Coral reef
Juvenile	Growth	H	L	-	-	-	-	L	L	-
	Mortality	H	L	-	-	L	-	-	M	-
	Carrying cap.	-	-	M	-	L	-	-	L	-
Adults	Growth	H	-	-	-	-	-	-	-	-
	Mortality	H	-	-	-	L	-	-	-	-
	Carrying cap.	-	-	M	-	-	-	-	-	-
	Reproduction	H	-	-	-	-	-	-	-	-
Larvae	Growth	H	L	-	-	-	-	M	-	-
	Mortality	H	L	-	-	-	-	M	-	-
	Advection	-	-	-	-	-	-	-	-	-

$$N_{s,y+1,m,r} = \left(N_{s,y,m-1,r}\, e^{-3M_s/4} + N_{s,y,m,r} e^{-3M_s/4} - C_{s,y,m-1,r} - C_{s,y,m,r}\right) e^{-M_s/4} \tag{3}$$

where:

N_{syar} is the number of holothurians of species s at the start of year y (which refers to a calendar year), at age a in subzone r;
R^Z_{sy} is the total recruitment (number of 0-year-old holothurians) in zone Z of species s at the start of year y;
$\rho_{s,r}$ is the proportion of the total recruitment of species s that settles in subzone r;
M_s denotes the (age-independent) natural mortality rate of species s; fishing was approximated as a pulse at the end of the 3rd quarter to simplify the computations and because this corresponds to the peak observed in monthly catch statistics;
C_{syar} is the predicted number of holothurians of species s, in year y, of age a, caught in subzone r; and,
m is the maximum age considered (taken to be a plus-group and set equal to 5 for all species).

The number of recruits of species s at the start of year y is assumed to be related to the spawning stock size (i.e. the biomass of mature holothurians) by a modified Beverton-Holt stock-recruitment relationship (Haddon 2011). The spawning biomass is summed over all subzones r located within zone Z, and the predicted recruitment is then assigned to each subzone r as per Equation (1) and after allowing for annual fluctuations about the deterministic relationship, with such fluctuations varying by species but not spatially:

$$R^Z_{sy} = \left[\sum_r \frac{\alpha_s B^{sp}_{syr}}{\beta_s + (B^{sp}_{syr})}\right] e^{\left(\varsigma_{sy} - (\sigma_{sR})^2/2\right)} \tag{4}$$

where:

α_s, β_s are spawning biomass-recruitment relationship parameters for species s (re-parameterised in terms of the pre-exploitation equilibrium spawning biomass K^{sp}_s for each species s (and for the entire model area), and the "steepness", h_s, of the stock-recruitment relationship—see Haddon 2011);
ζ_{sy} reflects variation about the expected recruitment for species s in year y, and is assumed to be normally distributed with a mean of zero and standard deviation σ_{sR} (which is input, based on the historic level of variability deduced from survey data). The $-(\sigma_{sR})^2/2$ is a log-normal bias correction term;
B^{sp}_{syr} is the spawning biomass for species s, in year y, in subzone r, computed as:

$$B^{sp}_{s,y,r} = \sum_{a=1}^{m} f_{s,a} w^{strt}_{s,a} N_{s,y,a,r} \tag{5}$$

except for black teatfish, which spawns in the Austral winter and hence is modified as follows:

$$B^{sp}_{s,y,r} = \sum_{a=1}^{m} f_{s,a} w^{mid}_{s,a} N_{s,y,a,r} e^{-M_s/2} \tag{6}$$

where:

w^{strt}_{sa} is the begin-year mass of a holothurian of species s, age a, and *strt* is start-of-year;
w^{mid}_{sa} is the mid-year mass of species s, age a, and *mid* is the middle of the year; and
f_{sa} is the proportion of holothurians of species s and of age a that are mature.

2.6 Reference set of OMs

Two key uncertainties in modelling resource status and productivity were: a) the natural mortality M_s of each species, and b) the steepness parameter h_s of the stock-recruitment functions. A Reference Set (RS) of operating models was thus constructed to include a sufficiently representative range of potential estimates of these parameters. In addition, to account for c) uncertainty as to the risks of posited climate-change effects, both high risk only and high-plus-medium risk combined scenarios were included in the RS. The fourth key uncertainty included in the RS was d) the consequence of the predicted impact of climate change on population variables, with an alternative scenario d) assuming a doubling of the impacts.

The RS cases were thus as follows:

M. Natural mortality:

M1: The average mortality estimates for each species were used, together with the growth parameters (length-weight-age relationships; Online Resource 2);
M2: The lower bound of the mortality estimates were used for each species, and because this is also a slow growth scenario, were combined with slow growth assumptions for the two teatfish species for which slow growth has been proposed as likely (Skewes et al. 2003; Uthicke et al. 2004).

