

# 20<sup>th</sup> meeting of the Hand Collectables Working Group (HCWG 20)

18-19 October 2023

TSRA Boardroom (Level 1 Torres Strait Haus, 46 Victoria Parade, Thursday Island)

If joining by Microsoft Teams, please refer to the meeting request for joining details

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### Draft Agenda

Agenda Item	Action required	Speaker	Time
<b>Day 1 – 18 October 2023 – 1300-1700 AEST</b>			
1. Opening prayer, acknowledgement of country, welcome and apologies	Information	Chair	<b>1300</b> 5 minutes
The Chair will welcome HCWG members and observers to HCWG 20.			
2. Adoption of agenda	Decision	Chair	<b>1305</b> 1 minute
The HCWG is invited to consider and adopt the draft agenda.			
3. Declarations of interests	Decision	Chair	<b>1306</b> 10 minutes
HCWG members and observers are invited to declare any real or potential conflicts of interests and decide whether a member may or may not be present during the discussion of or decisions made on matters which are the subject of a conflict.			
4. Actions arising from previous meetings	Discussion	AFMA	<b>1316</b> 10 minutes
The HCWG is invited to note the status of action items arising from previous meetings.			
5. Out-of-session correspondence	Information	AFMA	<b>1326</b> 4 minutes
The HCWG is invited to note any out-of-session correspondence to the HCWG since the last meeting.			
6. HCWG updates	Information	All members	<b>1330</b> 15 minutes
HCWG members and observers are invited to provide updates on matters relevant to Torres Strait hand collectable fisheries, including fishing conditions, research, management and Native Title matters. As members and observers will have provided updates at HCRA3, only new updates need be provided.			
7. Climate and ecosystem update	Discussion	AFMA	<b>1345</b> 15 minutes
The HCWG is invited to note an update on climate and ecosystem changes and discuss their impacts on Torres Strait hand collectable fisheries. As HCRA3 will have discussed this item, only new updates or considerations need be provided.			

8. Total allowable catches for the 2024 fishing season	Recommendation	AFMA	<b>1400</b> 1 hour
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Noting HCRA 3 advice, the HCWG is invited to review the current monitoring triggers and TACs for sea cucumber species under the guidance of the BDM Fishery Harvest Strategy, taking into account catches during recent fishing seasons and any other relevant information that is available. If required, the HCWG is invited to recommend to the Protected Zone Joint Authority (PZJA) new total allowable catches (TACs) for the 2024 fishing season.

#### Afternoon tea (1500-1515)

9. 2023 black teatfish opening and future openings (further time on Day 2)	Recommendation	AFMA + CSIRO	<b>1515</b> 1 hour 45 minutes (further time on Day 2)
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Noting HCRA 3 advice, the HCWG is invited to discuss management arrangements for future openings, including an appropriate TAC (if not discussed under agenda item 8), opening date, reporting and data collection requirements and any other conditions that should apply. Discussions to include consideration of relevant recommendations from the BDM Workshop held from 21-22 March 2023.

#### Day 2 – 19 October 2023 – 0900-1615 AEST

2023 black teatfish opening and future openings (continued from Day 1)	Recommendation	AFMA + CSIRO	<b>0900</b> 1 hour (continued from Day 1)
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#### Morning tea (1000-1015)

10. Management of white teatfish (further time after break)	Recommendation	AFMA	<b>1015</b> 2 hours (further time after break)
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The HCWG is invited to consider the recommendations from the BDM Workshop regarding an industry proposal for the use of hookah gear to fish for white teatfish. If required, the HCWG is invited to recommend to the PZJA arrangements for the progression of the industry proposal.

#### Lunch (1215-1300)

Management of white teatfish (continued)	Recommendation	AFMA	<b>1300</b> 1 hour (continued)
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11. Research priorities for 2025/26	Recommendation	AFMA + Steven Purcell	<b>1400</b> 1 hour
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Noting HCRA 3 advice, the HCWG is invited to review the five-year research plan for Torres Strait hand collectable fisheries and recommend research priorities to the Torres Strait Scientific Advisory Committee for funding in 2025/26 and beyond.

#### Afternoon tea (1500-1515)

12. Updates on other hand collectable fisheries	Recommendation	AFMA	<b>1515</b> 30 minutes
a. Pearl			
b. Crab			

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c. Trochus

The HCWG is invited to note updates on the other Torres Strait hand collectable fisheries, and if required, make recommendations to the PZJA regarding their management.

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13. Other business	Discussion	All members	<b>1545</b>
			15 minutes

The HCWG is invited to nominate any other business for discussion.

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14. HCWG priorities and next meeting	Discussion	AFMA	<b>1600</b>
			15 minutes

The HCWG is invited to discuss priorities for the year ahead and a suitable date for the next meeting.

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**The Chair must approve the attendance of all observers at the meeting. Individuals wishing to attend the meeting as an observer must contact AFMA ([fisheriesTI@afma.gov.au](mailto:fisheriesTI@afma.gov.au)).**

**The meeting will be recorded for the purpose of developing the meeting minutes and will be deleted once the meeting minutes have been finalised.**



<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20 18-19 October 2023</b>
<b>PRELIMINARIES</b> <b>Opening prayer, acknowledgement of country, welcome and apologies</b>	<b>Agenda Item 1 For INFORMATION</b>

#### **RECOMMENDATIONS**

1. That the Hand Collectables Working Group (HCWG) **NOTE** the:
  - a. Acknowledgement of Country;
  - b. the Chair's welcome address;
  - c. apologies received from HCWG members unable to attend.

#### **APOLOGIES**

2. No apologies from members have been received.

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>PRELIMINARIES</b> <b>Adoption of agenda</b>	<b>Agenda Item 2</b> <b>For DECISION</b>

#### **RECOMMENDATIONS**

1. That the Hand Collectables Working Group (HCWG) **CONSIDER** and **ADOPT** the draft agenda provided at **Attachment 2a**.

#### **BACKGROUND**

2. A draft agenda for this meeting was circulated to members and observers on 4 September 2023. The agenda was revised to take into account comments received. The revised draft agenda is provided at **Attachment 2a**.

## 20<sup>th</sup> meeting of the Hand Collectables Working Group (HCWG 20)

18-19 October 2023

TSRA Boardroom (Level 1 Torres Strait Haus, 46 Victoria Parade, Thursday Island)

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2. Adoption of agenda	Decision	Chair	<b>1305</b> 1 minute
The HCWG is invited to consider and adopt the draft agenda.			
3. Declarations of interests	Decision	Chair	<b>1306</b> 10 minutes
HCWG members and observers are invited to declare any real or potential conflicts of interests and decide whether a member may or may not be present during the discussion of or decisions made on matters which are the subject of a conflict.			
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Noting HCRAG 3 advice, the HCWG is invited to review the current monitoring triggers and TACs for sea cucumber species under the guidance of the BDM Fishery Harvest Strategy, taking into account catches during recent fishing seasons and any other relevant information that is available. If required, the HCWG is invited to recommend to the Protected Zone Joint Authority (PZJA) new total allowable catches (TACs) for the 2024 fishing season.

#### Afternoon tea (1500-1515)

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Noting HCRAG 3 advice, the HCWG is invited to discuss management arrangements for future openings, including an appropriate TAC (if not discussed under agenda item 8), opening date, reporting and data collection requirements and any other conditions that should apply. Discussions to include consideration of relevant recommendations from the BDM Workshop held from 21-22 March 2023.

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b. Crab			
c. Trochus			

The HCWG is invited to note updates on the other Torres Strait hand collectable fisheries, and if required, make

recommendations to the PZJA regarding their management.

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13. Other business	Discussion	All members	<b>1545</b> 15 minutes
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The HCWG is invited to nominate any other business for discussion.

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14. HCWG priorities and next meeting	Discussion	AFMA	<b>1600</b> 15 minutes
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The HCWG is invited to discuss priorities for the year ahead and a suitable date for the next meeting.

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**The Chair must approve the attendance of all observers at the meeting. Individuals wishing to attend the meeting as an observer must contact AFMA ([fisheriesTI@afma.gov.au](mailto:fisheriesTI@afma.gov.au)).**

**The meeting will be recorded for the purpose of developing the meeting minutes and will be deleted once the meeting minutes have been finalised.**

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>PRELIMINARIES</b> <b>Declarations of interests</b>	<b>Agenda Item 3</b> <b>For DECISION</b>

## RECOMMENDATIONS

1. That Hand Collectables Working Group (HCWG) 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 members that have declared a conflict of interest may or may not be present during discussion of or recommendations made on the matter which is the subject of the conflict;
  - c. **ABIDE** by decisions of the HCWG regarding the management of conflicts of interest; and
  - d. **NOTE** that the record of the meeting must record the fact of any disclosure, and the determination of the HCWG as to whether the member may or may not be present during discussion of, or recommendations 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. HCWG 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: Declarations of interest for HCWG members and observers.**

Name	Position	Declaration of interest
<b>Members</b>		
David Brewer	Acting Chair	Director of Upwelling P/L (David Brewer Consulting). Chair of Torres Strait Finfish RAG. Scientific member of Torres Strait Finfish Working Group. Scientific member of Northern Prawn Fishery RAG. Current consultancies with Quandamooka Yoolooburrabee Aboriginal Corporation, Newcrest Mining Ltd. Co-investigator on the current Torres Strait 'Non-commercial catch' project. As a fisheries consultant, may apply for funds for Torres Strait fishery research projects in the future where consistent with his role as Chair.
Nicole Murphy	Scientific Member	Employed by CSIRO and from time to time her organisation CSIRO receives funds to undertake research relating to Torres Strait fisheries.  Principal Investigator on the project black teatfish sampling and stock assessment, white teatfish stock assessment and the development of conversion ratios for curryfish projects.
Associate Professor Steven Purcell	Scientific Member	Employed full-time by Southern Cross University as a teaching-research academic. Has interest in invertebrate fishery research has previously worked in the assessment of sea cucumber fisheries in the Pacific and New Caledonia, and on restocking/sea-ranching research.  Specialist in sea cucumber ecology and fisheries. Currently involved in a sea cucumber population assessment in French Polynesia in partnership with Ginger-Soproner and CREOCEAN.  As of 2023, acting as the global focal-point on <i>Sustainable Use</i> within the IUCN Species Survival Commission's Sea Cucumber Specialist Group.  2023–2025 contracted by ADECAL-Technopole as the Scientific Member on a sea cucumber fishery advisory committee in New Caledonia.
John Tabo	Traditional Inhabitant Member, Kemer Kemer Meriam	Traditional Inhabitant Boat (TIB) licence holder with finfish, BDM, tropical rock lobster (TRL) and trochus entries.  Zenadth Kes Fisheries Limited member.
John Toshie Kris	Traditional Inhabitant Member, Maluialgal	TIB licence holder with TRL and Spanish mackerel entries.

		Zenadth Kes Fisheries Limited member.
Nicholas Pearson	Traditional Inhabitant Member, Kulkalgal	TIB licence holder with BDM, finfish and TRL entries. Family owns a commercial fishing company. Zenadth Kes Fisheries Limited member.
Pabai Pabai	Traditional Inhabitant Member, Gudumalulgal	Previously held a TIB licence and is considering renewing. Interested in taking up commercial fishing in the future. Zenadth Kes Fisheries Limited member.
Graham Hirakawa	Traditional Inhabitant Member Kaiwalagal	TIB licence holder with Spanish mackerel, pearl shell and TRL entries. Member of Zenadth Kes Fisheries Limited.
Natalie Couchman	AFMA Member	Employed by AFMA, no pecuniary interests or otherwise.
Damian Miley	TSRA Member	Employed by TSRA, no personal pecuniary interests or otherwise. TSRA holds finfish and TRL quota on behalf of Traditional Inhabitants.
Jenny Keys	QDAF Member	Employed by Queensland Government and working in the Management and Reform Section, managing the East Coast Sea Cucumber and other harvest fisheries in Queensland. No pecuniary interests or otherwise.
Joseph Posu	PNG NFA Member	Employed by the PNG Government. PNG shares some fish stocks with Australia and both countries have the option to enter into catch sharing arrangements for Article 22 fisheries under the Torres Strait Treaty. Nil financial interests in Torres Strait fisheries.
<b>Executive Officer</b>		
Sarah Kirkcaldie	Executive Officer	Employed by AFMA, no pecuniary interests or otherwise.
<b>Permanent Observers</b>		
Ned David	Malu Lamar (Torres Strait Islander) Corporation RNTBC	Chairperson of Malu Lamar.
<b>Observers</b>		
Ian Butler	Australian Bureau of Agriculture and	Employed by ABARES. No pecuniary interests or otherwise.



	Resource Economics (ABARES)	
Dr Eva Plaganyi	CSIRO	<p>Employed by CSIRO and from time to time her organisation CSIRO receives funding to undertake research relating to Torres Strait fisheries as well as other Australian and international fisheries.</p> <p>Scientific Member on the Tropical Rock Lobster (TRL) and Northern Prawn RAGs.</p> <p>Lead scientist for PZJA funded TRL research projects conducted by CSIRO.</p> <p>Co-investigator on the Torres Strait Scientific Advisory Committee (TSSAC) project 'Understanding climate variability and change relevant to key fisheries resources in the Torres Strait and adaptation and mitigation strategies'</p>
Tim Skewes	Fisheries consultant	<p>Independent consultant. Previously employed by CSIRO.</p> <p>Previous principal scientist and co-investigator for TSSAC and TSRA funded projects focused on the sea cucumber, TRL, finfish and traditional fisheries in the Torres Strait.</p> <p>Member on the TSSAC.</p> <p>Involved in the TSSAC endorsed research project 'Measuring non-commercial fishing catches (traditional subsistence fishing) in the Torres Strait in order to improve fisheries management and promote sustainable livelihoods' which is funded by the FRDC.</p>
Ian Tully	Industry	TBA
Simon Naawi	Industry	TBA
Maluwap Nona	Industry	TBA
Michael Passi	Industry	TBA
Dennis Passi	Industry	TBA

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>PRELIMINARIES</b> <b>Actions arising from previous meetings</b>	<b>Agenda Item 4</b> <b>For NOTING</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the progress against actions arising from previous meetings (**Attachment 4a**).
  - b. **NOTE** the final meeting record for the 19<sup>th</sup> meeting of the HCWG (HCWG19) held on 10 November 2023 (**Attachment 4b**).

## BACKGROUND

### *Actions arising*

2. Updates are provided on the status of actions arising from previous HCWG meetings at **Attachment 4a**.

### *Meeting record*

3. The draft meeting record for HCWG19 was provided out-of-session for comment on 4 January 2023. Comments from one member were received and incorporated. The record was finalised out-of-session following the closure of the comment period and circulated to members on 16 February 2023. The final meeting record is provided at **Attachment 4b** for information.

## Progress against actions arising from previous meetings

#	Meeting	Action item	Responsibility	Status
15.2 15.3 16.4	HCWG15 (1-2 August 2019)  HCWG16 (21 February 2020)	<p>TSRA and AFMA to develop a discussion paper outlining suggested management arrangements, based on HCWG discussions for pursuing the use of hookah to fish for white teatfish, for further consultation with communities and consideration by the HCWG and the PZJA.</p> <p>AFMA to arrange a half/full day future management priorities workshop in conjunction with the next Hand Collectables Working Group meeting.</p> <p>Malu Lamar to discuss the review of the hookah prohibition at the stakeholder workshop with a view to developing management recommendations.</p>	<p>TSRA</p> <p>AFMA</p> <p>Malu Lamar</p>	<p><b>Completed</b></p> <p>An BDM Workshop was held from 21-22 March 2023. Outcomes from the Workshop will be considered under <b>Agenda Items 9 and 11.</b></p>
16.1	HCWG16 (21 February 2020)	Malu Lamar to make recommendations to AFMA and TSRA on an as needs basis to establish an MOU to assist in improved data collection in the Fishery.	Malu Lamar	<p><b>In progress</b></p> <p>While no formal MOU has been developed, a suite of parallel activities has since taken place including a full round of community visits focussed on Fish Receiver System education and awareness, and more recently PZJA traditional inhabitant member cluster consultations. AFMA also continues to work with individual operators to improve data collection.</p> <p>The TSRA is also working with Malu Lamar to agree a service level MOU that may include programs aimed at improving reporting.</p> <p>At the HCWG16 meeting, the Malu Lamar Chairperson expressed preference to maintain an ongoing action item on</p>

				the development of the MOU to ensure it remains an option if needed.
16.2	HCWG16 (21 February 2020)	Malu Lamar to take the lead in convening a stakeholder workshop to further discuss and agree on cultural lore and industry agreements with respect to fishing for black teatfish and report outcomes to the HCWG.	Malu Lamar (supported by TSRA)	<p><b>In progress</b></p> <p>The stakeholder workshop was initially planned to take place on 7-8 April 2020 but had to be postponed due to the COVID-19 emergency and resulting restrictions. A further workshop was scheduled for the 4-5 August 2020, however, did not proceed. At the face-to-face community meetings convened by AFMA with assistance from Michael Passi and Maluwap Nona, time was provided for participants to discuss cultural protocols. At the Black Teatfish Industry Workshop held at Mer on 8-10 February 2021, Mr Ned David, Chairperson of Gur A Baradharaw Kod (GBK) Torres Strait Sea Land Council advised that the GBK will develop a template for the development of land and sea protocols. <a href="#">A summary of the Mer Industry Workshop</a>, including community meeting outcomes is available on the <a href="#">PZJA website</a>.</p>
18.2	HCWG18 (28-29 October 2021)	Scientific member Steven Purcell to present at future meetings of the WG and HCWAG his work on socioeconomic studies and how they have informed fisheries management.	Steven Purcell	<p><b>Completed</b></p> <p>Scientific member, Steven Purcell, gave a detailed presentation at the October 2022 meeting of the HCWG, entitled “The utility of socioeconomic research for managing hand-collectible fisheries”.</p>
19.1	HCWG19 (10 November 2022)	Scientific Member Assoc. Prof. Steven Purcell to present at future meetings of the WG and HCWAG on his work on New Caledonian fisheries and how they have informed fisheries development and management.	Steven Purcell	<p><b>In progress</b></p> <p>Scientific member, Steven Purcell, will provide a presentation under <b>Agenda Item 12</b>.</p>

19.2	HCWG19 (10 November 2022)	Clarify that catch reported in summaries is clearly labelled as wet gutted weight (landed weight that has been converted using the processed conversion ratios stipulated in the HS and TIB licence conditions).	AFMA	<b>Completed</b> Catch summaries now clearly labelled as wet gutted weight where applicable.
19.3	HCWG19 (10 November 2022)	Assoc. Prof. Purcell and Mr Richards to prepare a short introductory discussion paper (~5 pages) on the potential for socioeconomic data collection and market development in the fishery, with input from the WG Chair Nicholas McClean as required.	Steven Purcell  TSRA	<b>Completed</b> Scientific Member, Steven Purcell, prepared a discussion paper ('Concept Note') entitled "Socioeconomic assessment and value-chain analysis of the Torres Strait sea cucumber fishery", following discussions with TSRA and AFMA. This was submitted to AFMA. Some of the objectives and rationale for this study were taken onboard in a draft scope reviewed by TSSAC at the August 2023 meeting for consideration to allocate funding. This item will be further discussed under <b>Agenda Item 12.</b>



Australian Government  
Australian Fisheries Management Authority

## Torres Strait Hand Collectables Working Group

### Meeting 19

10 November 2022

### DRAFT record

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

[www.pzja.gov.au](http://www.pzja.gov.au)

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# 1 Preliminaries

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## 1.1 Acknowledgment of traditional owners, welcome and apologies

1. The Chair welcomed members and observers to the 19<sup>th</sup> meeting of the Torres Strait Hand Collectables Working Group (the WG), in particular the new Traditional Inhabitant Members Graham Hirakawa (Kaiwalagal) and Toshie Kris (Maluialgal). The Chair acknowledged the Traditional Owners of the lands on which members were participating both in the meeting and those members on video conference and paid respect to Elders past, present and emerging.
2. The Chair noted that apologies had been received from Nicole Murphy (Scientific Member), Pabai Pabai (Traditional Inhabitant Member for Gudumalulgal), and John Tabo (Traditional Inhabitant Member for Kemer Kemer Meriam).
3. The meeting was conducted as a face-to-face on Thursday Island and a video conference. The Scientific Member Steve Purcell, QDAF Member Jenny Keys and ABARES Observer Ian Butler participated by video conference. HCRA Scientific Member and CSIRO black teatfish stock assessment project Principal Investigator Dr Eva Plaganyi-Lloyd participated by video conference during Agenda Item 3.

## 1.2 Adoption of agenda

4. The WG adopted the draft agenda (**Attachment A**) with the AFMA Member noting that a staffing update would be provided under Agenda Item 8 (Other business). Members and observers did not object to the meeting being voice recorded for the purposes of developing the meeting record. The Chair noted that the recording is deleted once the meeting record is finalised and ratified by the WG.

## 1.3 Declarations of interest

5. The Chair advised members and observers, that as provided in the *PZJA Fisheries Management Paper No. 1 (FMP1)*, all members must declare all real and potential conflicts of interest in the Torres Strait Beche-de-mer Fishery (BDM Fishery) at the commencement of the meeting.
6. Where it is determined that a direct conflict of interest exists, the WG may allow the member(s) to continue to participate in the discussions relating to the matter but may also determine that, having made their contribution to the discussions, the member should retire from the meeting for the remainder of the discussions on that issue.
7. Declared interests are detailed in **Table 1** below. Each group of members and observers with similar interests were usually asked to leave the meeting to enable the remaining members to:
  - a. freely comment on the declared interests;
  - b. discuss if the interests preclude the members from participating in any discussions; and
  - c. agree on any actions to manage declared conflicts of interest.

but in this meeting the WG agreed to address any additional conflicts of interest should they arise throughout the discussion of agenda items.

8. The Chair encouraged open and honest discussion about the fishery, acknowledging that Traditional Inhabitants from the cluster Nations have an important role as owners to the access of the resource. The Chair noted that where industry members are involved there was agreement that there were no specific agenda items for which they should be excluded from discussion or recommendations. It was noted that members are attending to represent communities and represent the best interests of the entire fishery. If conflicts relating to individual commercial interests emerge and persist at the formulation of the Recommendation(s) it will need to be managed, noted and recorded in the minutes.
9. With respect to government members, it was recognised that while there was no specific conflict, there was a request that government members recognise that Traditional Inhabitant members are acting on behalf of the community and that they extend trust to the Traditional Inhabitant members in this regard.



10. With respect to scientific members it was identified that they should be part of the discussion but excluded from discussions about recommendations relating to research funding if there is likely to be a pecuniary interest in the recommendations.

**Table 1. Declared interests from each attendee**

Name	Position	Declaration of interest
<b>Members</b>		
Nicholas McClean	Chair	Employee of the University of Technology (Sydney). Principal investigator on project funded by FRDC in relation to Commonwealth fisheries. Co-investigator on BDM work in Philippines work on mariculture and various other fisheries research projects.
Steve Purcell	Scientific Member	Has interest in invertebrate fishery research has previously worked in the assessment of sea cucumber fisheries in the Pacific and New Caledonia, and on restocking/sea-ranching research. Specialist in sea cucumber ecology and fisheries. Will be involved in a sea cucumber population survey in New Caledonia to inform the CITES Appendix II listing of black and white teatfish.
Graham Hirakawa	Traditional Inhabitant Member Kaiwalagal	TIB licence holder with endorsements in the Spanish mackerel, pearl shell and tropical rock lobster fisheries. Member of Zenadth Kes Fisheries Limited.
Nicholas Pearson	Traditional Inhabitant Member Kulkagal	TIB licence holder with endorsements in the BDM, finfish and tropical rock lobster fisheries. Part of a family owned fishing business. Member of Zenadth Kes Fisheries Limited.
Toshie Kris	Traditional Inhabitant Member Maluialgal	TIB licence holder with endorsements in the Spanish mackerel and tropical rock lobster fisheries. Member of Zenadth Kes Fisheries Limited.
Emma Freeman	AFMA Member	Employed by AFMA, no pecuniary interests or otherwise.
Nicholas Richards	Torres Strait Regional Authority (TSRA) Member	Employed by TSRA, no pecuniary interests as an individual. TSRA holds fishing licences on behalf of Traditional Inhabitants.
Jenny Keys	QDAF Member	Employed by Queensland Government and working in the Management and Reform Section, managing the East Coast Sea Cucumber and other harvest fisheries in Queensland. No pecuniary interests or otherwise.

Name	Position	Declaration of interest
Danait Ghebrezgabhier	Executive Officer, AFMA	Employed by AFMA, no pecuniary interests or otherwise.
<b>Casual Observers</b>		
Quinten Hirakawa	TSRA	Employed by TSRA and TIB licence holder with endorsements in the tropical rock lobster and BDM fisheries.
Ian Butler	Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)	Employed by ABARES within the Department of Agriculture, Water and the Environment (DAWE). No pecuniary interests or otherwise.
Brodie Macdonald	AFMA	Employed by AFMA, no pecuniary interests or otherwise.

## 1.4 Action items from previous meetings

11. The WG noted the progress update provided against action items arising at previous WG meetings.
12. The WG agreed as follows in relation to the specific action items outlined below:
  - a. *Items 1, 2 and 5 (HCWG15/16)* – these three action items are now combined as they all relate to the hookah prohibition and all relate to the hosting of a future management workshop in 2023.
  - b. *Item 6* – replaced by new action item 1 following discussion of socio-economic under Agenda Item 6 (Research priorities).
  - c. *Items 3 and 4 (HCWG16)* – noting the recent changes to the Chairpersons and administration of the Malu Lamar (Torres Strait Islander) Corporation RNTBC, action items pertaining to Malu Lamar should remain open until they re-engage in the PZJA advisory process.
13. The WG noted that the TSRA, where they can, will try to coordinate community visits relating to fisheries matters with AFMA’s visits noting that there are other non-fisheries related projects that also require consultation.

## 2 Working group updates

### 2.1 Traditional Inhabitant members

14. The WG noted that the majority of the fishers in the inner islands are tropical rock lobster (TRL) fishers and have therefore not fished since the end of the TRL season on 30 September. Traditional Inhabitant members present did not participate in the 2022 black teatfish opening or the BDM Fishery and are reliant on members from the central and eastern islands that are full time fishers to provide updates on the operational aspects of the fishery. Traditional Inhabitant members noted that BDM fishers that attended the HCRA02 as industry observers have provided feedback on the 2022 black teatfish opening and the fishing season in general.
15. The Traditional Inhabitant Member for Maluialgal advised that mobility and fuel costs make it challenging for western island fishers to travel to the sea cucumber fishing grounds which are mostly located in the central and eastern region of the Torres Strait. The member further noted that industry should provide advice on the timing of the black teatfish closure.
16. The AFMA Member noted that AFMA values the feedback from fishers that have participated in the black teatfish opening to assist in designing opening and forecasting closure to ensure that the total allowable catch (TAC) is not exceeded. Based on feedback received from the 2021 opening, the 2022 was opened

on a neap tide and to avoid fishing on the Sabbath. Due to catch forecasts this year fishers were allowed half day of fishing. Feedback was that industry found it useful to fish but that it would have worked better if tide movements had been taken into consideration to maximise opportunity of this half day of fishing. AFMA is hopeful of opportunities in future for real time communication with industry to ensure that the opening can optimise fishing operations without risking the overcatch of the TAC.

17. An Industry member proposed that the prohibition on the use of hookah equipment to fish for deepwater species continues to be a barrier to participation in the fishery, especially for operators who predominantly operate in other Torres Strait fisheries. The WG noted that this was one of many management items to be discussed at the management workshop in early 2023.

## 2.2 Scientific members

18. The WG noted the following updates from the Scientific Member Assoc. Prof. Steven Purcell:
  - a. Close to finalising a project with the Food and Agriculture Organization of the United Nations that includes undertaking a market study in China to provide information on the price of some sea cucumber species harvested in the Torres Strait.
  - b. Continuing work of monitoring project of sea cucumber fisheries in New Caledonia. The New Caledonian fishery is the most similar to the BDM Fishery given the management arrangements, harvesting and status of stocks. Hearing about the evolution of the fishery could be useful for the BDM Fishery as a lens for what's happening and what can be learned from a similar fishery. The WG invited Assoc. Prof. Purcell to present on this work at the next WG and HCRAAG meetings.

**ACTION** – Scientific Member Assoc. Prof. Steven Purcell to present at future meetings of the WG and HCRAAG on his work on New Caledonian fisheries and how they have informed fisheries development and management.

## 2.3 Government agencies

19. The WG noted the verbal update provided by the QDAF Member Jenny Keys including:
  - a. Stock assessments from black and white teatfish were undertaken in 2021.
  - b. A Wildlife Trade Operation (WTO) was approved for the Queensland Sea Cucumber Fishery on 2 December 2021 and is valid until 30 November 2024.
  - c. A positive non-detrimental finding was not found for black teatfish and catches from 2 December 2021 are no-longer allowed to be exported.
  - d. Stock collected under the old WTO for black teatfish can still be exported.
  - e. Black teatfish can still be collected but can only be sold domestically.
  - f. The fishing season runs from 1 July to 30 June.
  - g. Quota used so far for the 2022 season is:
    - i. 100% for black teatfish (29.988 tonne);
    - ii. 96% for white teatfish (53 tonne);
    - iii. 31% other species (94.8 taken).
  - h. Economic data is collected for Queensland fisheries but it has been challenging to publish data for small fisheries due to confidentiality considerations.
20. The WG noted the update provided by the TSRA Member Nicholas Richards on items included in the agenda paper.
21. The WG noted the written update provided by AFMA in the agenda paper, including:
  - a. Progress to date against the nine WTO conditions for the BDM Fishery that will be provided to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in November

2022 as part of the annual reporting requirement. The WTO conditions for the BDM Fishery include additional requirements that need to be met by the PZJA in managing the harvest of black and white teatfish, species listed under Appendix II of CITES.

- b. A proposal from the European Union to include all species in the genus *Thelenota* (including Prickly redfish) under Appendix II of CITES will be discussed at the 19<sup>th</sup> meeting of the Conference of the Parties to CITES (CoP19) commencing the week of 14 November 2022.
- c. The Wildlife Trade Office at DCCEEW is leading the engagement with the various jurisdictions to better understand the potential business and regulatory impacts of the proposed listing. This information will inform Australia's negotiating position at CoP19 and the required Regulatory Impact Analysis and National Impact Analysis, to be considered by the Australian Parliament, should they be adopted. This information will also inform the necessary regulatory arrangements to allow international trade to continue.
- d. With respect to compliance activities and Traditional Inhabitant member concern regarding illegal, unreported and unregulated fishing on the southern part of Warrior Reef, AFMA's ongoing compliance presence is heavily reliant on Australian Navy and Australian Border Force platforms. The redirection of these platforms to other more urgent operations since 2020 has had an impact on the patrols that would normally be undertaken. AFMA continues to work with other enforcement agencies to collect intelligence. AFMA also works closely with the Papua New Guinea National Fisheries Authority (PNG NFA) to mitigate the risk of illegal fishing activity and ensure that there are complementary management arrangements in place for shared stocks.

## 2.4 Native Title

22. As there were no representatives from the Malu Lamar (Torres Strait Islanders) Corporation RNTBC, no update on Native Title matters was provided.

## 2.5 PNG National Fisheries Authority

23. The WG noted that although invited to the meeting, officials from the PNG NFA were not in attendance to provide a further update to the background information on the PNG BDM Fishery provided by AFMA in the agenda paper.

# 3 Black teatfish trial opening 9-12 May 2022 and future openings

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*Dr Eva Plaganyi-Lloyd joined the meeting at 1pm to answer questions relating to the preliminary black teatfish stock assessment results as presented to the HCRA02 meeting on 27-28 September 2022.*

24. The WG noted the update on the outcomes of the black teatfish trial opening on 9-12 May 2022 (**Attachment B**), including:
  - a. An overview of catch and effort reporting by licenced fish receivers. The catch of black teatfish was 17.05t (wet-gutted weight). During the opening, there were also 2t of other species caught, including blackfish, mixed curryfish, prickly redfish, and white teatfish.
  - b. That size frequency sampling was undertaken during the opening on Erub and Mer Islands and, to a limited extent, Bourke Islet. Dr Eva Plaganyi advised that, in the 2022 opening, there were fewer of the larger black teatfish caught and the size-frequencies were skewed more towards smaller individuals than in previous years.
  - c. That, having considered all available information, including the draft CSIRO analysis of the catch and sampling data from the openings, the HCRA02 recommended (draft) that black teatfish continues to open annually with a 20t TAC on the basis that:
    - i. The 2022 trial reopening TAC of 20t was not overcaught (condition 5 of the Torres Strait Beche-de-mer Harvest Strategy (the HS)).

- ii. Data were collected satisfactorily during the opening (condition 6 of the HS).
- iii. Updated modelling analysis, inclusive of 2022 catch and sampling data, confirmed that a 20t TAC is sustainable and would not lead to a decrease in black teatfish biomass after the first year of fishing (condition 7 of the HS). In contrast, the modelling found that catches of 30t could lead to a gradual depletion of the stock.
- iv. That AFMA continue to focus on communication and education on improving voluntary reporting of area and effort data by fishers and fish receivers, including preparing fact/information sheets and organising a teleconference with all fish receivers as a cost effective way to discuss ways of improving voluntary reporting.
- v. Given the usefulness of the size frequency sampling undertaken during the 2022 opening, continue to undertake scientifically designed sub-sampling during the opening to collect size and weight frequency data during black teatfish openings at key landing locations.

**CONDITION 5 - 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**

25. Noting that this is the second trial opening and that the 20t TAC was not exceeded (total catch was 17.06t), the HS recommendation that the fishery automatically pause for the following year if the TAC is exceeded by 5 per cent does not apply.

**CONDITION 6 - Was data collection during the trial conducted satisfactorily?**

26. The WG noted the draft HCRA02 advice that data collection during the trial opening was conducted satisfactorily based on the reliability of the total catch reported and the results of the CSIRO analysis. The WG specifically noted that there has been a significant improvement in the level of voluntary reporting of area information since the 2021 opening.
27. The Executive Officer clarified that the catch figures in the reported catch data summary were all based on wet gutted weight (landed weight that has been converted using the processed conversion ratios stipulated in the HS and Traditional Inhabitant Boat (TIB) licence conditions). The WG suggested that this needs to be clearly stipulated in future catch data summaries.

**ACTION** – Clarify that catch reported in summaries is clearly labelled as wet gutted weight (landed weight that has been converted using the processed conversion ratios stipulated in the HS and TIB licence conditions).

**CONDITION 7 - Noting the TAC was not exceeded and reliable data were collected, the data need to be analysed to review the TAC and potential for the fishery to stay open in the future, or be re-opened periodically after a pre-specified interval**

28. The WG noted the HCRA02's draft recommendations, based on its consideration of the updated fishery and scientific information (preliminary results of the catch and sampling data and the stock assessment):
- a. of a 20t TAC for the next black teatfish opening;
  - b. given two successful trial openings, that the species continue to open on an ongoing basis in accordance with the requirements of the HS.
29. The WG recognised the importance of fully realising the available TAC as the additional catches can make a substantial difference to communities given limited sources of alternative income, while noting some of the challenges associated with effectively administering the season. The closure arrangements adopted for the 2021 and 2022 openings, whilst considered strict by some, are one of the important ways in which AFMA tries to mitigate the risk of a TAC overcatch in a re-opened fishery. The last day of fishing is determined based on catch information from the first few days of the opening and as AFMA has limited real time information about how fishing effort may change on a daily basis it assumes that fishers may increase their effort, and hence the total landed catch, as daily catches approach the TAC. Furthermore, as catch reporting is still paper based and requires manual data entry once received as the season progresses, AFMA needs to allow adequate time to capture all the catch data, assess the daily catch rate

and advise fishers and fish receivers of the total catch for the day and whether the season is still open. A greater uptake of electronic catch disposal records (e-CDRs) could potentially streamline the reporting process for future openings.

30. The WG discussed at length various TAC setting and HS approaches to ensure that the 20t TAC is fully caught, ultimately agreeing that, in the short term, operational strategies that assist and support industry to fully utilise the black teatfish TAC would be most beneficial. Other approaches discussed include:
- a. *Setting an aspirational TAC of 22t with a hard 20t catch limit* – the WG discussed that there is currently no scientific basis to support a 22t aspirational TAC and the importance of being cognisant of the precedent that a departure from the current HS sets for the application of other harvest strategies and TACs. The WG further noted Dr Plaganyi's advice that the black teatfish stock assessment model will benefit from a time series of additional data, including catch, and that as the model becomes more integrated it will start accounting for undercaught TACs and help inform potential TAC increases in the future.
  - b. *Carry over of uncaught TAC between fishing seasons* – the WG noted that the HS does not currently provide for this due to lack of consensus on the inclusion of under catch provisions during its development. The carry-over of uncaught black teatfish TAC across fishing seasons needs to be scientifically informed and based on a defensible mechanism. It would also involve seeking a variation to WTO Condition 8 for the fishery from the DCCEEW, which currently limits the seasonal take of black teatfish to 20t. The WG noted that AFMA is currently seeking advice from the Wildlife Trade Office at the DCCEEW on their requirements for the variation of seasonal species catch limits in WTO conditions outside of the 3 year re-assessment cycle. Noting the in-built review mechanisms, the WG agreed the review of the HS is a key body of work for the future that will most likely require a research project.
  - c. *Community or fishers to distribute uncaught black teatfish TAC* – the WG agreed that any community-based arrangements would need to be equitable and acceptable to all fishers and suggested that options could be discussed at the industry workshop in early 2023.
31. The WG, **accepted** the HCRAAG's draft advice to transition fishing for black teatfish from a trial opening to an ongoing annual opening to be managed in accordance with the TS BDM HS, noting further discussions with fishers on strategies for fully utilising the black teatfish TAC at the industry workshop in early 2023.
32. The WG, noting the draft HCRAAG advice, **recommended** the continuation of the 20t TAC and sought advice from the HCRAAG on:
- a. the anticipated duration of an annual 20t catch limit, noting a few more years of data is required to increase certainty on what future annual TACs might be possible;
  - b. the scientific basis for the development and application of under catch carry-over provisions; and
  - c. options for the review of the BDM HS to include provisions to carry over undercatch and set provisional TACs.

## 4 Applying the harvest strategy to review total allowable catches (TACs)

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33. The WG noted that:
- a. On 19 November 2019 the PZJA agreed to adopt the HS. Current total allowable catches (TACs) (excluding black teatfish which is considered separately) were agreed in line with the starting TACs recommended in the HS and have applied since 1 January 2020.
  - b. All species assessed remain in the low tier of the HS as transition to the middle tier:
    - i. requires high quality data for at least two primary indicators; and
    - ii. is not applicable during the initial years of HS implementation as insufficient detailed historical fishery data are available.

- c. At its meeting on 28-29 September 2022, the HCRAAG, having applied the HS to all new information available since its last meeting (this being catch data for the 2021 fishing season as outlined in the species assessment sheets tabled under Agenda Item 4, Attachment 4a):
- i. **Recommended** no changes to current TACs (outlined in Table 2. below) for the 2023 fishing season, commencing on 1 January 2023.
  - ii. Upon the HCWG18's recommendation, **revisited** its advice to increase the curryfish vastus trigger limit from 15t to 30t and **recommended** that the trigger limit remain at 15t until such time there is new data to support an increase.
  - iii. **Noted** that no TACs or individual basket species trigger limits were exceeded during the 2021 fishing season, therefore low tier overcatch deduction provisions in the HS do not apply.

**Table 2. TACs for the 2023 BDM fishing season commencing on 1 January 2023**

Species	2023 TAC (t)
Curryfish basket (2 species)	60
Deepwater redfish	5
Greenfish	40
Hairy blackfish	5
Prickly redfish	15
Sandfish (CLOSED)	0
Surf redfish (CLOSED)	0
White teatfish	15
Other sea cucumbers (13 species)	50
<b>TOTAL</b>	<b>190</b>

34. Having considered the draft HCRAAG advice and noting that no TACs or individual basket species trigger limits were exceeded during the 2021 fishing season, the WG **recommended** the TACs in Table 2 for the 2023 fishing season commencing on 1 January 2023.
35. The WG noted that the prohibition on the use of hookah gear is impacting industry's ability to catch deeper water sea cucumber species such as white teatfish.
36. The ABARES Observer expressed the view that in his opinion white teatfish is currently being economically overfished due to consistently low recent catches compared to historical catches. However, Dr Plaganyi advised that care needs to be taken in interpreting changes in catch data as the species was historically fished using hookah.

## 5 Research priorities

37. The WG considered the information provided on the status of identified research priorities and needs for the BDM Fishery, and on the TSSAC research funding process, including funding available for the 2023/24 financial year. The WG also considered the additional analysis and sampling needs identified by the HCRAAG to address some of the key data gaps that exist in the fishery. The WG reviewed all identified research needs and priorities as outlined in Table 3, taking into account HCRAAG's draft advice on priorities and noting that draft scopes for high priority research needs (sandfish stock survey and black teatfish size frequency sampling) will be circulated for their consideration and comment.
38. Assoc. Prof. Steven Purcell presented to the group on research undertaken in the Pacific on the utility of socioeconomic research for managing hand-collectable fisheries. The WG noted that socioeconomic



surveys can produce data that complements biological, catch or survey information. Assoc. Prof. Purcell's presentation is included as **Attachment C**.

39. Mr Richards also presented to the group on the potential for market development for BDM in the Torres Strait and his presentation is included as **Attachment D**.
40. The WG agreed that socioeconomic research could assist in understanding the needs and aspirations of Indigenous fishers including the need to generate more income from fishing in the Torres Strait. The WG agreed that it would be important to identify the scope of this work (e.g. cross fishery or BDM specific) and identify the key information that needs to be collected through a scoping or discussion paper.

**ACTION** - Assoc. Prof. Purcell and Mr Richards to prepare a short introductory discussion paper (~5 pages) on the potential for socioeconomic data collection and market development in the fishery, with input from the WG Chair Nicholas McClean as required.

## 6 Update on new application to undertake aquarium fishing in the Torres Strait

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41. The WG noted the agenda paper on an application to undertake aquarium fishing in the Torres Strait and that the application had been considered by the HCRAAG at its meeting on 28-29 September 2022. The WG further noted that the PZJA, at its meeting on 4 October 2022, took a decision not to renew licenses that might allow this type of fishing and that the decision was published on the [PZJA website](#).

## 7 Future priorities and date for the next meeting

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42. The WG noted that the agenda paper on future priorities captures items previously identified and endorsed by the WG, as well as a progress update against each item. The WG also noted that the next WG meeting is tentatively scheduled for October 2023.

## 8 Other business

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43. The Chair thanked all members and observers for their contribution to a productive meeting. The Chair and members acknowledged and thanked the outgoing AFMA Senior Fisheries Management Officer for Hand Collectable Fisheries, Danait Ghebregabhier for all her work in and contributions to Torres Strait Fisheries.
44. Mr Nicholas Pearson closed the meeting at 5:22pm in Prayer.



<b>Table colour key</b>	<b>Completed</b>	<b>Scoped and/or costed</b>	<b>Not scoped/not costed</b>	<b>Funded</b>
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**Table 3. Overview and status update of research needs identified or discussed for Hand Collectable Fisheries at previous HCRAAG and HCWG meetings and the rolling five-year research plan.**

	<b>Research activity</b>	<b>Detail</b>	<b>Status</b>	<b>Draft HCRAAG02 advice</b>	<b>Draft HCWG19 advice</b>
1	Status of BDM stocks in relation to harvest strategy reference points	Consistent with the BDM harvest strategy and where there is sufficient information available, a tactical research project is needed to determine the current status of sea cucumber stocks in relation to the harvest strategy reference points, noting that the first step is to define the reference points for the species for which it may be possible.	Not scoped/not costed	Suggestion to remove this research activity and replace with species specific needs to define HS reference points and linked to the MSE of the BDM HS research activity.	
2	White teatfish modelling	Additional analysis on white teatfish to develop a rationale on the status of the stock in relation to harvest strategy reference points and modelling analysis on a sustainable TAC increase.	Funded and underway in 2022-23 FY	<b>High priority</b>	
3	Black teatfish sampling 2022	Representative sampling to collect size and weight frequencies during the black teatfish openings.	Funded and underway in 2022-23 FY	<b>High priority.</b> Develop a scope to undertake size frequency sampling during the 2023 opening.	Noted HCRAAG02 draft advice and that the draft scope will be provided to the HCWG.
4	Development of curryfish conversion ratios	Project to develop conversion ratios for curryfish with industry undertaking the sampling process.	Funded and underway in 2022-23 FY	<b>High priority.</b>	
5	Sandfish stock survey	Outstanding stock survey of Sandfish at Warrior Reef to better understand its status	Not scoped  Est. cost 150k – 300k	<b>High priority</b> subject to confirmation of support from Iama and Tudu Island PBC, GBK, Traditional Owners and fishers. Initial engagement to be led by the TSRA regarding support for the project to be	Noted HCRAAG02 draft advice and that the draft scope will be provided to the HCWG.