H. Steepness parameter:

H1: h is fixed at 0.7 (Myers et al. 1995);
H2: h is fixed at a more conservative value of 0.5;

R. Risks:

R1: High risks only included;
R2: High plus medium risks included.

I. Impact:

I1: The predicted impacts on biological parameters as shown in Online Resource 1;
I2: All impacts (positive and negative) doubled.

2.7 Hand collectibles location choice model

Location choice within the hand collectibles fishery is modelled as a simple function describing utility by zone (see Online Resource 2). Weightings are placed on "habituation", w_h, profitability, w_p, proximity of each zone to communities, w_r, and habitat area within each zone, w_a. The TAC or effort is then distributed in accordance with the relative utility of each zone.

2.8 Harvest strategy testing

The RS was projected 20-year forwards under a range of future fishing scenarios and management strategies (Table 3), which are hypothetical and have been selected to illustrate the range. The first scenario assumed that future catches continue roughly in the same manner as current (i.e. zero adaptation to climate change). The second set of six scenarios explore future strategies that are not reliant on monitoring, and are used to test the efficacy of

Table 3 Summary of the performance of A) status quo management and selected harvest strategies based on B) no monitoring and C) with monitoring, in terms of the risk metrics (shown as percentages) summarized across all species. The first three columns represent the percentage of species (from a total of eight) that are depleted below a specified level, the local depletion percentage is based on all individual runs that fell below *Blim* at any stage during the projection period, and the last column ignores any costs of monitoring and adaptive management

Harvest strategy	Risk of suboptimal management	Risk of depletion below B_{lim} of 20 % unfished	Risk of depletion below 30 % unfished	Risk of local depletion	Average annual profit (US$ million)
A. Current catch (status quo)	50	12.5	38	12	5.31
B. No monitoring:					
B1. Double catches	75	25	75	23	10.6
B2. Profit maximization	50	12.5	50	12	5.31
B3. Location choice based on area and distance	50	12.5	62.5	16	5.31
B4. Spatial rotation (3 year)	25	12.5	0	5	3.35
B5. Closed areas/sensitive species (Warrior, sandfish)	12.5	12.5	12.5	9	2.72
B6. Multi-species catch composition	12.5	12.5	37.5	6	3.08
C. Adaptive feedback/ monitoring:					
C1. Broken stick	37.5	12.5	37.5	9	3.65
C2. Broken stick with spatial management	12.5	12.5	12.5	0.8	5.31
C3. Spatial closure (Single species in Zone) (30%K trigger)	37.5	12.5	25	8	5.11
C4. Spatial closure (Entire Zone) (30%K trigger)	12.5	12.5	12.5	5	3.19
C5. Spatial closure (Entire Zone) (20%K trigger)	12.5	12.5	12.5	7	4.09

some data-limited strategies under changing climate. The final set of five scenarios include a range of alternatives that would be possible with monitoring and spatial management (i.e. adaptive feedback in response to climate change):

A. Current catch (average of past 5 years, w_h=1), plus small catch for species with current zero TAC
B. No monitoring or adaptation:

- B1. Double all catches (although unlikely, this is included to provide a contrast, as well as test a scenario in which there is increased pressure on some species due to declines in other resources)
- B2. Profit maximisation (w_p =1 to simulate future fisher location choice governed by profit considerations, with constant overall TAC)

B3. Location choice based on habitat area and distance from community (w_r, w_a= 0.5 to simulate future fisher location choice governed by habitat area and travel distance, with constant overall TAC)
B4. Spatial rotation (3-year spatial rotation strategy alternating between zones)
B5. Spatial closure (as no detailed data are assumed to become available to inform the choice of closure, this option tests an example that stops all fishing on sandfish, a sensitive species, and closes Warrior Reef, a known sensitive area)
B6. Multi-species catch composition (this option assumes that even without detailed monitoring, fishers will have some notion of changes in the overall species composition (simulated as the proportional abundance estimated with an error term added) and hence the TAC will be modified upwards (20 %) or temporary species-specific spatial closures implemented if the relative abundance of a species is thought to have changed by more than 20 % i.e. this is sampled with error in the model)

C. Adaptive feedback/monitoring:

C1. Broken stick based on overall species-specific depletion (i.e. based on future monitoring (simulated with an error term corresponding to a survey sampling CV of 25 %), if the overall abundance of a species drops below a trigger reference point (*Btrig*) of 30%K, the fishing mortality for that species is reduced proportionately, and set to zero for depletion levels below the limit reference point (*Blim*) of 20%K. Broken stick control rules imply constant rates until some trigger biomass threshold followed by linear declines in fishing mortality down to a limit threshold after which no fishing occurs. Thus the control rule resembles a bent or broken stick)
C2. Broken stick with spatial adaptive management (i.e. if the local abundance (at the finer reef scale) of a species drops below *Btrig*, the fishing mortality for that species in that zone is reduced proportionately, and set to zero for depletion levels below *Blim*).
C3. Spatial closure whereby fishing is prohibited (spatially) on a species in a zone where it is estimated to be depleted below a more conservative limit reference point of 30%K, based on monitoring.
C4. Spatial closure (Entire Zone) whereby (for practical reasons), an entire spatial zone is closed if any of the eight species is estimated to be depleted to 30 % or less of *K*, based on monitoring.
C5. Spatial closures (Entire Zone) (as above but with 20 % trigger depletion level)