	Research activity	Detail	Status	Draft HCRA02 advice	Draft HCWG19 advice
		(Note - Identified as a research need for the fishery by HCWG17 at its meeting 12 October 2020. Was part of the 2019-20 stock survey but did not proceed.)		followed by subsequent consultation by AFMA on the draft project scope and potentially proposal following HCRA02 review.	
7	Socio-economic metrics	Collecting data on socioeconomic indicators for the fishery through recall surveys.	Not scoped/not costed	<b>High priority.</b> Subject to: <ul style="list-style-type: none"> <li>further HCRA02 advice on the scope and additional work to be done to support it.</li> <li>more clarity on questions being asked, data required and indicative cost.</li> </ul> Project may fall within the remit of ACR.  Update scope to address any supply chain issues that could be addressed.	Action item for Scientific Member Steven Purcell and Mr Nicholas Richards (TSRA) to prepare a short discussion paper on the potential for socioeconomic data collection and market development in the fishery.
8	Management Strategy Evaluation (MSE) of the Beche-de-mer Harvest Strategy	1. Collate all data and biological information; 2. Update and extend the spatial multispecies TS BDM operating model developed earlier (or construct a new model); 3. Use MSE to evaluate how well the HS achieves the pre-specified objectives; 4. In consultation with stakeholders, use the MSE framework to investigate ways to improve the current HS.  (Note - Requires 3-5 years of BDM HS implementation.)	Not scoped  Est cost – \$130k	<b>Medium priority</b> and to be held off until the harvest strategy has been in place for a few years.  Interacts with no.1	
9	Supply chain	Better understanding of the supply chains as per other fisheries to better understand vulnerabilities and help develop an industry	Not scoped/not costed	Not prioritised – could benefit from better articulation to differentiate from a value chain issue and informed by any	

	Research activity	Detail	Status	Draft HCRA02 advice	Draft HCWG19 advice
		that is resilient to fluctuating export market conditions.		socioeconomic surveys that may be undertaken in the future.	
10	Ecological Risk Assessment (ERA) – Torres Strait Pearl Shell Fishery	Conduct an ERA for the Torres Strait Pearl Shell (TSPF) Fishery <b>(Note</b> - Identified as an essential research priority by HCWG in the rolling five-year research plan for Hand Collectable Fisheries)	Not scoped Est cost - \$20,400	<b>To be retained in research plan</b> and activated when fishing for pearl oysters commences. There is some information on Pearl shell stock estimates from Tropical Rock Lobster surveys.	
11	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	Not scoped/not costed	<b>Medium priority</b> and proposed that it be addressed as the need arises. There are conservative proxies that are best addressed through other avenues such as PhD projects and through QLDRAC given similar projects were recently funded by FRDC for finfish species in Qld.	Noted and supported draft HCRA02 advice. Sci Member Steven Purcell advised that some of this work is already underway in other areas.
12	Stock Status Survey	To undertake a stock survey of all Torres Strait beche-de-mer species with a focus on deeper water species	Completed in 2019 - 2020	Noted	Noted
13	Ecological Risk Assessment (ERA)	Conduct an ERA for the TSBDM Fishery	Final report completed on 21 Dec 2021	Noted	Noted
14	Climate Change impacts and vulnerability	Scoping study across all Torres Strait	Completed	Noted	Noted
15	Data analysis	Further analysis of catch data collected during the 2021 trial reopening of black teatfish to inform future openings and follow up work from the stock survey.	Completed	Noted	Noted

## Summary of actions arising from HCWG19

Action item	Actioning member
Scientific Member Assoc. Prof. Steven Purcell to present at future meetings of the WG and HCRAAG on his work on New Caledonian fisheries and how they have informed fisheries development and management.	Assoc. Prof. Purcell
Clarify that catch reported in summaries is clearly labelled as wet gutted weight (landed weight that has been converted using the processed conversion ratios stipulated in the HS and TIB licence conditions).	Executive Officer
Assoc. Prof. Purcell and Mr Richards to prepare a short introductory discussion paper (~5 pages) on the potential for socioeconomic data collection and market development in the fishery, with input from the WG Chair Nicholas McClean as required.	Assoc. Prof. Purcell and Mr Richards

## Summary of HCWG19 recommendations

Agenda item #	Recommendation
3	<p>The WG, <b>accepted</b> the HCRAAG's draft advice to transition fishing for black teatfish from a trial opening to an ongoing annual opening to be managed in accordance with the TS BDM HS, noting further discussions with fishers on strategies for fully utilising the black teatfish TAC at the industry workshop in early 2023.</p> <p>The WG, noting the draft HCRAAG advice, <b>recommended</b> the continuation of the 20t TAC and sought advice from the HCRAAG on:</p> <ol style="list-style-type: none"> <li>the anticipated duration of an annual 20t catch limit, noting a few more years of data is required to increase certainty on what future annual TACs might be possible;</li> <li>the scientific basis for the development and application of under catch carry-over provisions; and</li> <li>options for the review of the BDM HS to include provisions to carry over undercatch and set provisional TACs.</li> </ol>
4	Having considered the draft HCRAAG advice and noting that no TACs or individual basket species trigger limits were exceeded during the 2021 fishing season, the WG <b>recommended</b> the TACs in Table 2 for the 2023 fishing season commencing on 1 January 2023.

## List of attachments

**Attachment A** – Meeting agenda

**Attachment B** – CSIRO summary paper on the black teatfish trial fishery openings in 2021 and 2022

**Attachment C** – The utility of socioeconomic research for hand collectable fisheries (Assoc. Prof Steven Purcell)

**Attachment D** - Balancing the Dimensions of Sustainable BDM Fisheries Management (Nicholas Richards, TSRA)

**19th MEETING OF THE PZJA TORRES STRAIT HAND COLLECTABLES WORKING GROUP**

**10 Nov 2022 (8:30 am – 5:00pm)**

**TSRA Board Room, Level 1 Torres Strait Haus, 46 Victoria Parade, Thursday Island**

**(video conference)**

**DRAFT AGENDA**

**AGENDA ITEM 1          PRELIMINARIES**

**1.1      Acknowledgement of Traditional Owners, welcome and apologies**

The Chair will welcome HCWG members, permanent observers, and casual observers to the 19<sup>th</sup> Torres Strait Hand Collectables Working Group.

**1.2      Adoption of agenda**

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

**AGENDA ITEM 2          WORKING GROUP UPDATES**

**2.1      PZJA Traditional Inhabitant members**

PZJA TI members are invited to introduce themselves and provide an update on matters concerning the Torres Strait Hand Collectable fisheries, in particular, providing comment on fishing patterns, behaviours, prices, and market trends.

**2.2      Scientific members**

Scientific members are invited to provide an update on relevant research matters relevant to Torres Strait Hand Collectable fisheries.

**2.3      Government Agencies**

The Working Group will note updates from each of the PZJA government agency members on the latest developments relevant to Hand Collectable fisheries.

**2.4      Native Title**

The Working Group will note a verbal update from the Malu Lamar representative if in attendance.

**2.5      Papua New Guinea National Fisheries Authority**

The Working Group will note an update from the PNG NFA officials if in attendance.

**AGENDA ITEM 3            BLACK TEATFISH TRIAL OPENING 9-12 MAY 2022 AND FUTURE OPENINGS**

Having regard for advice from the Hand Collectable Resource Assessment Group (HCRAAG) and the application of the Harvest Strategy, the Working Group will discuss and provide advice on the potential for a future black teatfish opening and any arrangements required to support an opening.

**AGENDA ITEM 4            TOTAL ALLOWABLE CATCHES FOR THE 2023 FISHING SEASON**

Having regard for advice from the HCRAAG and applying the Harvest Strategy to all new information, the Working Group will discuss and provide advice on TACs for the 2022 fishing season.

**AGENDA ITEM 5            RESEARCH PRIORITIES**

Having regard for HCRAAG advice, the Working Group will discuss and provide advice to the TSSAC on research priorities for the beche-de-mer, trochus, mud crab and pearl shell fisheries under the Five-Year Rolling Research Plan. A five-year rolling research plan for Hand Collectable Fisheries is used to inform the Torres Strait Scientific Advisory Committee's (TSSAC) annual call for research funding proposals.

**AGENDA ITEM 6            UPDATE ON A RECENT APPLICATION TO UNDERTAKE AQUARIUM FISHING IN THE TORRES STRAIT AND RELATED LICENCING MATTERS**

The HCWG is asked to note updates on a recent application to undertake aquarium fishing in the Torres Strait and a PZJA decision on related licencing matters.

**AGENDA ITEM 7            FUTURE MANAGEMENT PRIORITIES AND DATE FOR NEXT MEETING**

The Working Group will discuss and provide advice on management priorities for Torres Strait Hand Collectable Fisheries. Having agreed management priorities and a work plan for Hand Collectable Fisheries aims to achieve a more efficient management process. The Working Group will consider a date and venue for HCWG20.

**AGENDA ITEM 8            OTHER BUSINESS**

The Working Group is invited to nominate any other business for discussion.

**CLOSE OF MEETING**

## Black teatfish trial fishery openings – 2021 & 2022



Nicole Murphy, Éva Plagányi and Tim Skewes

The data in this summary were gathered by AFMA logbooks and observers during the Black teatfish fishery openings in 2021 (April 30 to May 3) and 2022 (May 9 to May 12).

Thank you and appreciation to TSI fishers for providing their fishery data and AFMA Thursday Island and Observers Tamre Sarhan, Ben Lidell, David Schubert, Henry Oak and Stephen Hall.

This document provides a brief summary of some of the data in order to inform ongoing management.

### Length frequency

A total of 1886 Black teatfish were sampled for size frequency measurements of length and width during the 2022 fishery season, with 1701 weights also recorded. Measurements of length, width and weight were also recorded for other sea cucumber species (Table 1).

**Table 1. Number of sea cucumber species measured during Black teatfish opening in 2022.**

Common name	Whole Length (mm)	Number
Black teatfish	<i>Holothuria whitmaei</i>	1886
White teatfish	<i>Holothuria fuscogilva</i>	29
Curryfish common	<i>Stichopus herrmanni</i>	44
Curryfish vastus	<i>Stichopus vastus</i>	33
Prickly redfish	<i>Thelenota ananas</i>	24
Burrowing blackfish	<i>Actinopyga spinea</i>	2

Length frequency measurements (whole) from previous sea cucumber surveys (Figure 1) and observer data (Figure 2) are shown below. Unfortunately, the pre-2020 population survey data aren't sufficiently comparable to the 2022 Observer data (as the latter are based on commercial catches and a Minimum Legal Size (MLS) restriction), but data from future fishery openings will allow more detailed comparisons such as of the median size of animals caught, and trends in growth.

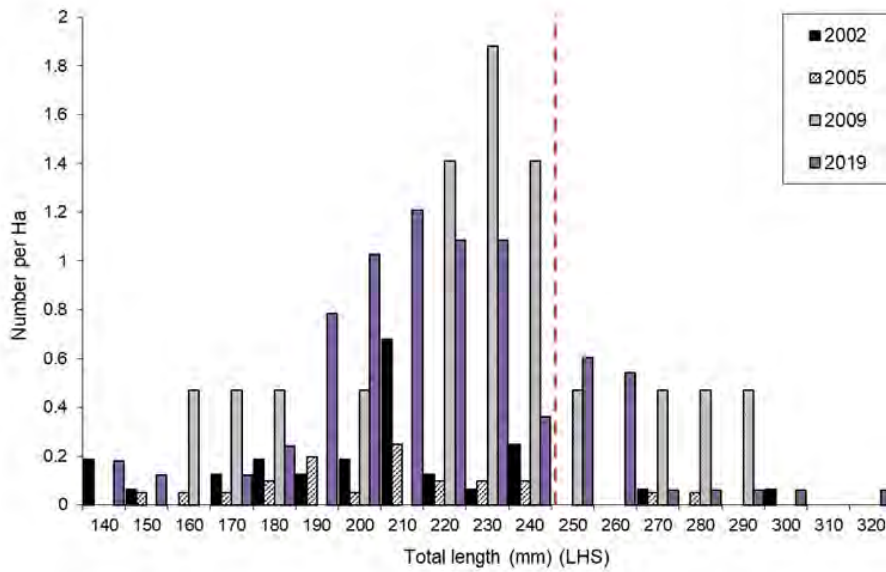


Figure 1. Length frequency for Black teatfish collected during population surveys in East Torres Strait in 2002, 2005, 2009 and 2019/2020. Minimum Legal Size (MLS) of 250 mm indicated; LHS = minimum size of bin range (Murphy et al. 2021).

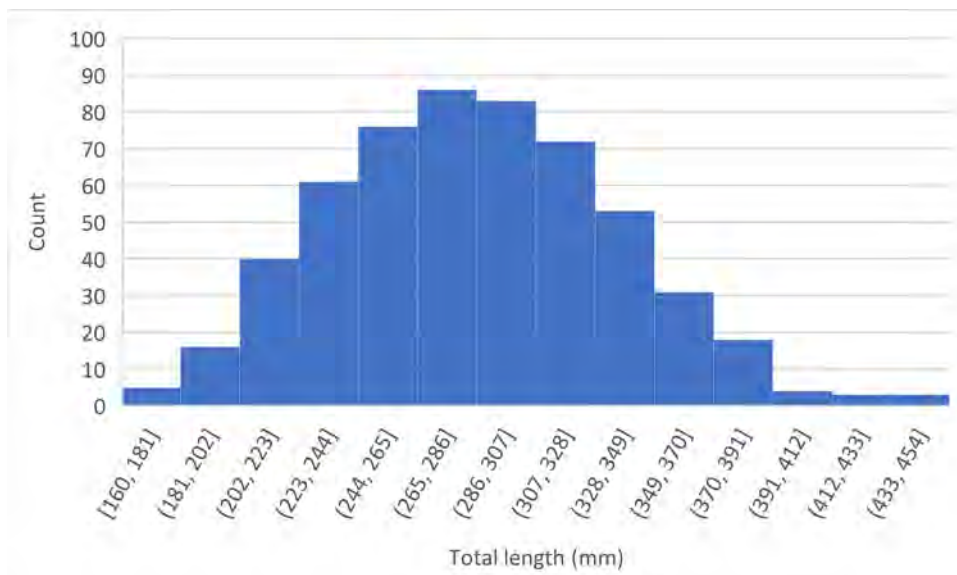


Figure 2. Length frequency measurements (whole) for Black teatfish for the 2022 fishery opening.



## Black teatfish catch

### Data analyses for 2021 and 2022 fishery openings

A summary of the total catch per area and per day, for 2021 and 2022 is shown in Table 2. Recorded weights have all been converted to standard units (wet-gutted weight) using the agreed conversion factors. The total Black teatfish catch for 2021 was 17.4 tonnes and for 2022 was 17.05 tonnes and hence below the TAC (Total Allowable Catch) limit of 20 tonnes, confirming that the trial openings for both years were successfully managed.

Whereas the total catch amounts were reliably reported in 2021, the majority (55%) of the catch did not include details such as the area caught. This limits the usefulness of the data to support additional analyses related to the sustainability and productivity of the stock. In 2022, catch amounts were again reliably reported and there was an improvement in reporting the area caught (logbook zone), with 68% of total records recording the corresponding area caught (Table 2).

\*Catch error – 2021: A slight dating error exists that has implication for the total catch for Black teatfish to date – a catch entry was entered for the 2<sup>nd</sup> of April due to a dating error on the CDR. This resulted in the record not being captured in the data extract for the opening period (30<sup>th</sup> April – 3<sup>rd</sup> May 2021). The record amount was 181.95 kg and brings the total catch of Black teatfish to 17,615.47 kg.

**Table 2. Sum of converted (gutted) weight (kg) for catch taken for logbook zones for each fishing day in years 2021 and 2022.**

	Day	Warrior	GNE Channel	Darnley	Cumberland	Don Cay	Seven Reefs	Barrier	Unknown*	Grand total
2021	30-Apr	-	119.78	41.24	468.95	311.13	-	-	3075.51	<b>4016.62</b>
2021	1-May	-	141.19	551.31	1392.45	-	-	-	2820.29	<b>4905.24</b>
2021	2-May	-	67.14	276.20	1030.81	-	-	-	166.42	<b>1540.57</b>
2021	3-May	50.95	-	1010.19	2210.87	145.56	-	-	3553.51	<b>6971.08</b>
<b>Total</b>		<b>50.95</b>	<b>328.12</b>	<b>1878.94</b>	<b>5103.08</b>	<b>456.69</b>	-	-	<b>9797.69</b>	<b>17615.47</b>
	Day	Warrior	GNE Channel	Darnley	Cumberland	Don Cay	Seven Reefs	Barrier	Unknown*	Grand total
2022	9-May	-	-	985.82	1768.25	1229.02	-	-	210.75	<b>4193.85</b>
2022	10-May	-	331.00	1379.75	1948.39	631.25	324.11	-	873.56	<b>5488.07</b>
2022	11-May	-	-	1065.44	4024.48	641.80	270.01	185.23	-	<b>6186.96</b>
2022	12-May	-	-	335.02	397.09	371.24	--	-	83.54	<b>1186.90</b>
<b>Total</b>		-	<b>331.00</b>	<b>3766.03</b>	<b>8138.22</b>	<b>594.13</b>	<b>2873.30</b>	<b>185.23</b>	<b>1167.85</b>	<b>17055.76</b>

*\*Unknown: Fished area left blank in reporting.*

## Catch per day

In 2021, the largest catch was taken on day 4 and the least on day 3. For 2022, the largest catch was taken on day 3 and the least on day 4 (Figure 3).

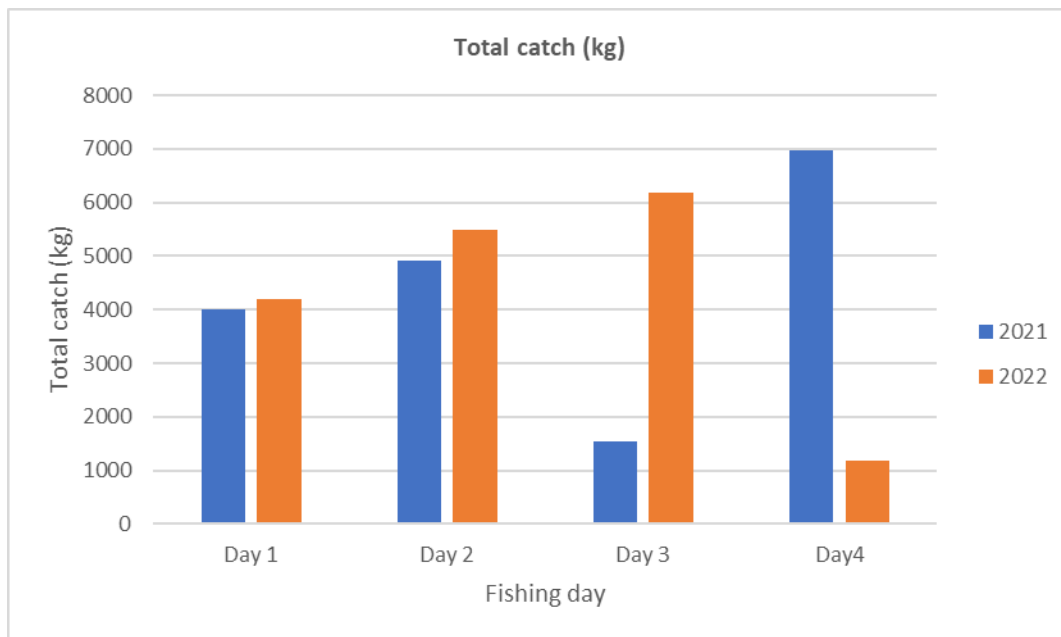


Figure 3. Total catch per day (gutted weight - kg).

The temporal pattern in catches as shown in Table 2 and Figure 3 suggest the following:

- No evidence of stockpiling as day 1 catches were not relatively large
- No evidence of declining catch after a few days, which would indicate depletion
- Low catch on day 3 - 2021 due to falling on the Sabbath
- Low catch on day 4 - 2022 due to fishery opening for a half day and some fishers choosing not to fish
- Cumulative catches were tracked and adhered to the management TAC
- The number of fishers participating in the fishery was only a fraction of the available fishing effort (i.e. potential TIB effort in Torres Strait) indicating possibly that fishing effort was controlled by local traditional “Island custom” management

## Area fished

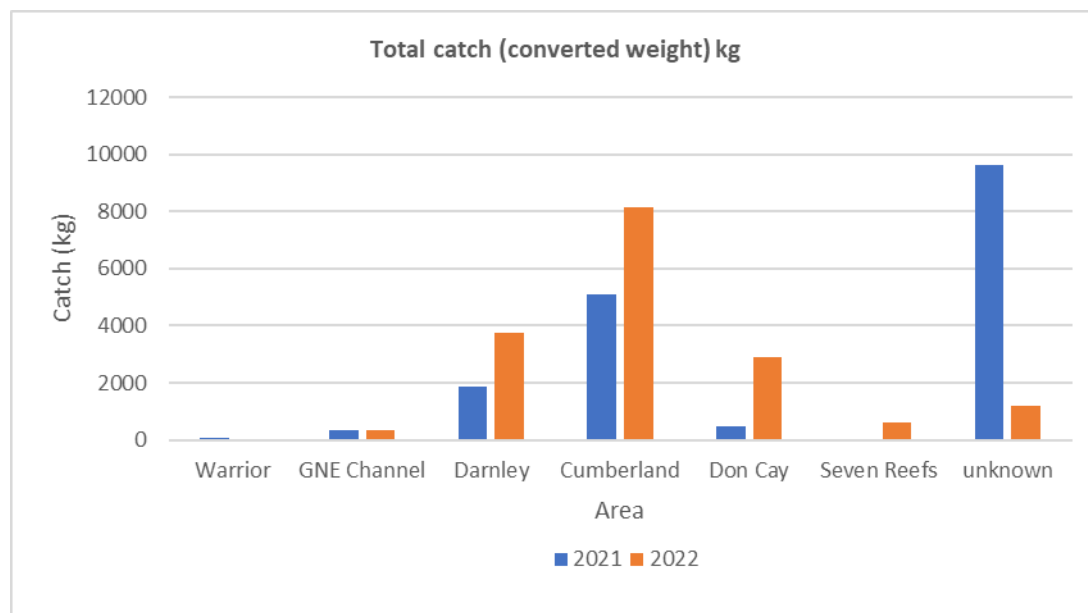
In 2021, the largest catch was taken from ‘Unknown’ area recorded in the catch data (Table 3; Figure 4). Following this opening, meetings stressed that it is important to improve communication for future fishing around the need to record location, as this limits the usefulness of the data.

In 2022, there was an improvement in recording location for catch (Table 3; Figure 4). The areas of Darnley, Cumberland and Don Cay received more effort, suggesting these areas may have contributed to the Unknown data in 2021. The areas of Seven Reefs and Barrier

were additionally fished—they were not in 2021. Further information as to why these areas were accessed would help scientific understanding of the information content of the data and inform on fisher behaviour.

**Table 3. Total sum of converted weight (kg) for catch taken for logbook zones for each fishing day between years.**

2021	Day	Warrior	GNE Channel	Darnley	Cumberland	Don Cay	Seven Reefs	Barrier	Unknown
	1	-	119.78	41.24	468.95	311.13	-	-	3075.51
	2	-	141.19	551.31	1392.45	-	-	-	2820.29
	3	-	67.14	276.20	1030.81	-	-	-	166.42
	4	50.95	-	1010.19	2210.87	145.56	-	-	3553.51
2022	Day	Warrior	GNE Channel	Darnley	Cumberland	Don Cay	Seven Reefs	Barrier	Unknown
	1	-	-	985.82	1768.25	1229.02	-	-	210.75
	2	-	331.000	1379.75	1948.39	631.25	324.11	-	873.56
	3	-	-	1065.44	4024.48	641.80	270.01	185.23	-
	4	-	-	335.02	397.09	371.24	-	-	83.54



**Figure 4. Total catch (converted weight - kg) for logbook zones between years.**

### Area fished across days

In 2021, most of the fishing effort was in the areas of Darnley and Cumberland, with similar effort across days (Figure 5).

For 2022, the majority of effort occurred at Cumberland, increasing across days. Effort was also seen at Darnley and Don Cay (Figure 5).

Travelling and processor location likely played a role in areas fished.

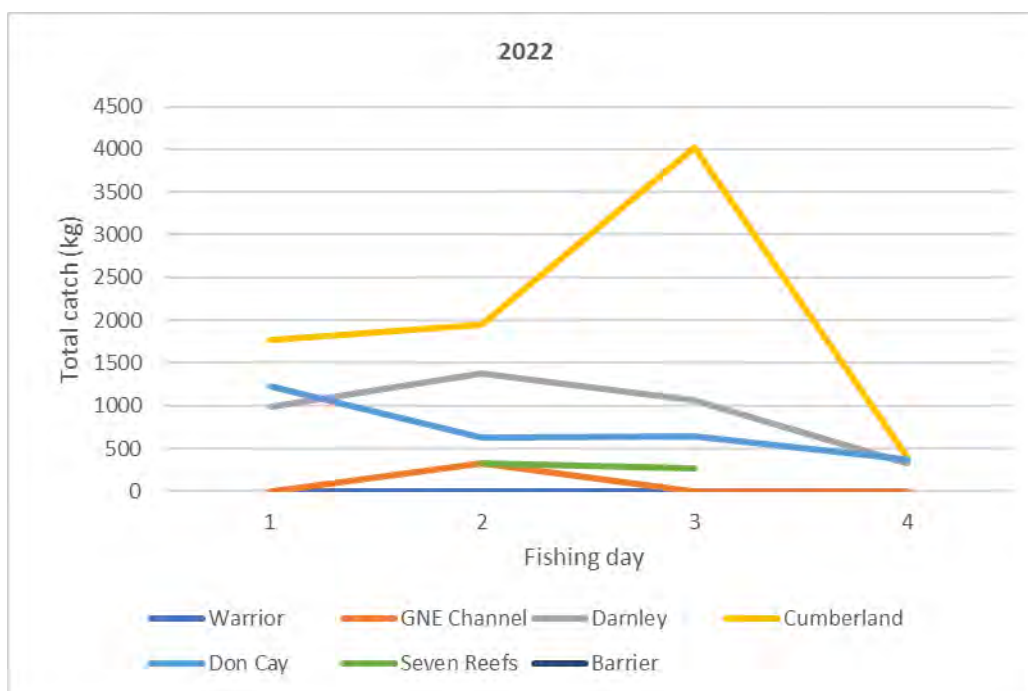
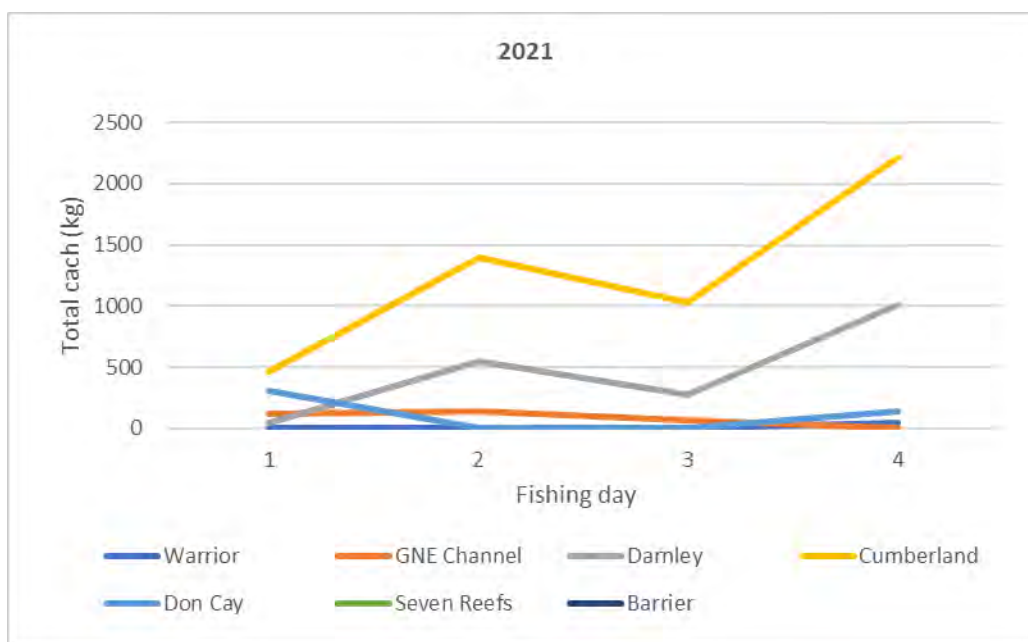


Figure 5. Total catch (converted weight - kg) for logbook zones for each fishing day for 2021 (top) and 2022 (bottom).

### Sea cucumber stock survey 2019/2020

The 2019/2020 sea cucumber survey found that areas with highest average densities were in Barrier and Don Cay, which is consistent with earlier surveys, and is consistent with surveys in other regions (e.g. Great Barrier Reef has highest population density in outer shelf and barrier reef (Benzie and Uthicke, 2003; Knuckey and Koopman, 2016).

The density in Cumberland in 2019/2020 was lower than in 2009 but still higher than historical surveys, and Seven Reefs had the highest density since surveys have been undertaken.

Darnley had the lowest density ever observed (though never a high-density zone in any year) and no Black teatfish were observed at the Great North East Channel zone (Figure 6; Murphy et al., 2021).

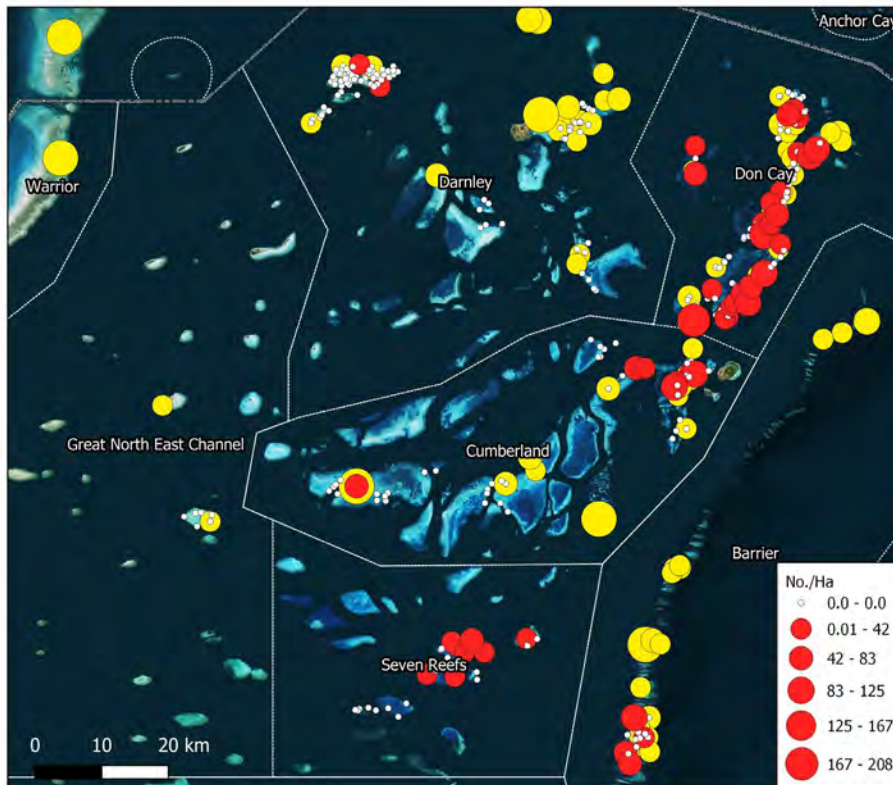
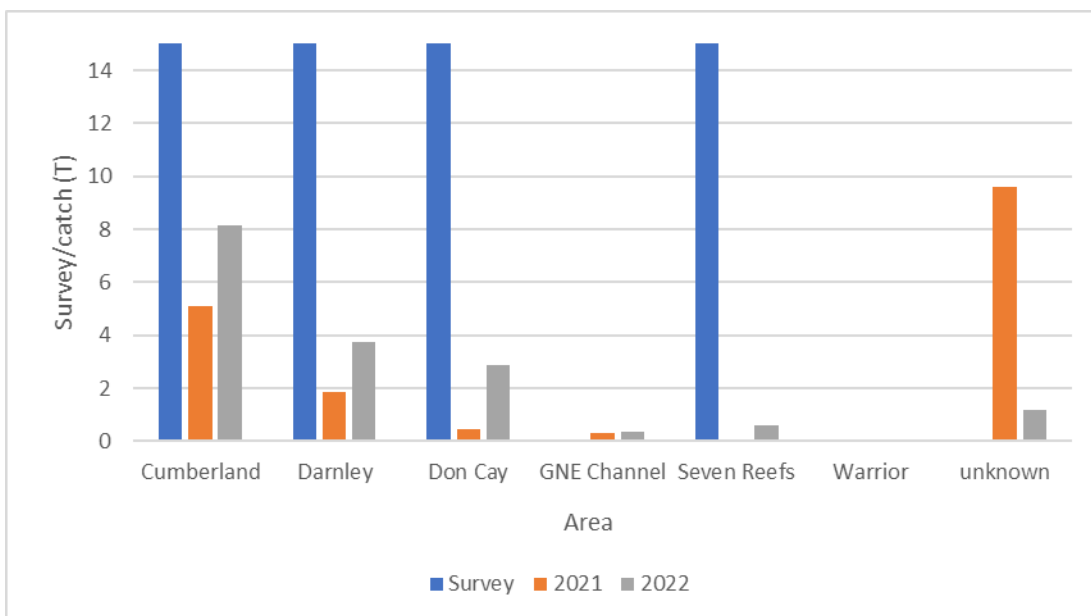
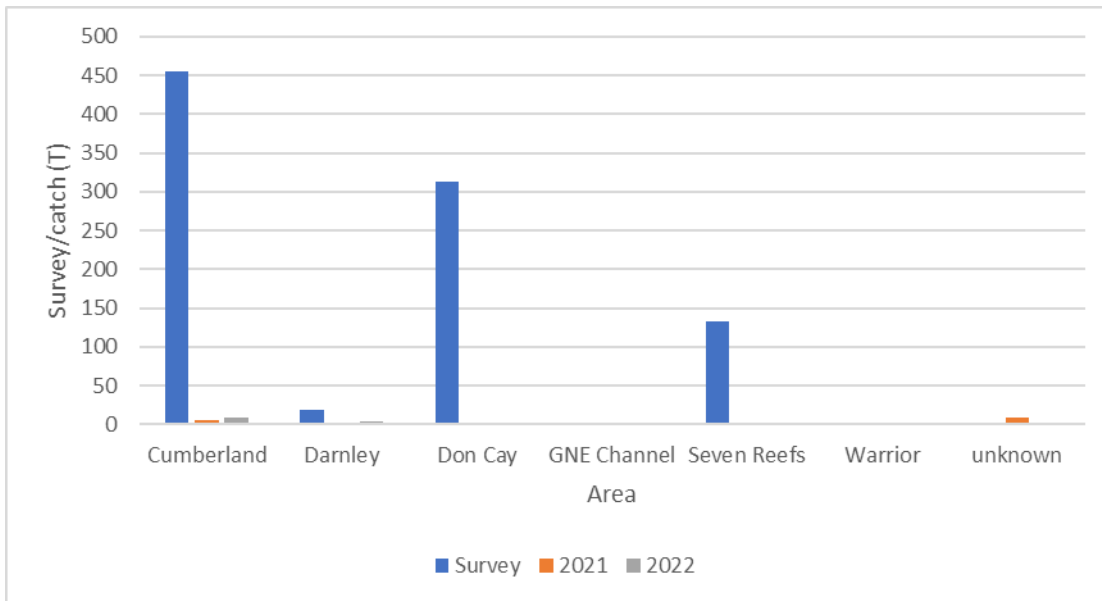


Figure 6. Density of Black teatfish (*H. whitmaei*) at individual survey sites during surveys in East Torres Strait from 1995 to 2009 (yellow) and 2019 (red).

### Survey versus catch data

The 2022 catch is modest in comparison to the 2019/2020 survey biomass estimate, even if all the Unknown catch was taken from any of the fished zones (Figure 7).



**Figure 7. Survey estimates (gutted weight - t) and catch (gutted weight - t) for logbook zones (bottom graph is the same at the top with a reduced (Y) scale).**

### Total daily catch

In 2021, the area noted 'Unknown' in catch records showed consistent catch effort over days fished. Cumberland was also fished consistently and it is likely that Unknown was taken from this logbook zone (Figure 8).

For 2022, consistent catch effort was seen for Cumberland and Darnley, with Don Cay fished more intensely on the first day, with less (but similar) effort for the remaining days (Figure 8).

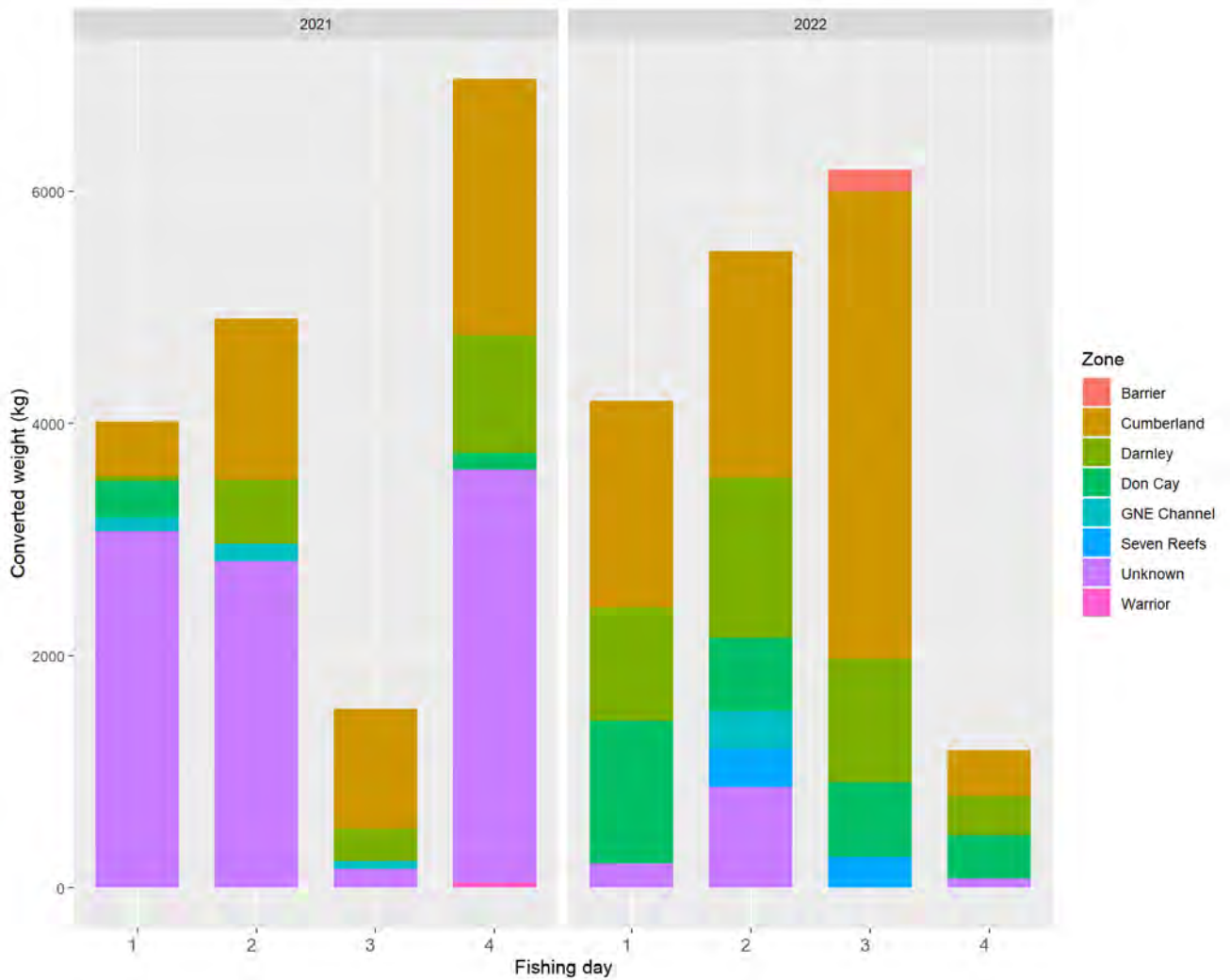
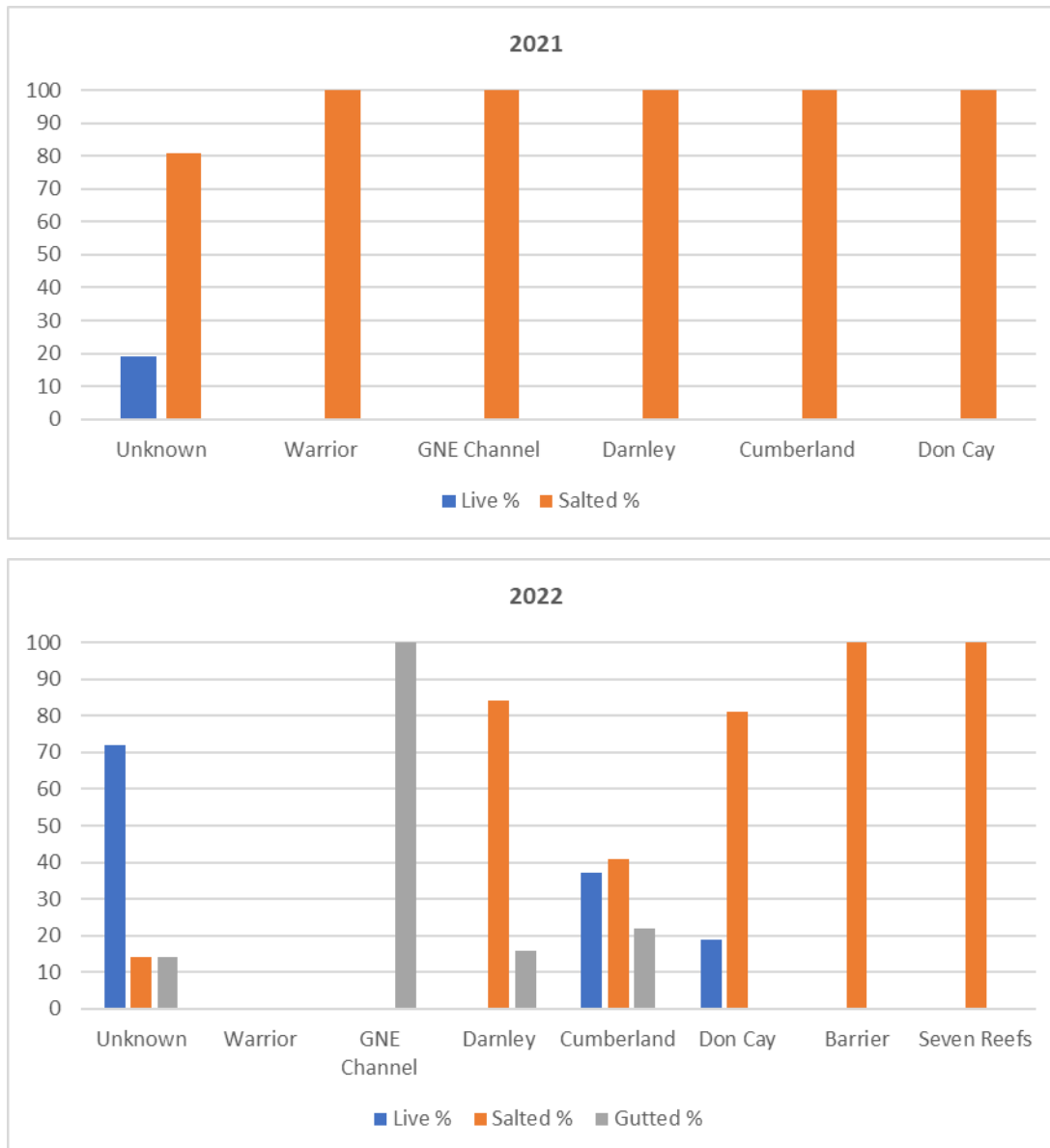


Figure 8. Total daily catch (converted weight – kg) across logbook zones for days fished, between years.

### Processing state

In 2021, the majority of product landed at fish receivers was salted, with ~20% live landed for one zone (Unknown) only (Figure 9).

For 2022, a greater variety of product types were landed. Gutted catch was recorded solely for the area of the Great North East Channel, as well as Unknown, Darnley and Cumberland. There was also live product landed for Unknown, Cumberland and Don Cay, which wasn't the case in 2021 (Figure 9).



**Figure 9. Percent product form of catch landed at fish receivers, also showing logbook zones for 2021 (top) and 2022 (bottom).**

## References

- Benzie JAH and Uthicke S. 2003. Stock size of *bêche-de-mer*, recruitment patterns and gene flow in black teatfish, and recovery of overfished black teatfish stocks in the Great Barrier Reef. Australian Institute of Marine Sciences, Townsville, Qld. 93 pp.
- Knuckey IA. and Koopman M. 2016. Survey to estimate the biomass and recovery of Black teatfish (*Holothuria whitmaei*) in Zone 1 of the Queensland Sea Cucumber Fishery (East Coast). Fishwell Consulting. 41 pp.
- Murphy NE, Plaganyi E, Edgar S, Salee K, Skewes T. 2021. Stock survey of sea cucumbers in East Torres Strait. Final report. May 2021. CSIRO, Australia. 138 pp.





# The utility of socioeconomic research for managing hand-collectible fisheries

Assoc.-Prof. Steve Purcell

National Marine Science Centre  
Southern Cross University, Australia

## Content

- Data for fisheries management
- Why use socioeconomic surveys to understand the fishery?
- Questionnaire-based interviews and data
- Management questions that can be answered for fishery management
  - Fishing practices
  - Catches
  - Income and livelihoods
  - Value-chain analysis
  - Preferences for regulations

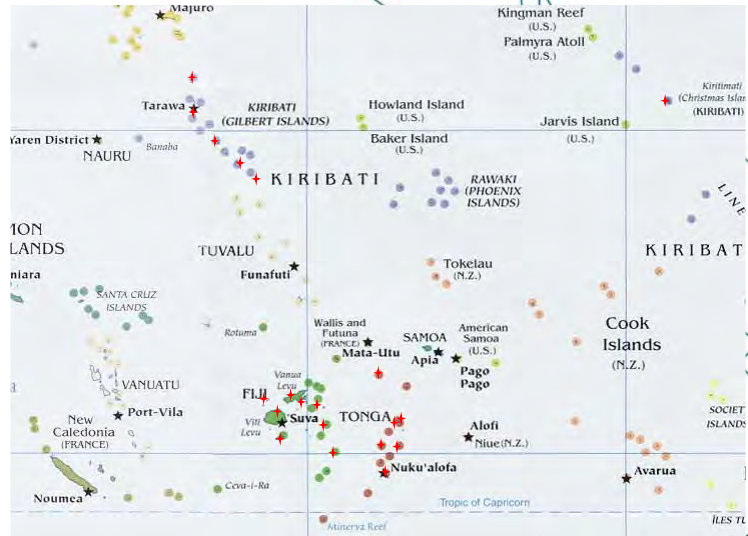


## Questionnaire-based surveys

Fiji, Tonga, Kiribati – for sea cucumbers



- Baseline questionnaire-based interviews of 453 fishers among 20 island regions across the three countries
- 278 fishers interviewed in follow-up surveys in Fiji



## Questionnaire-based surveys

Fiji, Tonga, Kiribati – for sea cucumbers



# Questionnaire-based surveys

## Samoa – for new trochus fishery



- Questionnaire-based interviews of 303 fishers among 34 villages



# Questionnaire-based surveys



**Fisher Questionnaire – Sea Cucumber Processing and Trade**  
(FAO/ICTA researchers to fill in during interviews)

Surveyor: \_\_\_\_\_ Date: / / Time start: \_\_\_\_\_  
Name: \_\_\_\_\_ Gender: female  male  age: \_\_\_\_\_  
Town/place of residence: \_\_\_\_\_

**Introduction to respondents:**

- Introduce who we are. Purpose of project.
- The questionnaire is part of a project to understand how you process the sea cucumbers you catch, so that we can find the best ways of providing you with training on optimal processing methods and modes for the sale of the processed animals. It will take about 30 mins.
- This study is funded by the Australian Centre for International Agricultural Research. It is conducted by a university researcher from Australia and officers from the national fishery agency.
- Your responses are completely voluntary. If you do not want to respond to a question, or feel uncomfortable about responding, you do not have to respond.
- Your personal information will not be shown to anyone other than the researchers in this project – so your personal responses will not be available to other fishers or processors. Our results will only show grouped information from villages or regions, not individuals. Your name is taken just in case we need to contact you again, and you may expect to not disclose it.

**Type and location of fishing**

1. Do you only fish commercially for sea cucumbers or do you also fish other resources?  
Only sea cucumbers:  Other resources too:

2. What type of fishing do you do for sea cucumbers?  
Benthic hand diving:  SCUBA or hookah diving:   
Gleaning by wading in shallow water:  Use of lead beach with barb:   
Other:  explain: \_\_\_\_\_

**Fishing effort**

3. Over the past year, how many days did you fish sea cucumbers each week, on average, during fishing months? \_\_\_\_\_ days per week.

4. Were there some months that you didn't fish? If so how many months per year not fishing? \_\_\_\_\_  
If you didn't fish some months, why? \_\_\_\_\_

5. Now we just want to know about your transport time. On your fishing trips, how many hours are spent to get to and from the fishing site, i.e. not including the fishing time? \_\_\_\_\_ hours.

6. When you are fishing, how many hours per day would you spend in the water fishing sea cucumbers? \_\_\_\_\_ hours. How many days per average trip? \_\_\_\_\_ days.

7. On a normal day during the past year, how many people would you fish sea cucumbers with? \_\_\_\_\_  
Are all of them fishing too? Yes  No  number fishing \_\_\_\_\_

8. During the past year, how many fresh sea cucumbers would you normally catch on average per day? \_\_\_\_\_ kg / pieces. In this period weight? Yes  No   
Is this average amount (or weight) just what you personally caught? (If no, revise answer above)

**The catch**

9. Which species of sea cucumbers do you collect? (Frequency: 1 = seldom, 2 = sometimes, 3 = often)

Species	Frequency (1, 2, or 3)	Frequency (1, 2, or 3)	
White seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Genesfish (cf. <i>Chelodactylus</i> )	<input type="checkbox"/>
Black seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Ambarfish (cf. <i>Ambar</i> )	<input type="checkbox"/>
Pinkish seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Chalkfish (cf. <i>Chalkfish</i> )	<input type="checkbox"/>
Shrimplike seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Spottedfish (cf. <i>Spottedfish</i> )	<input type="checkbox"/>
Deepwater seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Red seafish (cf. <i>Redsea</i> )	<input type="checkbox"/>
Many blackfish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Lobfish (cf. <i>Lobfish</i> )	<input type="checkbox"/>
Parrot's blackfish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Pinkfish (cf. <i>Pinkfish</i> )	<input type="checkbox"/>
Soft seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Golden sandfish (cf. <i>Golden</i> )	<input type="checkbox"/>
Shrimplike seafish (cf. <i>Asaphoteuthis</i> )	<input type="checkbox"/>	Semirabbit (cf. <i>Semirabbit</i> )	<input type="checkbox"/>
Leopardfish (cf. <i>Leopardfish</i> )	<input type="checkbox"/>	White threadfish (cf. <i>White</i> )	<input type="checkbox"/>
Brown sandfish (cf. <i>Brown</i> )	<input type="checkbox"/>		
Catfish (cf. <i>Catfish</i> )	<input type="checkbox"/>		

**Processing**

10. Do you eat sea cucumbers? Often (each week)  Sometimes  Rarely  Never

11. Do you process the sea cucumbers you collect? Yes  No  If no, go to Q11

12. Did somebody train you to process (partially) the sea cucumbers?  
No  Fishery officer  A town processor  Export agent  Other: \_\_\_\_\_

13. Have you seen or received any pamphlets or published material about how to process sea cucumbers?  
No  Poster  CD/DVD  Sample manual  Other: \_\_\_\_\_

14. What sort of fuel do you use to cook them?  
Wood  Kerosene  Bottled gas (Butane/propane)  Other: \_\_\_\_\_

Around 30–45 min

Mostly 'fully structured', although some qualitative notes also taken



# Questionnaire-based surveys



Fisher number (replicate)	1	2	3	4	5	6
ID Region	3					
Region name	Vava'u					
Waypoint number or coordinates	64					
Date of interview	19/04/2011					
Surveyor	Steve					
Fisher name	Sione Pahulu					
Gender	M					
Age	44					
Town of residence	Mata Maka					
Fishes only sea cucs?	0	0 = not used 1 = used				
Breath-hold diving	1					
Gleaning by wading	0					
SCUBA or hookah	0					
Use of lead bomb	0					
Other type of fishing	0					
Av days per week fishing	5	F = fishery was closed season R = had rest or vacation or sick C = ceremonies or cultural reason W = had other work B = bad weather O = other				
Number of months not fishing	7					
Reason for not fishing	F					
Hours round-trip travel to fishing site	8					
Hours per day in water fishing	6					
number of days per trip	3					
How many people fishing with?	4.5					
Av. N° sea cucs he/she collected per day	60					
Frequency white leaffish	2	1 = seldom/rarely 2 = sometimes 3 = often				
Frequency black leaffish	3					
Frequency Prickly redfish	2					
Frequency stonefish	2					
Frequency Deepwater redfish	0					
Frequency Hairy blackfish	3					
Frequency <i>A. palauensis</i>	0					

# Questionnaire-based surveys



Replicate	Fisher number	Waypoint	Date	Surveyor	Fisher name	Gender	Age	Town	Fishes only sea cucs?	Breath-hold diving	Gleaning by wading	SCUBA or hookah	Use of lead bomb	Other type of fishing	Av days per week fishing	Number of months not fishing	Reason for not fishing	Hours round-trip travel to fishing site	Hours per day in water fishing	number of days per trip	How many people fishing with?	Av. N° sea cucs he/she collected per day	Frequency white leaffish	Frequency black leaffish	Frequency Prickly redfish	Frequency stonefish	Frequency Deepwater redfish	Frequency Hairy blackfish	Frequency <i>A. palauensis</i>
1	1	64	19/04/2011	Steve	Sione Pahulu	M	44	Mata Maka	0	1	0	0	0	0	5	7	F	8	6	3	4.5	60	2	3	2	2	0	3	0
2	2	64	19/04/2011	Steve	Sione Pahulu	M	44	Mata Maka	0	1	0	0	0	0	5	7	F	8	6	3	4.5	60	2	3	2	2	0	3	0
3	3	64	19/04/2011	Steve	Sione Pahulu	M	44	Mata Maka	0	1	0	0	0	0	5	7	F	8	6	3	4.5	60	2	3	2	2	0	3	0
4	4	64	19/04/2011	Steve	Sione Pahulu	M	44	Mata Maka	0	1	0	0	0	0	5	7	F	8	6	3	4.5	60	2	3	2	2	0	3	0
5	5	64	19/04/2011	Steve	Sione Pahulu	M	44	Mata Maka	0	1	0	0	0	0	5	7	F	8	6	3	4.5	60	2	3	2	2	0	3	0
6	6	64	19/04/2011	Steve	Sione Pahulu	M	44	Mata Maka	0	1	0	0	0	0	5	7	F	8	6	3	4.5	60	2	3	2	2	0	3	0

## General characteristics of fishers in the fishery?

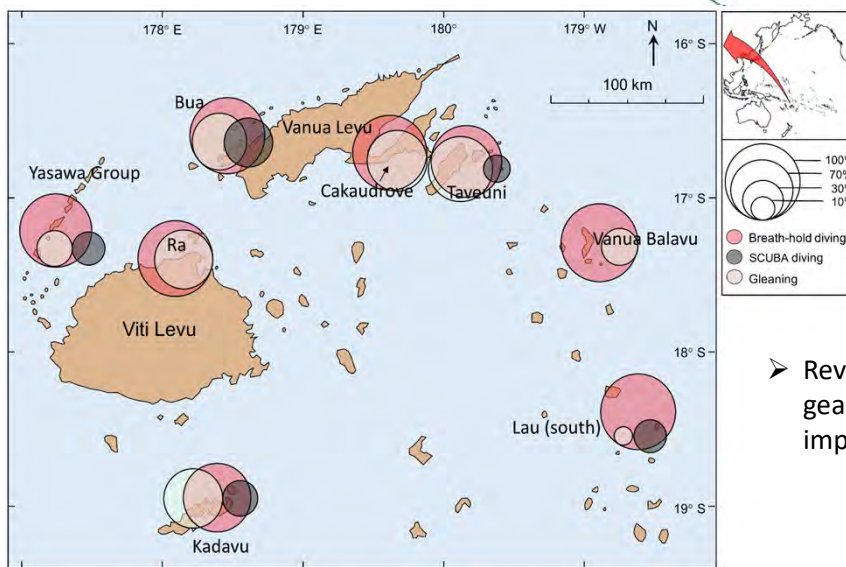


➤ Understand *who* is fishing

### Characteristics of respondents

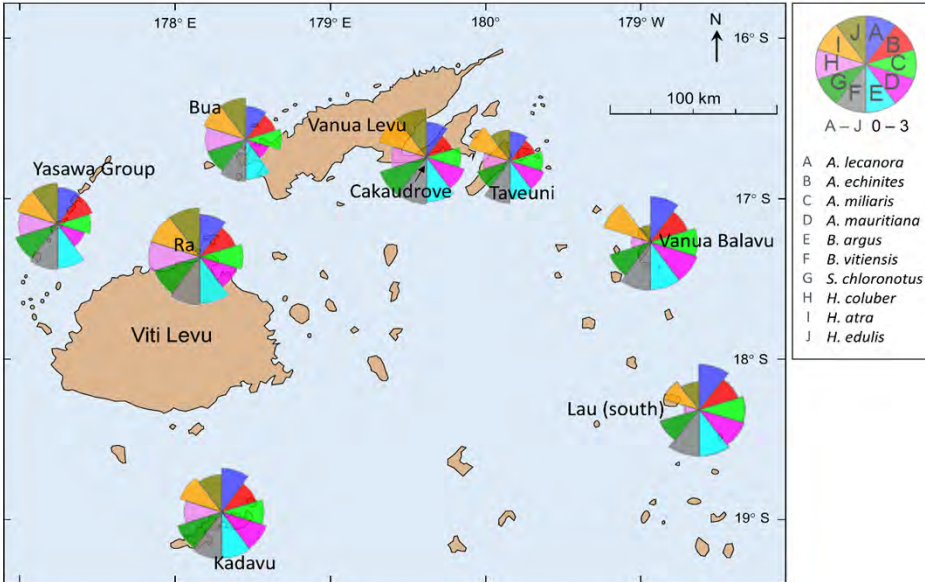
Location	Respondents (n)	Average age	Age range	% Males	Av. Experience (years fishing)
Kiribati	84	36	17–68	99	5
Tonga	134	40	15–67	81	7
Fiji	235	38	18–73	74	11
New Caledonia	26	42	19–67	85	8

## What fishing methods are being used?

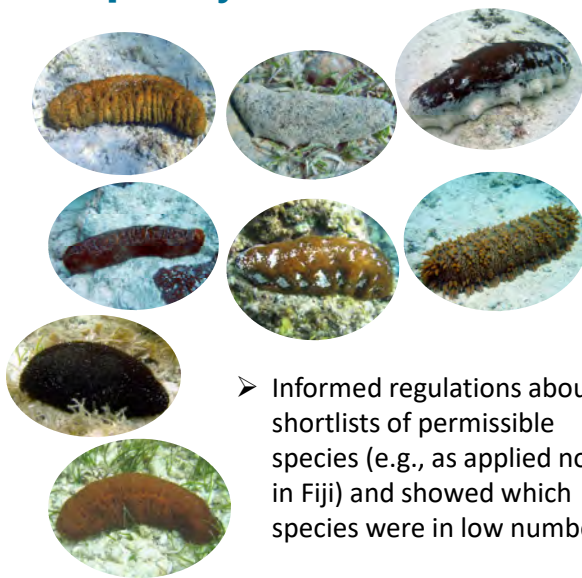


➤ Reveals the locations where gear restrictions would impact fishers the most.

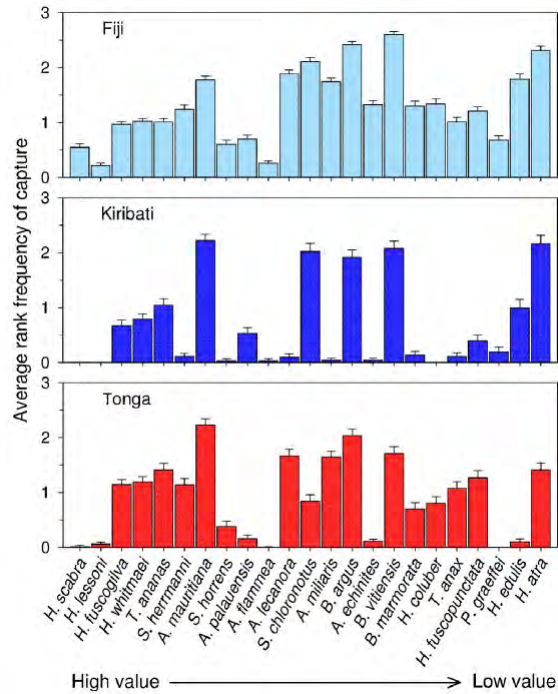
## What species are being caught where?



## What species are caught most frequently?

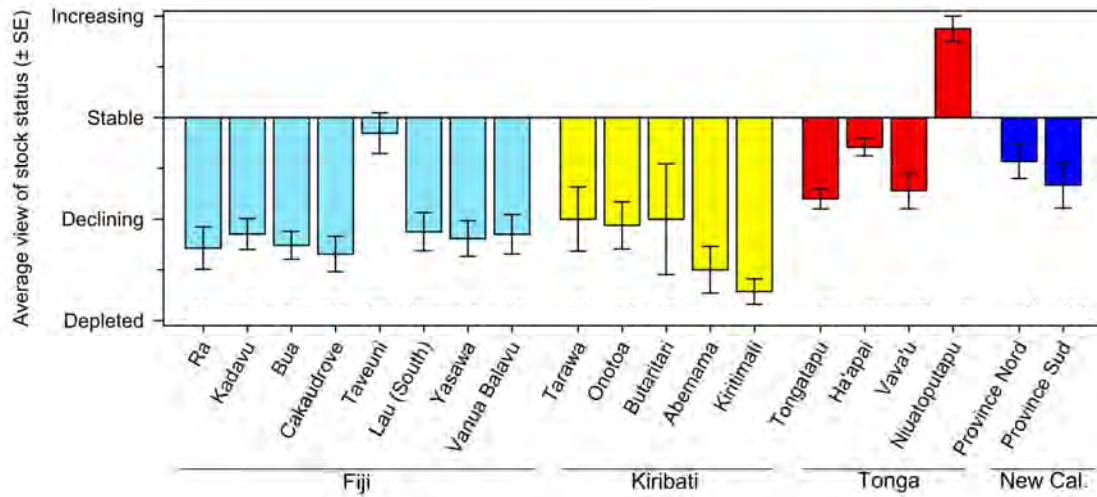


➤ Informed regulations about shortlists of permissible species (e.g., as applied now in Fiji) and showed which species were in low numbers.





## What do fishers think about stocks?

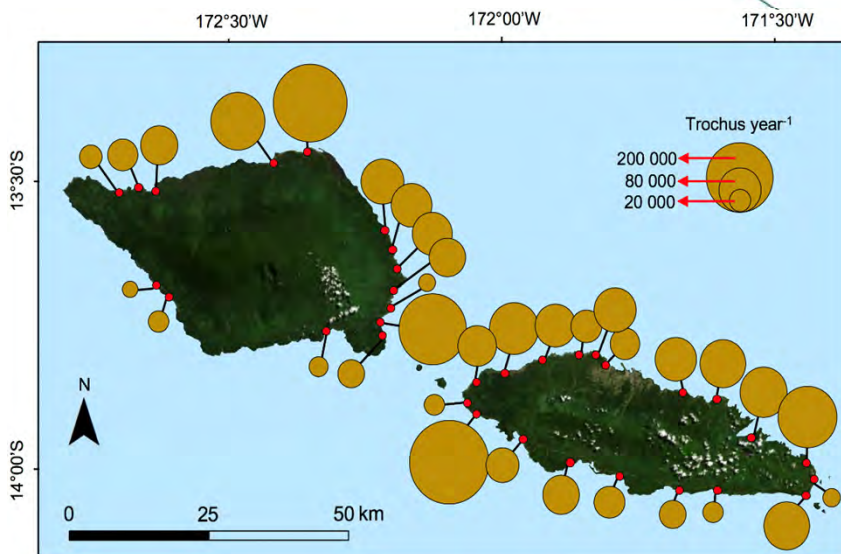


➤ Used as a gauge of stock status in different locations.

## Where are catches greatest?



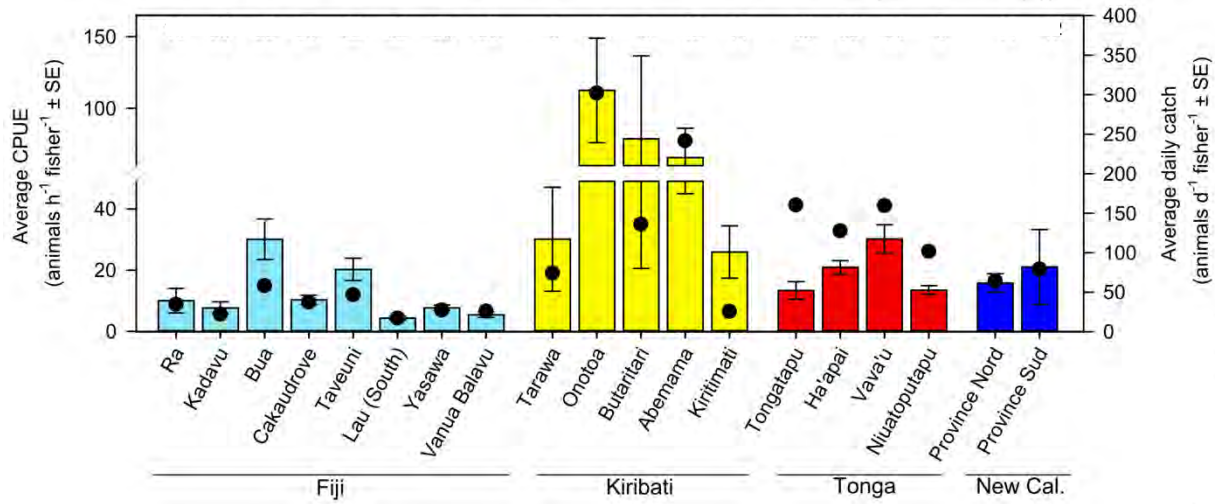
Annual catch (number of trochus) per village surveyed



## What about catch rates?



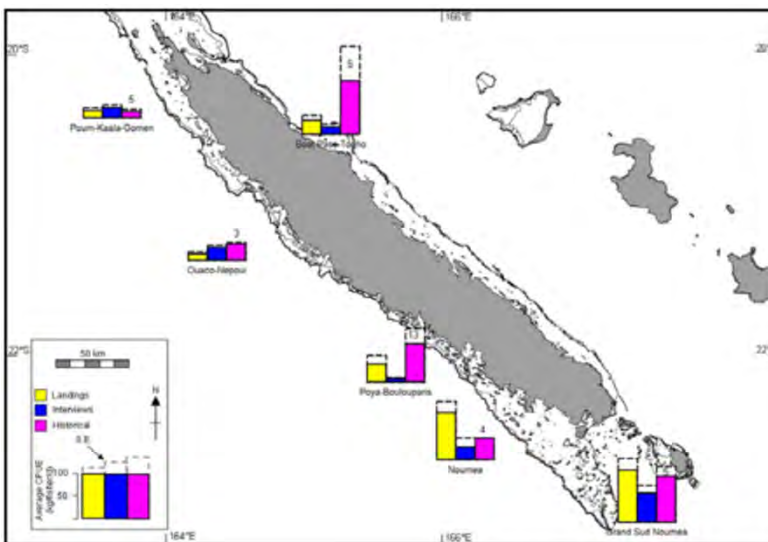
Catch-per-unit-effort (CPUE)



## What about catch rates?



Catch-per-unit-effort (CPUE)



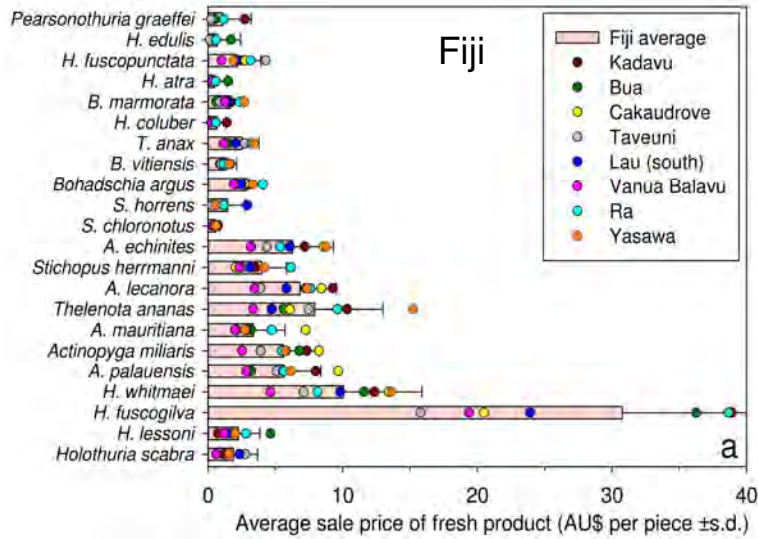
- CPUE data and fisher knowledge give an insight into abundance trends over time.
- Collected cheaply!



## How variable are sale prices among locations?



Variation in sale prices for fresh sea cucumbers

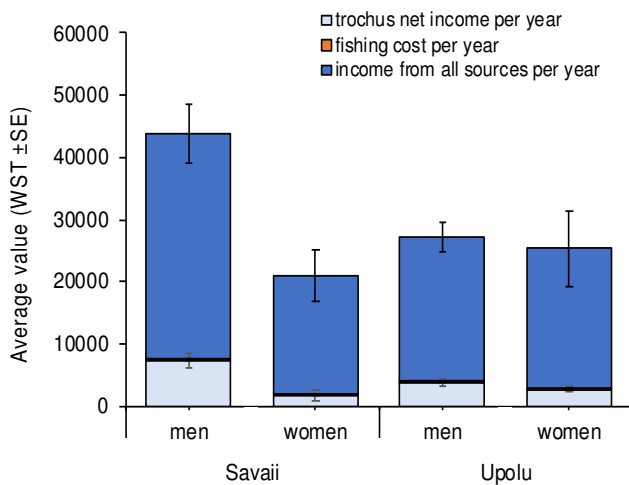


- Inconsistency in prices among locations.
- Outliers

## What is the economic importance to overall annual income of the fishers?

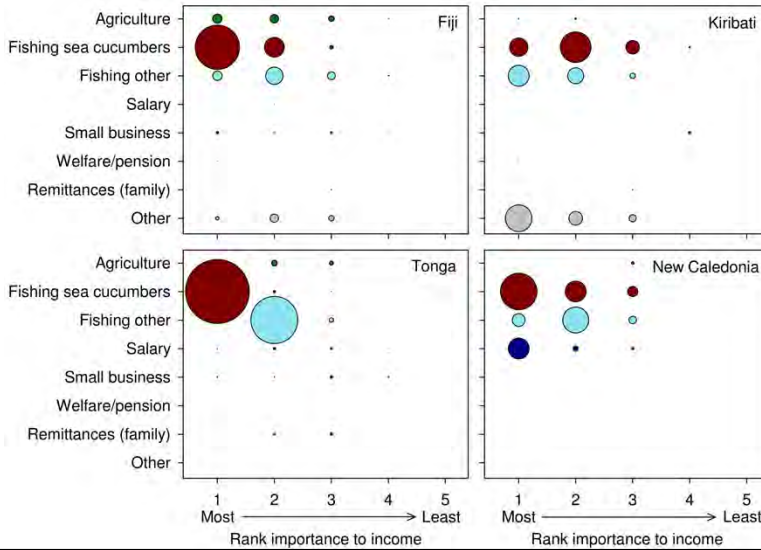


Trochus fishery in Samoa



- How dependent fishers are on a fishery.
- How bans or other fishery restrictions would impact their livelihoods.

## How dependent are fishers on income from fishing sea cucumber?

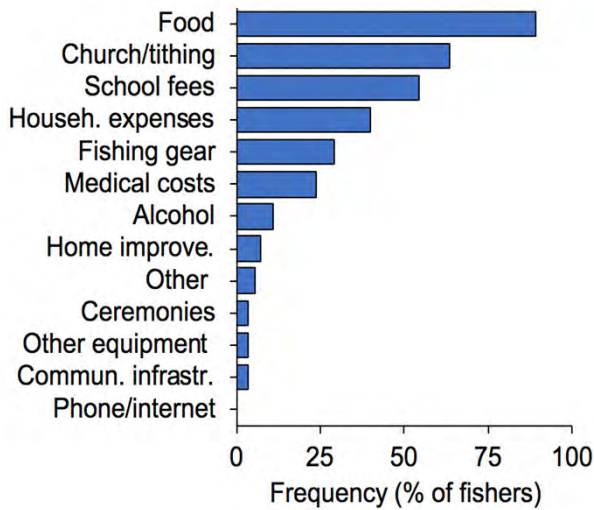


- Locations where fishers most dependent on the fishery.
- What other livelihoods they have to rely upon.

## What is the fishery income spent on?



The fishery fostered positive wellbeing outcomes



- How fishery income contributes to wellbeing of fishers and their communities

## What is the overall value of the fishery?



### Bioeconomic analysis for 2018 fishing of trochus in Samoa

- 7.0 ( $\pm 2.3$ ) million trochus were harvested across 170 villages
- Annual income from trochus flesh:
  - AUD \$830,000 domestically



- What the fishery is worth

## What is the estimated carbon emission from the fishery?

- 72 million finfish are caught annually by recreational fishers in Australia



### Fiji's sea cucumber fishery (just boat fuel)

- 8050 tonnes CO<sub>2</sub> ( $\pm 750$ ) per year

### Samoa's trochus fishery (just boat fuel)

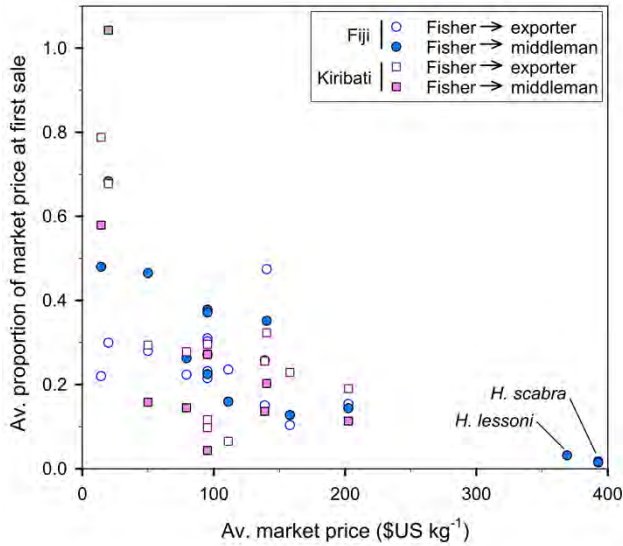
- 20 tonnes CO<sub>2</sub> ( $\pm 3$ ) per year



- How impactful the fishery is on national emissions

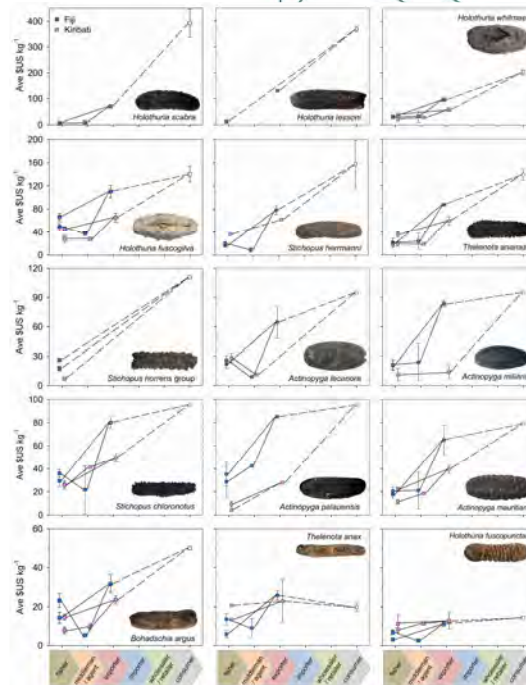
- Fishing practices emitting the most CO<sub>2</sub>

## Value chains: How much of the export value are fishers actually getting for various species?



- Greater transparency about prices was needed
- Support to help 'upgrade' the position of fishers in value chains

## Value chains: How much value of the product is taken by fishers compared to middlemen, exporters and retailers?



- Informing fishers about prices can empower them for bargaining with buyers
- Can highlight opportunities for capacity-building training



## Capacity building workshops

### Value-adding of trochus shells

- 5-day workshops held in four locations in Samoa



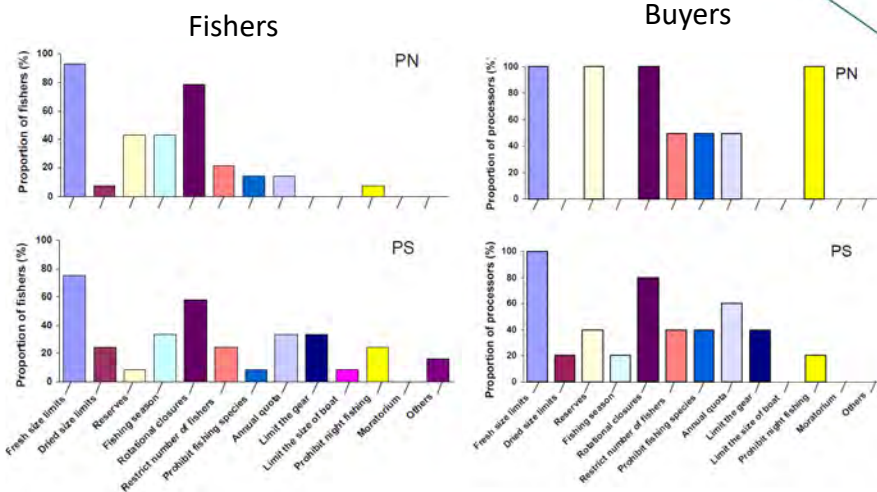
## Capacity building workshops

### Postharvest processing of sea cucumbers

- 1½ day workshops held in 90 villages in Fiji, Tonga and Kiribati



# What regulations are most favoured by fishers and buyers?



➤ Shows which regulations are most compatible with fishers and buyers

**Rebutals Research**

**Trends in small-scale artisanal fishing of sea cucumbers in Oceania**

Steven W. Purcell, Phyllis Ngululu, Katherine E. Ryan, Melissa Labadie

**Marine Policy**

**Distribution of artisanal catches in small-scale fisheries for commercial markets: A catch-class analysis**

Steven W. Purcell, Melissa Labadie, Katherine E. Ryan, Phyllis Ngululu

**ICES Journal of Marine Science**

**Original Article**

**Small-scale fishing income and fuel consumption: Fiji's artisanal sea cucumber fishery**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

**Discriminating Catch Composition and Fishing Modes in an Artisanal Multispecies Fishery**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

**Variation in postharvest processing of sea cucumbers by fishers and commercial processors among three Pacific Island countries**

Steven W. Purcell, Melissa Labadie, Katherine E. Ryan, Phyllis Ngululu

**2 Fisher perceptions about abundance and catch rates of sea cucumbers in Fiji**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

**Socioeconomic impacts of artisanal diversification from small-scale fishery development**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

**Understanding Gender and Factors Affecting Fishing in an Artisanal Shellfish Fishery**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

**Status and management of the sea cucumber fishery of La Grande Terre, New Caledonia**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

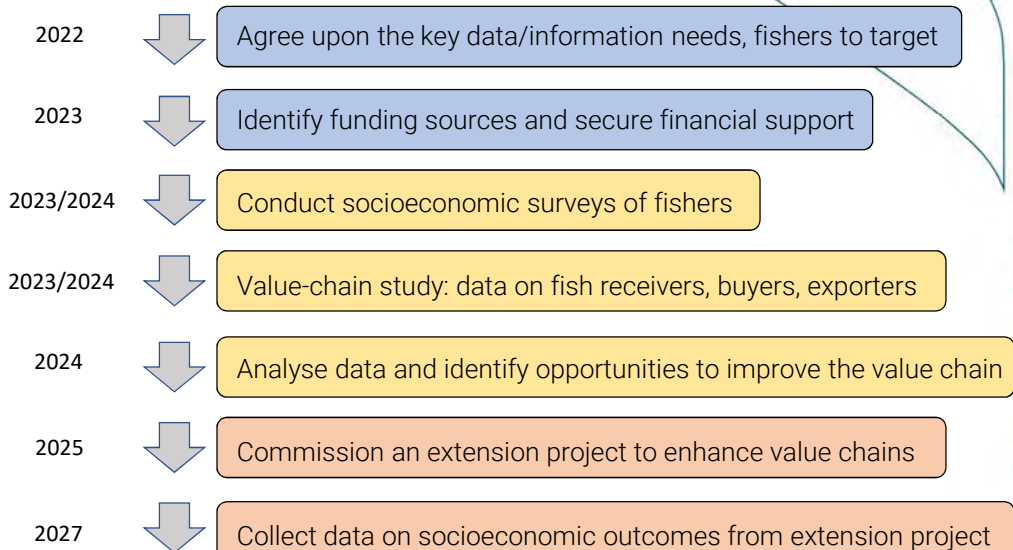
**Multiple Factors Affect Socioeconomics and Wellbeing of Artisanal Sea Cucumber Fishers**

Steven W. Purcell, Melissa Labadie, Phyllis Ngululu, Katherine E. Ryan

## Identify data needs

- Fishing practices/methods
- Fishing areas and habitats
- Experience
- Perspective on stock health/abundance
- Gender representation and roles
- Catch volume and catch composition
- Catch-per-unit-effort
- Travel and fishing costs
- Boat type and carbon emissions
- Postharvest processing
  - Methods used
  - Existing training and future needs
- Income from sea cucumbers and other fishing
- Rank dependency
- Income from non-fishing sources
- Expenditure of fishing income
- Value-chain and supply-chain analysis
  - Time spent processing
  - Who is product sold to
  - Problems with sales
  - Prices at sale
  - Satisfaction with income
  - Interviews with buyers
- Views on current management of fishery
- Preferences for regulations
- Recall of catch rates in past

## Advancing this work





Our vision

Empowering our people,  
in our decisions, in our culture,  
for our future



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# Balancing the Dimensions of Sustainable Beche de Mer (BDM) Fisheries Management:

.....continuing the discussions



# TSRA and Fisheries Program

## IMPACT:

Enhance the region's wealth by managing and maintaining sustainable fishing industries and increasing employment and economic opportunities for our people.

## STRATEGIES

- 100% ownership of fisheries
- Increased access and capacity to use fisheries
- Contribute to sustainable fisheries management
- Improved engagement and effectiveness of fishers in fisheries management
- TS Communities, Infrastructure, Services And The Sea Are Climate Resilient



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# DIMENSIONS OF SUSTAINABLE FISHERIES



# Highly Regulated Fishery Management

FISHERIES  
POPULATION  
DYNAMICS  
EFFECTIVELY  
MANAGED

- Three tiered system of harvest control via Torres Strait Beche de Mer Fishery Harvest Strategy 2019: graduated system of economic exploitation based on quality of data inputs and outputs
- Multi indicator framework for TAC decisions : CPUE, SIZE DISTRIBUTION, SPATIAL DISTRIBUTION, CATCH RECORDS
- Good history of stock assessment and density surveys : six since 1995 to 2021
- Input controls: no hookah, dinghy 7m, hand only
- 159 TIB licenced fishers connected to 80 BDM lic fish receivers
- Summary status defined for each key species
- Ecological Risk Assessment completed: no impacts

# Sea Cucumbers: ecological services

- Sea cucumbers excrement may help to offset increased acidity from climate changes (release carbonates into water)
- Nutrient and organic matter recycling in sea beds and fish ponds: 'earthworms of the sea'
- Part of the food chain ecosystems: prey and predator
- Symbiotic relationships with molluscs and crustacea
- Promoting biodiversity in marine ecosystems
- The draft Ecological Risk Assessment assessed impacts on BDM Fishery as minor or negligible scores and the low overall risk for the ecological impacts for the effects of fishing:

*Selective hand collection, no by catch or by products*

MARINE  
ECOLOGY AND  
ENVIRONMENT  
NOT  
THREATENED

# Torres Strait Islanders traditional owners of fisheries

TOs own 100 % of the fishery

SOCIAL AND  
CULTURAL  
NEEDS  
ADDRESSED

As owners they should:

- Benefit from the fishery economically through fishing and business activities
- Make decisions on the management of the fishery and regulations to control it
- Initiate and /or be actively engaged and approve changes to any decisions or rules
- Use traditional knowledge on harvesting and uses of the BDM species
- Apply customary and traditional laws as they need to



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# Climate change threats for BDM

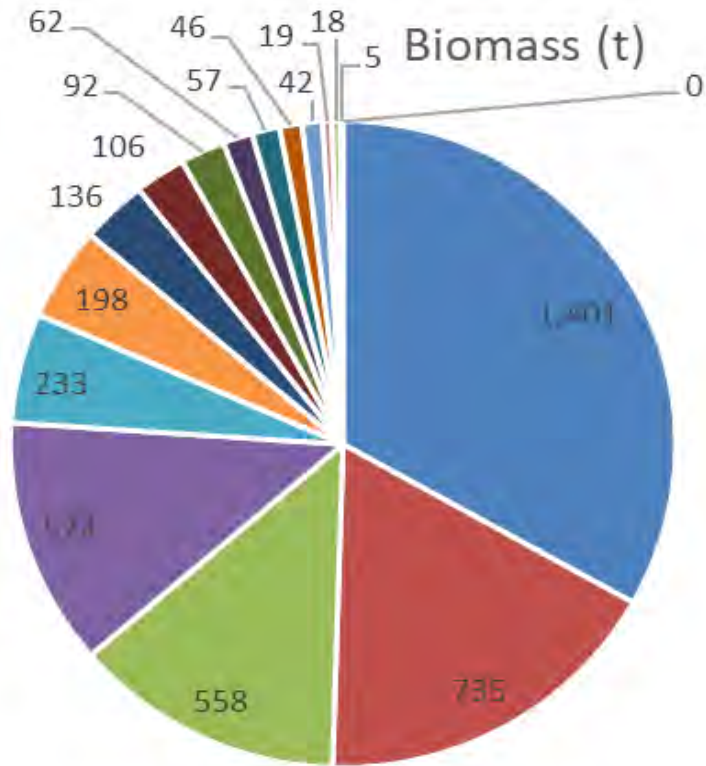
KEY CHANGES EXPECTED FROM CLIMATE CHANGES in North Eastern Australia: based on high carbon emissions model RCP8.5, 2090

- **Increased surface sea temperature**: 2.2 to 5.7 degrees C
- Highly variable rainfall: -62% to + 44% changes
- **Storms and cyclones** : likely to intensify
- More acidic oceans, salinity increases
- Sea level rises 0.38 to 0.88 metres
- Changes in ocean currents and circulation
- Extreme rain and heat wave events
- **BDM highly vulnerable to increased sea temperatures and increased acidity**
- **Some species in shallow water more susceptible to temperature increase**

CLIMATE CHANGE  
RESILIENCE  
THROUGH  
ADAPTATIONS  
AND  
MITIGATIONS

**CLOSED:** sandfish, surf redfish  
**TARGET SPECIES:** black teat fish, white teat, prickly red, hairy black, green fish, deep redfish.  
 Curry fish  
**BASKET SPECIES:** all others

**SECURE AND VIABLE LIVELIHOODS AND BUSINESSES**



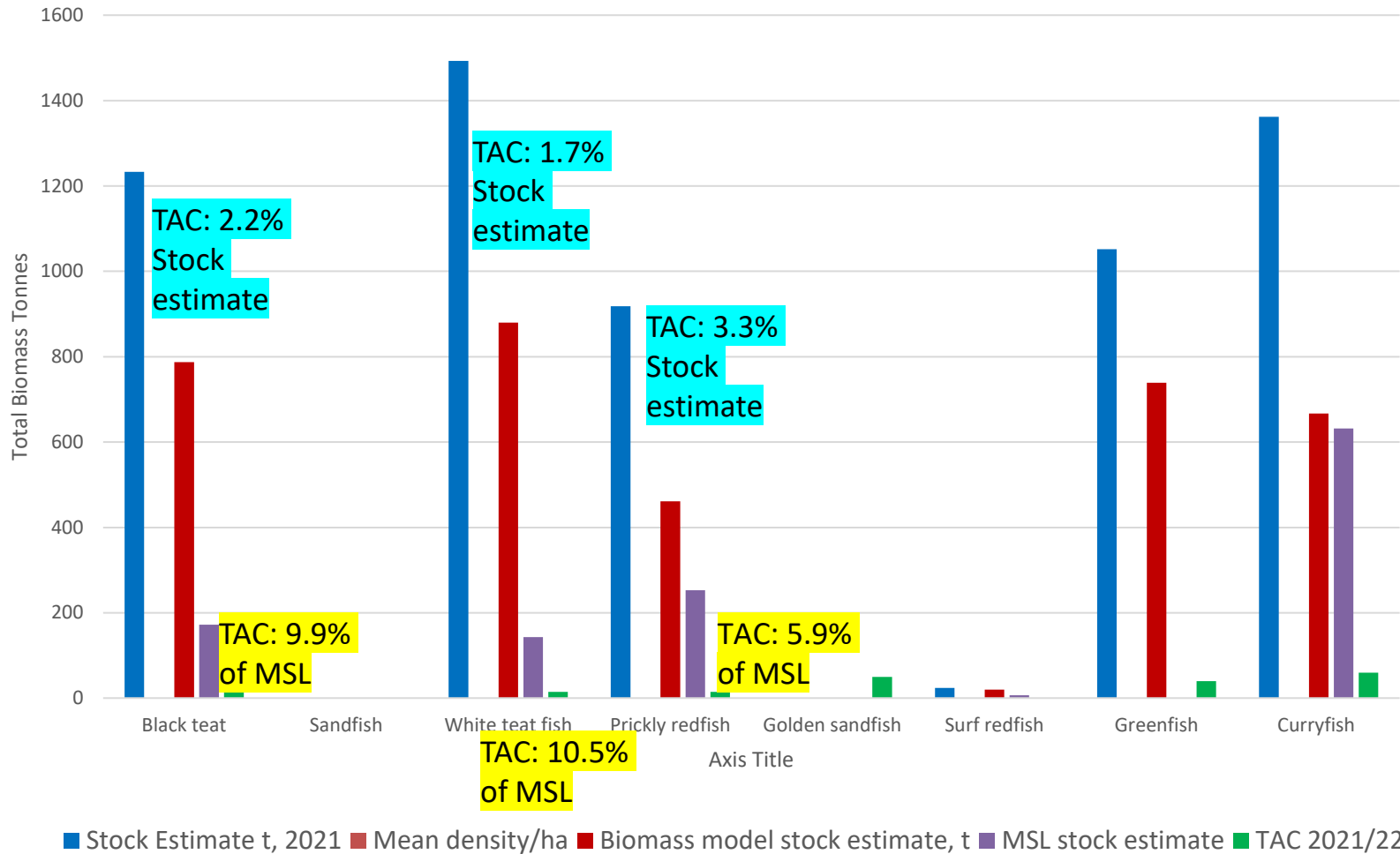
- Lollyfish
- Curryfish
- Greenfish
- Tigerfish
- Black teatfish
- Prickly redfish
- Amberfish
- Curryfish (vastus)
- Redfish
- Elephant trunkfish
- Deepwater redfish
- Snakefish
- White teatfish
- Blackfish
- Flowerfish
- Surf redfish
- Brown sandfish

**TAC INCREASES possible for white teatfish,**  
**NO CONCERN FOR TAC FOR:**  
**deepwater redfish, amberfish, leopard fish**

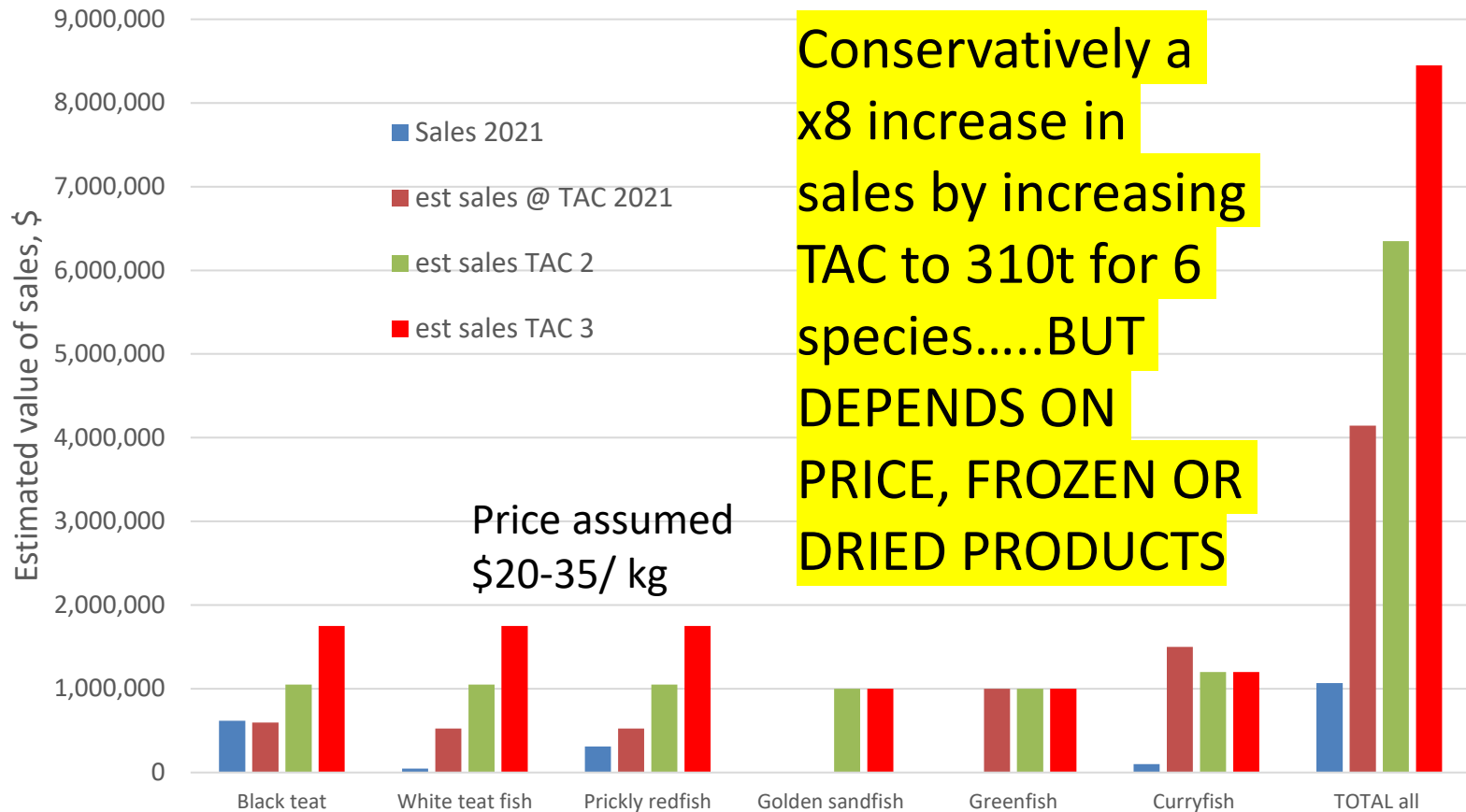
From TS BDM harvest strategy Nov 2019



# Measures of BDM stock estimates



# Estimated value of sales for different TAC scenarios



Actual catch 2021 TOTAL **39 TONNES** (6 SPECIES)

Scenario TAC 2021/22 **197 tonnes**

Scenario 2: TAC 2 **250 TONNES**

Scenario 3 TAC 3 **310 TONNES**

# Market system constraints and opportunities

RESILIENT  
MARKET  
SYSTEM  
ESTABLISHED

## FROM FRDC Report 2019:Market constraints TS

- Direct exporting is the preferred model with value benefits to fishers limited.
- Profits tend to be made by the ‘middle man’ or the wholesaler who buys direct from the TSF and then on-sells product to domestic or Chinese buyers
- Lack of market differentiation and branding of product in domestic markets or overseas export markets
- No control over where or how the product is marketed, no market information, poor market linkages
- Key barrier to development of TS fishery is the additional cost of reaching markets and the cost of doing business from a remote location

# MARKET NOTES Purcell et al 2018

- Consumer demand for healthy and safe foods in China has expanded the markets for mid- and low-value beche-de-mer consumed in everyday meals.
- Largest proportional increases in prices were for previously low- and medium-value species such as Curry fish, Brown sandfish and Elephant trunkfish
- Retail prices high-value beche-de-mer species White teatfish Golden sandfish and Sandfish increased exponentially with body length
- The higher values attained for large individuals of several high value species should provide adequate economic rationale for implementing large minimum size limits for several sea cucumber species harvested from the Indo-Pacific region.