2.9 Performance Statistics

The following performance statistics were computed for each harvest strategy (HS) tested over a 20-year projection period:

1. $B^{sp}_{2030}/B^{sp}_{1995}$, the expected spawning biomass at the end of the projection period, relative to the starting (1995) level (used as a proxy for K, the unfished biomass), for each species averaged across the entire area and separately for each zone.
2. $B^{sp}_{2030}/B^{sp}_{2030}$ (no fishing, no climate change), the expected spawning biomass at the end of the projection period, relative to the comparable simulation no-fishing trial with no climate-change effects, for each species averaged across entire area. The same set of random numbers was used to generate sets of 480 no-fishing projections for each species and zone, as a baseline for comparisons with the range of projections with fishing and climate change.

3. Risk of falling below limit biomass level of 20 % unfished biomass during the projection period for each species across all simulations and replicates, and for all spatial areas combined as well as for individual zones.
4. Average catch: $\frac{1}{20}\sum C_y$, over 2011 to 2030 (for each zone as well as the entire area, and for four groups of species: very high (sandfish), high (black teatfish and white teatfish), medium (surf redfish, prickly redfish, deepwater redfish and hairy blackfish) and low value (leopardfish).
5. Species composition computed as the relative abundance (in 2030) of each species compared with the species composition from a no-fishing no-climate-change scenario. This takes into account the sometimes large historic catches (Plagányi et al. 2011c) as well as allowing for a 20-year recovery period.

2.9.1 Summary risk metrics

To allow easier visualisation and cross-comparison of results, the following summary risk statistics were defined and computed for each HS (Table 3):

1. Risk of sub-optimal management: the percentage of species for which the median 2030 spawning biomass level was less than *Btarg* (0.48 K)
2. Risk of depletion below *Blim*: percentage of species for which the lower 90 % confidence limit of the 2030 RS projections was less than *Blim*
3. Risk of depletion below 30 % unfished: as above, but a more conservative risk measure
4. Risk of local depletion: percentage of all individual runs that fell below *Blim* at any stage during the projection period
5. Average annual profit (US$ million) computed as the landed weight of each species multiplied by current average market prices. This does not account for costs of monitoring and adaptive management.

3 Results

3.1 Climate change and its impacts

Growth in all life history stages (larval, juvenile and adults) was assessed as being at high risk related mostly to a likely increase in sea temperatures (Tables 1 and 2). This effect was assessed as being mostly positive for production and yields given the expected faster growth leading to larger sizes and increased fecundity. Medium risks contained both positive and negative effects. Positive effects were associated with an increase in larval growth due to projected increases in primary production (Brown et al. 2010), and faster adult growth and bigger sea cucumbers resulting in an increase in adult reproduction. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures and detrimental effects on the juvenile sandfish seagrass habitats.

3.2 Reference set of operating models

The posited climate change impacts resulted in both negative and positive effects, and when these were modelled as affecting the various life history variables in combination, the net effect was slightly more negative for most species. The largest differences between the 16

OMs in the reference set resulted from the more severe climate impact cases, with the more severe impact case (I2) leading to more negative spawning biomass trajectories (Fig. 2, see also Online Resource 3). Sensitivity varied across species and spatial areas—for example, some of the largest differences were evident for the redfish species. The next largest effect overall was due to whether the high risks only (R1) or high-plus-medium risk (R2) case was used, with the latter typically more negative. However for the shallow-water specialist species (black teatfish, sandfish, surf redfish) for which sea-level rise is predicted to increase habitat availability, there was less of a difference between the high-risk and high-plus-medium risk cases, and projections were more sensitive to the mortality and growth assumptions. The mortality and growth scenario M1 produced slightly more positive population trajectories than the low mortality and slow growth scenario M2 (Fig. 2). Recruitment variability is naturally high (sigma=0.5) and this largely swamped variability due to changing the steepness of the stock-recruit curve (H1 and H2). There were some differences between species, for example, those Leopardfish cases with a combination of high mortality rates and low steepness resulted in negative spawning biomass trajectories. As expected, teatfish population trajectories were more negative under the high mortality