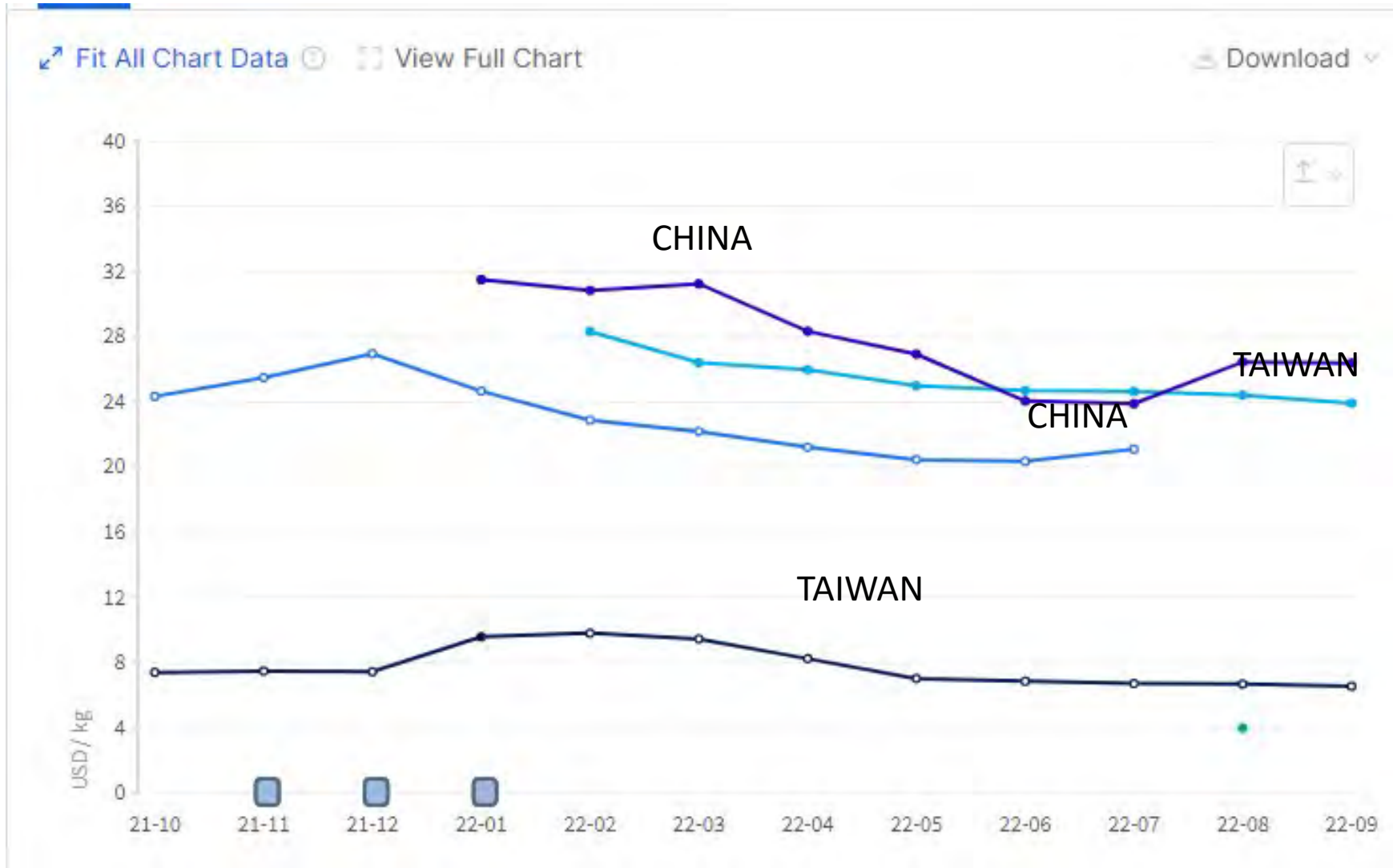


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# WHOLESALE MARKET PRICES PAST 12 MONTHS SEA CUCUMBER dried. [tridge.com/intelligences/sea-cucumber](https://tridge.com/intelligences/sea-cucumber)



**FRDC, Honey and Fox 2019: The product/market priority ranking resulting from the assessment of attractiveness and difficulty**

<b>Product (species and form)</b>	<b>Market</b>	<b>Ranking</b>
<b>ROCK LOBSTER LIVE</b>	CHINA/HONGKONG	1
<b>SEA CUCUMBER DRIED AND SALTED</b>	HONG KONG /SINGAPORE	2
<b>FINFISH FROZEN, CHILLED</b>	AUSTRALIA DOMESTIC	3
<b>ROCK LOBSTER FROZEN TAILS</b>	CHINA/HONGKONG	4

# Historical Research on TS Fishery Market Development

- Honey and Fox studies and reports for TSRA

Cultural Insights Desktop Market Research
Business Model and Stakeholder Analysis Market Research
Supply Chain Analysis Report (Public Version)
Torres Strait Brand Strategy
Torres Strait Brand Concepts
Product Marketing Priorities
TSF Infrastructure Review and Gap Analysis
Torres Strait Exporters Handbook

- Aquaculture studies and reports TSRA/ FRDC ...aquaculture new ventures and potential
- FRDC Report May 2019. Assessing Direct Export Feasibility, Marketing and Branding Opportunities for Torres Strait Fisheries Derived Products



## **Marketing and Branding Strategy ALLREADY DEVELOPED**

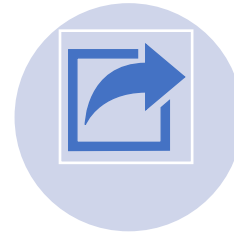
- A luxury differentiation strategy was determined as the best strategy for Torres Strait products due to the unique selling propositions of the following;
  - • Hand caught – natural harvesting
  - • Ecological sustainability
  - • History and culture
  - • The stories – 100 islands, 100 totems



# FRDC report and Honey and Fox studies (2019) demonstrated that:



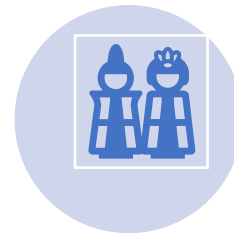
There is an opportunity and a willingness to develop a unified collaborative brand for the Torres Strait fisheries



Direct export is possible, but it will require investment in market development, supply chain establishment, export infrastructure and capacity building



The cost-benefit analysis shows that investing in these areas will provide a positive rate of return.



There is a willingness among the TSF to undertake direct export with a branded Torres Strait product

# From Torres Strait Fisheries Summit 2018 Final Presentation

## Create the TS Joint Seafood **Vision** 2030

1. **Engage Fishery Communities** to drive sustainable harvest of key species
2. **Engage Investment Partners** who can deliver Infrastructure (communications, logistics, skills, regulatory support)

## Build the TS Seafood Development **Plan**

1. **Establish** a TS Seafood Industry **Entity**, and management team
2. **Engage key supply chain and market partners**
3. Create a **unique TS seafood value proposition and brand**

## Prove up **Investment** Feasibility and Returns

1. Sustainable **Harvest** commitments
2. Product, process and chain **specifications and quality**
3. Fixed and working **capital** required
4. **Market** prices and margins
5. Long term **returns** on investment
6. TS **community dividends** – social, cultural and financial

**TORESS STRAIT FISHERY MARKET SYSTEM**

**MARKET LINKAGES**

**FISHERY ASSOCIATIONS**

**WAPIL PROJECT**

**SUPPORTING FUNCTIONS**

**ZKF OPERATIONS**

Infrastructure

Skills and technology

**WAPIL PROJECT**

**INFORMING, COMMUNICATING, ENABLING**

**TSSAC, RESEARCH PARTNERS AND AGENDA**

Information

Related services

**ACCESS TO FINANCE**

**CLIMATE CHANGE RESILIENCE**

**SUPPLY**

**CORE**

**DEMAND**

**QUALITY STANDS, FOOD SAFETY**

Standards

Informal rules and norms

**AILAN KASTOM**

**RAGS, WGs**

**SETTING AND ENFORCING RULES AND REGULATIONS**

Regulations

Laws

**PBC, GBK MALU LAMAR**

**FAC TSRA**

**TSSAC, RESEARCH PARTNERS**

**RULES**

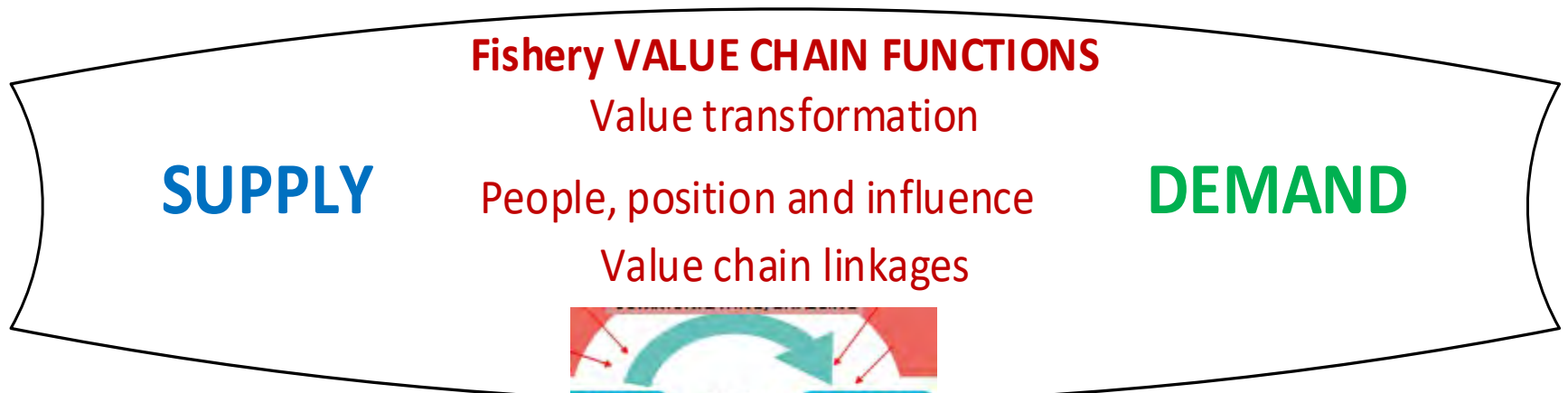
**WTO, CITES**

**PZJA PARTNERS**

**TSFA 1984, TS TREATY BILATERAL AGEEMNT PNG**

# THE SUPPLY CHAIN/ VALUE CHAN/ MARKET CHAIN

**OPPORTUNITIES (DRIVERS FOR GROWTH)**



**CONSTRAINTS (BLOCKERS FOR GROWTH)**

# FOR ONGOING DISCUSSION

- **Balancing** sustainability dimensions
- As per HCRAAG and HCWVG research into **socio economic analysis** of BDM fisheries is **HIGH PRIORITY**
- Promoting **lower and middle level valued BDMs** having higher TAC values through improved market linkages and market information
- Information on **markets and motivation** for BDM fishing: low TAC catch rates
- **Raising TACs** for black teat and key BDM species
- **Sandfish stock assessment** Warrior Reef
- **Aquaculture** scoping studies for climate change adaptation and ecological management of BDM species



## NEXT STEPS

- Ongoing review research papers FRDC, Honey and Fox on TS marketing strategy and branding
- DEVELOP DISCUSSION PAPER FOR BDM MARKET LINKAGES DEVELOPMENT
- DISTRIBUTE PAPER AND SEEK FEEDBACK
- COLLABORATION WITH STEVE PURCELL ON SOCIO ECON DATA COLLECTION CONCEPT
- PROMOTE DISCUSSION ON MARKET LINKAGES THROUGH WAPIL PROJECT AND ZKF
- TSRA FISHERY PROGRAM FOCUS: INDUSTRY DEVELOPMENT FOR OPTIMUM PRODUCTION AND VALUE
- MANAGING UNDERUTILISED QUOTA AND TAC EXISTING FISHERIES

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>PRELIMINARIES</b> <b>Out-of-session correspondence</b>	<b>Agenda Item 5</b> <b>For INFORMATION</b>

## RECOMMENDATIONS

1. That the Resource Assessment Group **NOTE** the correspondence circulated out-of-session.

## BACKGROUND

2. The following correspondence was circulated out-of-session since the 19<sup>th</sup> meeting of the HCWG (HCWG19) held on 10 November 2022 (**Table 1**). Copies of this correspondence can be requested at any time from the HCWG Executive Officer.
3. A correspondence summary is provided at each meeting to ensure members have not missed any out-of-session business or notifications.

**Table 1: Correspondence circulated out-of-session since HCWG19.**

<b>Date</b>	<b>Item</b>
4 January 2023	AFMA circulated the draft meeting record from HCWG19, for comment. Comments were sought by 25 January 2023.
2 February 2023	AFMA circulated a reminder regarding the draft meeting record from HCWG19, for comment. An extension for comments was provided until 8 February 2023.
16 February 2023	AFMA circulated the final meeting record from HCWG19.
14 April 2023	AFMA circulated a TSSAC research application received regarding the 2023 black teatfish size frequency sampling program, for member comment. Comments sought by 21 April 2023.
21 April 2023	AFMA circulated information regarding the 2023 black teatfish opening arrangements, for noting.
25 May 2023	AFMA circulated final catch statistics for the 2023 black teatfish opening, for noting.
26 May 2023	AFMA circulated information concerning the review of AFMA's approach to Ecological Risk Management. Public comment period closed on 31 July 2023.
5 June 2023	AFMA sought availabilities of all HCWG members and invited participants for the next meeting of HCWG (HCWG20), proposed for 17-18 October 2023. Availabilities sought by 16 June 2023.
15 June 2023	AFMA circulated information concerning the remaking of the <i>Torres Strait Fisheries (Furnishing of Logbooks) Instrument 2020</i> , for noting.

23 June 2023	AFMA circulated a draft Five-year Research Plan for Torres Strait Hand Collectable Fisheries: 2024/25-2028/29 and associated draft scopes, for member comment. Comments sought by 14 July 2023.
29 June 2023	AFMA circulated information concerning an invitation to comment on the re-assessment of the Torres Strait Beche-de-mer Fishery under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> . Public comment period closed on 28 July 2023.
19 July 2023	AFMA circulated the final Five-year Research Plan for Torres Strait Hand Collectable Fisheries: 2024/25-2028/29 and associated scopes, for noting.
3 August 2023	AFMA circulated information to Traditional Inhabitant members concerning a CSIRO workshop, Cultural License to Operate in the Blue Economy.
4 August 2023	AFMA confirmed HCWG20 will be held on 18-19 October 2023.
4 September 2023	AFMA circulated a draft agenda and declarations of interests for HCWG20, for member comment. Comments sought by 15 September 2023.
6 September 2023	AFMA circulated information to Traditional Inhabitant members concerning forecasted marine heatwave conditions for late 2023.
8 September 2023	AFMA circulated information concerning Torres Strait Scientific Advisory Committee's annual call for research proposals to address the research priorities identified for potential funding in 2024/25. Applications sought by 30 October 2023.



<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>HCWG UPDATES</b>	<b>Agenda Item 6</b> <b>For NOTING</b>

#### **RECOMMENDATIONS**

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** that HCRAAG members and observers will have provided updates at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting;
  - b. **NOTE** any new updates provided by HCWG members and observers, not already provided at the preceding HCRAAG meeting;
  - c. **DISCUSS** any strategic issues that may be relevant or of interest to Torres Strait hand collectable fisheries.

#### **KEY ISSUES**

2. HCWG members and observers are invited to provide updates on matters relevant to Torres Strait hand collectable fisheries, including fishing conditions, research, management and Native Title matters. As members and observers will have provided updates at the preceding HCRAAG meeting, only new updates need be provided.

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>CLIMATE AND ECOSYSTEM UPDATE</b>	<b>Agenda Item 7</b> <b>For DISCUSSION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** that an update on work being undertaken to incorporate climate change information into fisheries management advice and decisions for Commonwealth and Torres Strait fisheries was provided at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting;
  - b. **DISCUSS** the draft Climate and Ecosystem Status report for the Torres Strait hand collectables fisheries (**Attachment 7a**), and provide any comments additional to those already provided by the HCRAAG.

## KEY ISSUES

### ***Building climate change information into fisheries management processes***

2. In other Commonwealth managed fisheries (fisheries managed elsewhere in Australia by AFMA), a program of work is being undertaken to ensure that climate impacts are more strategically incorporated into the management of these fisheries to ensure that AFMA continues to meet legislative objectives relating to ecological sustainability. This work is a follow up action from the *Adaption of Commonwealth fisheries management framework to climate change project (FRDC project 2016-059)* (the climate adaptation project) that looked at the readiness of Commonwealth fisheries management arrangements to the potential impacts of climate change and provided a range of resources to assist with adaptation.
3. As a foundational element of the Climate Adaptation Program, the AFMA Commission endorsed a suite of actions to build explicit and structured consideration of climate change impacts into decision-making processes. These actions include adding a standing agenda item on climate change to advisory body meetings and preparing Climate and Ecosystem Status reports for key fisheries. Recognising the priority that the Torres Strait community places upon management of climate change impacts and the vulnerability of Torres Strait fisheries to climate change, AFMA is rolling out similar for Torres Strait fisheries through the PZJA's advisory committees.





### ***Draft Climate and Ecosystem Status Report***

4. To inform management decision-making processes, including advisory body discussions, annual Climate and Ecosystem Status reports are being developed for key Commonwealth fisheries. These reports are intended to provide a short, accessible update on key indicators of climatic or ecosystem status and trends relevant to the fishery, utilising readily available information.
5. Noting the interest in climate impacts on Torres Strait fisheries, and the body of work to better understand the effect of climate change on these fisheries, AFMA has prepared a draft Climate and Ecosystem Status report for consideration by the HCRAAG (see **Attachment 7a**). This report utilises currently available information, noting that limited climate and ecosystem/oceanographic observations are available in the Torres Strait.
6. The intent is that this report will be refined over time based on HCRAAG, HCWG and expert feedback. Feedback in particular is encouraged on the following:

- a. What key indicators would the HCWG like included in the report?
  - b. Is it useful and appropriate to capture fishers observations in the report?
  - c. What would be the preferred timing for production of this report?
7. Consideration of climate and ecosystem impacts in the context of fisheries management is complementary to a range of other work being undertaken by researchers to understand and model climate impacts on Torres Strait and related fisheries in northern Australia (see further information below).

***Climate related changes expected in Northern Australia***

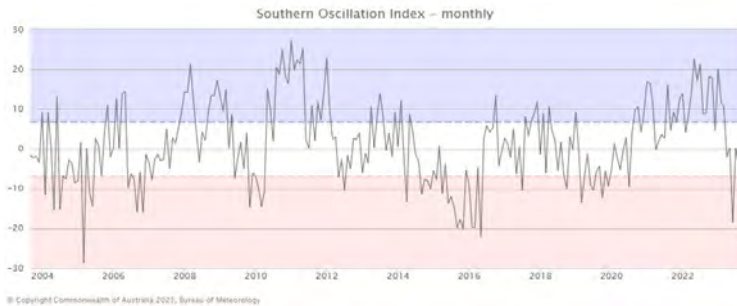
8. FRDC project 2016-059 produced a series of regional projections of climate impacts for Australian fisheries. While this did not include projections specific to the Torres Strait, the regional projection for northern Australia predicted climate-related changes as summarised in the table below.

	Observed change (vs 1950)	Future change (vs today)
OCEAN TEMPERATURE 	0.6 - 0.8°C increase	0.6 - 1.0°C increase
MARINE HEATWAVE 	15 - 20 day increase	>200 day increase
STORMS 	Conflicting information	Stronger & more variable
DROUGHTS 	Shorter, more intense	Longer, twice as frequent
RAINFALL 	Roughly steady	Roughly steady
SEALEVEL RISE 	20cm increase	20 - 40cm increase
OXYGEN 	Approx 2% decrease	5% decrease
ACIDIFICATION 	30% increase	20 - 120% increase

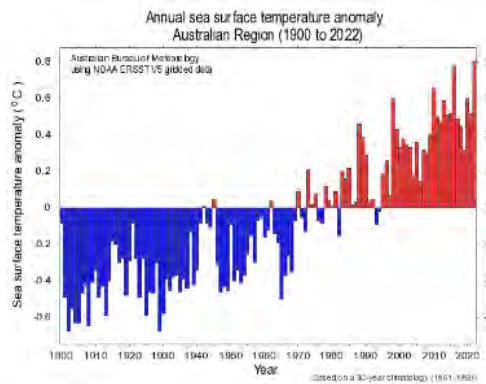
*(Excerpt from: [Regional Projection for Northern Australia](#). FRDC 2016-059: Guidance on Adaptation of Commonwealth Fisheries management to climate change)*

9. The draft Climate and Ecosystem Status Report (provided at **Attachment 7a**) provides an insight into recent trends in the Torres Strait, including valuable knowledge on changes being seen by fishers. Feedback will be sought at the meeting on the contents and any additional information that would be valuable to inform HCWG advice.

## Hindcast



Sustained negative values of below  $-7$  typically indicate El Niño, while sustained positive values above  $+7$  typically indicate La Niña



Sea surface temperature anomalies in the Australian region have been generally trending upwards over the past 30 years.

### What is happening on the water and what are fishers seeing?

- Sand incursions around Gudumalulgal islands that also affect surrounding reefs
- COTS outbreak near Mer and other eastern islands

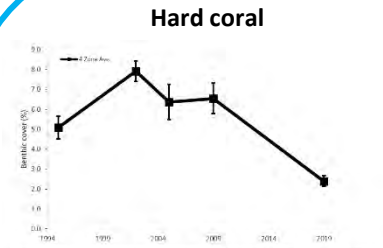


Figure 4-9. Zones (A) and East Torres Strait (4 zone) (B) average (stratified) benthic cover (%) for five coral (hard) from five surveys (does not include deep-reef strata) (error bars = 1 s.e.).

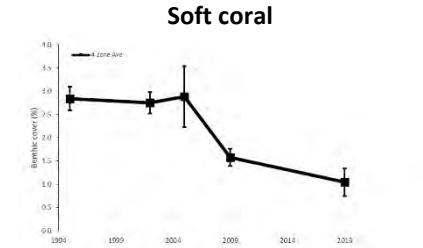


Figure 4-10. Zones (A) and East Torres Strait (4 zone) (B) average (stratified) benthic cover (%) for soft coral from five surveys (does not include deep-reef strata) (error bars = 1 s.e.).

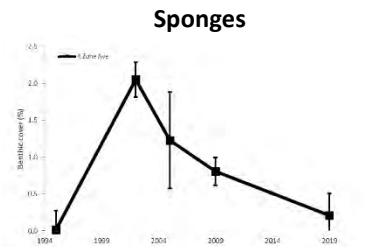


Figure 4-11. Zones (A) and East Torres Strait (4 zone) (B) average (stratified) benthic cover (%) for sponges from five surveys (does not include deep-reef strata) (error bars = 1 s.e.).

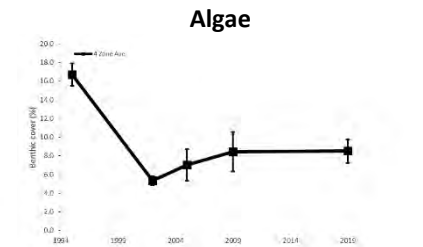


Figure 4-12. Zones (A) and East Torres Strait (4 zone) (B) average (stratified) benthic cover (%) for algae from five surveys (does not include deep-reef strata) (error bars = 1 s.e.).

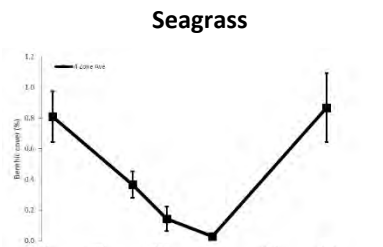


Figure 4-13. Zones (A) and East Torres Strait (4 zone) (B) average (stratified) benthic cover (%) for seagrass from five surveys (does not include deep-reef strata) (error bars = 1 s.e.).

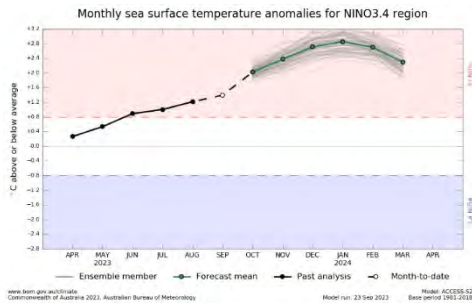
### In eastern Torres Strait:

- Cover of hard coral, soft coral and sponges has declined since 2002 – concern as perform key ecosystem functions
- Seagrass cover has increased since 2009

*Other indicators and trends e.g. turbidity, sea level, pH?*

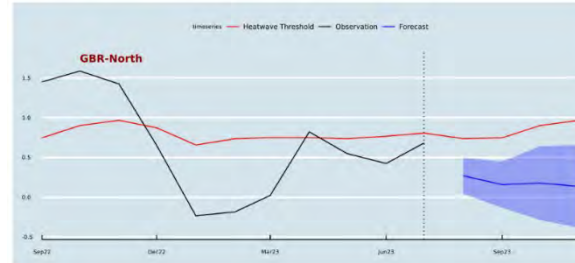
## Forecast

### ENSO outlook



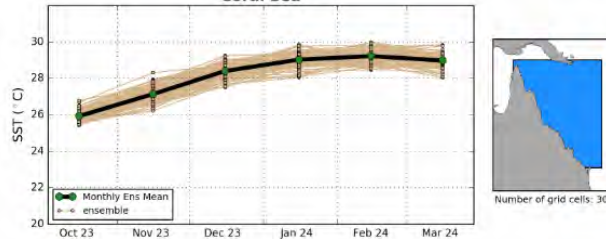
An El Niño has been declared and is underway. Climate model outlooks suggest this El Niño is likely to continue until at least the end of the southern hemisphere summer 2023–24. An El Niño phase typically produces drier years

### Marine heatwave forecast



Water temperatures up to November 2023 are not predicted to exceed the seasonal marine heatwave threshold (red line)

### Coral Sea

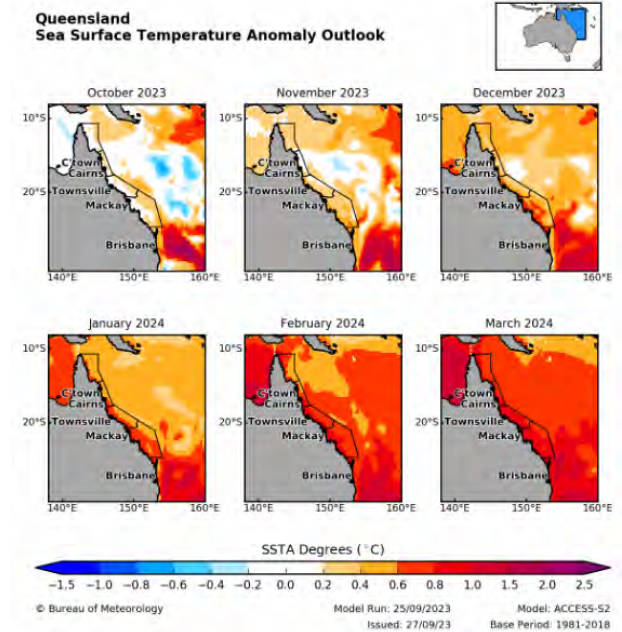


Water temperatures for the Coral Sea (closest to Torres Strait) are forecast to be about 26°C in October 2023, increasing to 29°C by March 2024

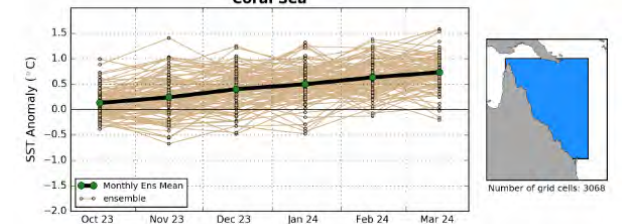
*Other indicator forecasts?*

### SST anomaly outlook

#### Queensland Sea Surface Temperature Anomaly Outlook



### Coral Sea



Between October 2023 and March 2024, water temperatures are predicted to be between 0.1-0.75°C above the long-term average water temperature



<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>TOTAL ALLOWABLE CATCHES FOR THE 2024 FISHING SEASON</b>	<b>Agenda Item 8</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the discussions and recommendations at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting, concerning the application of the Torres Strait Beche-de-mer Fishery Harvest Strategy (the Harvest Strategy) (**Attachment 8a**) and recommended total allowable catches (TACs) for the Torres Strait Beche-de-mer Fishery (BDM Fishery) for the 2024 fishing season commencing on 1 January 2024;
  - b. Having **CONSIDERED** the HCRAAG advice, **DISCUSS** and **PROVIDE ADVICE** on recommended TACs for the BDM Fishery for the 2024 fishing season commencing on 1 January 2024. This advice is to include advice on TACs for black teatfish and white teatfish. In providing this advice:
    - i. AFMA recommends that the HCWG work through the species summaries provided at **Attachment 8b**, to guide the formulation of its advice. These species summaries will be updated with HCRAAG discussions and recommendations during the preceding meeting and will be presented at the HCWG meeting for further advice;
    - ii. as appropriate, consider issues raised at previous HCRAAG and HCWG meetings.

## KEY ISSUES

### Current TACs

2. The Harvest Strategy is based on a tiered framework which accounts for improvements in data and information. The Strategy applies to 18 species (inclusive of the 2 closed species). Current TACs and catch monitoring triggers are detailed in **Table 1**.

**Table 1. Current TACs and catch monitoring triggers (tonnes, wet gutted weight) for the BDM Fishery for the 2023 fishing season.**

Species	TAC (t, wet gutted weight)	Catch monitoring trigger (t, wet gutted weight)
Black teatfish ( <i>Holothuria whitmaei</i> )	20	-
Curryfish (common) ( <i>Stichopus herrmanni</i> )	60 (curryfish basket)	-
Curryfish vastus ( <i>Stichopus vastus</i> )		15
Deepwater redfish ( <i>Actinopyga echinites</i> )	5	-
Greenfish ( <i>Stichopus chloronotus</i> )	40	-
Hairy blackfish ( <i>Actinopyga miliaris</i> )	5	-
Prickly redfish ( <i>Theleota ananas</i> )	15	-
Sandfish ( <i>Holothuria scabra</i> )	0 (closed)	-
Surf redfish ( <i>Actinopyga mauritiana</i> )	0 (closed)	-



White teatfish ( <i>Holothuria fuscogilva</i> )	15	-
Elephant trunkfish ( <i>Holothuria fuscopunctata</i> )	50 (all other species basket)	15
Lollyfish ( <i>Holothuria atra</i> )		40
Burrowing blackfish ( <i>Actinopyga spinea</i> )		5
Deepwater blackfish ( <i>Actinopyga palauensis</i> )		0.5
Golden sandfish ( <i>Holothuria lessoni</i> )		0.5
Brown sandfish ( <i>Bohadschia vitiensis</i> )		3
Leopardfish ( <i>Bohadschia argus</i> )		40
Stonefish ( <i>Actinopyga lecanora</i> )		5

### ***New information***

3. Since the Harvest Strategy was implemented for the 2020 fishing season, new information to inform understanding of the status of commercial sea cucumber species in the BDM Fishery has been collected, including:
  - a. a scientific survey undertaken of the East Torres Strait in 2019/20;
  - b. catch and effort data collected through the mandatory Fish Receiver System. A summary of recent catch data for each species is provided in **Attachment 8b**. A summary of historical catch data is provided in **Attachment 8c**;
  - c. stock assessment modelling was undertaken for black teatfish and white teatfish:
    - i. black teatfish – in 2022, the HCRAg and HCWG considered results of updates to the surplus production model as well as a newly developed age-structured model (based on the size frequency data collected in 2022). Results of updates to the surplus production model (based on available data up to 2023) will be considered by the HCRAg at the preceding meeting;
    - ii. white teatfish – results of a newly developed stock assessment model (based on available data up to 2022) will be considered by the HCRAg at the preceding meeting.
4. At the preceding meeting, the HCRAg was asked to consider the latest information available and:
  - a. confirm the appropriate decision rule tier for each species. A summary of each Harvest Strategy tier is provided in the Background;
  - b. apply the Harvest Strategy decision rules (otherwise known as control rules) within the tier OR recommend further analysis to be undertaken. Given the number of species being reviewed, the HCRAg was asked to prioritise any recommendations for further analysis across species; and
  - c. identify any short to medium term data and research needs.
5. To assist the HCRAg and HCWG in formulating advice on TACs for the 2024 fishing season, species summaries have been developed for each species (**Attachment 8b**). These species summaries will be updated with HCRAg discussions and recommendations during the preceding meeting and will be presented at the HCWG meeting for further advice.

### ***Previous HCRAg and HCWG consideration***

6. At the last meetings of the HCRAg and HCWG, particular focus was given to black teatfish, white teatfish, prickly redfish, curryfish species, deepwater redfish, hairy blackfish, golden sandfish. Details of these previous considerations are detailed in **Attachment 8b**.

## BACKGROUND

7. On 19 November 2019, the Protected Zone Joint Authority (PZJA) agreed to adopt the Harvest Strategy. TACs were agreed in line with the starting TACs recommended in the harvest strategy and applied from 1 January 2020. There have been no changes to TACs since 2020, except for black teatfish.

### *Harvest Strategy tiers*

#### *Low Tier*

8. In the low tier, the minimum data needed for each species is the total catch taken each fishing season. The low tier has rules to guide:
  - a. what happens to a species if the TAC is overcaught or a trigger limit for a species within a joint TAC is reached; and
  - b. what happens if there is no data reported for a species at all.
9. Depending on the information available, the low tier allows single species TACs to be maintained or reduced. For species with individual catch monitoring triggers, within a basket TAC, the low tier may allow changes to the basket TAC, or to individual catch monitoring triggers (up or down).

#### *Middle Tier*

10. To transition to the middle tier, two or more primary indicators must be available. The Harvest Strategy states however that the middle tier is not applicable during the initial years of implementation as insufficient detailed historical fishery data are available.
11. For the purposes of the middle tier the primary indicators are:
  - a. Catch per unit effort;
  - b. Spatial footprint;
  - c. Average size; and
  - d. Catch proportion.
12. The information from these primary indicators will guide how much TACs should be varied. If the primary indicators suggest an increase is possible, there are pre-agreed rules that set a maximum level that the TAC can increase by before high quality survey data is required (refer to Table 3 in the Harvest Strategy for the maximum middle tier TAC increase).

#### *High Tier*

13. The high tier may be applied to all species if species specific, high quality survey data becomes available. Under this tier, TACs may be adjusted 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).

#### *Closed Species*

14. A species may be closed to fishing if it has been overfished, the TAC has been significantly over caught, or if fishing has been occurring but there is no reported catch. The Harvest Strategy has rules to guide how to re-open a fishery if enough information is available.



Australian Government  
Australian Fisheries Management Authority

# Torres Strait Beche-de-mer Fishery Harvest Strategy

November 2019\*

This harvest strategy is based on outcomes from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Oceans and Atmosphere Division project, *Harvest Strategies for the Torres Strait Beche-de-mer (sea cucumber) Fishery*. The project was funded by the Australian Fisheries Management Authority (AFMA).

AFMA Project No. 2016/0823.

Project Authors: Éva Plagányi (Principal Investigator), Nicole Murphy, Tim Skewes, Mibu Fischer, Leo Dutra, Natalie Dowling, Margaret Miller

\*This harvest strategy was edited by AFMA on 7 April 2021 to correct the reference in the last column of Table 5 (page 41) to surf redfish as part of the 80t basket species limit as it is a no take species.

[www.csiro.au](http://www.csiro.au) | [www.afma.gov.au](http://www.afma.gov.au) | [www.pzja.gov.au](http://www.pzja.gov.au)

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## Glossary

### Types of reference points:

Reference Point	Description
Target	The desired state of the stock or fishery (for example, MEY or $B_{TARG}$ ) <sup>1</sup>
Limit	The level of an indicator (such as biomass or fishing mortality) beyond which the risk to the stock is regarded as unacceptably high <sup>1</sup>
MEY	The sustainable catch or effort level for a commercial fishery that allows net economic returns to be maximised. In this context, maximised equates to the largest positive difference between total revenue and total cost of fishing <sup>1</sup>
MSY	The maximum average annual catch that can be removed from a stock over an indefinite period under prevailing environmental conditions <sup>1</sup>

### Notation:

Notation	Description
B	Spawning biomass - the total weight of all adult (reproductively mature) fish in a population <sup>1</sup>
$B_0$	The unfished spawning biomass (determined from an appropriate reference point)
F	Fishing mortality rate
$B_{LIM}$	Biomass limit reference point - the point beyond which the risk to the stock is regarded as unacceptably high
$B_{TARG}$	Biomass target reference point - the desired biomass of the stock

### Other acronyms:

Acronym	Description
AFMA	Australian Fisheries Management Authority
BDM	Beche-de-mer
CPUE	Catch per unit effort
CSIRO	Commonwealth Scientific and Industrial Research Organisation
HCR	Harvest Control Rule - pre-determined rules that control fishing activity according to the biological and economic conditions of the fishery (as defined by monitoring or assessment). Also called 'decision rules'. HCR are a key element of a harvest strategy <sup>1</sup>

<sup>1</sup> Definition sourced from the *Commonwealth Fisheries Harvest Strategy Policy: Framework for applying an evidence-based approach to setting harvest levels in Commonwealth fisheries* (June 2018).

Acronym	Description
HCWG	Hand Collectables Collectables Working Group
HS	Torres Strait Beche-de-mer Fishery Harvest Strategy
HSF	Harvest Strategy Framework
HSP	Commonwealth Harvest Strategy Policy and Guidelines 2018
MSE	Management Strategy Evaluation - a procedure whereby alternative management strategies are tested and compared using simulations of stock and fishery dynamics <sup>1</sup>
PZJA	Protected Zone Joint Authority
RBC	Recommended Biological Catch
RNTBC	Registered Native Title Body Corporate
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
QDAF	Queensland Department of Fisheries and Agriculture

## Overview

---

The Torres Strait Sea Cucumber or Beche-de-mer Fishery (the Fishery) Harvest Strategy (HS) sets out the management actions needed to achieve the agreed Fishery objectives. The HS describes the performance indicators used for monitoring the condition of a 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 Beche-de-mer 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 HS describes a clear and transparent protocol, agreed on by stakeholders, for monitoring, information gathering, assessment and management into the foreseeable future. It applies to all Torres Strait BDM species, with these classified into groups; closed species, target species, curryfish species and basket species.

The HS depends critically on fishery data provided through the Torres Strait Fish Receiver System that was implemented on 1 December 2017. The strategy 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 HS framework is a tiered system which accounts for understanding that more data and more information reduces the risk to a resource and reduces the need for precautionary management. This means higher catch limits are possible if there are more, better quality data available.

The HS uses data from fishers and surveys (where available). Primary Indicators (in order of importance) from fisher data are:

- a) Catch per species per day (including discards) converted to gutted weight (using revised conversion ratios compiled as part of the HS)
- b) Catch Per Unit Effort (CPUE) – requires Effort (e.g. hours fished)
- c) Proportional composition of different species in catch if individual species mass is not recorded
- d) Size composition (per species) of a representative catch sample
- e) Area (and depth) of each species caught (preferably fine-scale information)

The HS includes different rules for the following cases:

1. Monitoring and adjusting TACs annually, with agreement that a fishery will be closed if no catch-reported data are provided.
2. Rules for managing mixed species/basket catch limits. Species specific monitoring is necessary to support future growth of the fishery. This requires as many target species as possible to 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 increase TACs if high quality fishery data are available and indicate an increase is possible

4. Rules for how to further increase TACs if high quality survey data become available.
5. Rules for how to re-open a fishery that has been closed. This includes fisheries that have been closed due to overfishing (e.g. sandfish), concerns about underreporting (e.g. black teatfish), or due to TACs being exceeded. There are guidelines for supporting species recovery and improved catch reporting 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.

The strategy also includes some static controls such as minimum size limits and the option for spatial closures to complement fishery management measures and other traditional community management initiatives (e.g. a proposed 10 nautical mile voluntary spatial closure on fishing for prickly redfish around home reefs).

The HS meets the requirements of the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2018* (HSP) by applying a precautionary approach as well as a tiered approach that applies different harvest control rules (HCR) 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 stock status. This intends to maintain the same level of risk across the different tiers.

Harvest Strategy 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 HS maps a pathway for ongoing improvements and refinements, through further data collection and a clear role for community-level data and local knowledge.

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.

## 1 Background

---

This Harvest Strategy has been developed in accordance with the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2018* (HSP) and is consistent with objectives of the *Torres Strait Fisheries Act 1984* (the Act).

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

- to provide for the sustainable use of all Beche-de-mer stocks in Torres Strait;
- to develop Beche-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 where relevant. 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 Maluialgal Nation, Saabi law of Gudamalulgal Nation and Kulkalgal Nation and Saabi law of Kaurareg Nation.

The HS uses a tiered approach to cater for different amounts of data available and different species groups and types of assessments (e.g. 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 HCR and associated rules that are used to determine an RBC.

## 1.1 Commonwealth Fisheries Harvest Strategy Policy

The objective of the HSP is the ecologically sustainable and profitable use of Australia's Commonwealth commercial fisheries resources (where ecological sustainability takes priority) - through implementation of harvest strategies.

To pursue this objective the Australian Government will implement harvest strategies that:

- a) ensure exploitation of fisheries resources and related activities are conducted in a manner consistent with the principles of ecologically sustainable development, including the exercise of the precautionary principle
- b) maximise net economic returns to the Australian community from management of Australian fisheries - always in the context of maintaining commercial fish stocks at sustainable levels
- c) maintain key commercial fish stocks, on average, at the required target biomass to produce maximum economic yield from the fishery
- d) maintain all commercial fish stocks, including byproduct, above a biomass limit where the risk to the stock is regarded as unacceptable ( $B_{LIM}$ ), at least 90 per cent of the time
- e) ensure fishing is conducted in a manner that does not lead to overfishing - where overfishing of a stock is identified, action will be taken immediately to cease overfishing
- f) minimise discarding of commercial species as much as possible
- g) are consistent with the *Environment Protection and Biodiversity Conservation Act 1999* and the *Guidelines for the Ecologically Sustainable Management of Fisheries*.

For fisheries that are managed jointly by an international organisation or arrangement, the HSP does not prescribe management arrangements. This includes management arrangements for commercial fishing in the Torres Strait Protected Zone, which are governed by provisions of the Torres Strait Treaty and the *Torres Strait Fisheries Act 1984*. However, it does articulate the government's preferred approach.