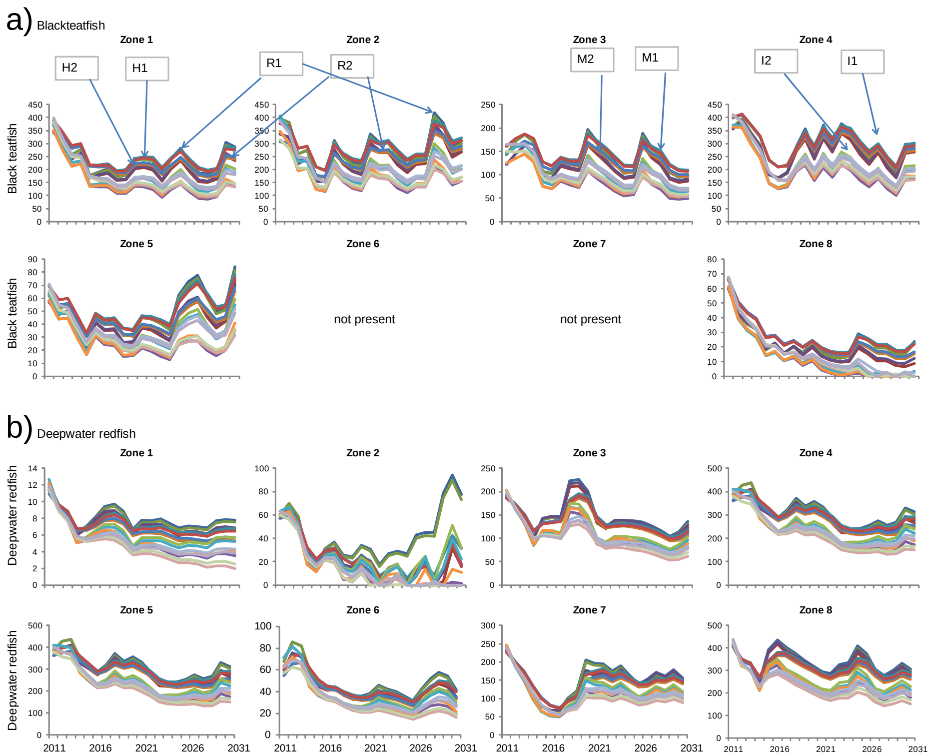

Fig. 2 Reference Set model spawning biomass (t) projections for two species in each of the zones in which the species occurs, under no-fishing scenarios but with climate change effects. The alternative model versions differ in terms of choice of natural mortality (M), the steepness parameter *hs* of the stock-recruitment functions (H), whether both high risk only and high-plus-medium risk combined climate change scenarios are used (R) and the consequence of the predicted impact of climate change on population variables (I). Full results for all species are provided in Online Resource 3

and slow growth cases (Fig. 2). Median spawning biomass trajectories are shown in Online Resource 3.

3.3 Harvest strategy testing

None of the populations in any of the spatial zones decreased below B_{lim} when the RS was projected 20-year forwards under the assumption of zero future fishing. However, if future patterns of catches were similar to current (in terms of total TACs, spatial distribution of fishing effort and choice of species), there were substantial declines predicted in some species and local crashes of populations (Fig. 2, Online Resource 3). Similar results were obtained when assuming future fishing location choices were based on drivers such as profit maximisation and distance from communities, without adaptively modifying harvest strategies to account for climate change. The probability envelopes encompassing the range of biological and climate uncertainties in the projections were fairly broad, but it was nonetheless possible to discriminate between alternative harvest strategies.

Our simulation testing suggested that the following harvest strategies would perform better under changing climate:

HS1: In data-limited situations with no future monitoring assumed, spatial rotation harvest strategies, such as those based on a 3-year rotation (Table 3), substantially reduced the risk to the resource under changing climate, and simultaneously resulted in moderately high overall profits being achieved.

HS2. In data-rich scenarios, with regular updates of resource status possible based on surveys (with assumed error added), a broken stick control rule was shown to substantially reduce the risk to the resource under changing climate, and simultaneously resulted in high overall profits being achieved. Spatial closures based on monitoring information were also successful in reducing the risks of overall as well as localised resource depletion.

Sandfish and leopardfish (respectively very high and low value species) are predicted to increase in relative abundance under a fishing and changing climate scenario (Fig. 3). The largest decrease in relative abundance compared with a reference species composition was predicted for black teatfish, a high value species.

4 Discussion

4.1 Risk assessment

Climate-change related changes in environmental variables such as temperature (Table 2) were predicted to have a positive effect on the growth of bêche-de-mer, with this counteracted by negative effects due to increased larval and juvenile mortality, as well as declines in seagrass habitats necessary for sandfish juveniles.

Although there is considerable uncertainty associated with this analysis, the effects of this uncertainty have been explored in the assessment, which can be updated in the future as more information becomes available. It is thus a practical first step towards linking the range of climatic effects over a range of life history components and critical habitats for fisheries and quantifying the resultant impact on fisheries productivity (Norman-López et al. 2012).