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, including those that exceed the minimum standards, must be demonstrated to be compliant with the HSP objective.

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 close 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; 1-2 August 2019 and out of session 16-30 September 2019).

## 2 The Beche-de-mer Fishery Harvest Strategy

### 2.1 Scope

This HS applies to the whole Torres Strait Beche-de-mer Fishery comprised of 18 commercial species (Table 1).

The HS outlines the control rules used to develop advice on the recommended biological catch (RBC) and recommend Total Allowable Catches. The HS sets the criteria that pre-agreed management decisions will be based on in order to achieve the Fishery objectives.

Over time, the HS will be subject to periodic reviews and updates with ongoing opportunities to refine and improve the strategy in future. Summaries of local knowledge, observations, preferences, outcomes of local management practices including community-specific closures and spatial rotations as to where fishing takes place could be used in an iterative manner to continually improve the HS and ensure customary practices receive appropriate acknowledgement.

Table 1. Summary of key Beche-de-mer species in Torres Strait.

Common name	Scientific name	Common name	Scientific name
Sandfish	<i>Holothuria scabra</i>	Deepwater redfish	<i>Actinopyga echinites</i>
Surf redfish	<i>Actinopyga mauritiana</i>	Curryfish vastus	<i>Stichopus vastus</i>
Black teatfish	<i>Holothuria whitmaei</i>	Burrowing blackfish	<i>Actinopyga spinea</i>
White teatfish	<i>Holothuria fuscogilva</i>	Deepwater blackfish	<i>Actinopyga palauensis</i>
Prickly redfish	<i>Thelenota ananas</i>	Golden sandfish	<i>Holothuria lessoni</i>
Hairy blackfish	<i>Actinopyga miliaris</i>	Brown sandfish	<i>Bohadschia vitiensis</i>
Curryfish common	<i>Stichopus herrmanni</i>	Leopardfish	<i>Bohadschia argus</i>
Elephant trunkfish	<i>Holothuria fuscopunctata</i>	Greenfish	<i>Stichopus chloronotus</i>
Lollyfish	<i>Holothuria atra</i>	Stonefish	<i>Actinopyga lecanora</i>

## 2.2 Objectives

The objectives of this Harvest Strategy are:

- a) to provide for the sustainable use of all Beche-de-mer in Torres Strait to take account of long-term sustainability for future generations;
- b) to develop Beche-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 acknowledges the important ecological role of sea cucumbers and
- e) to develop long-term recovery strategies for species, where appropriate.

## 2.3 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 area by the Fishery in a fishing season. The HSP states that when setting the TAC for the next fishing season the HS should take into account all sources of fishing mortality.

## 2.4 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 as catch reporting was only made compulsory in December 2017. It is anticipated that there will be a time lag before reliable catch and effort data are available for analysis.

The HS therefore outlines a starting point in terms of data collection, analysis and use to inform decision making, however this may need to be revised as more data become available and as data needs arise. 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 strategy clearly maps a pathway for ongoing improvements and refinements, including further data collection as well as a clear role for community-level data and local knowledge.

### 2.4.1 Fishery independent surveys

There are a 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 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:

- a) Small-scale experimental fishing surveys with local fisher participation and possible cost-recovery via fishers being permitted to sell animals surveyed;



- b) 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)
- c) 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. 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. Most surveys will yield an index of relative stock abundance, however 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 therefore all references to survey data in the HS assume that the survey design and execution have been approved by qualified scientific expertise.

#### 2.4.2 Catch and effort information

Fishers are required to record catch information on Torres Strait Catch Disposal Records (TDB02) as part of the mandatory Fish Receiver System. This includes reporting the total mass of each species landed, as well as the processing method so that conversion ratios (see Table 4) can be used to convert all reported catch to a standard weight (wet gutted). It is important that these records also include an accurate estimate of the total discards (which includes product lost in the processing phase). Accurate total catch per species, including discards needs to be provided in a timely manner and is a critical data input to the low tier decision rules. While catch disposal records do not require reporting of discards, changes to reporting requirements may be needed to facilitate this.

It is important that total catches are separated by species and where there is uncertainty regarding accurate species identification, it is recommended that representative photos of the catch be taken for later identification (e.g. with the assistance of scientists or experienced industry persons). In this instance 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 herrmanni* 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). A Torres Strait Beche-de-mer species identification guide is available to assist in identifying individual species (Murphy et al. 2019).

Catch per day and per spatial location are needed to support scientific assessments of the fishery (lumped and stockpiled data are less useful). Other very useful data to support scientific assessment include fishing effort (e.g. hours fished) and size of animals caught. Information about the area where the sea cucumbers were caught is extremely valuable and needs to be recorded as accurately as possible. If high quality area-specific and depth information are recorded, these data could be used as inputs to the middle tier decision

rules. The provision of effort information under the TDB02 is voluntary, but is strongly encouraged to support scientific assessments of the fishery. Detailed logbook information including fishing effort, area fished and depth supplied on HC01 Daily Fishing Log can be completed and submitted now on a voluntary basis. This data is treated by AFMA as confidential.

Fishing effort is a key measure that is used to calculate Catch-Per-Unit-Effort (CPUE) which can serve as an index of abundance and inform on stock status and trends. 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. 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 data provide a valuable input that can be used to support decision making and progression to the middle tier.

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 in some instances, (e.g. when re-opening a fishery) additional constraints may be imposed on the recording of catch and effort information.

### **2.4.3 Catch sub-sampling information**

Estimates of the size distribution of individual species are additional data required as inputs to the middle tier decision rule for use in adjusting TACs. It isn't necessary to measure every animal caught, however accurate measures of the length and mass of a representative (by area and species) sub-sample is an important data input. Size frequency sub-sample information could be collected by volunteers, nominated fishers or trained fish receivers. These data could also be complemented by additional detailed information such as the proportion of each species comprising a mixed bag catch.

### **2.4.4 Environmental Indicators**

Data on environmental indicators are not currently collected in the BDM fishery. However, as a longer term 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 framework was developed to operationalise these indicators in a decision framework to provide a defensible basis on which to make recommendations for local management measures. The 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 abundance etc.), density estimated from diver camera surveys, surveys of dead individuals on the beach and perceived extent of illegal, unreported or unregulated (IUU) fishing. This framework is described in Plagányi et al. (2019) 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.

### 2.4.5 Information based on local knowledge

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 supported 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.

## 2.5 Static Management Controls

The Harvest Strategy framework (Figure 1) identifies 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.

### 2.5.1 Size limits<sup>2</sup>

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. Table 5 summarises recommended HS size limits.

### 2.5.2 Spatial and temporal closures

Beche-de-mer 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. An example of industry proposed spatial closures discussed during HS workshops can be found at Figure 7.

## 2.6 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 four species categories as described in Table 2.

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<sup>2</sup> 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 Beche-de-mer Fishery.

Species may change categories over time depending on available information and the associated management decisions made.

Table 2. TS BDM species category definitions as at November 2019.

Category	Examples of species in category as at November 2019	Category definition
Closed	sandfish surf redfish black teatfish	Species closed to fishing due to concerns of overfishing or stock depletion, underreporting, or significant overcatch of the TAC
Target species	white teatfish prickly redfish 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 basket with trigger to identify species of growing commercial interest

## 2.7 Total Allowable Catch (TAC)

Changes to the TACs (pre-Harvest Strategy implementation, see Table 3) are recommended to reflect the revised classification of the component fishery species into categories. Starting TACs and trigger limits are based on a series of stock surveys carried out between 1995 and 2011 (Skewes et al., 2010; Murphy et al., 2011), and estimates of fishery harvests up to 2018. Starting TACs under the HS have been set at less than 10% of population biomass and are designed to be sustainable medium-term annual limits that result in low risk to overexploitation. The trigger limits are even more conservative and include species with a high uncertainty in population estimates and/or biological parameters, allowing for potential increase if more information on species stock status is forthcoming. Changes in market value and demand mean that several additional species were identified as target species needing to have specific TACs or triggers (with associated actions). These include curryfish, greenfish, hairy blackfish and deepwater redfish (Table 3).

Table 3. Starting HS TAC Recommendations

Common name	Scientific name	Commercial value	Pre-HS TAC (t) <sup>3</sup>	Recommended HS Starting TAC (t)	Basket triggers (t)	Notes	Max middle tier TAC increase (based on indicators) before needing survey	Max recorded historical catch and year (not necessarily sustainable catch)
Sandfish	<i>Holothuria scabra</i>	High	Closed	Closed			5	1200t (1995)
Surf redfish	<i>Actinopyga mauritiana</i>	Medium	Closed	Closed			5	60.2t (1998)*
Black teatfish	<i>Holothuria whitmaei</i>	High	Closed	Trial 15t			25	52.7t (1996)
White teatfish	<i>Holothuria fuscogilva</i>	High	15	15			20	16.3t (2014)
Prickly redfish	<i>Thelenota ananas</i>	High	15 (↓ from 20)	15			20	28.1t (2015)
Deepwater redfish	<i>Actinopyga echinites</i>	Medium	Part of 80t basket	5 <sup>#</sup>			40t based on surveys	5.5t (2015)*
Hairy blackfish	<i>Actinopyga miliaris</i>	Medium	Part of 80t basket	5			10 (lower CI survey as uncertain)	28.5t (2001)
Greenfish	<i>Stichopus chloronotus</i>	Medium	Part of 80t basket	40t			40	1.2t (2002)
Curryfish common	<i>Stichopus herrmanni</i>	Medium	Part of 80t basket	60t curryfish			60 (herrmanni)	6.1t (2015); 15t (mid-2018)
Curryfish vastus	<i>Stichopus vastus</i>	Medium	Part of 80t basket	60t curryfish	15	new trigger	20 (vastus)	see curryfish
Elephant trunkfish	<i>Holothuria fuscopunctata</i>	Low	Part of 80t basket	Part of 50t basket	15	existing trigger	15	0.4t (2004)
Lollyfish	<i>Holothuria atra</i>	Low	Part of 80t basket	Part of 50t basket	40	half existing	80	0
Burrowing blackfish	<i>Actinopyga spinea</i>	Medium	Part of 80t basket	Part of 50t basket	5	trial new species	10 (survey e.g. high around Warrior)	0
Deepwater blackfish	<i>Actinopyga palauensis</i>	Medium	Part of 80t basket	Part of 50t basket	0.5	previous catch	10	0.5t (2001)*
Golden sandfish	<i>Holothuria lessoni</i>	High	Part of 80t basket	Part of 50t basket	0.5	previous catch	5	0.35t (2014)
Brown sandfish	<i>Bohadschia vitiensis</i>	Medium	Part of 80t basket	Part of 50t basket	3	previous catch	5	3.4t (2002)
Leopardfish	<i>Bohadschia argus</i>	Medium	Part of 80t basket	Part of 50t basket	40	existing trigger	40	9.6t (2003)
Stonefish	<i>Actinopyga lecanora</i>	Medium	Part of 80t basket	Part of 50t basket	5	existing trigger	5	0.5t (2010)
TOTAL			110t	205t <sup>§</sup>			415t	

Notes: <sup>§</sup> including trial openings for black teatfish; # catches over 2013-15 approx 5.5t/yr ; \* possible misidentification

<sup>3</sup> Prior to Harvest Strategy implementation, the TACs for most species were set based on a conservative estimate of biomass from historical surveys.

## 2.8 Reference Points

There were no existing adopted proxy reference points consistent with the 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. Instead, starting TACs are set conservatively and in that respect reflect an intention to meet the HSP. Additionally, the HS proposes use of some reference point proxies that are fairly conservative and consistent with the HSP.

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 5 and Figure 8. 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 biomass 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 Figure 8).

$F_{TARG}$   $F_{LIM}$  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 pre-existing conservative fishing mortalities to conservative biomass estimates.

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. The status of each stock depends on comparison with agreed Reference Points as specified. For example, if total catch exceeds a pre-specified limit or CPUE is below a pre-specified limit reference level then it may indicate that a 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 catch limits to achieve desired targets and satisfy the overall fishery objectives.

## 2.9 Stock Assessment Cycle

The Hand Collectables Working Group (HCWG) meets at least once annually to review all available catch data as well as primary indicators data, and advises on analyses needed as well as any future monitoring needs and revisions to the HS.



## 2.10 Data Summary

The annual data summary reviews the catch and catch per unit effort (CPUE) from the fishery as well as all other information, including 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.

## 2.11 Decision Rules

In order to manage the TS BDM stocks to meet the operational objectives of the HS and the BDM Fishery more broadly, the HS includes a mix of approaches as described above:

- a) Effort controls and temporal closures;
- b) Spatial management;
- c) Total Allowable Catches to limit total amount caught; and
- d) Complementary minimum size limits to allow animals a chance to breed before being caught.

A summary of the harvest strategy framework is provided below, and includes Decision Rules specified within each tier.

### Low Tier:

- i. **Catch-based Decision Rule** – TACs are monitored and adjusted annually, with agreement that a fishery will be closed if no data are provided. Overcatch of the TAC may result in a corresponding reduction from the TAC the following year, a 1 year pause in fishing, or a closure of the species, depending on the severity of the overcatch.
- ii. **Joint TAC trigger-limit Decision Rule** – Basket species are managed under a joint TAC with species specific triggers. If the trigger limit of an individual basket species is exceeded by more than 10 per cent, all available information must be considered and changes to basket TACs or individual basket species trigger limits may be possible.

### Middle Tier:

- i. **Multiple Indicator Decision Rule** – TACs may be increased or decreased if high quality fishery data are available from at least two primary indicators. The potential increase to TACs may be capped at a specified level depending on the proportional change (10% or more) in the multiple indicator adjustment factor. If the proportional change in the multiple indicator adjustment factor is less than 10%, the TAC stays the same.

### High Tier:

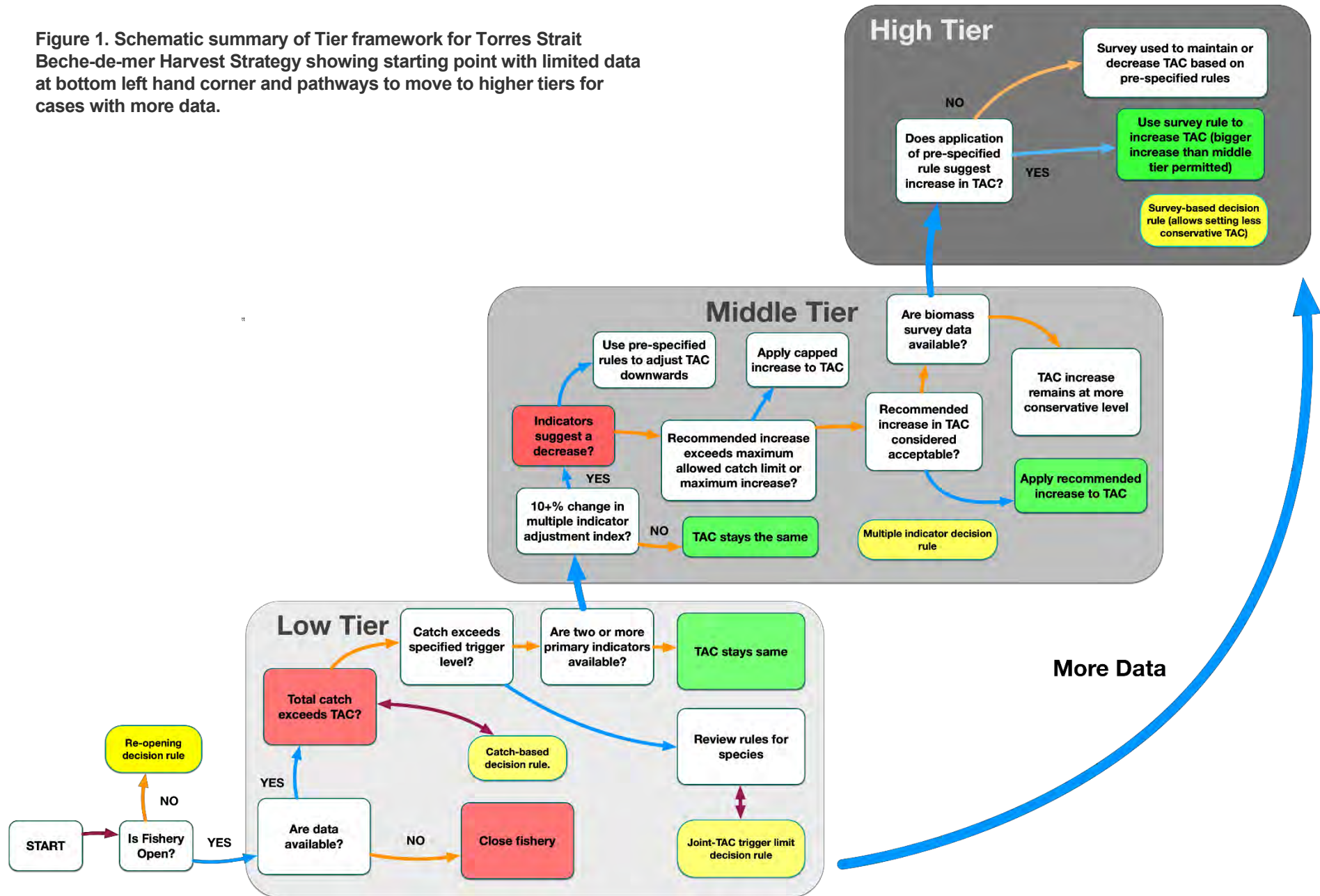
- i. **Survey-based Decision Rule** – TACs may be increased or decreased using high quality survey data based on trends or total biomass estimates.

### Closed Species:

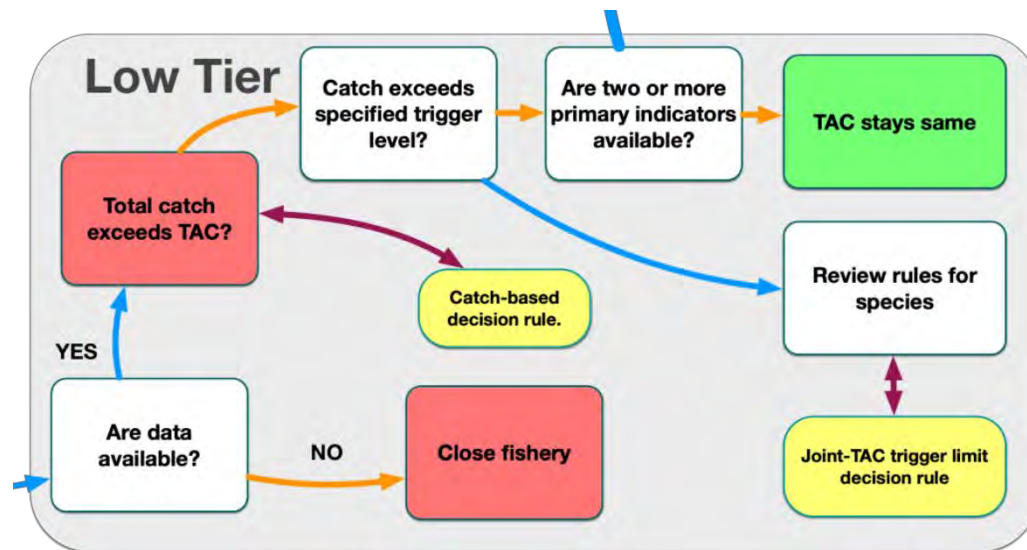
An additional **Re-opening Decision Rule** applies for species that have been closed to fishing due to concerns of overfishing or stock depletion, significantly exceeding catches beyond the TAC, or in the absence of reported catches.



Figure 1. Schematic summary of Tier framework for Torres Strait Beche-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.



### 2.11.1 Low Tier Decision Rules



#### When is the low tier applied?

In the absence of data other than the total amount of reported catch by species or combined basket.

#### What are the decision rules?

There are two decision rules that operate within the low tier:

- Catch-based decision rule
- Joint TAC trigger-limit decision rule

#### What do the decision rules allow?

For species with individual TACs, the low tier allows the TAC to either be maintained or reduced depending on the information available. A transition to the middle tier, and increased TACs is not possible unless two or more primary indicators are available.

For species with individual triggers, within a basket with a joint TAC, the low tier may allow changes to the joint TAC, or individual triggers, depending on the information available.

### 2.11.1.1 Low Tier Catch-Based Decision Rule

This is a low tier rule that is applied to all species in the absence of data other than total annual catch per species:

1. If no reliable catch-reported data, then TAC = 0;
2. If reported catches exceed the TAC by more than double, close the fishery;
3. If reported catches exceed the TAC by >20% and <100% (double), then pause fishing for one fishing season;
4. If the cumulative reported catches over a three year period exceed the TAC by >5% and <20%, then deduct the total overcatch from the TAC in the next full fishing season.

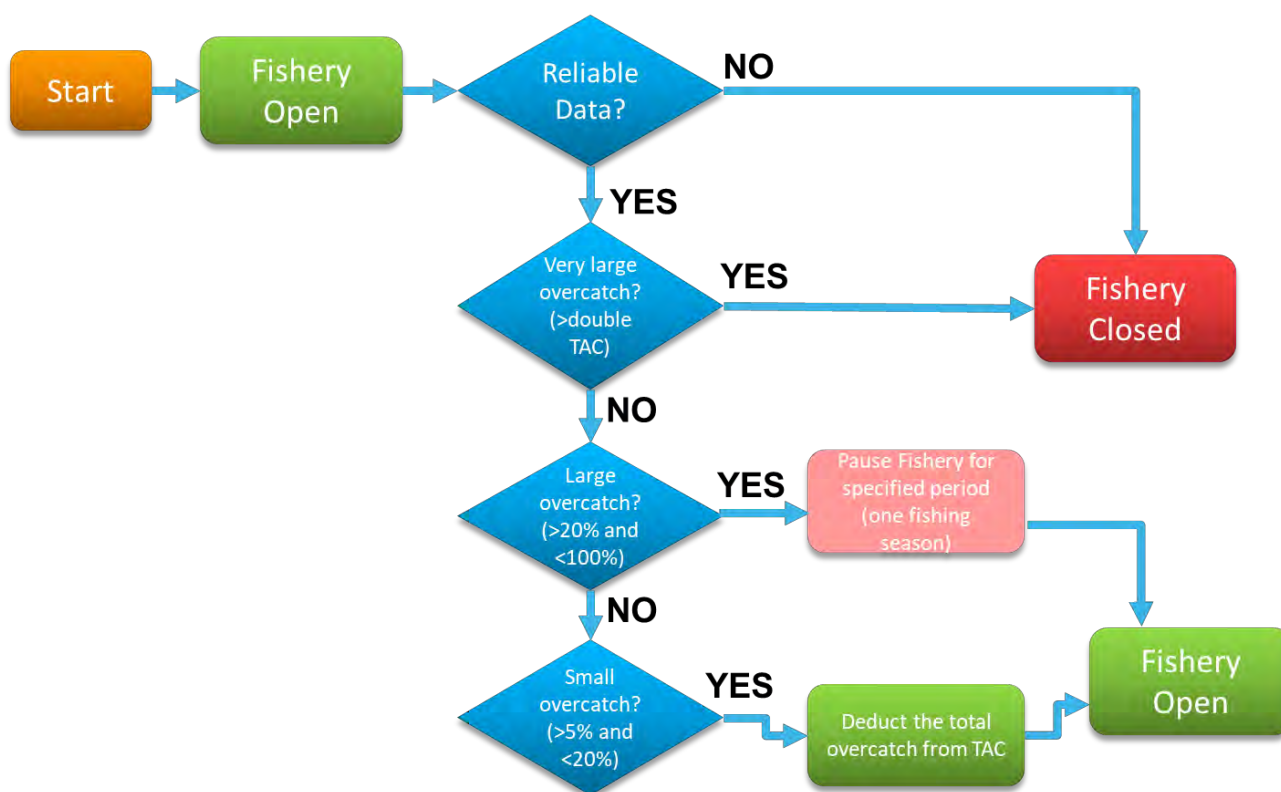


Figure 2. Flowchart summarising low tier catch-based decision rule.

### 2.11.1.2 Low Tier Joint TAC Trigger-Limit Decision Rule

This is a low tier rule that is applied to species with specific triggers within a basket:

1. Calculate the total catch (including discards) of all species in the species basket;
2. Calculate 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;
3. 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:
  - a) to make a change to the basket TAC, or individual species trigger, or
  - b) a species-specific TAC is justified, or
  - c) a closure is deemed necessary, or
  - d) recommend further data be collected (e.g. in the form of a survey, or indicator before any change to the joint TAC or trigger limit is allowed).

Such data and information may include but is not limited to, updated information on stock distribution, stock status or biomass estimates from nearby fisheries (e.g. Queensland East Coast BDM Fishery) of the same species, or new information on life history characteristics, biology, or market value.

The current TAC and trigger limit will remain in place unless the above (3a – d) suggests a change. For 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 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 (*Stichopus hermanni* and *S. vastus*) due to improved processing methods and market opportunities (Purcell et al., 2014).

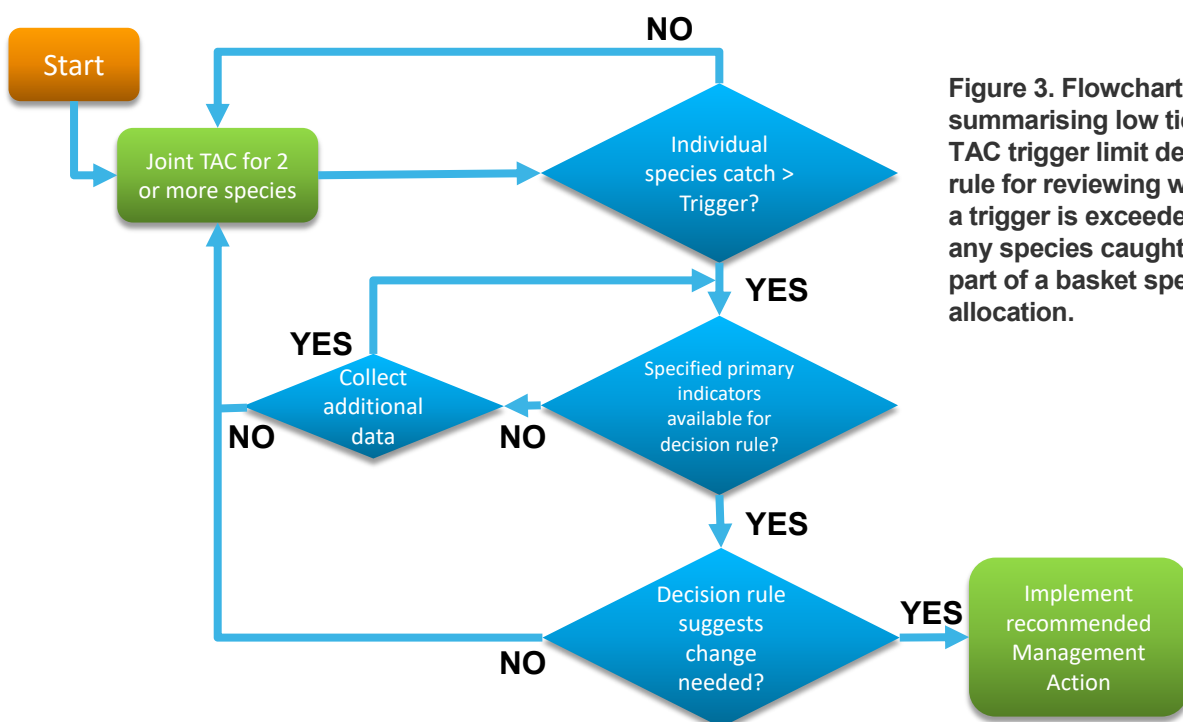
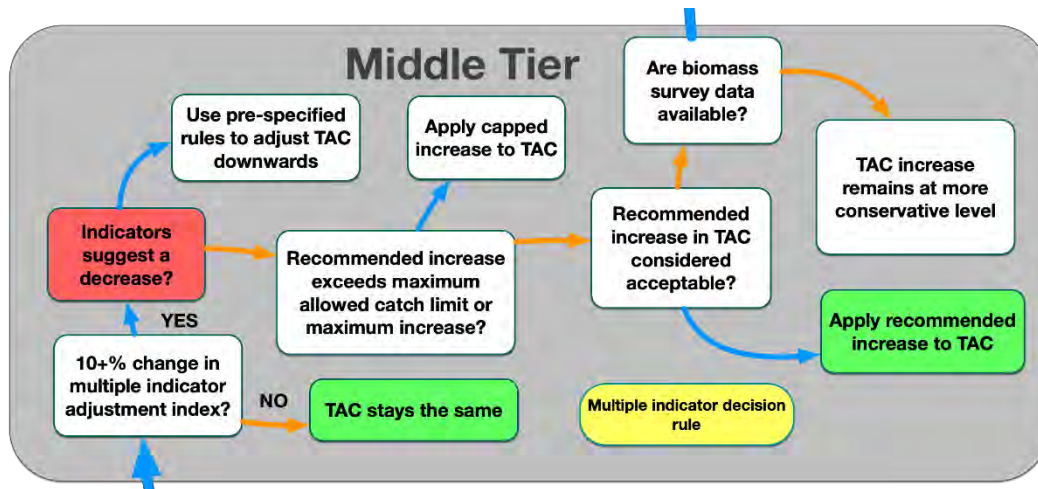


Figure 3. Flowchart summarising low tier Joint TAC trigger limit decision rule for reviewing whether a trigger is exceeded for any species caught as part of a basket species allocation.

## 2.11.2 Middle Tier Decision Rules



### When is the Middle Tier applied?

The Middle tier applies when high quality data are available from several primary indicators in addition to total catch per species.

The Middle Tier is not applicable during the initial years of HS implementation as insufficient detailed historical fishery data are available, but it provides a pathway for improving and growing the fishery in line with the HS objectives.

### What does the Middle Tier decision rule allow?

The Middle Tier Decision Rules specify how to increase TACs if good quality fishery data are available and indicate a capped increase is possible (see Table 3, maximum middle tier TAC increase).

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 (Figure 4).



### 2.11.2.1 Middle Tier 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 based on a Recommended Biological Catch (RBC) calculated using two 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 (Figure 4):

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

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  $A < \text{maximum increase permitted (MAX}_{sp})$ :

$$\begin{aligned} RBC &= \min(A, A_{cap}) \times C_{CUR} & RBC &\leq MAX_{sp} \\ RBC &= TAC & \min(A, A_{cap}) \times C_{CUR} &> MAX_{sp} \end{aligned}$$

The **Multiple indicator rule** can be summarised as follows:

- a) Calculate 2 or more of the individual Indicator adjustment factors described below
- b) Work out the average  $A$  of these values or a weighted average if assigning different weights to different contributions
- c) Calculate the average recent catch (past 3 years)
- d) 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
- e) Multiply the average recent catch by the indicator average to obtain the new Recommended Biological Catch (RBC)
- f) Check that the RBC does not exceed a pre-specified maximum catch limit (Table 3).

The multiple indicator rule will typically be applied to species which are highly targeted and 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. 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 calculated as described below, with a mathematical formulation first specified followed by plain English summary of the rule.

## Multiple Indicator Decision Rule

- Use CPUE plus at least 1 other (out of possible 3) indicators
- Calculate average trend in these combined indicators
- If positive, then increase in TAC could be considered (& conversely if negative)
- Set upper catch limit allowed (need survey to increase beyond this)

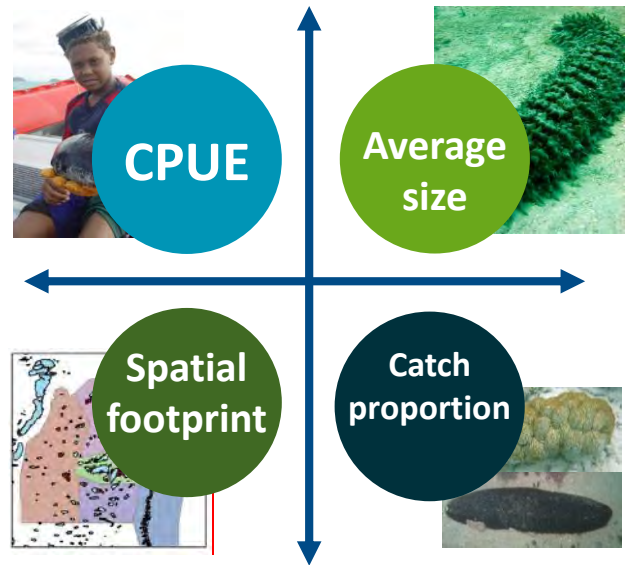


Figure 4. Schematic summary of the Middle Tier Multiple Indicator Decision Rule and its components



## Calculating Middle Tier Individual Indicator Adjustment Factors

### *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

### *Calculating the Middle Tier CPUE Indicator Adjustment Factor*

- 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.

### Average Size Indicator (based on recent average size relative to historical average)

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

- 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  $\bar{s}$  of previously sampled animals
- Parameter  $c_2$  accounts for how reliable data are (e.g. is the size sample representative), with guidance provided on default settings

### Calculating Middle Tier Average Size Indicator Adjustment Factor

- 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 Plagányi et al. (2019) 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

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

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

- 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 (e.g. due to local depletion)
- Parameter  $c_3$  accounts for how reliable data are (e.g. are there spatial references in the logbook used to compute the change in spatial footprint), with guidance provided on default settings

**Calculating Middle Tier Area Fished Indicator Adjustment Factor**

- 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 down weights 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.

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

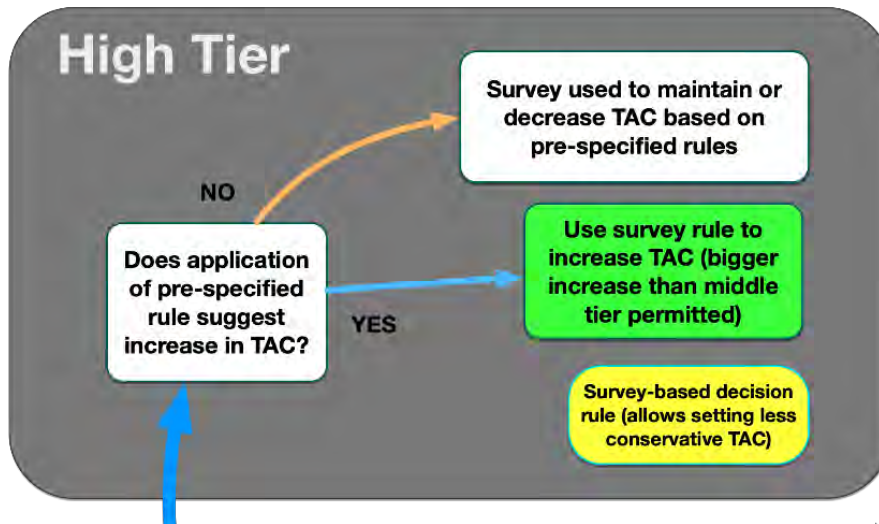
$$I_{prop} = 1 + c_4 \left( \frac{\sum_{y-2}^y p_y / 3 - \bar{p}}{\bar{p}} \right)$$

- 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  $\bar{p}$
- Parameter  $c_4$  accounts for how reliable data are (e.g. were representative catch samples used, data from logbooks), with guidance provided on default settings

**Calculating the Catch Proportion Indicator Adjustment Factor**

- 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 down weights 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.

### 2.11.3 High Tier Decision Rules



#### When is the High Tier applied?

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).

#### What do the High Tier decision rules allow?

The high tier 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 if total catch of a species is close to the current TAC.

### 2.11.3.1 Survey-based Decision Rule for adjusting TACs

This section describes the use of survey data as relative indices of abundance, as well as for estimating total standing stock biomass. There are a number of spatially-representative 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 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. 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 if total catch of a species is close to the current TAC.

### 2.11.3.2 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 (e.g. survey extent, intensity and standard error). Default 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.

### 2.11.3.3 Survey-Based Decision Rule based on total biomass estimate

For most species the starting TAC is set based on a conservative estimate of historical biomass (Figure 5). The survey biomass estimates can be used to inform baseline target and limit densities. 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. However, challenges need to be recognised in obtaining comparable and representative estimates for different species with differing habitats or spatial distributions. Any density measure needs to be sufficiently representative of the broader area in which that species occurs.

Given that the BDM Fishery includes many species occupying different habitats, the HS recognises that the same survey design isn't appropriate for all species. For species concentrated in a specific area (e.g. sandfish on 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 pursued to obtain an estimate of relative abundance as described above.

In contrast, for species which occur mostly in deeper waters (e.g. white teatfish), a survey with representative sites could be used to estimate the total standing stock biomass occupying previously unsurveyed areas or depths (in this case, depths in excess of 20m). This new information can inform 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 (Skewes et al., 2010).

Similarly, for species of concern, (e.g. 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.

The HS also recognises that technologies and survey techniques are developing and that innovative new survey methods may need to be included in future revisions of the HS.

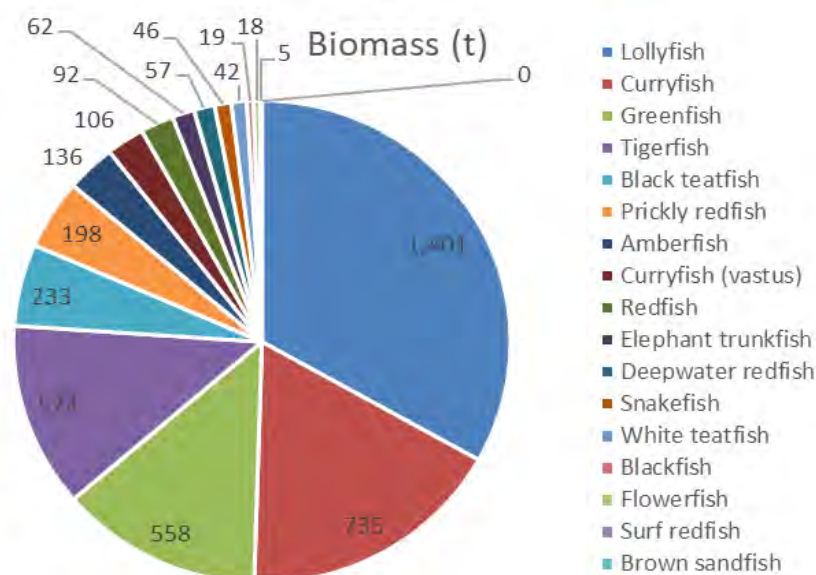
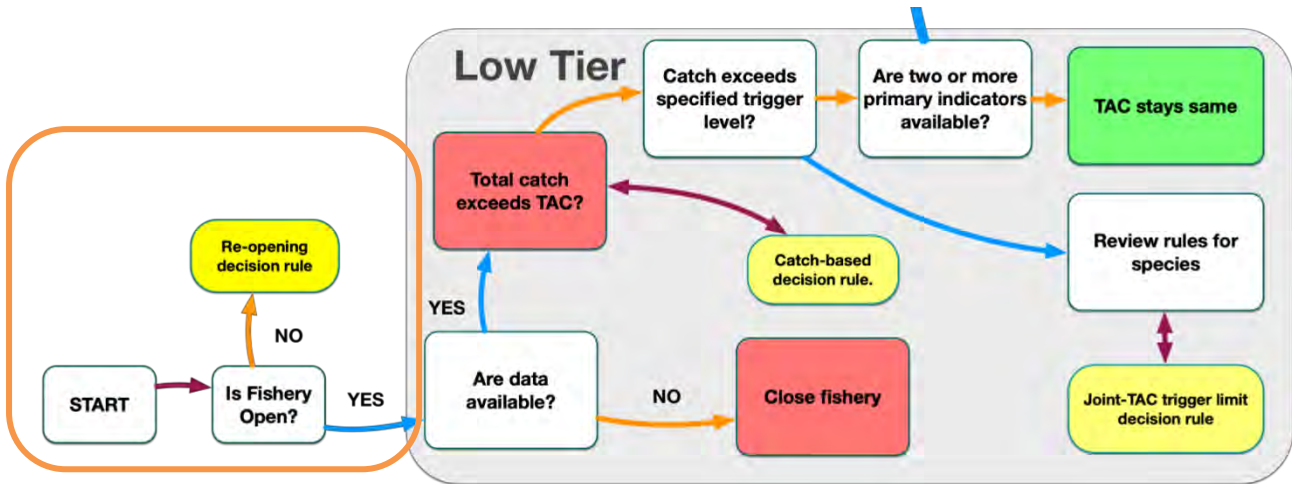


Figure 5. Schematic showing average survey-based Torres Strait biomass estimates (t) for species as shown for use in comparing with future survey-based biomass estimates.



2.11.4 Re-opening Decision Rule



This 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 due to concerns around stock status and depletion, or for reasons such as needing to first ensure adequately precautionary measures are in place so that overfishing does not occur or the stock does not become overfished.

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 (e.g. black teatfish). Note this also takes into account findings from testing spatial rotation strategies for Beche-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 decision rule which prescribes a pause in fishing following instances of heavy fishing (see [Low Tier Catch-Based Decision Rule](#)).

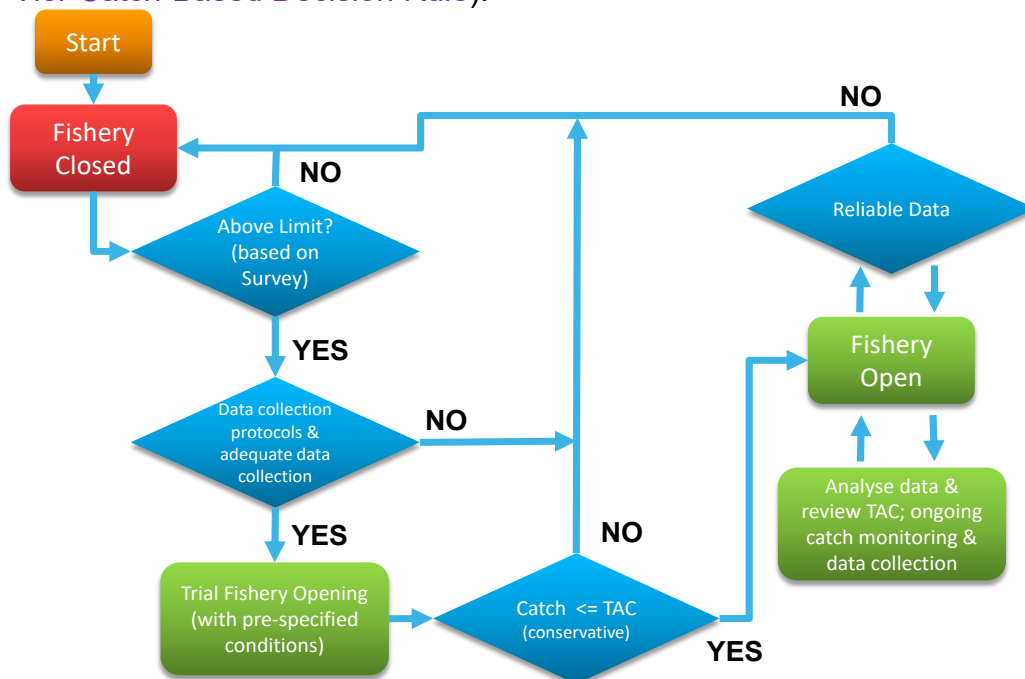


Figure 6. Flowchart summarising process for re-opening a closed fishery

If considering re-opening a closed fishery (Figure 6):

1. Using all available information, first establish that the stock is above a limit reference point level.
  - In the absence of reliable information, this may require conducting a new stock survey and comparing the biomass results with the limit reference point (see [High Tier Decision Rules](#)).
  - Only proceed to the next step in potential opening if the survey or available information suggests the stock is above a limit reference point.
2. Evaluate 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.
3. If the above conditions are met, then a trial opening is possible with the following conditions attached:
  - Accurate daily catch and effort reporting is required
  - A precautionary 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 trial TAC to allow all catch reported data to be entered and processed.
  - Further conditions may also be considered, including limitations on which species can be harvested in conjunction with a re-opened species, or with a particular gear (e.g. hookah).
  - Trial opening dates should be considered in relation to seasonal fishing dates. For example, industry have advised that the opening of a high value species such as black teatfish should preferably occur during the same time that the TRL fishery is open to hookah fishing to reduce pressure on the BDM stocks This may also account for equity considerations for fishers dedicated to 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.
4. The Trial opening TAC needs to be set at a demonstrably conservative level with reference to values as shown in Table 3.
5. 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.
6. If data collection during the Trial opening was not conducted satisfactorily, then the fishery is closed again and the re-opening decision rule process can commence again.
7. 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.
8. 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 Rule).

### 3 Governance

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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.

### 4 Review

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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 BDM 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 HS may be amended to incorporate decision rules appropriate for those assessments.

### 5 References

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## Appendix A.1 – Conversion Ratios

Table 4. 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	<i>Holothuria scabra</i>	0.496 <sup>4</sup>	0.355 <sup>4</sup>	AVE=0.049 <sup>a14</sup>	0.758 <sup>4</sup>	0.094 <sup>4</sup>	0.125 <sup>4</sup>	1.319 <sup>d</sup>	10.638 <sup>e4</sup>
Surf Redfish	<i>Actinopyga mauritiana</i>	0.684 <sup>2*</sup>	-	AVE=0.084 <sup>a12*</sup>	0.873 <sup>4</sup>	AVE=0.187 <sup>2*4</sup>	0.286 <sup>4</sup>	1.145 <sup>d</sup>	AVE=5.930 <sup>2*e4g</sup>
Black Teatfish	<i>Holothuria whitmaei</i>	AVE=0.677 <sup>2*34</sup>	0.529 <sup>3</sup>	AVE=0.108 <sup>a12*3</sup>	0.824 <sup>f,4</sup>	AVE=0.177 <sup>2*f3</sup>	0.220 <sup>f</sup>	1.213 <sup>f,4</sup>	AVE=5.663 <sup>2*f3g</sup>
White Teatfish	<i>Holothuria fuscogilva</i>	AVE=0.627 <sup>2*c4</sup>	0.593 <sup>c</sup>	AVE: 0.137 <sup>1ab2*</sup>	0.775 <sup>1</sup>	AVE=0.237 <sup>12*</sup>	0.309 <sup>1</sup>	1.290 <sup>1</sup>	AVE=4.219 <sup>12*g</sup>
Prickly Redfish	<i>Thelenota ananas</i>	AVE=0.667 <sup>c4</sup>	0.481 <sup>c</sup>	AVE=0.055 <sup>1ab4</sup>	AVE=0.736 <sup>14</sup>	AVE=0.088 <sup>14</sup>	AVE=0.118 <sup>14</sup>	AVE=1.382 <sup>1d4</sup>	AVE=12.502 <sup>1e4</sup>
Hairy Blackfish	<i>Actinopyga miliaris</i>	0.480 <sup>4</sup>	-	AVE=0.067 <sup>a14</sup>	0.964 <sup>4</sup>	0.209 <sup>4</sup>	0.217 <sup>4</sup>	1.037 <sup>d</sup>	4.785 <sup>e</sup>
Curryfish (common)	<i>Stichopus herrmanni</i>	0.651 <sup>2</sup>	-	AVE=0.036 <sup>a1</sup>	-	0.114 <sup>2</sup>	-	-	8.772 <sup>2g</sup>
Elephants Trunkfish	<i>Holothuria fuscopunctata</i>	0.519 <sup>4</sup>	-	AVE=0.133 <sup>a1b4</sup>	0.911 <sup>4</sup>	0.242 <sup>4</sup>	0.263 <sup>4</sup>	1.097 <sup>d4</sup>	8.772 <sup>e4</sup>
Lollyfish	<i>Holothuria atra</i>	AVE=0.436 <sup>c12*</sup>	0.236 <sup>c1</sup>	AVE=0.063 <sup>a1bc2*</sup>	0.586 <sup>1</sup>	0.150 <sup>12*</sup>	0.256 <sup>1</sup>	1.706 <sup>1</sup>	5.917 <sup>12*g</sup>
Deepwater redfish	<i>Actinopyga echinites</i>	0.692	-	AVE=0.088 <sup>a13</sup>	-	0.152 <sup>f3</sup>	-	-	6.600 <sup>f3</sup>
Curryfish (vastus)	<i>Stichopus vastus</i>	-	-	-	-	-	-	-	-

Common name	Species	Live to Guttled	Live to Salted	Live to Dried	Guttled to Salted	Guttled to Dried	Salted to Dried	Salted to Guttled	Dried to Guttled
Burrowing blackfish	<i>Actinopyga spinea</i>	0.544 <sup>3</sup>	0.375 <sup>3</sup>	0.073 <sup>1a</sup>	0.689 <sup>f3</sup>	0.135 <sup>f3</sup>	0.195 <sup>f3</sup>	1.449 <sup>f3</sup>	7.424 <sup>f3</sup>
Deepwater blackfish	<i>Actinopyga palauensis</i>	AVE=0.818 <sup>c13</sup>	AVE=0.593 <sup>c1</sup> <sub>3</sub>	AVE=0.175 <sup>a1b</sup>	AVE=0.728 <sup>1f3</sup>	AVE=0.190 <sup>1f3</sup>	AVE=0.262 <sup>1f3</sup>	AVE=1.374 <sup>1f3</sup>	AVE=5.335 <sup>1f3</sup>
Golden sandfish	<i>Holothuria lessoni</i>	0.645 <sup>3</sup>	0.526 <sup>3</sup>	0.098 <sup>a</sup>	0.815 <sup>f3</sup>	0.152 <sup>f3</sup>	0.186 <sup>f3</sup>	1.226 <sup>f3</sup>	6.588 <sup>f</sup>
Brown sandfish	<i>Bohadschia vitiensis</i>	0.735 <sup>c1</sup>	0.612 <sup>c1</sup>	0.116 <sup>c1</sup>	0.834 <sup>1</sup>	0.157 <sup>1</sup>	0.189 <sup>1</sup>	1.199 <sup>1</sup>	6.337 <sup>1</sup>
Leopardfish	<i>Bohadschia argus</i>	AVE=0.665 <sup>c12</sup>	0.572 <sup>c1</sup>	AVE=0.115 <sup>c12</sup>	0.777 <sup>1</sup>	AVE=0.171 <sup>12</sup>	0.233 <sup>1</sup>	1.286 <sup>1</sup>	AVE=5.841 <sup>12g</sup>
Greenfish	<i>Stichopus chloronotus</i>	-	-	-	-	-	-	-	-
Stonefish	<i>Actinopyga lecanora</i>	0.894 <sup>c1</sup>	0.652 <sup>c1</sup>	AVE=0.154 <sup>c12*</sup>	0.729 <sup>1</sup>	AVE=0.158 <sup>12</sup> <sub>*</sub>	0.253 <sup>1</sup>	1.372 <sup>1</sup>	5.418 <sup>1</sup>

#### References – Table 4

- <sup>1</sup>Ngaluafe, P. & Lee, J. 2013. Change in weight of sea cucumbers during processing: Ten common commercial species in Tonga. SPC Beche-de-mer Information Bulletin 33: 3-8.
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- <sup>2\*</sup>Calculations from raw data used in Prescott et al., 2015. (Data provided by Shijie Zhou).
- <sup>3</sup>Purcell, S.W., Gossuin, H., Agudo, N.S. 2009. Changes in weight and length of sea cucumbers during conversion to processed beche-de-mer: Filling gaps for some exploited tropical species. SPC Beche-de-mer Information Bulletin 29: 3-6.
- <sup>4</sup>Skewes, T., Smith, L., Dennis, D., Rawlinson, N., Donovan, A. & Ellis, N. 2004. Conversion ratios for commercial beche-de-mer species in Torres Strait. AFMA Final Report #R02/119. 20 pp.
- <sup>a</sup>Ngaluafe & Lee, 2013. Table 3; percent conversion ratios, total whole/fresh weight, from wet to dry product including values from other studies.

<sup>b</sup>Ngaluafe & Lee, 2013. Table 1; wet-to-dry conversion ratios.

<sup>c</sup>Whole fresh weights noted in Purcell et al., 2009.

<sup>d</sup>Derived: Inverse gutted to salted value Skewes et al. 2004.

<sup>e</sup>Derived: Inverse dried to gutted value Skewes et al. 2004.

<sup>e</sup>Empirical: Values calculated from Purcell et al. 2009.

<sup>g</sup>Inverse: Values calculated from Prescott et al., 2015.

### Footnote

<sup>a</sup>Ngaluafe & Lee, 2013. Table 3, percent conversion ratios, total whole/fresh weight, from wet to dry product including values from other studies.

<sup>f</sup>Empirical: Values calculated from Purcell et al. 2009.

### Data

<sup>h</sup>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)



## Appendix A.2 – Size limit information

Table 5. Size limits

Common name	Species	Maximum length cm (guide)	Size at maturity cm	Size limit TS	Proposed size limit TS*	Size limit East Coast	Age at maturity TS yrs (size, cm) (model)	TAC Torres Strait (t)
Sandfish	<i>Holothuria scabra</i>	32	13-25	18	Leave <sup>4</sup>	20	2 (16.5)	No take
Surf Redfish	<i>Actinopyga mauritiana</i>	38	22-23	22	Leave	25	3 (13.8)	No take
Black Teatfish	<i>Holothuria whitmaei</i>	30	22-26	25	Leave	30	4 (24)	No take
White Teatfish	<i>Holothuria fuscogilva</i>	55	32	32	Leave	40	4 (30.4)	15
Prickly Redfish	<i>Thelenota ananas</i>	70	30-35	35	Leave	50	4 (30.4)	20
Hairy Blackfish	<i>Actinopyga miliaris</i>	35	12	22	Leave	20	3 (19.2)	Part of 80t limit
Curryfish (common)	<i>Stichopus herrmanni</i>	55	27-31	27	31 <sup>2</sup>	35	-	Part of 80t limit
Elephants Trunkfish	<i>Holothuria fuscopunctata</i>	66	35	24	Leave <sup>5</sup>	40	-	Part of 80t limit
Lollyfish	<i>Holothuria atra</i>	65	12-19	15	Leave <sup>5</sup>	20	-	Part of 80t limit
Deepwater Redfish	<i>Actinopyga echinites</i>	35	9-12	12	20 <sup>3</sup>	20	3 (19.5)	Part of 80t limit
Curryfish ( <i>vastus</i> )	<i>Stichopus vastus</i>	35	-	nil	15 <sup>1</sup> (5t trigger)	15	-	Part of 80t limit
Burrowing blackfish	<i>Actinopyga spinea</i>	40	-	22	Leave	20	-	Part of 80t limit
Deepwater blackfish	<i>Actinopyga palauensis</i>	35	-	22	Leave	20	-	Part of 80t limit
Golden sandfish	<i>Holothuria lessoni</i>	46	22	18	22 <sup>2</sup>	15	-	Part of 80t limit
Brown sandfish	<i>Bohadschia vitiensis</i>	40	15-26	nil	25 <sup>1,2</sup>	25	-	Part of 80t limit
Leopardfish	<i>Bohadschia argus</i>	60	30	nil	30 <sup>1</sup>	35	3	Part of 80t limit
Greenfish	<i>Stichopus chloronotus</i>	38	14	nil	Leave	20	-	Part of 80t limit
Stonefish	<i>Actinopyga lecanora</i>	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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## Appendix A.3 – Sea cucumber Spawning Information

Table 6. Sea cucumber spawning information

Common name	Species	Spawning time	Country
Sandfish	<i>Holothuria scabra</i>	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	<i>Actintopyga mauritiana</i>	June to April	Guam
		December, January	New Caledonia
Black Teatfish	<i>Holothuria whitmaei</i>	June, July	New Caledonia
		April	Aldabra, Seychelles
		December*	GBR, Australia*
White Teatfish	<i>Holothuria fuscogilva</i>	Part of November, December, January	New Caledonia
Prickly Redfish	<i>Thelenota ananas</i>	January, February, March	New Caledonia
		December*	John Brewer Reef, GBR, Australia*
Hairy Blackfish	<i>Actinopyga miliaris</i>	July (new moon)	Japan
		May, November to December	New Caledonia
		November*	Orpheus Island, Australia*
Curryfish (common)	<i>Stichopus herrmanni</i>	December, January	New Caledonia
		June to July	Straits of Malacca, Malaysia
		November, December, January*	Little Broadhurst Reef, GBR, Australia*
Elephants Trunkfish	<i>Holothuria fuscopunctata</i>	December, January, part of February	New Caledonia
		December*	Lizard Island, Australia*
		December*	John Brewer, GBR, Australia*

Common name	Species	Spawning time	Country
Lollyfish	<i>Holothuria atra</i>	November	Solomon Islands
		August	Peninsular Malaysia
		October*	Davies Reef, GBR, Australia*
Deepwater Redfish	<i>Actinopyga echinites</i>	January, February	New Caledonia
Curryfish ( <i>vastus</i> )	<i>Stichopus vastus</i>	-	-
Burrowing blackfish	<i>Actinopyga spinea</i>	-	-
Deepwater blackfish	<i>Actinopyga palauensis</i>	-	-
Golden sandfish	<i>Holothuria lessoni</i>	November, December, January, part of February	New Caledonia
		November	New Caledonia
Brown sandfish	<i>Bohadschia vitiensis</i>	November, December	New Caledonia
Leopardfish	<i>Bohadschia argus</i>	October to January*	GBR, Australia*
		October, November, December, January*	GBR, Australia*
Greenfish	<i>Stichopus chloronotus</i>	April to June, December to February	Straits of Malacca, Malaysia
		November, January*	Myrmidon Reef, Davies Reef, GBR, Australia*
Stonefish	<i>Actinopyga lecanora</i>	July	Peninsular Malaysia
		December*	GBR, Australia*

## References – Table 6

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## Appendix A.4 – Average density from surveys

Table 7. Average density (per ha) of sea cucumbers from surveys. Densities were 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	<b>1.6</b>
High value	-	18.03	14.74	<b>-18.3</b>
Med value	-	55.99	53.93	<b>-3.7</b>
<i>H. whitmaei</i>	Black teatfish	4.00	3.08	<b>-22.8</b>
<i>H. fuscogilva</i>	White teatfish	5.43	3.57	<b>-34.1</b>
<i>T. ananas</i>	Prickly redfish	8.61	8.09	<b>-6.0</b>
<i>A. miliaris</i>	Blackfish	1.64	3.79	<b>131.3</b>
<i>A. lecanora</i>	Stonefish	0.10	0.00	<b>-100.0</b>
<i>A. mauritiana</i>	Surf redfish	1.02	0.00	<b>-100.0</b>
<i>A. echinites</i>	Deep water redfish	1.43	0.51	<b>-64.3</b>
<i>All Actinopyga</i>		4.20	4.30	<b>2.4</b>
<i>H. atra</i>	Lollyfish	25.60	33.91	<b>32.5</b>
<i>H. fuscopunctata</i>	Elephant trunkfish	15.30	15.43	<b>0.9</b>
<i>H. coluber</i>	Snakefish	0.61	4.41	<b>616.7</b>
<i>H. edulis</i>	Pinkfish	30.79	27.97	<b>-9.2</b>
<i>B. graeffei</i>	Flowerfish	3.59	3.72	<b>3.8</b>
<i>B. argus</i>	Leopardfish	12.91	11.32	<b>-12.3</b>
<i>S. chloronotus</i>	Greenfish	23.16	24.71	<b>6.7</b>
<i>T. anax</i>	Amberfish	2.56	2.59	<b>1.3</b>
<i>S. herrmanni</i>	Curryfish	10.60	10.18	<b>-4.0</b>
<i>H. leucospilota</i>	Black tarzan	1.54	2.56	<b>66.7</b>

## Appendix A.5 – Industry proposed closures

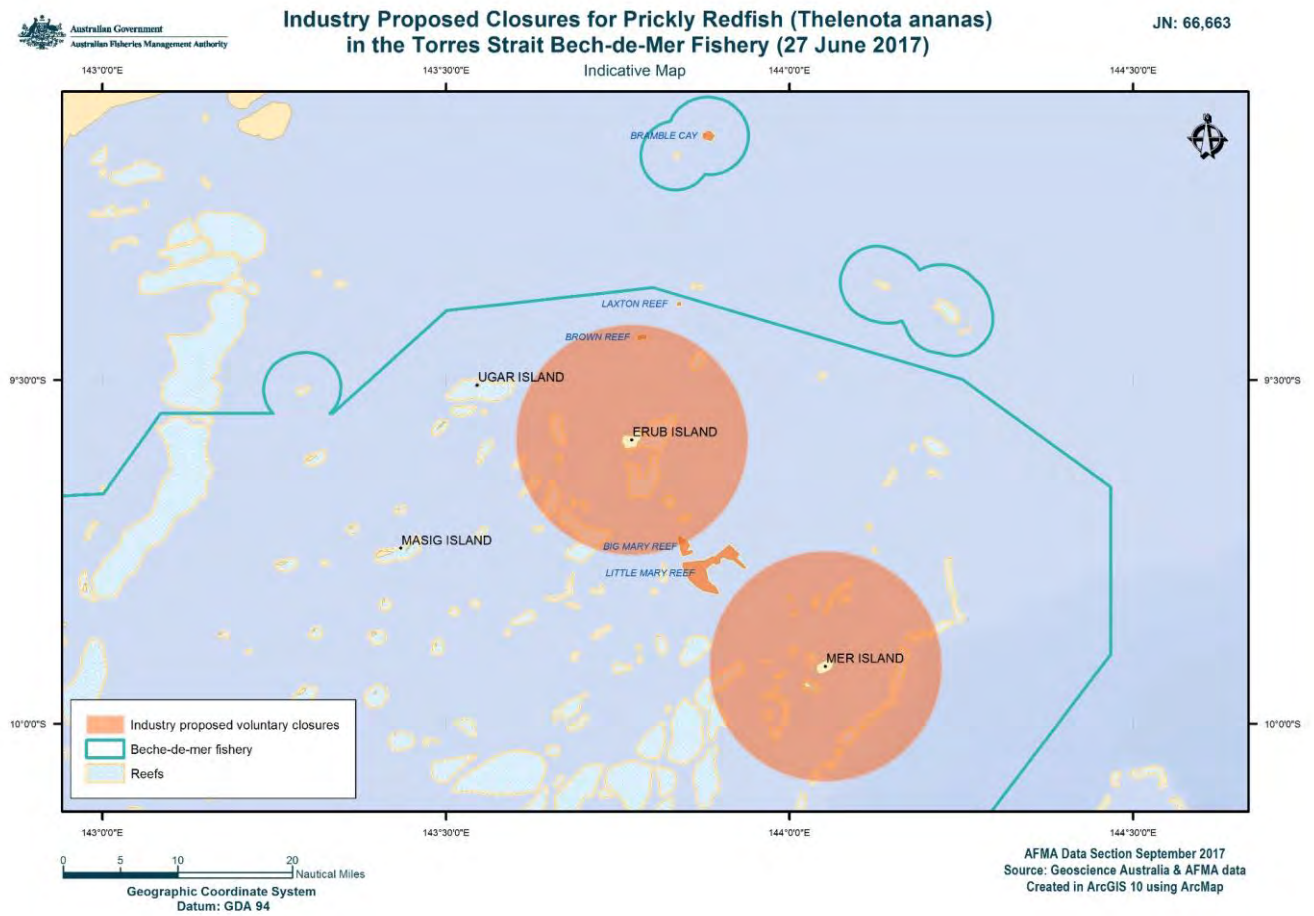


Figure 7. Industry proposed closures for Prickly Redfish (*Thelenota ananas*) in the Torres Strait Beche-de-mer Fishery (27 June 2017).



## Appendix A.6 – Sandfish historical survey data

### Warrior Reef sandfish example

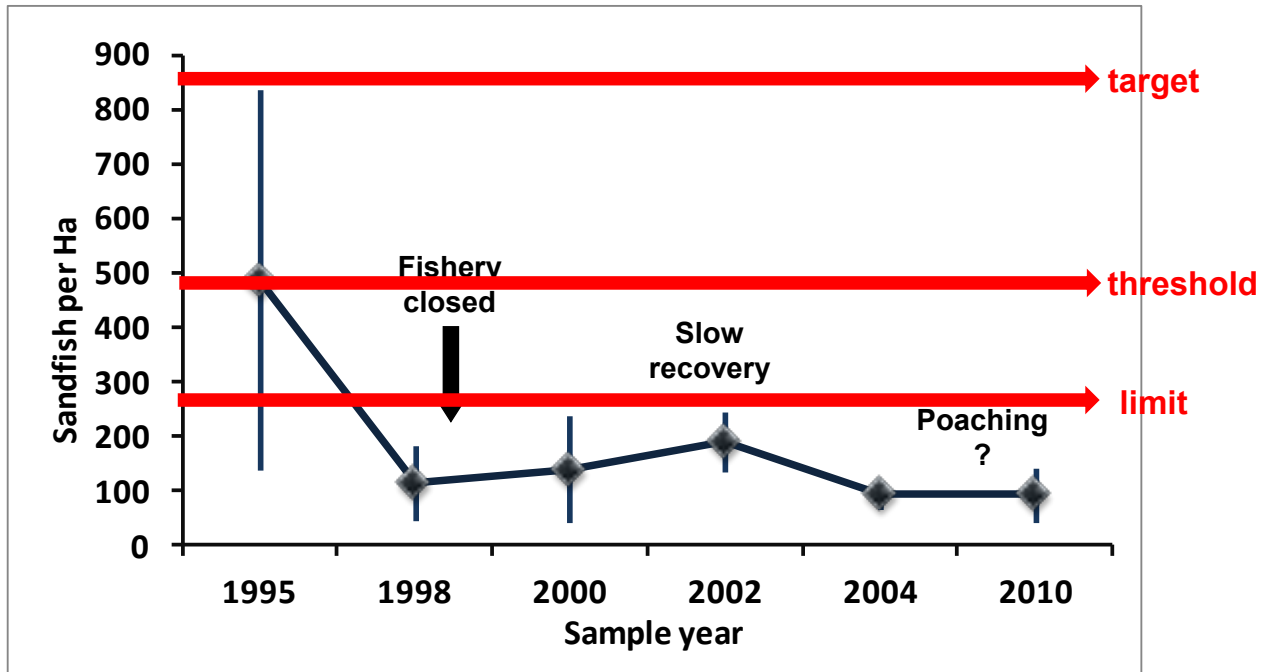


Figure 8. Example using Warrior Reef historical survey data for sandfish and comparison with sandfish density estimates from other locations, to inform choice of a limit reference point (below which the fishery should be closed), a threshold reference point (which is set higher than the limit reference point and serves as a trigger to re-open a fishery) and a target level that should ideally be aimed for.



**Australian Government**

**Australian Fisheries Management Authority**

# **Torres Strait Bêche-de-mer (BDM) Fishery**

## **2023 Species Summaries**

Prepared for the 3<sup>rd</sup> meeting of the Hand Collectables Resource Assessment Group (HCRAAG) and 20<sup>th</sup> meeting of the Hand Collectable Working Group (HCWG)

17-19 October 2023

Thursday Island

DRAFT

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## Purpose

This document is intended to be used in conjunction with the Torres Strait Beche-de-mer Fishery Harvest Strategy (November 2019) (the Harvest Strategy), available fishery dependent (e.g. catch and effort) and independent data (e.g. scientific surveys), including applicable species stock assessments.

These species summaries are aimed at guiding the Hand Collectables Resource Assessment Group (HCRAAG) and Hand Collectables Working Group (HCWG) in their assessment of commercial sea cucumber species in the Torres Strait Beche-de-mer Fishery (the BDM Fishery) under the Harvest Strategy, and to determine the recommended biological catches (RBCs) and/or total allowable catches (TACs) for the fishing season commencing on 1 January each year.

These species summaries provide a stepped application of the Harvest Strategy's decision rules to recommend RBCs and/or TACs for each species, taking into account the latest fishery dependant and independent data and information available. The summaries also provide a summary of stock status and assessment details for each species.

This resource is also intended to be used by the HCRAAG and HCWG to identify information gaps and research needs for each species that can feed into the research need identification and prioritisation process for Torres Strait fisheries.

## Individual target species

## Black teatfish

Species Summary				
Common names	Black teatfish			
Scientific name	<i>Holothuria whitmaei</i>			
Species ecology	Found on shallow reefs of East Torres Strait. It is almost entirely an Australian population. Reef flats, reef fronts and reef passes. 1-20 m			
Status open/closed	Open			
Pre-Harvest Strategy TAC	Closed			
Current TAC	20 tonnes (wet weight of gutted fish), based on stock assessment			
Basket trigger	N/A			
Minimum size limit	25 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	787	172.3	Yes
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	No	HCRAG and HCWG to discuss
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	<p>The overall average density for black teatfish in 2019/20 was slightly lower than 2009, which in turn, were the highest ever observed in Torres Strait since surveys began, though with low statistical confidence. Given the low levels of exploitation since the fishery was closed in 2003 (~40 tonnes) relative to current estimates of fishery biomass, and current density relative to previous surveys, there is some confidence that the population is likely to be above the limit reference point (<math>B_{lim}</math>) of 40% <math>B_0</math>. Furthermore, high densities observed in the preferred black teatfish habitats (reef-top buffer strata) of Don Cay and Barrier, and observations of long-term Traditional Owner fishers (reported anecdotally at HCWG meetings), indicate the population is likely near virgin biomass levels (<math>B_0</math>). However, there are still some uncertainties in the assessment, particularly with regard to the lower density values in the Darnley and Cumberland zones - two zones that are subject to the highest fishing pressure in the reopened fishery</p>			
Summary of stock assessment model findings (Murphy <i>et al</i> , 2021, Plaganyi <i>et al</i> , 2022)	<p>In 2020, the HCWG considered the preliminary results of a newly developed surplus production model for black teatfish. Results of updates to the surplus production model for black teatfish were subsequently considered by the HCRAG and HCWG in 2021. In 2022, the HCRAG and HCWG again considered results of updates to the surplus production model based on catch data up to 2022 as well as a newly developed age-structured model based on the size frequency data collected in 2022. When last considered by the HCRAG, both model results were considered consistent with previous outcomes that, based on the data currently available for the fishery, an annual 20 tonne TAC continues to be sustainable, whereas an annual TAC of 30 tonne is projected to lead to a constant decline after the first year of fishing. Future iterations of the model will benefit from: inclusion of missing historical catch data – invited industry observers confirmed that there is catch data missing for 1993 and 1996; articulation of species-specific harvest strategy reference points. There are no agreed BMSY and BMEY levels, although modelling indicates the stock is considered to be above the optimal target level and well above the precautionary proxy BLIM of 40%; and data on larger</p>			

	individuals in the stock to provide some certainty on whether the stock's reproductive potential has recovered to that of pre-fished levels.					
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023					
<b>Price data (as advised by industry from 2023 opening)</b>	Beach price is \$36/kg (gutted salted)					
<b>Climate considerations (Dutra et al, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi et al. 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).					
<b>Any other changes in the fishery?</b>	None identified					
<b>Any other sources of mortality apart from fishing?</b>	None identified					
<b>ABARES Fishery Status Report (Patterson et al, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Catch below TAC in 2021			<b>Biomass: Not overfished</b> Biomass likely to be above the limit reference point		
<b>Other information</b>	Listed under Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This listing came into effect on 28 August 2020. Additional assessment requirements apply under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Additional export requirements apply. Also listed as endangered (global) on the IUCN Red list due to a decreasing population trend					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	17.615	20	88.1	No	N/A
	2022	17.057	20	85.3	No	N/A
	2023	17.902	20	89.5	No	N/A
<b>Applicable decision rules</b>	Low Tier Catch-Based Decision Rule applies (decision rule 2.11.1.1)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p><b>Insert recommendations from HCRAG and HCWG</b></p> <p>2022 HCRAG and HCWG advice: The stock assessment was considered by the HCRAG and informed its recommendation to open black teatfish on an annual basis from 2023 with a 20 tonnes TAC, on the basis that:</p> <ul style="list-style-type: none"> <li>- The success of the 2021 and 2022 trial openings have demonstrated that there are sufficient management, monitoring and compliance tools in place to mitigate the risk of overcatch;</li> <li>- The updated stock assessment confirmed that a 20 tonne TAC continues to be sustainable and would not lead to a consistent decline in black teatfish biomass after the first year of fishing;</li> <li>- A size frequency sampling program was successfully undertaken during the 2022 season and is recommended to be continued;</li> <li>- Black teatfish will continue to be assessed under the BDM Fishery Harvest Strategy.</li> </ul> <p>This recommendation was supported by the HCWG.</p>					

### Species specific data gaps and needs

Ongoing size frequency data needed. General need to improve area and effort reporting in CDRs

### Species specific research and priorities

Under AFMA project 2021 0817, CSIRO in partnership with AFMA scientific observers undertook size frequency sampling of black teatfish catches during the 2022 trial opening. Opportunistic sampling of other species was also undertaken where landed catches included species other than black teatfish. Size frequency sampling was again undertaken during the 2023 opening. Analysis of data from the opening will be undertaken shortly by CSIRO and will include refinements to the stock assessment model (AFMA project 2023-0800). Outcomes from this project will be considered at this meeting of the HCRAAG and HCWG (October 2023).

Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAAG and HCWG advice will be sought on any proposals received

HCRAAG and HCWG recommendations regarding RBC and/or TAC	Fishing season	RBC (t)	Overcatch to be discounted (t)	Other source(s) of mortality (t)	TAC (t, wet gutted weight)
	2023				

Insert recommendations from HCRAAG and HCWG



Species Summary				
<b>Common names</b>	Deepwater redfish			
<b>Scientific name</b>	<i>Actinopyga echinites</i>			
<b>Species ecology</b>	Shallow reef habitat in central Torres Strait and Warrior Reef. Coastal reef in rubble, seagrass beds or sand between corals. 0-10 m			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	5 tonnes (wet weight of gutted fish), based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	N/A, previously 5 tonnes basket trigger limit			
<b>Minimum size limit</b>	20 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy et al, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	66	55	No evidence that the species is below the default limit reference point
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	No	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy et al, 2021)</b>	Catches low relative to biomass. Increasing overall trend in density. No concern for TAC			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	Not targeted due to low beach price of 3/kg (wet), \$7/kg (boiled), \$80-\$100/kg (dried)			
<b>Climate considerations (Dutra et al, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi et al. 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			
<b>Any other sources of mortality apart from fishing?</b>	None identified			

<b>ABARES Fishery Status Report (Patterson et al, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Catch below TAC in 2021		<b>Biomass: Uncertain</b> Unable to reconcile biomass status with available information. Survey data indicates that the deepwater redfish stock in Torres Strait may have been reduced to below the limit reference point			
<b>Other information</b>	Listed as vulnerable (global) on the IUCN Red list due to a decreasing population trend.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0.031	5	0.6	No	N/A
	2022	0.049	5	1	No	N/A
	2023 (partial)	0	5	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Catch-Based Decision Rule applies (decision rule 2.11.1.1)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: With regards to deepwater redfish and hairy blackfish, the HCRAG and HCWG noted:</p> <ul style="list-style-type: none"> <li>- Catches to date have been low and the advice from industry that fishing for these species is heavily market driven;</li> <li>- The ABARES observer's comment that these species are classified as uncertain in the ABARES Fishery Status Reports due to a low biomass estimate for the species relative to the TAC, compared to historically higher biomass estimates;</li> <li>- The most recent biomass estimates for both species were obtained from a scientific survey that was not optimised for their patchy distribution and did not include areas where they are known to occur such as Warrior Reef (as also confirmed by fishers on the ground that it does occur here);</li> <li>- Previous advice from CSIRO that there is no concern for the current level of TAC for deepwater redfish as catches remain low relative to biomass and the overall increasing trend in density;</li> <li>- More targeted survey and/or sampling of hairy blackfish is required to get sufficient information to assess its status however current catches are too low to justify the substantial investment in research;</li> <li>- AFMA will continue to work with industry to improve the quality of catch reporting, particularly with regards to spatial reporting and species identification.</li> </ul>					
<b>Species specific data gaps and needs</b>						
General need to improve species identification, area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					

Insert recommendations from HCRAAG and HCWG

Species Summary				
Common names	Greenfish			
Scientific name	<i>Stichopus chloronotus</i>			
Species ecology	Found in reef top and reef top buffer waters in East Torres Strait. 0-20 m			
Status open/closed	Open			
Pre-Harvest Strategy TAC	Part of 80 tonnes basket species TAC			
Current TAC	40 tonnes (wet weight of gutted fish), based on Harvest Strategy starting TAC			
Basket trigger	N/A			
Minimum size limit	Nil			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	906	-	No evidence that the species is below the default limit reference point
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	No	HCRAG and HCWG to discuss
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	Catches low. Generally increasing density trend. No concern for TAC			
Summary of stock assessment model findings	N/A			
Catch data	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
Price data (as advised by industry at HCRAG 1 meeting)	HCRAG and HCWG to discuss			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
Any other changes in the fishery?	None identified			
Any other sources of mortality apart from fishing?	None identified			

<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Catch below TAC in 2021	<b>Biomass: Not overfished</b> Biomass likely to be above the limit reference point				
<b>Other information</b>	Listed as least concern (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0	40	0	No	N/A
	2022	0	40	0	No	N/A
	2023 (partial)	0	40	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Catch-Based Decision Rule applies (decision rule 2.11.1.1)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
<p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

Species Summary				
<b>Common names</b>	Hairy blackfish, blackfish			
<b>Scientific name</b>	<i>Actinopyga miliaris</i>			
<b>Species ecology</b>	Broad distribution. High density on shallow reef habitat in central Torres Strait and Warrior Reef. Muddy-sand lagoons, reef flats, fore reef pavement. 1-20 m			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	5 tonnes (wet weight of gutted fish), based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	N/A, previously 5 tonnes basket trigger limit			
<b>Minimum size limit</b>	22 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	- (landed (wet gutted) weight of 15 tonnes)	-	Insufficient information to assess the status of the stock in relation to the limit reference point
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Limited	No	Yes	<b>HCrag and HCWG to discuss</b>
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	Status remains relatively unknown. Possible decline or natural variability. Targeted survey sampling may need to be factored into future fishery surveys			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCrag 1 meeting)</b>	Low beach price of \$3-\$7.50/kg ( <b>processed form to be confirmed</b> ), \$15/kg ( <b>frozen whole - processed form to be confirmed</b> ), \$80-\$100/kg (dry)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			

Any other sources of mortality apart from fishing?	None identified					
ABARES Fishery Status Report (Patterson <i>et al</i> , 2022)	<b>Fishing mortality: Uncertain</b> Unable to reconcile fishing mortality status with available information. Level of catch taken in recent years is high relative to the biomass estimated though survey in 2019/20			<b>Biomass: Uncertain</b> Unable to reconcile biomass status with available information. Large decrease in estimated density between 2009 and 2019/20 surveys potentially indicating a substantial reduction in the population between surveys and possible overexploitation		
Other information	Listed as vulnerable (global) on the IUCN Red list due to a decreasing population trend.					
<b>Low Tier</b>						
Catch and TAC (t)	Fishing season	Catch (t, wet gutted weight)	TAC (t, wet gutted weight)	% TAC caught	TAC or basket trigger exceeded?	% of TAC overcatch
	2021	0.519	5	10.4	No	N/A
	2022	0.696	5	13.9	No	N/A
	2023 (partial)	-*	5	-*	No	N/A
Applicable decision rules	Low Tier Catch-Based Decision Rule applies (decision rule 2.11.1.1)					
HCRAG and HCWG recommendations regarding application of the decision rules	<p>Insert recommendations from HCRAG and HCWG</p> <p>2022 HCRAG and HCWG advice: With regards to deepwater redfish and hairy blackfish, the HCRAG and HCWG noted:</p> <ul style="list-style-type: none"> <li>- Catches to date have been low and the advice from industry that fishing for these species is heavily market driven;</li> <li>- The ABARES observer's comment that these species are classified as uncertain in the ABARES Fishery Status Reports due to a low biomass estimate for the species relative to the TAC, compared to historically higher biomass estimates;</li> <li>- The most recent biomass estimates for both species were obtained from a scientific survey that was not optimised for their patchy distribution and did not include areas where they are known to occur such as Warrior Reef (as also confirmed by fishers on the ground that it does occur here);</li> <li>- Previous advice from CSIRO that there is no concern for the current level of TAC for deepwater redfish as catches remain low relative to biomass and the overall increasing trend in density;</li> <li>- More targeted survey and/or sampling of hairy blackfish is required to get sufficient information to assess its status however current catches are too low to justify the substantial investment in research;</li> <li>- AFMA will continue to work with industry to improve the quality of catch reporting, particularly with regards to spatial reporting and species identification.</li> </ul>					
<b>Species specific data gaps and needs</b>						
Targeted survey sampling may need to be factored into future fishery surveys (Murphy <i>et al</i> , 2021). General need to improve species identification, area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						



HCRAg and HCWG recommendations regarding RBC and/or TAC	Fishing season	RBC (t)	Overcatch to be discounted (t)	Other source(s) of mortality (t)	TAC (t, wet gutted weight)
	2023				
Insert recommendations from HCRAg and HCWG					

\* Confidential information, information does not represent data from five or more vessels and so is not able to be publicly released under AFMA's Information Disclosure Policy.

Species Summary				
Common names	Prickly redfish, pineapple sea cucumber			
Scientific name	<i>Thelenota ananas</i>			
Species ecology	Found in reef edge and pass waters in East Torres Strait. Lagoons, in areas with rubble and passes. 1-35 m			
Status open/closed	Open			
Pre-Harvest Strategy TAC	15 tonnes, reduced from 20 tonnes in 2017			
Current TAC	15 tonnes (wet weight of gutted fish), based on Harvest Strategy starting TAC			
Basket trigger	N/A			
Minimum size limit	35 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	461	253.3	Yes
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	Yes	Close monitoring
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	Slight decline (in slope - density over time), suggesting some concern given reports of sustained high catches. Close monitoring recommended			
Summary of stock assessment model findings	N/A			
Catch data	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
Price data (as advised by industry at HCRAAG 1 meeting)	Beach price is \$61-\$85/kg (processed form to be confirmed)			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
Any other changes in the fishery?	Industry use a voluntary rotational harvesting approach			
Any other sources of mortality apart from fishing?	None identified			

<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Catch below TAC in 2021		<b>Biomass: Not overfished</b> Biomass likely to be above the limit reference point			
<b>Other information</b>	Listed under Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This listing will come into effect on 25 May 2024. Additional assessment requirements apply under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Additional export requirements will also apply. Also listed as endangered (global) on the IUCN Red list due to a decreasing population trend					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	15.036	15	100.2	Yes, TAC exceeded	0.2
	2022	13.514	15	90.1	No	N/A
	2023 (partial)	6.108	15	40.7	No	N/A
<b>Applicable decision rules</b>	<p>Low Tier Catch-Based Decision Rule applies (decision rule 2.11.1.1): if reported catches exceed the TAC by more than double, close the fishery; if reported catches exceed the TAC by &gt;20% and &lt;100% (double), then pause fishing for one fishing season; if the cumulative reported catches over a three year period exceed the TAC by &gt;5% and &lt;20%, then deduct the total overcatch from the TAC in the next full fishing season.</p> <p>Annual reported catches in the last three fishing seasons have not exceeded the TAC by &gt;20%. Cumulative reported catches for the last three fishing seasons was 44.204 tonnes.</p>					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p><b>Insert recommendations from HCRAG and HCWG</b></p> <p>2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch. Reported overcatch in 2020 did not trigger any of the overcatch decision rules. HCRAG advised that a TAC reduction may need to be considered if the species continues to be overcaught in subsequent fishing seasons</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
<b>Insert recommendations from HCRAG and HCWG</b>						

Species Summary				
<b>Common names</b>	White teatfish			
<b>Scientific name</b>	<i>Holothuria fuscogilva</i>			
<b>Species ecology</b>	Found in deeper reef edge and reef pass waters in far East Torres Strait. There is no evidence it is found in deeper open water habitats (e.g. it was not observed during Torres Strait seabed surveys). Lagoons and passes on pavement or sand. 3-40 m			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	15 tonnes			
<b>Current TAC</b>	15 tonnes (wet weight of gutted fish), based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	N/A			
<b>Minimum size limit</b>	32 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	880	142.9	Yes
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	No	Review current hookah prohibition
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	A deepwater survey of the East Torres Strait was undertaken for the first time in 2019/20. There is confidence that the survey quantified the white teatfish population in the East Torres Strait. The survey trend for shallow reef population fairly constant over time. Review TAC, potential to increase, however some population modelling and/or additional fishery dependent data required			
<b>Summary of stock assessment model findings (Murphy <i>et al</i>, 2023)</b>	An integrated age-structured production model was developed. For all model versions, the model estimated the spawning biomass over the past period 1995 to 2022 and projected forward to 2031, when assuming future annual catches (gutted biomass) were fixed at levels of 15, 30 and 50 tonnes. Despite the considerable uncertainty, the model outputs suggests that the current white teatfish TAC of 15 tonnes is conservative and that an annual catch of 15 tonnes will decrease the white teatfish population marginally. Based on extensive sensitivity testing using a broad range of alternative models, there is insufficient data to reliably inform on maximum sustainable yield (MSY). There is scope to increase the TAC for this species. However, this should be done in a step-wise manner in order to first obtain more information on the white teatfish productivity rate, so as to improve the reliability of model estimates. Data needs include total catch, total fishing effort, catch-per-unit-effort (CPUE), length frequency of a representative sub-sample of the catch, average individual weight taken from a sub-sample of the catch and spatial footprint (location) of the catch and effort			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	Beach price is \$30/kg (salted), \$40-\$50/kg (gutted and salted)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects			

	were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).					
<b>Any other changes in the fishery?</b>	None identified					
<b>Any other sources of mortality apart from fishing?</b>	None identified					
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Catch below TAC in 2021			<b>Biomass: Not overfished</b> Biomass likely to be above the limit reference point		
<b>Other information</b>	Listed under Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This listing came into effect on 28 August 2020. Additional assessment requirements apply under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Additional export requirements apply. Also listed as vulnerable (global) on the IUCN Red list due to a decreasing population trend					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	1.994	15	13.3	No	N/A
	2022	2.495	15	16.6	No	N/A
	2023 (partial)	1.052	15	7	No	N/A
<b>Applicable decision rules</b>	Low Tier Catch-Based Decision Rule (decision rule 2.11.1.1) or Survey-Based Decision Rule based on total biomass estimate (decision rule 2.11.3.3) apply					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
Data needs identified to support an increase in the TAC for white teatfish (Murphy <i>et al</i> , 2023) include total catch, total fishing effort, CPUE, length frequency of a representative sub-sample of the catch, average individual weight taken from a sub-sample of the catch and spatial footprint (location) of the catch and effort						
<b>Species specific research and priorities</b>						
<p>Under AFMA project 2021-0815, CSIRO developed a new stock assessment for white teatfish using results from the recent sea cucumber survey of East Torres Strait and other data inputs. Outcomes from this project are summarised above and will be considered at this meeting of the HCRAG and HCWG (October 2023).</p> <p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					

Insert recommendations from HCRAAG and HCWG

## Basket species – curryfish species

Curryfish (common)

Species Summary				
<b>Common names</b>	Curryfish (common)			
<b>Scientific name</b>	<i>Stichopus herrmanni</i>			
<b>Species ecology</b>	Protected reef edges in central, East Torres Strait and Warrior Reef. 1-30 m			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	60 tonnes (wet weight of gutted fish) curryfish basket TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	N/A			
<b>Minimum size limit</b>	31 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	667	632.4	Yes
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	Yes	Close monitoring Implement a trigger limit
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	Possible decline (noting fairly negative trend fitted to survey data). Close monitoring recommended - part of 'curryfish mixed' (catch split 50:50 between curryfish species when not identified). Appears that the catch split is changing over time, with higher proportion of <i>S. vastus</i> . Could be an identification problem with <i>S. vastus</i> during the 1995/96 survey			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRA 1 meeting)</b>	Beach price \$15-22/kg (boiled and salted), \$150/kg (dried)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	While common curryfish used to make up most of the catch in the past, industry reported noticing a generally even split between the two curryfish species with some regional differences			



<b>Any other sources of mortality apart from fishing?</b>	None identified. Previously recorded high discard levels have reduced due to more appropriate species processing methods					
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Assessment for curryfish species (combined). Catch below TAC in 2021			<b>Biomass: Not overfished</b> Assessment for curryfish species (combined). Biomass likely to be above the limit reference point		
<b>Other information</b>	Listed as vulnerable (global) on the IUCN Red list due to a decreasing population trend.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	4.054 6.690 (mixed)	60	6.8 11.2 (mixed)	No	N/A
	2022	0.400 1.558 (mixed)	60	0.7 2.6 (mixed)	No	N/A
	2023 (partial)	0 - (mixed)*	60	0 - (mixed)*	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG HCWG regarding the total catch. The HCRAG agreed to consider the need for a trigger limit for the species</p>					
<b>Species specific data gaps and needs</b>						
HCRAG agreed it is a high priority to improve species differentiation in CDRs as well as general improvements to area and effort reporting						
<b>Species specific research and priorities</b>						
<p>Under AFMA project 2021-0815, CSIRO have developed conversion ratios for curryfish species (<i>S. herrmanni</i> and <i>S. vastus</i>) as well as described new processing techniques for curryfish species. Outcomes from this project will be considered at this meeting of the HCRAG and HCWG (October 2023).</p> <p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

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Species Summary				
Common names	Curryfish ( <i>vastus</i> )			
Scientific name	<i>Stichopus vastus</i>			
Species ecology	Protected reef edges in central, East Torres Strait and Warrior Reef. 1-30 m			
Status open/closed	Open			
Pre-Harvest Strategy TAC	Part of 80 tonnes basket species TAC			
Current TAC	60 tonnes (wet weight of gutted fish) curryfish basket TAC, based on Harvest Strategy starting TAC			
Basket trigger	15 tonnes (wet weight of gutted fish) species trigger limit			
Minimum size limit	15 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	168	168	Yes
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	Yes	Close monitoring
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	Higher ratio of <i>S. vastus</i> observed in 2019/20 survey. Close monitoring recommended - part of 'curryfish mixed' (suggest splitting catch 50:50 between curryfish species when not identified)			
Summary of stock assessment model findings	N/A			
Catch data	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
Price data (as advised by industry at HCRAG 1 meeting)	Beach price \$15-22/kg (boiled and salted), \$150/kg (dried)			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
Any other changes in the fishery?	Industry reported noticing a generally even split between the two curryfish species with some regional differences and increasingly more <i>S. vastus</i>			
Any other sources of mortality apart from fishing?	None identified			

<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> Assessment for curryfish species (combined). Catch below TAC in 2021	<b>Biomass: Not overfished</b> Assessment for curryfish species (combined). Biomass likely to be above the limit reference point				
<b>Other information</b>	Listed as least concern (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	1.860 6.690 (mixed)	60 (15 t trigger limit)	3.1 11.2 (mixed)	No	N/A
	2022	0.400 1.558 (mixed)	60 (15 t trigger limit)	0.7 2.6 (mixed)	No	N/A
	2023 (partial)	0 - (mixed)*	60 (15 t trigger limit)	0 - (mixed)*	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: The HCRAG revisited its advice to increase the curryfish vastus trigger limit from 15t to 30t and recommended that the trigger limit remain at 15t until such time there is new data to support an increase. No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
HCRAG agreed it is a high priority to improve species differentiation in CDRs as well as general improvements to area and effort reporting						
<b>Species specific research and priorities</b>						
<p>Under AFMA project 2021-0815, CSIRO have developed conversion ratios for curryfish species (<i>S. herrmanni</i> and <i>S. vastus</i>) as well as described new processing techniques for curryfish species. Outcomes from this project will be considered at this meeting of the HCRAG and HCWG (October 2023).</p> <p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
<p style="color: red;">Insert recommendations from HCRAG and HCWG</p>						

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## Basket species – all other species

## Elephant trunkfish

Species Summary				
<b>Common names</b>	Elephant trunkfish			
<b>Scientific name</b>	<i>Holothuria fuscopunctata</i>			
<b>Species ecology</b>	-			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	15 tonnes (wet weight of gutted fish) species trigger limit			
<b>Minimum size limit</b>	24 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	451	-	Not assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	Yes	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	Catch rates low. The overall average zone density was higher in 2019/20 than the 2009 survey, but less than previous survey years. Possible decline or natural variability			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	Beach price is \$2/kg (wet gutted)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			