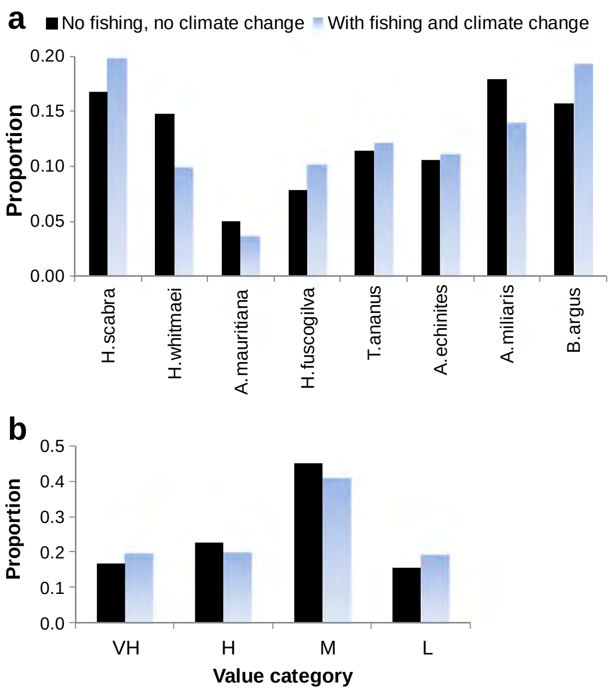

Fig. 3 Comparison of no-fishing no-climate-change scenario compared with a fishing and climate-change scenario on **a** model projected species composition (proportion of total biomass in year 2030) and **b** proportion of the total biomass under each scenario that is comprised of very high (VH), high (H), medium (M) and low (L) value species

4.2 Risk management

Traditional fisheries management specifies a number of objectives that seek to minimise risks (usually quantified as a high probability of achieving a favourable outcome) such as a) the risk of sub-optimal management; b) risk of overall and local depletion; c) risk of ecosystem effects; and d) risk of a non-viable fishery (profits, catch rates non-profitable). Climate change poses an additional risk, namely that of not responding appropriately or in a timely manner to changes in resource and ecosystem productivity, abundance, and distribution in response to climate change. Uncertainty pervades all aspects of fisheries management, from understanding of climate impacts, biology, monitoring, predicting future fisher behaviour and market changes. Our approach provides a biological complement to climate ensemble modeling approaches, and accounts for important sources of uncertainty that are an integral part of effective risk management decision making (Fig. 4).

Use of a Reference Set of models, rather than a single model, enabled collective capturing of some of the key biological uncertainties (model parameterisation—e.g. natural mortality estimates and steepness of the stock-recruitment relationship), as well as uncertainty as to the likelihood (using high risk scenarios only versus assuming both high and medium risk scenarios occur) and consequence (accounting for a doubling of the severity of each postulated effect) of climate-change effects. The posited climate effects generally had a greater impact on model projections than the biological uncertainties (Fig. 2). We did not incorporate in our analyses uncertainty pertaining to climate modelling, especially as there is a lack of deviations among the various models until about 2030, but future work could include alternative emission scenarios or use of multiple climate models, although such modelling should focus on periods after 2050.

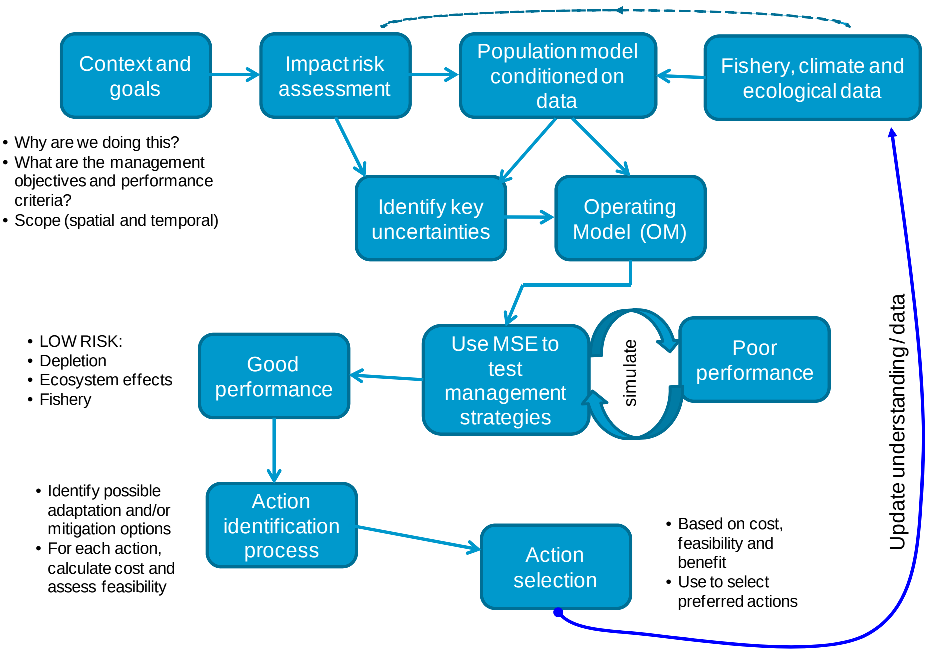

Fig. 4 Schematic overview of risk assessment and management process (adapted from Australian National Emergency Risk Assessment Guidelines)

Our paper provides a demonstration that MSE adheres to the guiding principles, summarized in the Australian national risk framework (Anon. 2009), that are needed to underpin and support effective risk management: Creates and protects value (contributes to societal objectives); informs decision making; explicitly addresses uncertainty; is systematic, structured and timely; is based on best available information; is tailored; considers and takes account of human and cultural factors; is transparent and inclusive; is dynamic, iterative and responsive to change; and facilitates continual improvement. The adaptive risk management framework we summarise in Fig. 4 has broad applicability to many natural resource management problems where it is important to consider both biological and climate variability and uncertainty in a balanced way.

4.3 Comparison of harvest strategies

Bêche-de-mer fisheries are difficult to manage globally, and there is some evidence from observations that management approaches based on reduced quotas, license restrictions, spatial rotation and adaptive management may lead to some success (Anderson et al. 2011). In evaluating alternative harvest strategies based on the setting of Total Allowable Catches, we simultaneously accounted for uncertainty in biological understanding as well as projected climate change impacts. In addition to more traditional performance measures to compare strategies (i.e. risk of depletion, overall profit), we demonstrated the utility of a novel measure based on multi-species composition.

When compared with a reference species composition for the entire Torres Straits area, sandfish and leopardfish (respectively very high and low value species) were predicted to increase in relative abundance under a fishing and changing climate scenario (Fig. 3). The largest decrease in relative abundance was predicted for black teatfish, stressing that climate change can impact not only the composition but also the value of a fishery. The multi-species catch composition harvest strategy performed well in terms of reducing the risk of resource depletion, without overly reducing profits, and hence merits further exploration as a strategy for data-poor multi-species fisheries.

Overall our results suggested that status quo management would result in half the species falling below target levels (suboptimal management occurs 50 % of the time), moderate risks of overall and local depletion, and significant changes in species composition (Table 3). The three simple strategies with no monitoring (spatial rotation, closed areas, multi-species composition) were all successful in reducing these risks, but with fairly substantial decreases in the associated average annual profit (Table 3). Higher profits (for the same risk levels) could only be achieved with strategies that included monitoring and hence adaptive management. Spatial management approaches based on adaptive feedback performed best overall. Dowling et al. (2008) similarly concluded that harvest control rules that include triggers and the use of spatial management may be most appropriate for small data-poor fisheries, and stressed the need for identifying data gathering protocols and simple analyses for these hard-to-manage fisheries.

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Attachment 3.4.2d

Torres Strait Fisheries Strategic Research Plan 2018-2023

TORRES STRAIT PZJA PROTECTED ZONE JOINT AUTHORITY

Australian Government
Australian Fisheries Management Authority

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

CONTENTS

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

	AFMA EXECUTIVE *Decides on which research proposals are to funded.*

AFMA EXECUTIVE

Decides on which research proposals are to funded.

MACs, WGs and RAGs

- Develop and implement individual fisheries five year research plans based on the SRP five year strategic priorities.
- Review project milestones/final reports and provide comments to author/s when requested by TSSAC.
- Advise on management implications of research outcomes.

TSSAC

- Annually reviews fishery research plans.
- Reviews and advises the AFMA Executive (or other funding bodies) on research, monitoring and assessment priorities for PZJA fisheries developed by AFMA Management in conjunction with management advisory committees, resource assessment groups and working groups.
- Develops, maintains and approves TSSAC Five Year Strategic Research Plan.
- Provides advice to other funding bodies (such as FRDC) on priorities for potential funding.
- Manages research contract and milestone reports, assessing them against the evaluation document before payment (AFMA as TSSAC executive officer)
- Assesses final research project outcomes to ensure the research conducted achieved objectives and meaningful outcomes.

External funding bodies

- Applications unable to be funded by TSSAC can be forward to FRDC or other agencies (by the researcher) for consideration.

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?												