<b>Any other sources of mortality apart from fishing?</b>	None identified					
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information			<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information		
<b>Other information</b>	Listed as least concern (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0	50 (15 t trigger limit)	0	No	N/A
	2022	0	50 (15 t trigger limit)	0	No	N/A
	2023 (partial)	0	50 (15 t trigger limit)	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

Species Summary				
<b>Common names</b>	Lollyfish			
<b>Scientific name</b>	<i>Holothuria atra</i>			
<b>Species ecology</b>	-			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	40 tonnes (wet weight of gutted fish) species trigger limit			
<b>Minimum size limit</b>	15 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	2,857	-	Yes
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	Yes	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	Noted catch increase. The overall 4 zone average density was lower in 2019/20 compared to the 2009 survey and similar to previous survey years. Possible decline or natural variability.			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	Beach price is \$2-\$5/kg (wet gutted)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	Noted catch increase in 2019 fishing season followed by decline in subsequent seasons. Further information required from Poruma fishers on reduced catches to ascertain whether this is due to home reef depletion given its susceptibility to being caught			

<b>Any other sources of mortality apart from fishing?</b>	None identified					
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information			<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information		
<b>Other information</b>	Listed as least concern (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0.422	50 (40 t trigger limit)	0.8	No	N/A
	2022	0	50 (40 t trigger limit)	0	No	N/A
	2023 (partial)	_*	50 (40 t trigger limit)	_*	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
Noted catch increase in 2019 fishing season followed by decline in subsequent seasons. Further information required from Poruma fishers on reduced catches to ascertain whether this is due to home reef depletion given its susceptibility to being caught. General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

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Species Summary				
<b>Common names</b>	Burrowing blackfish			
<b>Scientific name</b>	<i>Actinopyga spinea</i>			
<b>Species ecology</b>	Broad distribution. High density on shallow reef habitat in central Torres Strait and Warrior Reef. Muddy-sand lagoons, reef flats, fore reef pavement. 1-20 m			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	5 tonnes (wet weight of gutted fish) species trigger limit			
<b>Minimum size limit</b>	22 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	N/A, not recorded during survey	N/A, not recorded during survey	Not assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	No	N/A, not recorded during survey	N/A, not recorded during survey	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	A pre-cautionary approach is needed for burrowing blackfish as their status still remains relatively unknown			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	HCRAG and HCWG to discuss			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			

<b>Any other sources of mortality apart from fishing?</b>	None identified					
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information			<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information		
<b>Other information</b>	Listed as least concern (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0	50 (5 t trigger limit)	0	No	N/A
	2022	0	50 (5 t trigger limit)	0	No	N/A
	2023 (partial)	0	50 (5 t trigger limit)	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

Species Summary				
<b>Common names</b>	Deepwater blackfish			
<b>Scientific name</b>	<i>Actinopyga palauensis</i>			
<b>Species ecology</b>	Broad distribution. High density on shallow reef habitat in central Torres Strait and Warrior Reef. Muddy-sand lagoons, reef flats, fore reef pavement. 1-20 m			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	0.5 tonnes (wet weight of gutted fish) species trigger limit			
<b>Minimum size limit</b>	22 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	- (landed (wet gutted) weight of 15 tonnes)	-	Not assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Limited	No	Yes	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	Deepwater blackfish were only properly identified in surveys and catch in 2019, after concerted review of taxonomy and working with Torres Strait Islander fishers. A pre-cautionary approach is needed for deepwater blackfish as their status still remains relatively unknown. Targeted survey sampling may need to be factored into future fishery surveys			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	Beach price is \$15/kg (wet gutted)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			

<b>Any other sources of mortality apart from fishing?</b>	None identified					
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information			<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information		
<b>Other information</b>	Listed as least concern (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0.184	50 (0.5 t trigger limit)	0.4	No	N/A
	2022	0.648	50 (0.5 t trigger limit)	1.3	TAC - no Trigger - yes	TAC – N/A Trigger – 29.6
	2023 (partial)	0.244	50 (0.5 t trigger limit)	0.5	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2): If the catch of any species exceeds the species-specific trigger by more than 10%, then collect data and information to decide whether: a) to make a change to the basket TAC, or individual species trigger, or b) a species-specific TAC is justified, or c) a closure is deemed necessary, or d) recommend further data be collected (e.g. in the form of a survey, or indicator before any change to the joint TAC or trigger limit is allowed					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
<p>May benefit from a dedicated survey in the future.</p> <p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

Species Summary				
<b>Common names</b>	Golden sandfish			
<b>Scientific name</b>	<i>Holothuria lessoni</i>			
<b>Species ecology</b>	-			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	0.5 tonnes (wet weight of gutted fish) species trigger limit			
<b>Minimum size limit</b>	22 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	N/A, not recorded during survey	N/A, not recorded during survey	Not assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	No	N/A, not recorded during survey	N/A, not recorded during survey	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	During the 2019/20 survey, separate intensive sampling of Ugar Island and Campbell reefs was also undertaken to investigate sea cucumber populations and their habitats, in order to identify suitable species and locations for reseeded research. A mix of juvenile and adult golden sandfish were found at an area to the East of Ugar island and were either almost fully or partially buried			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	HCRAG and HCWG to discuss			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			
<b>Any other sources of mortality apart from fishing?</b>	None identified			

<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information		<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information			
<b>Other information</b>	Listed as endangered (global) on the IUCN Red list due to a decreasing population trend.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0	50 (0.5 t trigger limit)	0	No	N/A
	2022	0	50 (0.5 t trigger limit)	0	No	N/A
	2023 (partial)	0	50 (0.5 t trigger limit)	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p><b>Insert recommendations from HCRAG and HCWG</b></p> <p>2022 HCRAG and HCWG advice: The HCRAG noted that golden sandfish were hardly observed during the 2019/20 scientific sea cucumber or annual TRL surveys due to minimal overlap with their habitat and there is currently no new information, including catch data, to assess the species under the BDM Fishery Harvest Strategy.</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
<b>Insert recommendations from HCRAG and HCWG</b>						

Species Summary				
Common names	Brown sandfish			
Scientific name	<i>Bohadschia vitiensis</i>			
Species ecology	-			
Status open/closed	Open			
Pre-Harvest Strategy TAC	Part of 80 tonnes basket species TAC			
Current TAC	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
Basket trigger	3 tonnes (wet weight of gutted fish) species trigger limit			
Minimum size limit	25 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	N/A, not recorded during survey	N/A, not recorded during survey	Not assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	No	N/A, not recorded during survey	N/A, not recorded during survey	HCRAG and HCWG to discuss
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	During the 2019/20 survey, separate intensive sampling of Ugar Island and Campbell reefs was also undertaken to investigate sea cucumber populations and their habitats, in order to identify suitable species and locations for reseeded research. Brown sandfish were observed in reef top survey sites.			
Summary of stock assessment model findings	N/A			
Catch data	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
Price data (as advised by industry at HCRAG 1 meeting)	HCRAG and HCWG to discuss			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
Any other changes in the fishery?	None identified			
Any other sources of mortality apart from fishing?	None identified			



<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information			<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information		
<b>Other information</b>	Listed as data deficient (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0	50 (3 t trigger limit)	0	No	N/A
	2022	0	50 (3 t trigger limit)	0	No	N/A
	2023 (partial)	0	50 (3 t trigger limit)	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	<p style="color: red;">Insert recommendations from HCRAG and HCWG</p> <p style="color: red;">2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
<p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

Species Summary				
<b>Common names</b>	Leopardfish			
<b>Scientific name</b>	<i>Bohadschia argus</i>			
<b>Species ecology</b>	-			
<b>Status open/closed</b>	Open			
<b>Pre-Harvest Strategy TAC</b>	Part of 80 tonnes basket species TAC			
<b>Current TAC</b>	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
<b>Basket trigger</b>	40 tonnes (wet weight of gutted fish) species trigger limit			
<b>Minimum size limit</b>	30 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
<b>Latest scientific survey data (Murphy <i>et al</i>, 2021)</b>	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	508	-	No assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	No	HCRAG and HCWG to discuss
<b>Summary of scientific survey findings (Murphy <i>et al</i>, 2021)</b>	Catches low. Generally increasing density trend. No concern for TAC			
<b>Summary of stock assessment model findings</b>	N/A			
<b>Catch data</b>	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
<b>Price data (as advised by industry at HCRAG 1 meeting)</b>	Beach price is \$15/kg (gutted salted), \$120/kg (dried)			
<b>Climate considerations (Dutra <i>et al</i>, 2020)</b>	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
<b>Any other changes in the fishery?</b>	None identified			
<b>Any other sources of mortality apart from fishing?</b>	None identified			

<p><b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b></p>	<p><b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information</p>			<p><b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information</p>		
<p><b>Other information</b></p>	<p>Listed as least concern (global) on the IUCN Red list.</p>					
<p><b>Low Tier</b></p>						
<p><b>Catch and TAC (t)</b></p>	<p><b>Fishing season</b></p>	<p><b>Catch (t, wet gutted weight)</b></p>	<p><b>TAC (t, wet gutted weight)</b></p>	<p><b>% TAC caught</b></p>	<p><b>TAC or basket trigger exceeded?</b></p>	<p><b>% of TAC overcatch</b></p>
	<p>2021</p>	<p>0.207</p>	<p>50 (40 t trigger limit)</p>	<p>0.4</p>	<p>No</p>	<p>N/A</p>
	<p>2022</p>	<p>0</p>	<p>50 (40 t trigger limit)</p>	<p>0</p>	<p>No</p>	<p>N/A</p>
	<p>2023 (partial)</p>	<p>0</p>	<p>50 (40 t trigger limit)</p>	<p>0</p>	<p>No</p>	<p>N/A</p>
<p><b>Applicable decision rules</b></p>	<p>Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)</p>					
<p><b>HCRAG and HCWG recommendations regarding application of the decision rules</b></p>	<p><i>Insert recommendations from HCRAG and HCWG</i> 2022 HCRAG and HCWG advice: No concerns from HCRAG and HCWG regarding the total reported catch</p>					
<p><b>Species specific data gaps and needs</b></p>						
<p>General need to improve area and effort reporting in CDRs</p>						
<p><b>Species specific research and priorities</b></p>						
<p>Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received</p>						
<p><b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b></p>	<p><b>Fishing season</b></p>	<p><b>RBC (t)</b></p>	<p><b>Overcatch to be discounted (t)</b></p>	<p><b>Other source(s) of mortality (t)</b></p>	<p><b>TAC (t, wet gutted weight)</b></p>	
	<p>2023</p>					
<p><i>Insert recommendations from HCRAG and HCWG</i></p>						

Species Summary				
Common names	Stonefish			
Scientific name	<i>Actinopyga lecanora</i>			
Species ecology	-			
Status open/closed	Open			
Pre-Harvest Strategy TAC	Part of 80 tonnes basket species TAC			
Current TAC	50 tonnes (wet weight of gutted fish) basket species TAC, based on Harvest Strategy starting TAC			
Basket trigger	5 tonnes (wet weight of gutted fish) species trigger limit			
Minimum size limit	Nil			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	N/A, not recorded during survey	N/A, not recorded during survey	Not assessed
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	No	N/A, not recorded during survey	N/A, not recorded during survey	HCRAG and HCWG to discuss
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	Nil			
Summary of stock assessment model findings	N/A			
Catch data	TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided in species summary as at 25 September 2023			
Price data (as advised by industry at HCRAG 1 meeting)	HCRAG and HCWG to discuss			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
Any other changes in the fishery?	None identified			
Any other sources of mortality apart from fishing?	None identified			

<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Uncertain</b> Assessment for all other species (combined). Unable to reconcile fishing mortality status for one species in the basket (deepwater blackfish) with available information			<b>Biomass: Uncertain</b> Assessment for all other species (combined). Unable to reconcile biomass status for one species in the basket (deepwater blackfish) with available information		
<b>Other information</b>	Listed as data deficient (global) on the IUCN Red list.					
<b>Low Tier</b>						
<b>Catch and TAC (t)</b>	<b>Fishing season</b>	<b>Catch (t, wet gutted weight)</b>	<b>TAC (t, wet gutted weight)</b>	<b>% TAC caught</b>	<b>TAC or basket trigger exceeded?</b>	<b>% of TAC overcatch</b>
	2021	0	50 (5 t trigger limit)	0	No	N/A
	2022	0	50 (5 t trigger limit)	0	No	N/A
	2023 (partial)	0	50 (5 t trigger limit)	0	No	N/A
<b>Applicable decision rules</b>	Low Tier Joint TAC Trigger-Limit Decision Rule applies (decision rule 2.11.1.2)					
<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	Insert recommendations from HCRAG and HCWG					
<b>Species specific data gaps and needs</b>						
General need to improve area and effort reporting in CDRs						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	<b>Fishing season</b>	<b>RBC (t)</b>	<b>Overcatch to be discounted (t)</b>	<b>Other source(s) of mortality (t)</b>	<b>TAC (t, wet gutted weight)</b>	
	2023					
Insert recommendations from HCRAG and HCWG						

## Closed species

## Sandfish

Species Summary				
Common names	Sandfish			
Scientific name	<i>Holothuria scabra</i>			
Species ecology	Sandfish are almost exclusively found on Warrior Reef. It is a shared stock with PNG, with approximately half the population on each side. Muddy-sand seagrass beds and reef flats. 0.5-20 m			
Status open/closed	Closed, since 1998 due to sustainability concerns			
Pre-Harvest Strategy TAC	0 tonnes			
Current TAC	0 tonnes			
Basket trigger	N/A			
Minimum size limit	18 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2011)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2010	112.5	48.73	Insufficient information to assess the status of the stock in relation to the limit reference point
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	Yes	Undertake new scientific survey
Summary of scientific survey findings (Murphy <i>et al</i> , 2011)	2010 survey densities were found to be at similar levels to 2004, and again were ~80% less than observed in 1995/96, at which time the population was considered to be overexploited. Continued closure and regular surveys recommended			
Summary of stock assessment model findings	N/A			
Catch data	N/A, closed. TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided (if any) in species summary as at 25 September 2023			
Price data	N/A, closed			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al.</i> 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. 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. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish). Climate change is expected to affect distribution and phenology (likely changes in timing of spawning), and to a lesser extent in abundance of sandfish (Fulton <i>et al.</i> 2018).			

<b>Any other changes in the fishery?</b>	None identified	
<b>Any other sources of mortality apart from fishing?</b>	None identified	
<b>ABARES Fishery Status Report (Patterson <i>et al</i>, 2022)</b>	<b>Fishing mortality: Not subject to overfishing</b> No reported catch in 2021	<b>Biomass: Overfished</b> Last full survey (2010) indicated that the stock was overfished
<b>Other information</b>	Listed as endangered (global) on the IUCN Red list due to a decreasing population trend.	

**Re-opening Tier**

	Fishing season	Catch (t, wet gutted weight)	TAC (t, wet gutted weight)	% TAC caught	TAC or basket trigger exceeded?	% of TAC overcatch
<b>Catch and TAC (t)</b>	2021	0	0	0	No	N/A
	2022	0	0	0	No	N/A
	2023 (partial)	0	0	0	No	N/A

<b>Applicable decision rules</b>	Re-opening Decision Rule applies (decision rule 2.11.4)
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<b>HCRAG and HCWG recommendations regarding application of the decision rules</b>	Insert recommendations from HCRAG and HCWG
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**Species specific data gaps and needs**

N/A

**Species specific research and priorities**

The HCRAG and HCWG have recommended a research project to undertake a survey of sea cucumber stocks on Warrior Reef area with a focus on sandfish and other commercially important sea cucumber species. This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received.

Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received

<b>HCRAG and HCWG recommendations regarding RBC and/or TAC</b>	Fishing season	RBC (t)	Overcatch to be discounted (t)	Other source(s) of mortality (t)	TAC (t, wet gutted weight)
	2023				

Insert recommendations from HCRAG and HCWG



Species Summary				
Common names	Surf redfish			
Scientific name	<i>Actinopyga mauritiana</i>			
Species ecology	High energy zone on the front of East Torres Strait reefs. Murray Island, Don Cay. 0-10 m			
Status open/closed	Closed, since 2003 due to sustainability concerns			
Pre-Harvest Strategy TAC	0 tonnes			
Current TAC	0 tonnes			
Basket trigger	N/A			
Minimum size limit	22 cm			
New information since the TAC was last considered (i.e. since the implementation of the Harvest Strategy)				
Latest scientific survey data (Murphy <i>et al</i> , 2021)	Year	Standing stock biomass (90 <sup>th</sup> percentile) (t)	Standing stock biomass above minimum species size limit (t)	Is standing stock biomass above the default limit reference point?
	2019/20	20	6.7	Insufficient information to assess the status of the stock in relation to the limit reference point
	Survey adequate for species?	Any unexpected results?	Any concerns with biomass trend or absolute abundance?	Need for management response?
	Yes	No	No	HCRAG and HCWG to discuss
Summary of scientific survey findings (Murphy <i>et al</i> , 2021)	Surf redfish were found in higher numbers relative to previous surveys, which supports species recovery. However, it is recommended that surf redfish remains closed. While the species is showing signs of recovery, biomass is low at 24 tonnes and current densities of 0.3 per Ha are low in comparison to 1.54 per Ha recorded in 2002			
Summary of stock assessment model findings	N/A			
Catch data	N/A, closed. TDB02 catch disposal record (CDR) data collected since 1 December 2017. Data provided (if any) in species summary as at 25 September 2023			
Price data (as advised by industry at HCRAG 1 meeting)	N/A, closed			
Climate considerations (Dutra <i>et al</i> , 2020)	Recent studies have shown that considerable uncertainty exists for the potential impacts on sea cucumbers for most combinations of physical and biological variables (Plagányi <i>et al</i> . 2013). Climate change impacts may have both negative and positive effects on sea cucumbers. Negative effects were associated with increased larval and juvenile mortality related to higher sea surface temperatures. Sea level rise was assessed as being mostly positive for shallow water species (e.g. sandfish, black teatfish).			
Any other changes in the fishery?	None identified			

Any other sources of mortality apart from fishing?	None identified					
ABARES Fishery Status Report (Patterson <i>et al</i> , 2022)	Fishing mortality: Not subject to overfishing No reported catch in 2021			Biomass: Uncertain Unable to reconcile biomass status with available information		
Other information	Listed as vulnerable (global) on the IUCN Red list due to a decreasing population trend.					
<b>Re-opening Tier</b>						
Catch and TAC (t)	Fishing season	Catch (t, wet gutted weight)	TAC (t, wet gutted weight)	% TAC caught	TAC or basket trigger exceeded?	% of TAC overcatch
	2021	0	0	0	No	N/A
	2022	0	0	0	No	N/A
	2023 (partial)	0	0	0	No	N/A
Applicable decision rules	Re-opening Decision Rule applies (decision rule 2.11.4)					
HCRAG and HCWG recommendations regarding application of the decision rules	Insert recommendations from HCRAG and HCWG					
<b>Species specific data gaps and needs</b>						
N/A						
<b>Species specific research and priorities</b>						
Consistent with the Commonwealth Fisheries Harvest Strategy Policy, the HCRAG and HCWG have recommended a research project to undertake management strategy evaluation (MSE) testing of the Harvest Strategy, including determining the current status of sea cucumber stocks in relation to the Harvest Strategy reference points (or species specific reference points if sufficient data is available). This project has been included in the Torres Strait Scientific Advisory Committee (TSAAC) 2023 call for research. Research proposals are due 30 October 2023. HCRAG and HCWG advice will be sought on any proposals received						
HCRAG and HCWG recommendations regarding RBC and/or TAC	Fishing season	RBC (t)	Overcatch to be discounted (t)	Other source(s) of mortality (t)	TAC (t, wet gutted weight)	
	2023					
Insert recommendations from HCRAG and HCWG						

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**Table 1: Torres Strait Beche-de-mer Fishery historical annual catch records from 2005 to 2023. All catch weights provided have been converted to wet weight of gutted fish using the processing conversion factors applied at the time (source: refer to endnotes).**

Common name	Scientific name	TAC (t)	Fishing season <sup>1</sup>															
			2005 (kg)	2007 (kg)	2010 (kg)	2011 (kg)	2012 (kg)	2013 (kg)	2014 (kg)	2015 (kg)	2016 (kg) <sup>2</sup>	2017 (kg) <sup>3</sup>	2018 (kg) <sup>4</sup>	2019 (kg)	2020 (kg) <sup>5</sup>	2021 (kg)	2022 (kg)	2023 (kg) <sup>6</sup>
Black teatfish	<i>Holothuria whitmaei</i>	20 <sup>7</sup>				75	2,001	138	16,624	23,303			6			17,615	17,057	17,902
Prickly redfish	<i>Thelenota ananas</i>	15 <sup>8</sup>	5,564	128	146	11,056	1,255	5,888	9,173	28,110	11,211	13,227	14,741	11,875	15,654	15,036	13,514	6,108
Sandfish	<i>Holothuria scabra</i>	0 <sup>9</sup>			5	31	2,152	26	6				18					
Surf redfish	<i>Actinopyga mauritiana</i>	0 <sup>10</sup>						52	1				74			199		
White teatfish	<i>Holothuria fuscogilva</i>	15	367			3,179	13,294	12,633	16,341	4,200	990	841	1,774	1,564	1,767	1,994	2,495	1,052
Blackfish (hairy)	<i>Actinopyga miliaris</i>	5 <sup>11</sup>	186	128		507	73	216	1,960	3,596	1,098	1,237	1,368	3,475	1,399	519	696	- <sup>12</sup>
Deepwater redfish	<i>Actinopyga echinites</i>	5 <sup>13</sup>			7			5,024	4,229	5,546		597	172	50		31	49	
Greenfish	<i>Stichopus chloronotus</i>	40 <sup>14</sup>						1	1	14			1,013	271	15			
Undifferentiated curryfish						1,118				6,099	1,085	17,018	42,392	14,538	10,521	6,690	1,558	- <sup>16</sup>
Curryfish (common)	<i>Stichopus herrmanni</i>	60t basket <sup>15</sup>												1,343	621	4,054	400	
Curryfish vastus	<i>Stichopus vastus</i>													491	153	1,860	400	
Deepwater blackfish	<i>Actinopyga palauensis</i>													177	166	184	648	244
Elephant trunkfish	<i>Holothuria fuscopunctata</i>					4	28	2		133			354	12				
Golden sandfish	<i>Holothuria lessoni</i>							52	351	55		146	8	32				
Burrowing blackfish	<i>Actinopyga spinea</i>	50t basket <sup>17</sup>												10				
Stonefish	<i>Actinopyga lecanora</i>				459													
Leopardfish	<i>Bohadschia argus</i>											63	2,322	958	206	207		

Brown sandfish	<i>Bohadschia vitiensis</i>										6	30	204					
Lollyfish	<i>Holothuria atra</i>											455	3,997	1,272	422		-.18	
Unidentified sea cucumbers				683	88		177	1,574	918	13	6,876	67						
<b>CURRYFISH SPECIES BASKET TOTAL</b>															<b>11,295</b>	<b>12,604</b>	<b>2,358</b>	-.19
<b>OTHER SPECIES BASKET TOTAL</b>		<b>186</b>	<b>128</b>	<b>1,149</b>	<b>1,717</b>	<b>101</b>	<b>5,472</b>	<b>8,115</b>	<b>16,361</b>	<b>2,196</b>	<b>25,942</b>	<b>48,181</b>	<b>25,557</b>	<b>1,644</b>	<b>812</b>	<b>648</b>	<b>244</b>	
<b>GRAND TOTAL</b>		<b>6,117</b>	<b>256</b>	<b>1,300</b>	<b>12,879</b>	<b>18,803</b>	<b>24,209</b>	<b>50,260</b>	<b>71,974</b>	<b>14,397</b>	<b>40,085</b>	<b>64,720</b>	<b>38,996</b>	<b>31,972</b>	<b>48,611</b>	<b>36,816</b>	<b>25,306</b>	

**Table 2: Torres Strait Beche-de-mer Fishery historical annual catch records from 1993 to 2004 (source: Tim Skewes who sourced the data QDPI logbook database, AFMA docket book (TDB01) database and industry sources).**

Common Name	Recorded catch (kg) <sup>20</sup>										
	1993 <sup>21</sup>	1994	1995 <sup>22</sup>	1996	1997	1998	1999	2000	2001	2002	2004
Black Teatfish		20,000	50,000	52,777	40,190	18,462	9,196		11,820	3,392	
Prickly Redfish				7	41	620	3,332	347	160	10,451	1,188
Sandfish	40,000	200,000	1,200,000	30,000	29,955	48	39				
Surf Redfish	20,000			34,990	51,658	60,289	1,497		59,655	6,487	
White Teatfish					123	855	1,064	1,207	3,023	147	25
Blackfish					65	1,211	1,675		28,502	10,663	
Curryfish											
Deepwater Redfish					12		38	252			
Elephant Trunkfish									374	389	
Golden Sandfish											
Greenfish						440			88	1,166	
Stonefish											
Leopardfish									30	9,643	
Brown sandfish							30		382	3,378	
Deepwater Blackfish							223	160	470		
Amberfish									192		

Grand Total	60,000	220,000	1,250,000	117,774	122,044	81,925	17,094	1,966	104,696	45,716	1,213
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<sup>1</sup> The fishing season runs from 1 January to 31 December annually. No catches of sea cucumber were reported for the 2006, 2008 and 2009 fishing seasons. Weights are in kg of gutted wet weight. Processing conversion factors in effect at the time of capture have been applied as needed.

<sup>2</sup> Catch data for 2005 to 2016 is based on catch reported through tax invoices, HC01 and HC02 Logbooks, TDB01 Catch Disposal Records and verbal reports obtained from industry during the 2015 black teatfish opening. Verification was conducted to remove possible duplicates between records.

<sup>3</sup> Catch data for the 2017 fishing season is converted weights where processed form is known (47kg unknown), based on catch reported through tax invoices, HC01 and HC02 Logbooks, TDB01 and TBD02 Catch Disposal Records. Verification was conducted to remove possible duplicates between records.

<sup>4</sup> Catch data for the 2018 fishing season onwards is reported through TDB02 Catch Disposal Records only and converted to wet weight gutted using the processing conversion factors applied at the time.

<sup>5</sup> New processing conversion factors as detailed in the BDM Fishery Harvest Strategy were implemented for some species on 1 January 2020.

<sup>6</sup> 2023 fishing season catches current as at 22 September 2023.

<sup>7</sup> A 15t TAC applied during trial openings undertaken in 2014 and 2015. A 20t TAC applied during trial openings undertaken in 2021 and 2022. A 20t TAC applied during the 2023 opening.

<sup>8</sup> A 20t TAC applied until the end of 2017.

<sup>9</sup> Commercial fishing for sandfish was closed in 1998.

<sup>10</sup> Commercial fishing for surf redfish was closed in 2000.

<sup>11</sup> New individual species TAC as of 1 January 2020, previously part of the 80t basket species TAC.

<sup>12</sup> Catch reported, unable to be released due to information disclosure requirements, information does not represent data from five or more vessels.

<sup>13</sup> New individual species TAC as of 1 January 2020, previously part of the 80t basket species TAC.

<sup>14</sup> New individual species TAC as of 1 January 2020, previously part of the 80t basket species TAC.

<sup>15</sup> New curryfish species basket TAC as of 1 January 2020, previously part of the 80t basket species TAC.

<sup>16</sup> Catch reported, unable to be released due to information disclosure requirements, information does not represent data from five or more vessels.

<sup>17</sup> Prior to 1 January 2020, the TAC for basket species was 80t.

<sup>18</sup> Catch reported, unable to be released due to information disclosure requirements, information does not represent data from five or more vessels.

<sup>19</sup> Catch reported, unable to be released due to information disclosure requirements, information does not represent data from five or more vessels.

<sup>20</sup> There was no catch reported in 2003.

<sup>21</sup> Estimates obtained from industry sources.

<sup>22</sup> Estimates from Williams *et al*, 2000.

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>2023 BLACK TEATFISH OPENING AND FUTURE OPENINGS</b> <b>Future openings</b>	<b>Agenda Item 9</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the discussions and recommendations at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting, concerning the proposed management arrangements for future black teatfish openings, in particular the timing of openings, the carryover of total allowable catch (TAC) overcatch and undercatch amounts between fishing seasons, as well as data and assessment needs;
  - b. **CONSIDER** the outcomes of the Beche-de-mer (BDM) Workshop held on 21-22 March 2023 regarding management arrangements for future openings of black teatfish in the Torres Strait BDM Fishery (BDM Fishery) (**Attachment 10a**);
  - c. **CONSIDER** the proposed management arrangements for the 2024 black teatfish opening;
  - d. **DISCUSS** and **PROVIDE ADVICE** on:
    - i. the proposed timing for the next opening, in particular any management or operational considerations that need to be taken into account;
    - ii. the carryover of total allowable catch (TAC) overcatch and undercatch amounts between fishing seasons;
    - iii. daily landing and catch and effort reporting by fishers and fish receivers using the TDB02 Catch Disposal Record (CDR);
    - iv. community involvement in the delivery of the size frequency sampling program.
  - e. In providing this advice, **CONSIDER** any requirements under the BDM Fishery Harvest Strategy.

## KEY ISSUES

### **2024 black teatfish opening**

2. Proposed management arrangements for the 2024 black teatfish opening are detailed in **Table 1**. Those aspects to be discussed by each the HCRAAG and HCWG are provided for guidance.

**Table 1: Proposed management arrangements for the 2024 black teatfish opening.**

<b>Details of management arrangement</b>	<b>HCRAAG to consider?</b>	<b>HCWG to consider?</b>
Opening date in late April/May	Yes – HCRAAG to discuss biological aspects (e.g. spawning)	Yes – HCWG to discuss dates, management and operational aspects
20 tonne TAC	Yes – HCRAAG advice will be sought on the TAC and the carryover of TAC overcatch and	Yes – HCWG advice will be sought on the TAC (under <b>Agenda Item 8</b> ) and the carryover of TAC overcatch and



	undercatch amounts between fishing seasons	undercatch amounts between fishing seasons
Daily landing and catch and effort reporting by fishers and fish receivers using the TDB02 Catch Disposal Record (CDR)	No	Yes – HCWG to discuss the timing on when CDRs are due each day, including on the day of closure as well as any other issues concerning CDR reporting (e.g. accurate weights)
Size frequency sampling program	Yes – HCWAG to discuss any technical changes to the sampling program and any additional data needs not currently being met through current collection programs	Yes – HCWG to discuss any implementation issues, including community involvement in the delivery of the sampling program
Fishers and fish receivers must be appropriately licenced, including the nomination of agents	No, no change	No, no change
Fish receivers to nominate landing locations, which must have mobile phone reception and/or an internet connection to transmit daily reporting	No, no change	No, no change
Minimum size limit (25 cm)	No, no change	No, no change
TIB licenced boats must only be crewed by Traditional Inhabitants	No, no change	No, no change
Prohibition on the use of hookah gear	No, no change	No, no change
Prohibition on fishing for black teatfish once the fishery is closed (i.e. after the TAC Date)	No, no change	No, no change

3. The above arrangements will be supported by a communication program in the lead up to the next opening, in order to ensure fishers and fish receivers are prepared and able to meet requirements during the opening (e.g. licenced and CDRs completed and submitted correctly). Fishers will be asked to ensure they are appropriately licenced and have arrangements in place ready to meet requirements prior to the opening, as AFMA has limited capacity to process licencing applications during the opening period. As per previous years, there will also be a compliance program prior to, during and after the opening.

**Timing of openings**

- 4. At the BDM Workshop, industry participants were asked to identify optimal timing for annual black teatfish openings, including the 2023 opening. While industry participants were able to identify a preferred opening date for 2023, were unable to advise on the optimal timing for future black teatfish openings, until another survey of the BDM Fishery is undertaken to determine, where and when spawning of key species, including black teatfish, is occurring (e.g. cold water).
- 5. Key factors taken into consideration in setting past opening dates, include:

- a. favourable weather – February to May;
  - b. favourable tides – neap tide preferred, in 2022, the last half day fell on a high tide which was not good for fishing;
  - c. not on the Sabbath or public holiday;
  - d. during TRL openings – season and hookah;
  - e. avoid spawning – June-July and December;
6. Opening dates being considered for the 2024 black teatfish opening, which look to satisfy the above factors, include: 15 April; 29 April and 13 May 2024. Each date falls during favourable weather (Feb-May), over a quarter moon (neap), not on a weekend, not on a public holiday (public holidays in 2024 include Easter from 29 March to 1 April, ANZAC Day on 25 April and Labour Day on 6 May), not during a moon-tide hookah closure (closures are proposed to be 7-13 March, 6-12 April and 5-11 May), not during spawning (June-July, December).
  7. Tide charts for Mer, Aureed and Erub are provided at **Attachment 9a**. Tide charts for other locations in the Torres Strait (e.g. Masig) can be found here by clicking on the location on the map: <http://www.bom.gov.au/australia/tides/#!/qld-meer-island-barge>
  8. Taking into consideration HCRAAG advice from the preceding meeting, HCWG advice is sought on a preferred opening date for 2024 and future fishing seasons, noting any management or operational concerns.

#### ***Carryover of TAC overcatch and undercatch***

9. At the last HCWG meeting held on 10 November 2022 (HCWG19), the HCWG recommended the continuation of the 20 tonne TAC for black teatfish and sought advice from the HCRAAG on:
  - a. the anticipated duration of an annual 20 tonne catch limit, noting a few more years of data is required to increase certainty on what future annual TACs might be possible;
  - b. the scientific basis for the development and application of undercatch carryover provisions; and
  - c. options for the review of the BDM Fishery Harvest Strategy to include provisions to carry over undercatch and set provisional TACs.
10. HCRAAG advice is being sought at the preceding meeting concerning this matter.
11. The TAC for black teatfish is currently limited to 20 tonnes under a condition of the BDM Fishery's Wildlife Trade Operation (WTO) approval. As detailed under **Agenda Item 7**, the BDM Fishery is currently undergoing re-assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). If the BDM Fishery is approved as a WTO, this approval will be subject to conditions. AFMA have met with the Department of Climate Change, Energy, the Environment and Water (DCCEEW) and sought the removal of fixed caps on TACs to enable the carryover of TAC undercatch amounts between fishing seasons and allow for the full implementation of the BDM Fishery Harvest Strategy with respect to TAC overcatch.
12. TAC overcatch is currently accounted for under the BDM Fishery Harvest Strategy. Under the Low Tier Catch-Based Decision Rule (decision rule 2.11.1.1) TACs are monitored and adjusted annually, with agreement that a fishery will be closed if no data are provided. Overcatch of the TAC may result in a corresponding reduction from the TAC the following year, a 1 year pause in fishing, or a closure of the species, depending on the severity of the overcatch. However, there is currently no provision in the BDM Fishery Harvest Strategy for the carryover of TAC undercatch.
13. AFMA have implemented overcatch and undercatch arrangements in the majority of Commonwealth fisheries, under [Fisheries Management Policy 10](#). This policy does not apply to Torres Strait fisheries, but contains some key principles (some of which are not directly applicable to non-quota managed fisheries) that can be used to guide the implementation of such arrangements:

- a. in quota managed fisheries, a correctly set and sufficiently precautionary TAC is the primary management tool for pursuing sustainability and economic efficiency.
  - b. the use of undercatch/overcatch arrangements can provide flexibility in the fishery, although it is recognised that such arrangements are likely to constrain the efficient operations of the quota market and may impact negatively on sustainability.
  - c. to minimise such distortions, the parameters for such arrangements should reflect the characteristics of the species/fishery in which they operate but generally percentage/quantity levels should be minimal (10 percent or below) or zero.
  - d. the level of undercatch/overcatch must be taken into account when setting a TAC. The level of undercatch is particularly important where TACs need to be reduced. If there is a high possibility that a TAC needs to be reduced or there is uncertainty in stock assessment advice, then it is preferable not to set a high undercatch/overcatch for that species.
  - e. undercatch/overcatch arrangements should be set in conjunction with TACs for a fishing year and not varied once in place.
14. Taking into consideration HCRAAG advice from the preceding meeting, HCWG advice is sought on any management considerations that should be taken into account in the development and application of undercatch carryover provisions for the BDM Fishery, noting any possible broader application to other Torres Strait fisheries.

#### ***Daily landing and reporting***

15. Daily landing and catch and effort reporting by fishers and fish receivers using the TDB02 CDR is a mandatory requirement during black teatfish openings. Specifically, during the opening:
- a. Fishers - must land all catches of black teatfish taken to a holder of a Fish Receiver Licence within the same day that it is taken;
  - b. Fish receivers - must send AFMA electronically to email: [blackteatfish@afma.gov.au](mailto:blackteatfish@afma.gov.au) or SMS: 0437 825 291 or fax: 07 4069 1277, an image of the white original copy of the completed TDB02 Catch Disposal Record pages within the same day of receiving catches of black teatfish.
16. During the last day of fishing:
- a. Fishers – must stop all fishing for black teatfish by 12pm (midday) AEST and land all their black teatfish catches to a licenced fish receiver by 6pm AEST;
  - b. Fish receivers - must stop receiving black teatfish by 6pm AEST.
17. Daily landing and reporting was to allow real time monitoring of catches against the TAC and ensure the fishery could be closed before the TAC was exceeded. The requirements during the last day of fishing, were to ensure fishing ceased and final catches reported.
18. The midnight cut-off for daily reporting during the opening caused delays in providing information to fishers and fish receivers on the status of the TAC and fishing arrangements for the following day, including the setting of the TAC Date (closure date). The 6pm cut-off for the last day of fishing, resulted in some fishers remaining at sea, despite the direction to stop fishing by 12pm. A cut-off time of 8pm or 10pm for a full fishing day during the opening/last day of fishing (full day) and a 2pm and 4pm cut-off time for fishers and fish receivers on a last day of fishing (half day) respectively, would allow information to be provided earlier and closure arrangements to be finalised sooner.
19. HCWG advice is sought on the cut-off time for when CDRs are due each day (full and half days), including on the day of closure, as well as any other issues concerning CDR reporting, including:
- a. obtaining accurate weights – during the last opening, there were some reports that tubs were being weighed, which contained liquid/salt in addition to the catches themselves;

- b. voluntary reporting – a communication program during the last opening focussed on increasing voluntary reporting of catch and effort information in Part B of the TDB02 CDR.

***Size frequency sampling program***

- 20. An ongoing condition of the fishery remaining open is that reliable data collection continues, and preferably, under the middle tier decision rules, includes additional data such as CPUE, spatial footprint and size composition.
- 21. The size frequency sampling program is a key data source supporting the assessment and management of the BDM Fishery. There have been growing calls from industry for future size frequency sampling programs to have greater involvement of community members.
- 22. Taking into consideration HCRAAG advice from the preceding meeting, HCWG advice is sought on options for community involvement in the size frequency sampling program and any implementation issues for attention prior to the 2024 black teatfish opening.
- 23. Continuous guidance and feedback is needed from Traditional Inhabitant and scientific members on how best to structure future data collection programs to ensure programs are effective and have community support.

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AUREED ISLAND – QUEENSLAND

LAT 9° 57' S LONG 143° 17' E

Times and Heights of High and Low Waters

2024

Local Time

Table with columns for months (JANUARY, FEBRUARY, MARCH, APRIL) and days (1-31). Each entry includes Time, m (height), and Moon Phase Symbols (New Moon, First Quarter, Full Moon, Last Quarter).

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

◐ First Quarter

○ Full Moon

◑ Last Quarter

Caution: Predictions are of secondary quality



AUREED ISLAND – QUEENSLAND

LAT 9° 57' S LONG 143° 17' E

Times and Heights of High and Low Waters

2024

Local Time

Table with columns for months MAY, JUNE, JULY, and AUGUST. Each month contains a grid of tide data with time and height for high and low tides, and moon phase symbols.

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

◐ First Quarter

○ Full Moon

◑ Last Quarter

Caution: Predictions are of secondary quality



AUREED ISLAND – QUEENSLAND

LAT 9° 57' S LONG 143° 17' E

Times and Heights of High and Low Waters

2024

Local Time

Table with 4 columns: SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. Each column contains tide data for days 1-31, including time, high water (m), and low water (m) with moon phase symbols.