Attachment 3.4.2e

Torres Strait fisheries strategic research themes, strategies and research activities

<table>
<tr><td colspan="2">Theme 1: Protecting the Torres Strait marine environment for the benefit of Traditional Inhabitants</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td>Strategy 1a - Fishery stocks, biology and marine environment</td><td>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.</td></tr>
<tr><td>Strategy 1b – Catch sharing with Papua New Guinea</td><td>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.</td></tr>
<tr><td colspan="2">Theme 2: Social and Economic Benefits</td></tr>
<tr><td colspan="2">Aim: Increase social and economic benefits to Traditional Inhabitants from Torres Strait Fisheries.</td></tr>
<tr><td>Strategy 2a - Promoting social benefits and economic development in the Torres Strait, including employment opportunities for Traditional Inhabitants</td><td>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.</td></tr>
<tr><td colspan="2">Theme 3: Technology and Innovation</td></tr>
<tr><td colspan="2">Aim: To have policies and technology that promote economic, environmental and social benefits from the fishing sector.</td></tr>
<tr><td>Strategy 3a – Develop technology to support the management of Torres Strait fisheries.</td><td>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.</td></tr>
</table>

Attachment 3.4.2f

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.
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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.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT **Future Management Priorities**	**Agenda Item 3.5** **For DISCUSSION & ADVICE**

RECOMMENDATIONS

1. That the Working Group **DISCUSS** and **ADVISE** on future management priorities for the Hand Collectables Fisheries.

BACKGROUND

2. This is a standing item for the HCWG. Having agreed management priorities (management issues to focus on) and a work plan aims to achieve a more efficient management process.
3. Based on discussions convened in the meeting and / or advice from individual members the Working Group is asked to review the standing management priorities and provide advice on any changes.
4. Where necessary, the Working Group should aim to assign an order of priority to items and a desired timeline.
5. Importantly the Working Group will need to have regard for resourcing. AFMA's budget for Hand Collectables Fisheries is tabled under Agenda Item 3.6 for information.
6. At its June 2016 meeting, the Working Group identified the following future management priorities:
   a) development of a harvest strategy and recovery plans for overfished species;
   b) future management arrangements for Black Teatfish and White Teatfish;
   c) review the size limits set for the Torres Strait Beche-de-mer Fishery taking into consideration the size limits in place for the Queensland and the Commonwealth Coral Sea Fishery;
   d) review weight conversion ratios for gutted and dried beche-de-mer species; and
   e) develop communication materials to assist industry members.
7. At its July 2017 meeting, the Working Group added the following future management priorities to the list:
   a) developing a Beche-de-mer management plan;
   b) continuing education and awareness training with the Fish Receiver System; and
   c) improving communications and engagement with industry.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
MANAGEMENT **Hand Collectables Budget 2018/19**	**Agenda Item 3.6** **For NOTING**

RECOMMENDATIONS

1. That the Working Group **NOTE** AFMA's budget for managing Hand Collectable Fisheries in 2018/19.

KEY ISSUES

2. Each year, AFMA's annual operating budget is determined by the Australian Government. AFMA uses part of its budget to provide management services to the Protected Zone Joint Authority. AFMA's Torres Strait budget is apportioned across a range of activities and each fishery.
3. AFMA consults on its budget with all Commonwealth managed fisheries. Consultation with industry provides accountability and assists with driving management efficiency and priority setting. While Torres Strait fisheries management costs are not currently cost recovered, industry and management are likely to benefit in the same way from understanding and discussing AFMA's budgeting arrangements.
4. AFMA's 2018/19 budget for direct costs for the Hand Collectable fisheries is $86,678 (**Table 4**).
5. The budget covers:
    a) One 3-day Working Group meeting on Thursday Island (**Table 1**)
    b) One 2-day Working Group meeting on Thursday Island (**Table 2**)
    c) One 1-day Industry Workshop (based on costs if convened in Erub) (**Table 3**)
6. A breakdown of the budget is provided in **Attachment 3.6a.**
7. Note that this budget does not include AFMA salaries and other indirect costs for example, other AFMA compliance and operating costs such as overheads, research administration, logbook programs (including entering Catch Disposal Records) data management and licensing costs.
8. In addition to the budgeted direct costs, AFMA has commissioned the CSIRO project to develop a harvest strategy for the Beche-de-mer Fishery. In this financial year AFMA has contributed an additional $72,049 of its research budget to extend this project.
9. This years budgeted direct costs represent a $54,807 increase over the last 2017/18 budget of $31,871. This increase is primarily due to holding additional HCWG meeting days to support the development of the Beche-de-mer harvest strategy. Extra funding has been allocated to support travel expenses for industry stakeholders to provide input to the development of the harvest strategy.

10. Note that this information only relates to AFMA's budget. TSRA provides funding to facilitate Traditional Inhabitant industry member representation at all PZJA Forums.

Attachment 3.6a

Table 1. Budget for meeting costs including air fares, accommodation, ferry, meals/catering and venue hire for a 3-day meeting based on Thursday Island.

1 x 3-day meeting based on Thursday Island									
Member	**Origin**	**Plane Fares**	**Accomm**	**Taxi/ferry /parking**	**TA**	**Meeting Dinner**	**Venue Hire**	**1 x 3-day meeting total (excluding sitting fees)**	**Sitting Fees**
HCWG Chair	Cairns	700	900	173	636	375	900	3684	3735
Scientific Member	Brisbane	1000	900	173	636			2709	2244
Scientific Member	TBC* (based on Brisbane base)	1000	900	173	636			2709	2244
AFMA staff	TI	0	0	0	0			0	0
AFMA staff	TI	0	0	0	0			0	0
Malu Lamar Rep	TBC	1250	1200	53	0			2503	1449
Invited participant (for consultation at Harvest Strategy Workshop)	Mer	1250	1200	53	636			3139	0
Invited participant (for consultation at Harvest Strategy Workshop)	Ugar	6500	900	0	636			8036	0
Invited participant (for consultation at Harvest Strategy Workshop)	Masig	1200	1200	53	636			3089	0
Invited participant (for consultation at Harvest Strategy Workshop)	Poruma	1000	1200	53	636			2889	0
	Totals	**$13,900**	**$8,400**	**$731**	**$5,088**	**$375**	**$900**	**$29,394**	**$9,672**
								TOTAL $39,066	

Notes
The chair is paid 1 extra day of sitting fees for preparation time per meeting plus 50% of travel times.
The scientific member is paid 50% of travel time.

Table 2. Budget for meeting costs including air fares, accommodation, ferry, meals/catering and venue hire for a 2-day meeting based on Thursday Island

1 x 2-day meeting based on Thursday Island									
Member	**Origin**	**Plane Fare**	**Accomm**	**Taxi/ferry/ parking**	**TA**	**Meeting Dinner**	**Venue Hire**	**1 x 2-day meeting total**	**Sitting Fees**
HCWG Chair	Cairns	700	600	173	477	375	600	2,925	2,988
Scientific Member	Brisbane	1,000	600	173	477			2,250	1,683
Scientific Member	TBA* (based on Brisbane base)	1,000	600	173	477			2,250	1,683
AFMA staff	TI	0		0	0			0	0
AFMA staff	TI	0		0	0			0	0
Malu Lamar Rep	TBA*	1,250	900	53				2,203	966
	Totals	**$3,950**	**$2,700**	**$572**	**$1,431**	**$375**	**$600**	**$9,628**	**$7,320**
								TOTAL $16,948	

Notes
The chair is paid 1 extra day of sitting fees for preparation time per meeting plus 50% of travel times.
The scientific member is paid 50% of travel time.

Table 3. Budget for industry workshop on Erub

Charters	$14,369
Helicopter	$6,500
Accommodation/Catering	$4,500
Sitting Fees	$2,805
Total	**$28,174.00**

Table 4. Summary of budgeted 2018/19 HCWG meetings

Total Cost for 1 x 3-day meeting (T.I.)	**$39,066**
Total cost for 1 x 2-day meeting (T.I.)	**$16,948**
Total cost for Industry workshop (Erub)	**$28,174**
Admin costs	**$2,490**
Total	**$86,678**

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
OTHER BUSINESS	Agenda Item 4 For DISCUSSION

RECOMMENDATIONS

1. That the Working Group **NOMINATE** any further business for discussion.

TORRES STRAIT HAND COLLECTABLES WORKING GROUP	Meeting 14 24 October 2018
DATE AND VENUE FOR NEXT MEETING	**Agenda Item 5** **For DISCUSSION and ADVICE**

RECOMMENDATIONS

1. That the Working Group **DISCUSS** and **ADVISE** on a date for the next meeting of the Hand Collectables Working Group.

BACKGROUND

2. The table below outlines an approximate schedule of upcoming work and meetings related to the Hand Collectables Fisheries.

Time frame	Meeting / Key Business	
October 2018	HCWG14	Final advice on draft Beche-de-mer Harvest Strategy
November 2018		Pending final HCWG advice, submission of draft Harvest Strategy to PZJA for decision to release for public comment
February 2019	PZJA	PZJA decision to release draft Harvest Strategy for public comment and Native Title Notification (6 weeks consultation, plus 1 month NTN)
	HCWG (OOS)	Out of session update on Black Teatfish reporting progress
April 2019	HCWG15	1. Discuss Harvest Strategy public comments 2. Update on Black Teatfish reporting progress
May 2019		1. Preparation for submission of Black Teatfish proposal to PZJA 2. Submission of final Harvest Strategy to PZJA for final endorsement
June 2019		Native Title Notification of proposed Black Teatfish opening (1 month)
July 2019		Submission of PZJA paper on proposed Black Teatfish opening
August 2019	PZJA	PZJA decision on final endorsement of Beche-de-mer Harvest Strategy
October 2019	HCWG16	TBC
	PZJA	PZJA decision on Black Teatfish opening
November 2019		Industry notification of Black Teatfish opening (pending PZJA decision)
December 2019		Black Teatfish opening (pending PZJA decision)