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

◐ First Quarter

○ Full Moon

◑ Last Quarter

Caution: Predictions are of secondary quality

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# DARNLEY ISLAND BARGE – QUEENSLAND

LAT 9° 35' S LONG 143° 45' E

Times and Heights of High and Low Waters

# 2024

Local Time

JANUARY				FEBRUARY				MARCH				APRIL																																																																																																																	
Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m																																																																																																														
<b>1</b> 0031 2.02 0618 1.58 MO 1403 2.95 2137 1.78	<b>16</b> 0143 2.48 0742 1.32 TU 1418 3.29 2137 1.33	<b>1</b> 0109 2.19 0621 1.93 TH 1337 2.64 2041 1.76	<b>16</b> 0455 2.74 1129 1.92 FR 1535 2.36 2330 1.43	<b>1</b> 0034 2.49 0606 2.01 FR 1220 2.62 1839 1.61	<b>16</b> 0430 2.95 1151 1.84 SA 1535 2.06 2304 1.63	<b>1</b> 0400 2.69 1220 2.04 MO 1401 2.07 2145 1.79	<b>16</b> 0617 3.18 1325 1.38 TU 1940 2.37	<b>2</b> 0123 1.96 0643 1.75 TU 1443 2.80 2233 1.75	<b>17</b> 0308 2.42 0913 1.64 WE 1511 3.00 2249 1.30	<b>2</b> 0308 2.16 0430 2.16 FR 1412 2.48 2224 1.70	<b>17</b> 0632 2.97 1306 1.76 SA 1829 2.23	<b>2</b> 0145 2.42 0639 2.25 SA 1243 2.43 1912 1.69	<b>17</b> 0606 3.10 1309 1.62 SU 1920 2.19	<b>2</b> 0548 2.90 1251 1.79 TU 1654 2.07 2341 1.60	<b>17</b> 0048 1.59 0659 3.23 WE 1354 1.29 2000 2.52	<b>3</b> 0512 1.95 0724 1.94 WE 1525 2.68 2319 1.67	<b>18</b> 0511 2.52 1108 1.81 TH 1611 2.73 2355 1.22	<b>3</b> 0705 2.42 1213 2.24 SA 1517 2.35 2333 1.56	<b>18</b> 0039 1.33 0730 3.22 SU 1403 1.57 1944 2.30	<b>3</b> 0603 2.51 1245 2.22 SU 1404 2.23 2240 1.73	<b>18</b> 0024 1.54 0703 3.26 MO 1352 1.43 1958 2.36	<b>3</b> 0634 3.16 1321 1.52 WE 1845 2.35	<b>18</b> 0130 1.49 0730 3.27 TH 1419 1.24 2016 2.66	<b>4</b> 0652 2.16 1024 2.09 TH 1612 2.58 2354 1.54	<b>19</b> 0640 2.79 1245 1.78 FR 1730 2.53	<b>4</b> 0722 2.69 1323 2.07 SU 1648 2.29	<b>19</b> 0131 1.21 0810 3.41 MO 1445 1.40 2022 2.41	<b>4</b> 0645 2.77 1318 1.98 MO 1619 2.15	<b>19</b> 0117 1.41 0742 3.38 TU 1425 1.31 2020 2.51	<b>4</b> 0037 1.33 0712 3.43 TH 1353 1.25 1923 2.66	<b>19</b> 0201 1.41 0756 3.29 FR 1441 1.19 2034 2.79	<b>5</b> 0718 2.39 1209 2.08 FR 1702 2.51	<b>20</b> 0050 1.11 0738 3.07 SA 1355 1.66 1852 2.44	<b>5</b> 0025 1.37 0745 2.98 MO 1402 1.85 1820 2.36	<b>20</b> 0214 1.11 0841 3.53 TU 1518 1.29 2049 2.53	<b>5</b> 0002 1.53 0715 3.07 TU 1347 1.71 1835 2.31	<b>20</b> 0158 1.29 0811 3.45 WE 1452 1.23 2039 2.65	<b>5</b> 0124 1.05 0747 3.67 FR 1426 1.00 2000 2.97	<b>20</b> 0229 1.36 0819 3.29 SA 1458 1.15 2055 2.91	<b>6</b> 0025 1.38 0742 2.65 SA 1315 1.99 1754 2.50	<b>21</b> 0138 1.01 0821 3.32 SU 1447 1.51 1950 2.43	<b>6</b> 0112 1.14 0814 3.28 TU 1437 1.60 1924 2.53	<b>21</b> 0249 1.03 0909 3.61 WE 1547 1.22 2113 2.64	<b>6</b> 0057 1.26 0746 3.38 WE 1418 1.44 1929 2.58	<b>21</b> 0230 1.20 0837 3.50 TH 1517 1.19 2057 2.77	<b>6</b> 0209 0.82 0823 3.84 SA 1500 0.79 2040 3.25	<b>21</b> 0253 1.35 0843 3.25 SU 1513 1.10 2116 3.01	<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62		
<b>2</b> 0123 1.96 0643 1.75 TU 1443 2.80 2233 1.75	<b>17</b> 0308 2.42 0913 1.64 WE 1511 3.00 2249 1.30	<b>2</b> 0308 2.16 0430 2.16 FR 1412 2.48 2224 1.70	<b>17</b> 0632 2.97 1306 1.76 SA 1829 2.23	<b>2</b> 0145 2.42 0639 2.25 SA 1243 2.43 1912 1.69	<b>17</b> 0606 3.10 1309 1.62 SU 1920 2.19	<b>2</b> 0548 2.90 1251 1.79 TU 1654 2.07 2341 1.60	<b>17</b> 0048 1.59 0659 3.23 WE 1354 1.29 2000 2.52	<b>3</b> 0512 1.95 0724 1.94 WE 1525 2.68 2319 1.67	<b>18</b> 0511 2.52 1108 1.81 TH 1611 2.73 2355 1.22	<b>3</b> 0705 2.42 1213 2.24 SA 1517 2.35 2333 1.56	<b>18</b> 0039 1.33 0730 3.22 SU 1403 1.57 1944 2.30	<b>3</b> 0603 2.51 1245 2.22 SU 1404 2.23 2240 1.73	<b>18</b> 0024 1.54 0703 3.26 MO 1352 1.43 1958 2.36	<b>3</b> 0634 3.16 1321 1.52 WE 1845 2.35	<b>18</b> 0130 1.49 0730 3.27 TH 1419 1.24 2016 2.66	<b>4</b> 0652 2.16 1024 2.09 TH 1612 2.58 2354 1.54	<b>19</b> 0640 2.79 1245 1.78 FR 1730 2.53	<b>4</b> 0722 2.69 1323 2.07 SU 1648 2.29	<b>19</b> 0131 1.21 0810 3.41 MO 1445 1.40 2022 2.41	<b>4</b> 0645 2.77 1318 1.98 MO 1619 2.15	<b>19</b> 0117 1.41 0742 3.38 TU 1425 1.31 2020 2.51	<b>4</b> 0037 1.33 0712 3.43 TH 1353 1.25 1923 2.66	<b>19</b> 0201 1.41 0756 3.29 FR 1441 1.19 2034 2.79	<b>5</b> 0718 2.39 1209 2.08 FR 1702 2.51	<b>20</b> 0050 1.11 0738 3.07 SA 1355 1.66 1852 2.44	<b>5</b> 0025 1.37 0745 2.98 MO 1402 1.85 1820 2.36	<b>20</b> 0214 1.11 0841 3.53 TU 1518 1.29 2049 2.53	<b>5</b> 0002 1.53 0715 3.07 TU 1347 1.71 1835 2.31	<b>20</b> 0158 1.29 0811 3.45 WE 1452 1.23 2039 2.65	<b>5</b> 0124 1.05 0747 3.67 FR 1426 1.00 2000 2.97	<b>20</b> 0229 1.36 0819 3.29 SA 1458 1.15 2055 2.91	<b>6</b> 0025 1.38 0742 2.65 SA 1315 1.99 1754 2.50	<b>21</b> 0138 1.01 0821 3.32 SU 1447 1.51 1950 2.43	<b>6</b> 0112 1.14 0814 3.28 TU 1437 1.60 1924 2.53	<b>21</b> 0249 1.03 0909 3.61 WE 1547 1.22 2113 2.64	<b>6</b> 0057 1.26 0746 3.38 WE 1418 1.44 1929 2.58	<b>21</b> 0230 1.20 0837 3.50 TH 1517 1.19 2057 2.77	<b>6</b> 0209 0.82 0823 3.84 SA 1500 0.79 2040 3.25	<b>21</b> 0253 1.35 0843 3.25 SU 1513 1.10 2116 3.01	<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62										
<b>3</b> 0512 1.95 0724 1.94 WE 1525 2.68 2319 1.67	<b>18</b> 0511 2.52 1108 1.81 TH 1611 2.73 2355 1.22	<b>3</b> 0705 2.42 1213 2.24 SA 1517 2.35 2333 1.56	<b>18</b> 0039 1.33 0730 3.22 SU 1403 1.57 1944 2.30	<b>3</b> 0603 2.51 1245 2.22 SU 1404 2.23 2240 1.73	<b>18</b> 0024 1.54 0703 3.26 MO 1352 1.43 1958 2.36	<b>3</b> 0634 3.16 1321 1.52 WE 1845 2.35	<b>18</b> 0130 1.49 0730 3.27 TH 1419 1.24 2016 2.66	<b>4</b> 0652 2.16 1024 2.09 TH 1612 2.58 2354 1.54	<b>19</b> 0640 2.79 1245 1.78 FR 1730 2.53	<b>4</b> 0722 2.69 1323 2.07 SU 1648 2.29	<b>19</b> 0131 1.21 0810 3.41 MO 1445 1.40 2022 2.41	<b>4</b> 0645 2.77 1318 1.98 MO 1619 2.15	<b>19</b> 0117 1.41 0742 3.38 TU 1425 1.31 2020 2.51	<b>4</b> 0037 1.33 0712 3.43 TH 1353 1.25 1923 2.66	<b>19</b> 0201 1.41 0756 3.29 FR 1441 1.19 2034 2.79	<b>5</b> 0718 2.39 1209 2.08 FR 1702 2.51	<b>20</b> 0050 1.11 0738 3.07 SA 1355 1.66 1852 2.44	<b>5</b> 0025 1.37 0745 2.98 MO 1402 1.85 1820 2.36	<b>20</b> 0214 1.11 0841 3.53 TU 1518 1.29 2049 2.53	<b>5</b> 0002 1.53 0715 3.07 TU 1347 1.71 1835 2.31	<b>20</b> 0158 1.29 0811 3.45 WE 1452 1.23 2039 2.65	<b>5</b> 0124 1.05 0747 3.67 FR 1426 1.00 2000 2.97	<b>20</b> 0229 1.36 0819 3.29 SA 1458 1.15 2055 2.91	<b>6</b> 0025 1.38 0742 2.65 SA 1315 1.99 1754 2.50	<b>21</b> 0138 1.01 0821 3.32 SU 1447 1.51 1950 2.43	<b>6</b> 0112 1.14 0814 3.28 TU 1437 1.60 1924 2.53	<b>21</b> 0249 1.03 0909 3.61 WE 1547 1.22 2113 2.64	<b>6</b> 0057 1.26 0746 3.38 WE 1418 1.44 1929 2.58	<b>21</b> 0230 1.20 0837 3.50 TH 1517 1.19 2057 2.77	<b>6</b> 0209 0.82 0823 3.84 SA 1500 0.79 2040 3.25	<b>21</b> 0253 1.35 0843 3.25 SU 1513 1.10 2116 3.01	<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																		
<b>4</b> 0652 2.16 1024 2.09 TH 1612 2.58 2354 1.54	<b>19</b> 0640 2.79 1245 1.78 FR 1730 2.53	<b>4</b> 0722 2.69 1323 2.07 SU 1648 2.29	<b>19</b> 0131 1.21 0810 3.41 MO 1445 1.40 2022 2.41	<b>4</b> 0645 2.77 1318 1.98 MO 1619 2.15	<b>19</b> 0117 1.41 0742 3.38 TU 1425 1.31 2020 2.51	<b>4</b> 0037 1.33 0712 3.43 TH 1353 1.25 1923 2.66	<b>19</b> 0201 1.41 0756 3.29 FR 1441 1.19 2034 2.79	<b>5</b> 0718 2.39 1209 2.08 FR 1702 2.51	<b>20</b> 0050 1.11 0738 3.07 SA 1355 1.66 1852 2.44	<b>5</b> 0025 1.37 0745 2.98 MO 1402 1.85 1820 2.36	<b>20</b> 0214 1.11 0841 3.53 TU 1518 1.29 2049 2.53	<b>5</b> 0002 1.53 0715 3.07 TU 1347 1.71 1835 2.31	<b>20</b> 0158 1.29 0811 3.45 WE 1452 1.23 2039 2.65	<b>5</b> 0124 1.05 0747 3.67 FR 1426 1.00 2000 2.97	<b>20</b> 0229 1.36 0819 3.29 SA 1458 1.15 2055 2.91	<b>6</b> 0025 1.38 0742 2.65 SA 1315 1.99 1754 2.50	<b>21</b> 0138 1.01 0821 3.32 SU 1447 1.51 1950 2.43	<b>6</b> 0112 1.14 0814 3.28 TU 1437 1.60 1924 2.53	<b>21</b> 0249 1.03 0909 3.61 WE 1547 1.22 2113 2.64	<b>6</b> 0057 1.26 0746 3.38 WE 1418 1.44 1929 2.58	<b>21</b> 0230 1.20 0837 3.50 TH 1517 1.19 2057 2.77	<b>6</b> 0209 0.82 0823 3.84 SA 1500 0.79 2040 3.25	<b>21</b> 0253 1.35 0843 3.25 SU 1513 1.10 2116 3.01	<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																										
<b>5</b> 0718 2.39 1209 2.08 FR 1702 2.51	<b>20</b> 0050 1.11 0738 3.07 SA 1355 1.66 1852 2.44	<b>5</b> 0025 1.37 0745 2.98 MO 1402 1.85 1820 2.36	<b>20</b> 0214 1.11 0841 3.53 TU 1518 1.29 2049 2.53	<b>5</b> 0002 1.53 0715 3.07 TU 1347 1.71 1835 2.31	<b>20</b> 0158 1.29 0811 3.45 WE 1452 1.23 2039 2.65	<b>5</b> 0124 1.05 0747 3.67 FR 1426 1.00 2000 2.97	<b>20</b> 0229 1.36 0819 3.29 SA 1458 1.15 2055 2.91	<b>6</b> 0025 1.38 0742 2.65 SA 1315 1.99 1754 2.50	<b>21</b> 0138 1.01 0821 3.32 SU 1447 1.51 1950 2.43	<b>6</b> 0112 1.14 0814 3.28 TU 1437 1.60 1924 2.53	<b>21</b> 0249 1.03 0909 3.61 WE 1547 1.22 2113 2.64	<b>6</b> 0057 1.26 0746 3.38 WE 1418 1.44 1929 2.58	<b>21</b> 0230 1.20 0837 3.50 TH 1517 1.19 2057 2.77	<b>6</b> 0209 0.82 0823 3.84 SA 1500 0.79 2040 3.25	<b>21</b> 0253 1.35 0843 3.25 SU 1513 1.10 2116 3.01	<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																		
<b>6</b> 0025 1.38 0742 2.65 SA 1315 1.99 1754 2.50	<b>21</b> 0138 1.01 0821 3.32 SU 1447 1.51 1950 2.43	<b>6</b> 0112 1.14 0814 3.28 TU 1437 1.60 1924 2.53	<b>21</b> 0249 1.03 0909 3.61 WE 1547 1.22 2113 2.64	<b>6</b> 0057 1.26 0746 3.38 WE 1418 1.44 1929 2.58	<b>21</b> 0230 1.20 0837 3.50 TH 1517 1.19 2057 2.77	<b>6</b> 0209 0.82 0823 3.84 SA 1500 0.79 2040 3.25	<b>21</b> 0253 1.35 0843 3.25 SU 1513 1.10 2116 3.01	<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																										
<b>7</b> 0057 1.20 0806 2.91 SU 1404 1.85 1843 2.53	<b>22</b> 0220 0.92 0858 3.51 MO 1530 1.38 2034 2.46	<b>7</b> 0156 0.90 0846 3.57 WE 1514 1.36 2014 2.72	<b>22</b> 0319 0.99 0936 3.63 TH 1615 1.21 2135 2.71	<b>7</b> 0143 0.97 0819 3.67 TH 1451 1.17 2010 2.86	<b>22</b> 0258 1.15 0901 3.51 FR 1539 1.18 2115 2.86	<b>7</b> 0254 0.69 0900 3.90 SU 1536 0.64 2123 3.46	<b>22</b> 0316 1.38 0904 3.19 MO 1529 1.06 2141 3.08	<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																		
<b>8</b> 0131 1.01 0834 3.17 MO 1445 1.69 1930 2.60	<b>23</b> 0258 0.87 0930 3.63 TU 1608 1.29 2111 2.51	<b>8</b> 0240 0.68 0922 3.82 TH 1551 1.15 2100 2.90	<b>23</b> 0345 0.99 1002 3.62 FR 1639 1.24 2156 2.75	<b>8</b> 0226 0.71 0855 3.91 FR 1527 0.95 2051 3.11	<b>23</b> 0320 1.14 0925 3.49 SA 1557 1.19 2135 2.92	<b>8</b> 0340 0.69 0938 3.81 MO 1613 0.59 2209 3.57	<b>23</b> 0343 1.44 0924 3.09 TU 1546 1.02 2206 3.13	<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																										
<b>9</b> 0209 0.82 0905 3.43 TU 1526 1.51 2015 2.68	<b>24</b> 0331 0.86 1002 3.68 WE 1643 1.26 2144 2.54	<b>9</b> 0323 0.50 1000 4.00 FR 1630 1.00 2146 3.02	<b>24</b> 0407 1.04 1028 3.55 SA 1659 1.29 2216 2.75	<b>9</b> 0309 0.53 0933 4.05 SA 1604 0.80 2134 3.28	<b>24</b> 0341 1.18 0947 3.42 SU 1613 1.20 2157 2.95	<b>9</b> 0427 0.83 1016 3.59 TU 1649 0.65 2300 3.57	<b>24</b> 0411 1.54 0944 2.98 WE 1605 1.00 2234 3.15	<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																		
<b>10</b> 0249 0.67 0941 3.65 WE 1608 1.35 2102 2.75	<b>25</b> 0402 0.90 1034 3.66 TH 1715 1.29 2213 2.54	<b>10</b> 0407 0.43 1042 4.06 SA 1712 0.93 2233 3.07	<b>25</b> 0427 1.12 1052 3.44 SU 1715 1.36 2238 2.73	<b>10</b> 0353 0.47 1012 4.06 SU 1643 0.73 2220 3.37	<b>25</b> 0401 1.26 1008 3.32 MO 1628 1.21 2218 2.96	<b>10</b> 0519 1.09 1056 3.25 WE 1728 0.82 2356 3.47	<b>25</b> 0443 1.65 1004 2.85 TH 1626 1.03 2305 3.13	<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																										
<b>11</b> 0332 0.56 1021 3.81 TH 1651 1.23 2150 2.78	<b>26</b> 0429 0.97 1104 3.59 FR 1744 1.36 2239 2.51	<b>11</b> 0452 0.49 1125 4.00 SU 1756 0.95 2324 3.03	<b>26</b> 0446 1.23 1114 3.30 MO 1730 1.42 2300 2.68	<b>11</b> 0438 0.57 1052 3.91 MO 1722 0.77 2310 3.34	<b>26</b> 0425 1.37 1026 3.18 TU 1644 1.22 2243 2.94	<b>11</b> 0619 1.41 1137 2.84 TH 1806 1.07	<b>26</b> 0518 1.78 1029 2.70 FR 1647 1.10 2344 3.07	<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																																		
<b>12</b> 0416 0.53 1105 3.88 FR 1737 1.17 2242 2.76	<b>27</b> 0451 1.07 1134 3.47 SA 1809 1.46 2302 2.46	<b>12</b> 0538 0.69 1208 3.80 MO 1843 1.05	<b>27</b> 0506 1.39 1132 3.14 TU 1747 1.47 2324 2.63	<b>12</b> 0525 0.83 1132 3.61 TU 1803 0.91	<b>27</b> 0448 1.53 1043 3.03 WE 1700 1.25 2309 2.90	<b>12</b> 0100 3.32 0743 1.71 FR 1222 2.43 1848 1.37	<b>27</b> 0602 1.92 1057 2.52 SA 1710 1.22	<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																																										
<b>13</b> 0502 0.58 1152 3.87 SA 1827 1.18 2335 2.69	<b>28</b> 0512 1.20 1202 3.32 SU 1830 1.57 2325 2.39	<b>13</b> 0020 2.92 0627 1.02 TU 1252 3.48 1935 1.20	<b>28</b> 0527 1.58 1148 2.97 WE 1803 1.52 2353 2.56	<b>13</b> 0005 3.24 0617 1.21 WE 1214 3.21 1846 1.13	<b>28</b> 0515 1.71 1100 2.87 TH 1715 1.29 2342 2.84	<b>13</b> 0215 3.17 0940 1.82 SA 1326 2.08 2010 1.65	<b>28</b> 0036 2.99 0712 2.04 SU 1135 2.32 1736 1.38	<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																																																		
<b>14</b> 0550 0.74 1240 3.75 SU 1922 1.24	<b>29</b> 0531 1.35 1228 3.16 MO 1851 1.66 2349 2.32	<b>14</b> 0125 2.79 0727 1.44 WE 1338 3.10 2041 1.36	<b>29</b> 0545 1.79 1203 2.79 TH 1819 1.56	<b>14</b> 0111 3.08 0727 1.63 TH 1258 2.77 1940 1.38	<b>29</b> 0543 1.90 1118 2.69 FR 1730 1.37	<b>14</b> 0347 3.09 1142 1.70 SU 1809 1.98 2225 1.77	<b>29</b> 0148 2.93 1002 2.02 MO 1238 2.12 1819 1.57	<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71		<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																																																										
<b>15</b> 0034 2.58 0641 1.00 MO 1329 3.55 2026 1.30	<b>30</b> 0550 1.52 1251 2.98 TU 1915 1.72	<b>15</b> 0247 2.68 0911 1.82 TH 1428 2.70 2204 1.45	<b>15</b> 0232 2.95 0932 1.91 FR 1350 2.36 2115 1.59	<b>30</b> 0025 2.76 0620 2.11 SA 1140 2.50 1747 1.47	<b>15</b> 0517 3.11 1247 1.51 MO 1913 2.19 2352 1.70	<b>30</b> 0316 2.93 1125 1.81 TU 1428 1.99 2117 1.71																																																																																																																							
	<b>31</b> 0020 2.25 0607 1.71 WE 1313 2.81 1945 1.75			<b>31</b> 0136 2.67 1033 2.27 SU 1209 2.28 1813 1.62																																																																																																																									

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

◐ First Quarter

○ Full Moon

◑ Last Quarter

Caution: Predictions are of secondary quality

# DARNLEY ISLAND BARGE – QUEENSLAND

LAT 9° 35' S LONG 143° 45' E

Times and Heights of High and Low Waters

# 2024

Local Time

MAY				JUNE				JULY				AUGUST																																																																																																																																																																																																																																																																																																																							
Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m																																																																																																																																																																																																																																																																																																																				
<b>1</b>	0444 1212 WE 1731 ☉ 2311	3.04 1.57 2.10 1.58	<b>16</b>	0600 1316 TH 1931	3.00 1.35 2.39	<b>2</b>	0545 1249 TH 1831	3.21 1.33 2.38	<b>17</b>	0047 0636 FR 1340 1952	1.70 2.99 1.28 2.55	<b>3</b>	0013 0630 FR 1325 1911	1.38 3.38 1.09 2.70	<b>18</b>	0125 0707 SA 1359 2014	1.64 2.99 1.21 2.71	<b>4</b>	0105 0711 SA 1400 1950	1.19 3.51 0.86 3.02	<b>19</b>	0158 0733 SU 1414 2037	1.60 2.97 1.12 2.88	<b>5</b>	0154 0748 SU 1434 2032	1.05 3.56 0.67 3.31	<b>20</b>	0230 0759 MO 1430 2102	1.58 2.93 1.02 3.03	<b>6</b>	0244 0827 MO 1510 2116	0.98 3.52 0.55 3.53	<b>21</b>	0300 0822 TU 1450 2130	1.58 2.87 0.92 3.16	<b>7</b>	0335 0905 TU 1546 2204	1.00 3.37 0.52 3.66	<b>22</b>	0333 0845 WE 1513 2158	1.59 2.81 0.85 3.25	<b>8</b>	0428 0945 WE 1623 ☉ 2255	1.11 3.13 0.59 3.68	<b>23</b>	0408 0912 TH 1539 ☉ 2230	1.60 2.74 0.81 3.31	<b>9</b>	0525 1027 TH 1700 2349	1.27 2.83 0.77 3.61	<b>24</b>	0447 0941 FR 1608 2307	1.63 2.66 0.83 3.32	<b>10</b>	0628 1111 FR 1738	1.45 2.50 1.02	<b>25</b>	0531 1016 SA 1641 2351	1.67 2.54 0.92 3.29	<b>11</b>	0046 0745 SA 1201 1816	3.47 1.61 2.19 1.31	<b>26</b>	0625 1059 SU 1717	1.72 2.40 1.05	<b>12</b>	0148 0915 SU 1315 1907	3.30 1.67 1.95 1.59	<b>27</b>	0043 0738 MO 1152 1802	3.24 1.75 2.24 1.22	<b>13</b>	0256 1050 MO 1710 2115	3.15 1.62 1.89 1.78	<b>28</b>	0143 0912 TU 1304 1905	3.18 1.71 2.09 1.41	<b>14</b>	0407 1203 TU 1834 2252	3.05 1.51 2.07 1.81	<b>29</b>	0245 1030 WE 1437 2050	3.15 1.57 2.03 1.55	<b>15</b>	0511 1246 WE 1908 ☉ 2359	3.01 1.42 2.23 1.76	<b>30</b>	0350 1129 TH 1645 2236	3.14 1.39 2.13 1.55	<b>1</b>	0545 1257 SA 1903	3.16 0.98 2.70	<b>16</b>	0048 0607 SU 1310 1959	1.87 2.62 1.26 2.61	<b>2</b>	0054 0632 SU 1335 1948	1.40 3.15 0.80 3.02	<b>17</b>	0137 0643 MO 1329 2023	1.81 2.59 1.13 2.83	<b>3</b>	0153 0716 MO 1413 2032	1.32 3.10 0.64 3.31	<b>18</b>	0218 0715 TU 1352 2049	1.75 2.56 0.99 3.02	<b>4</b>	0249 0800 TU 1450 2117	1.26 3.00 0.55 3.54	<b>19</b>	0255 0746 WE 1419 2117	1.68 2.56 0.85 3.20	<b>5</b>	0344 0843 WE 1528 2203	1.22 2.87 0.53 3.68	<b>20</b>	0330 0818 TH 1450 2147	1.59 2.57 0.74 3.35	<b>6</b>	0436 0927 TH 1606 ☉ 2250	1.22 2.70 0.60 3.72	<b>21</b>	0407 0854 FR 1525 2222	1.51 2.58 0.67 3.45	<b>7</b>	0530 1013 FR 1645 2338	1.26 2.51 0.75 3.65	<b>22</b>	0446 0933 SA 1602 ☉ 2300	1.44 2.57 0.65 3.52	<b>8</b>	0624 1100 SA 1722	1.34 2.32 0.96	<b>23</b>	0530 1017 SU 1644 2344	1.39 2.53 0.69 3.53	<b>9</b>	0026 0721 SU 1149 1758	3.51 1.44 2.14 1.19	<b>24</b>	0618 1106 MO 1727	1.38 2.45 0.80	<b>10</b>	0114 0825 MO 1245 1831	3.33 1.53 1.98 1.42	<b>25</b>	0031 0715 TU 1202 1815	3.49 1.40 2.34 0.97	<b>11</b>	0202 0934 TU 1358 1909	3.14 1.59 1.88 1.63	<b>26</b>	0121 0822 WE 1308 1909	3.40 1.41 2.23 1.18	<b>12</b>	0252 1046 WE 1659 2022	2.97 1.59 1.88 1.81	<b>27</b>	0213 0935 TH 1425 2023	3.27 1.37 2.17 1.42	<b>13</b>	0344 1147 TH 1826 2228	2.84 1.54 2.02 1.89	<b>28</b>	0305 1043 FR 1609 2207	3.12 1.27 2.22 1.59	<b>14</b>	0436 1226 FR 1906 ☉ 2346	2.74 1.47 2.20 1.90	<b>29</b>	0401 1142 SA 1759 ☉ 2345	2.95 1.14 2.44 1.64	<b>15</b>	0525 1251 SA 1933	2.67 1.38 2.40	<b>30</b>	0500 1232 SU 1904	2.80 0.99 2.74	<b>1</b>	0105 0602 MO 1317 1954	1.59 2.67 0.84 3.06	<b>16</b>	0138 0543 TU 1248 2009	1.94 2.24 1.22 2.79	<b>2</b>	0210 0700 TU 1400 2038	1.47 2.59 0.72 3.34	<b>17</b>	0217 0639 WE 1322 2032	1.80 2.26 1.04 3.03	<b>3</b>	0304 0754 WE 1442 2119	1.34 2.53 0.63 3.54	<b>18</b>	0249 0725 TH 1358 2100	1.64 2.34 0.86 3.24	<b>4</b>	0353 0844 TH 1521 2159	1.22 2.50 0.60 3.66	<b>19</b>	0320 0807 FR 1436 2130	1.48 2.45 0.69 3.44	<b>5</b>	0437 0930 FR 1600 2239	1.15 2.46 0.63 3.69	<b>20</b>	0354 0848 SA 1515 2204	1.31 2.57 0.54 3.61	<b>6</b>	0520 1012 SA 1635 ☉ 2317	1.14 2.41 0.73 3.62	<b>21</b>	0430 0931 SU 1557 ☉ 2243	1.17 2.66 0.46 3.71	<b>7</b>	0600 1052 SU 1708 2356	1.20 2.34 0.88 3.49	<b>22</b>	0511 1016 MO 1639 2323	1.07 2.70 0.46 3.73	<b>8</b>	0642 1128 MO 1735	1.30 2.24 1.06	<b>23</b>	0554 1104 TU 1722	1.04 2.68 0.56	<b>9</b>	0032 0723 TU 1202 1759	3.31 1.43 2.13 1.26	<b>24</b>	0006 0641 WE 1157 1807	3.66 1.07 2.60 0.77	<b>10</b>	0108 0808 WE 1237 1819	3.11 1.55 2.03 1.45	<b>25</b>	0051 0734 TH 1257 1858	3.49 1.14 2.49 1.08	<b>11</b>	0143 0900 TH 1324 1840	2.91 1.64 1.94 1.65	<b>26</b>	0136 0839 FR 1409 2004	3.24 1.21 2.39 1.44	<b>12</b>	0218 1000 FR 1508 1904	2.72 1.66 1.90 1.85	<b>27</b>	0224 0953 SA 1550 2205	2.94 1.24 2.38 1.72	<b>13</b>	0257 1056 SA 1858 2152	2.55 1.61 2.08 2.06	<b>28</b>	0317 1108 SU 1755 ☉ 2152	2.63 1.20 2.58 3.25	<b>14</b>	0342 1140 SU 1926 ☉ 1908	2.39 1.52 2.31 2.88	<b>29</b>	0007 0428 MO 1215 1908	1.74 2.37 1.10 2.88	<b>15</b>	0031 0439 MO 1215 1947	2.05 2.29 1.38 2.55	<b>30</b>	0129 0616 TU 1310 1958	1.59 2.24 0.97 3.16	<b>31</b>	0225 0734 WE 1358 2036	1.40 2.25 0.85 3.38	<b>16</b>	0309 0823 TH 1439 2112	1.23 2.33 0.75 3.54	<b>31</b>	0231 0721 FR 1341 2034	1.53 2.27 0.92 3.30	<b>17</b>	0259 0802 SA 1422 2104	1.30 2.49 0.68 3.55	<b>18</b>	0423 0935 SA 1551 2217	1.04 2.49 0.69 3.61	<b>19</b>	0456 1006 SU 1621 ☉ 2248	1.04 2.52 0.75 3.54	<b>20</b>	0526 1034 MO 1647 2318	1.10 2.50 0.87 3.42	<b>21</b>	0553 1100 TU 1708 2346	1.20 2.44 1.02 3.25	<b>22</b>	0616 1124 WE 1727	1.32 2.36 1.19	<b>23</b>	0012 0635 TH 1148 1745	3.06 1.44 2.27 1.39	<b>24</b>	0033 0652 FR 1215 1802	2.85 1.52 2.19 1.60	<b>25</b>	0051 0713 SA 1257 1815	2.64 1.58 2.11 1.83	<b>26</b>	0106 0740 SU 1501 1636	2.45 1.62 2.06 2.05	<b>27</b>	0117 0906 MO 1930	2.27 1.64 2.31	<b>28</b>	1114 1928 TU 1928 ☉ 1928	1.55 2.55 2.55 3.25	<b>29</b>	0149 0421 WE 1213 1945	1.93 2.00 1.38 2.79	<b>30</b>	0208 0626 TH 1300 2007	1.74 2.08 1.16 3.05	<b>31</b>	0328 0903 SA 1506 2119	1.01 2.54 0.82 3.51
<b>10</b>	0628 1111 FR 1738	1.45 2.50 1.02	<b>25</b>	0531 1016 SA 1641 2351	1.67 2.54 0.92 3.29	<b>11</b>	0046 0745 SA 1201 1816	3.47 1.61 2.19 1.31	<b>26</b>	0625 1059 SU 1717	1.72 2.40 1.05	<b>12</b>	0148 0915 SU 1315 1907	3.30 1.67 1.95 1.59	<b>27</b>	0043 0738 MO 1152 1802	3.24 1.75 2.24 1.22	<b>13</b>	0256 1050 MO 1710 2115	3.15 1.62 1.89 1.78	<b>28</b>	0143 0912 TU 1304 1905	3.18 1.71 2.09 1.41	<b>14</b>	0407 1203 TU 1834 2252	3.05 1.51 2.07 1.81	<b>29</b>	0245 1030 WE 1437 2050	3.15 1.57 2.03 1.55	<b>15</b>	0511 1246 WE 1908 ☉ 2359	3.01 1.42 2.23 1.76	<b>30</b>	0350 1129 TH 1645 2236	3.14 1.39 2.13 1.55	<b>1</b>	0545 1257 SA 1903	3.16 0.98 2.70	<b>16</b>	0048 0607 SU 1310 1959	1.87 2.62 1.26 2.61	<b>2</b>	0054 0632 SU 1335 1948	1.40 3.15 0.80 3.02	<b>17</b>	0137 0643 MO 1329 2023	1.81 2.59 1.13 2.83	<b>3</b>	0153 0716 MO 1413 2032	1.32 3.10 0.64 3.31	<b>18</b>	0218 0715 TU 1352 2049	1.75 2.56 0.99 3.02	<b>4</b>	0249 0800 TU 1450 2117	1.26 3.00 0.55 3.54	<b>19</b>	0255 0746 WE 1419 2117	1.68 2.56 0.85 3.20	<b>5</b>	0344 0843 WE 1528 2203	1.22 2.87 0.53 3.68	<b>20</b>	0330 0818 TH 1450 2147	1.59 2.57 0.74 3.35	<b>6</b>	0436 0927 TH 1606 ☉ 2250	1.22 2.70 0.60 3.72	<b>21</b>	0407 0854 FR 1525 2222	1.51 2.58 0.67 3.45	<b>7</b>	0530 1013 FR 1645 2338	1.26 2.51 0.75 3.65	<b>22</b>	0446 0933 SA 1602 ☉ 2300	1.44 2.57 0.65 3.52	<b>8</b>	0624 1100 SA 1722	1.34 2.32 0.96	<b>23</b>	0530 1017 SU 1644 2344	1.39 2.53 0.69 3.53	<b>9</b>	0026 0721 SU 1149 1758	3.51 1.44 2.14 1.19	<b>24</b>	0618 1106 MO 1727	1.38 2.45 0.80	<b>10</b>	0114 0825 MO 1245 1831	3.33 1.53 1.98 1.42	<b>25</b>	0031 0715 TU 1202 1815	3.49 1.40 2.34 0.97	<b>11</b>	0202 0934 TU 1358 1909	3.14 1.59 1.88 1.63	<b>26</b>	0121 0822 WE 1308 1909	3.40 1.41 2.23 1.18	<b>12</b>	0252 1046 WE 1659 2022	2.97 1.59 1.88 1.81	<b>27</b>	0213 0935 TH 1425 2023	3.27 1.37 2.17 1.42	<b>13</b>	0344 1147 TH 1826 2228	2.84 1.54 2.02 1.89	<b>28</b>	0305 1043 FR 1609 2207	3.12 1.27 2.22 1.59	<b>14</b>	0436 1226 FR 1906 ☉ 2346	2.74 1.47 2.20 1.90	<b>29</b>	0401 1142 SA 1759 ☉ 2345	2.95 1.14 2.44 1.64	<b>15</b>	0525 1251 SA 1933	2.67 1.38 2.40	<b>30</b>	0500 1232 SU 1904	2.80 0.99 2.74	<b>1</b>	0105 0602 MO 1317 1954	1.59 2.67 0.84 3.06	<b>16</b>	0138 0543 TU 1248 2009	1.94 2.24 1.22 2.79	<b>2</b>	0210 0700 TU 1400 2038	1.47 2.59 0.72 3.34	<b>17</b>	0217 0639 WE 1322 2032	1.80 2.26 1.04 3.03	<b>3</b>	0304 0754 WE 1442 2119	1.34 2.53 0.63 3.54	<b>18</b>	0249 0725 TH 1358 2100	1.64 2.34 0.86 3.24	<b>4</b>	0353 0844 TH 1521 2159	1.22 2.50 0.60 3.66	<b>19</b>	0320 0807 FR 1436 2130	1.48 2.45 0.69 3.44	<b>5</b>	0437 0930 FR 1600 2239	1.15 2.46 0.63 3.69	<b>20</b>	0354 0848 SA 1515 2204	1.31 2.57 0.54 3.61	<b>6</b>	0520 1012 SA 1635 ☉ 2317	1.14 2.41 0.73 3.62	<b>21</b>	0430 0931 SU 1557 ☉ 2243	1.17 2.66 0.46 3.71	<b>7</b>	0600 1052 SU 1708 2356	1.20 2.34 0.88 3.49	<b>22</b>	0511 1016 MO 1639 2323	1.07 2.70 0.46 3.73	<b>8</b>	0642 1128 MO 1735	1.30 2.24 1.06	<b>23</b>	0554 1104 TU 1722	1.04 2.68 0.56	<b>9</b>	0032 0723 TU 1202 1759	3.31 1.43 2.13 1.26	<b>24</b>	0006 0641 WE 1157 1807	3.66 1.07 2.60 0.77	<b>10</b>	0108 0808 WE 1237 1819	3.11 1.55 2.03 1.45	<b>25</b>	0051 0734 TH 1257 1858	3.49 1.14 2.49 1.08	<b>11</b>	0143 0900 TH 1324 1840	2.91 1.64 1.94 1.65	<b>26</b>	0136 0839 FR 1409 2004	3.24 1.21 2.39 1.44	<b>12</b>	0218 1000 FR 1508 1904	2.72 1.66 1.90 1.85	<b>27</b>	0224 0953 SA 1550 2205	2.94 1.24 2.38 1.72	<b>13</b>	0257 1056 SA 1858 2152	2.55 1.61 2.08 2.06	<b>28</b>	0317 1108 SU 1755 ☉ 2152	2.63 1.20 2.58 3.25	<b>14</b>	0342 1140 SU 1926 ☉ 1908	2.39 1.52 2.31 2.88	<b>29</b>	0007 0428 MO 1215 1908	1.74 2.37 1.10 2.88	<b>15</b>	0031 0439 MO 1215 1947	2.05 2.29 1.38 2.55	<b>30</b>	0129 0616 TU 1310 1958	1.59 2.24 0.97 3.16	<b>31</b>	0225 0734 WE 1358 2036	1.40 2.25 0.85 3.38	<b>16</b>	0309 0823 TH 1439 2112	1.23 2.33 0.75 3.54	<b>31</b>	0231 0721 FR 1341 2034	1.53 2.27 0.92 3.30	<b>17</b>	0259 0802 SA 1422 2104	1.30 2.49 0.68 3.55	<b>18</b>	0423 0935 SA 1551 2217	1.04 2.49 0.69 3.61	<b>19</b>	0456 1006 SU 1621 ☉ 2248	1.04 2.52 0.75 3.54	<b>20</b>	0526 1034 MO 1647 2318	1.10 2.50 0.87 3.42	<b>21</b>	0553 1100 TU 1708 2346	1.20 2.44 1.02 3.25	<b>22</b>	0616 1124 WE 1727	1.32 2.36 1.19	<b>23</b>	0012 0635 TH 1148 1745	3.06 1.44 2.27 1.39	<b>24</b>	0033 0652 FR 1215 1802	2.85 1.52 2.19 1.60	<b>25</b>	0051 0713 SA 1257 1815	2.64 1.58 2.11 1.83	<b>26</b>	0106 0740 SU 1501 1636	2.45 1.62 2.06 2.05	<b>27</b>	0117 0906 MO 1930	2.27 1.64 2.31	<b>28</b>	1114 1928 TU 1928 ☉ 1928	1.55 2.55 2.55 3.25	<b>29</b>	0149 0421 WE 1213 1945	1.93 2.00 1.38 2.79	<b>30</b>	0208 0626 TH 1300 2007	1.74 2.08 1.16 3.05	<b>31</b>	0328 0903 SA 1506 2119	1.01 2.54 0.82 3.51																																																						
<b>1</b>	0545 1257 SA 1903	3.16 0.98 2.70	<b>16</b>	0048 0607 SU 1310 1959	1.87 2.62 1.26 2.61	<b>2</b>	0054 0632 SU 1335 1948	1.40 3.15 0.80 3.02	<b>17</b>	0137 0643 MO 1329 2023	1.81 2.59 1.13 2.83	<b>3</b>	0153 0716 MO 1413 2032	1.32 3.10 0.64 3.31	<b>18</b>	0218 0715 TU 1352 2049	1.75 2.56 0.99 3.02	<b>4</b>	0249 0800 TU 1450 2117	1.26 3.00 0.55 3.54	<b>19</b>	0255 0746 WE 1419 2117	1.68 2.56 0.85 3.20	<b>5</b>	0344 0843 WE 1528 2203	1.22 2.87 0.53 3.68	<b>20</b>	0330 0818 TH 1450 2147	1.59 2.57 0.74 3.35	<b>6</b>	0436 0927 TH 1606 ☉ 2250	1.22 2.70 0.60 3.72	<b>21</b>	0407 0854 FR 1525 2222	1.51 2.58 0.67 3.45	<b>7</b>	0530 1013 FR 1645 2338	1.26 2.51 0.75 3.65	<b>22</b>	0446 0933 SA 1602 ☉ 2300	1.44 2.57 0.65 3.52	<b>8</b>	0624 1100 SA 1722	1.34 2.32 0.96	<b>23</b>	0530 1017 SU 1644 2344	1.39 2.53 0.69 3.53	<b>9</b>	0026 0721 SU 1149 1758	3.51 1.44 2.14 1.19	<b>24</b>	0618 1106 MO 1727	1.38 2.45 0.80	<b>10</b>	0114 0825 MO 1245 1831	3.33 1.53 1.98 1.42	<b>25</b>	0031 0715 TU 1202 1815	3.49 1.40 2.34 0.97	<b>11</b>	0202 0934 TU 1358 1909	3.14 1.59 1.88 1.63	<b>26</b>	0121 0822 WE 1308 1909	3.40 1.41 2.23 1.18	<b>12</b>	0252 1046 WE 1659 2022	2.97 1.59 1.88 1.81	<b>27</b>	0213 0935 TH 1425 2023	3.27 1.37 2.17 1.42	<b>13</b>	0344 1147 TH 1826 2228	2.84 1.54 2.02 1.89	<b>28</b>	0305 1043 FR 1609 2207	3.12 1.27 2.22 1.59	<b>14</b>	0436 1226 FR 1906 ☉ 2346	2.74 1.47 2.20 1.90	<b>29</b>	0401 1142 SA 1759 ☉ 2345	2.95 1.14 2.44 1.64	<b>15</b>	0525 1251 SA 1933	2.67 1.38 2.40	<b>30</b>	0500 1232 SU 1904	2.80 0.99 2.74	<b>1</b>	0105 0602 MO 1317 1954	1.59 2.67 0.84 3.06	<b>16</b>	0138 0543 TU 1248 2009	1.94 2.24 1.22 2.79	<b>2</b>	0210 0700 TU 1400 2038	1.47 2.59 0.72 3.34	<b>17</b>	0217 0639 WE 1322 2032	1.80 2.26 1.04 3.03	<b>3</b>	0304 0754 WE 1442 2119	1.34 2.53 0.63 3.54	<b>18</b>	0249 0725 TH 1358 2100	1.64 2.34 0.86 3.24	<b>4</b>	0353 0844 TH 1521 2159	1.22 2.50 0.60 3.66	<b>19</b>	0320 0807 FR 1436 2130	1.48 2.45 0.69 3.44	<b>5</b>	0437 0930 FR 1600 2239	1.15 2.46 0.63 3.69	<b>20</b>	0354 0848 SA 1515 2204	1.31 2.57 0.54 3.61	<b>6</b>	0520 1012 SA 1635 ☉ 2317	1.14 2.41 0.73 3.62	<b>21</b>	0430 0931 SU 1557 ☉ 2243	1.17 2.66 0.46 3.71	<b>7</b>	0600 1052 SU 1708 2356	1.20 2.34 0.88 3.49	<b>22</b>	0511 1016 MO 1639 2323	1.07 2.70 0.46 3.73	<b>8</b>	0642 1128 MO 1735	1.30 2.24 1.06	<b>23</b>	0554 1104 TU 1722	1.04 2.68 0.56	<b>9</b>	0032 0723 TU 1202 1759	3.31 1.43 2.13 1.26	<b>24</b>	0006 0641 WE 1157 1807	3.66 1.07 2.60 0.77	<b>10</b>	0108 0808 WE 1237 1819	3.11 1.55 2.03 1.45	<b>25</b>	0051 0734 TH 1257 1858	3.49 1.14 2.49 1.08	<b>11</b>	0143 0900 TH 1324 1840	2.91 1.64 1.94 1.65	<b>26</b>	0136 0839 FR 1409 2004	3.24 1.21 2.39 1.44	<b>12</b>	0218 1000 FR 1508 1904	2.72 1.66 1.90 1.85	<b>27</b>	0224 0953 SA 1550 2205	2.94 1.24 2.38 1.72	<b>13</b>	0257 1056 SA 1858 2152	2.55 1.61 2.08 2.06	<b>28</b>	0317 1108 SU 1755 ☉ 2152	2.63 1.20 2.58 3.25	<b>14</b>	0342 1140 SU 1926 ☉ 1908	2.39 1.52 2.31 2.88	<b>29</b>	0007 0428 MO 1215 1908	1.74 2.37 1.10 2.88	<b>15</b>	0031 0439 MO 1215 1947	2.05 2.29 1.38 2.55	<b>30</b>	0129 0616 TU 1310 1958	1.59 2.24 0.97 3.16	<b>31</b>	0225 0734 WE 1358 2036	1.40 2.25 0.85 3.38	<b>16</b>	0309 0823 TH 1439 2112	1.23 2.33 0.75 3.54	<b>31</b>	0231 0721 FR 1341 2034	1.53 2.27 0.92 3.30	<b>17</b>	0259 0802 SA 1422 2104	1.30 2.49 0.68 3.55	<b>18</b>	0423 0935 SA 1551 2217	1.04 2.49 0.69 3.61	<b>19</b>	0456 1006 SU 1621 ☉ 2248	1.04 2.52 0.75 3.54	<b>20</b>	0526 1034 MO 1647 2318	1.10 2.50 0.87 3.42	<b>21</b>	0553 1100 TU 1708 2346	1.20 2.44 1.02 3.25	<b>22</b>	0616 1124 WE 1727	1.32 2.36 1.19	<b>23</b>	0012 0635 TH 1148 1745	3.06 1.44 2.27 1.39	<b>24</b>	0033 0652 FR 1215 1802	2.85 1.52 2.19 1.60	<b>25</b>	0051 0713 SA 1257 1815	2.64 1.58 2.11 1.83	<b>26</b>	0106 0740 SU 1501 1636	2.45 1.62 2.06 2.05	<b>27</b>	0117 0906 MO 1930	2.27 1.64 2.31	<b>28</b>	1114 1928 TU 1928 ☉ 1928	1.55 2.55 2.55 3.25	<b>29</b>	0149 0421 WE 1213 1945	1.93 2.00 1.38 2.79	<b>30</b>	0208 0626 TH 1300 2007	1.74 2.08 1.16 3.05	<b>31</b>	0328 0903 SA 1506 2119	1.01 2.54 0.82 3.51																																																																																										
<b>10</b>	0114 0825 MO 1245 1831	3.33 1.53 1.98 1.42	<b>25</b>	0031 0715 TU 1202 1815	3.49 1.40 2.34 0.97	<b>11</b>	0202 0934 TU 1358 1909	3.14 1.59 1.88 1.63	<b>26</b>	0121 0822 WE 1308 1909	3.40 1.41 2.23 1.18	<b>12</b>	0252 1046 WE 1659 2022	2.97 1.59 1.88 1.81	<b>27</b>	0213 0935 TH 1425 2023	3.27 1.37 2.17 1.42	<b>13</b>	0344 1147 TH 1826 2228	2.84 1.54 2.02 1.89	<b>28</b>	0305 1043 FR 1609 2207	3.12 1.27 2.22 1.59	<b>14</b>	0436 1226 FR 1906 ☉ 2346	2.74 1.47 2.20 1.90	<b>29</b>	0401 1142 SA 1759 ☉ 2345	2.95 1.14 2.44 1.64	<b>15</b>	0525 1251 SA 1933	2.67 1.38 2.40	<b>30</b>	0500 1232 SU 1904	2.80 0.99 2.74	<b>1</b>	0105 0602 MO 1317 1954	1.59 2.67 0.84 3.06	<b>16</b>	0138 0543 TU 1248 2009	1.94 2.24 1.22 2.79	<b>2</b>	0210 0700 TU 1400 2038	1.47 2.59 0.72 3.34	<b>17</b>	0217 0639 WE 1322 2032	1.80 2.26 1.04 3.03	<b>3</b>	0304 0754 WE 1442 2119	1.34 2.53 0.63 3.54	<b>18</b>	0249 0725 TH 1358 2100	1.64 2.34 0.86 3.24	<b>4</b>	0353 0844 TH 1521 2159	1.22 2.50 0.60 3.66	<b>19</b>	0320 0807 FR 1436 2130	1.48 2.45 0.69 3.44	<b>5</b>	0437 0930 FR 1600 2239	1.15 2.46 0.63 3.69	<b>20</b>	0354 0848 SA 1515 2204	1.31 2.57 0.54 3.61	<b>6</b>	0520 1012 SA 1635 ☉ 2317	1.14 2.41 0.73 3.62	<b>21</b>	0430 0931 SU 1557 ☉ 2243	1.17 2.66 0.46 3.71	<b>7</b>	0600 1052 SU 1708 2356	1.20 2.34 0.88 3.49	<b>22</b>	0511 1016 MO 1639 2323	1.07 2.70 0.46 3.73	<b>8</b>	0642 1128 MO 1735	1.30 2.24 1.06	<b>23</b>	0554 1104 TU 1722	1.04 2.68 0.56	<b>9</b>	0032 0723 TU 1202 1759	3.31 1.43 2.13 1.26	<b>24</b>	0006 0641 WE 1157 1807	3.66 1.07 2.60 0.77	<b>10</b>	0108 0808 WE 1237 1819	3.11 1.55 2.03 1.45	<b>25</b>	0051 0734 TH 1257 1858	3.49 1.14 2.49 1.08	<b>11</b>	0143 0900 TH 1324 1840	2.91 1.64 1.94 1.65	<b>26</b>	0136 0839 FR 1409 2004	3.24 1.21 2.39 1.44	<b>12</b>	0218 1000 FR 1508 1904	2.72 1.66 1.90 1.85	<b>27</b>	0224 0953 SA 1550 2205	2.94 1.24 2.38 1.72	<b>13</b>	0257 1056 SA 1858 2152	2.55 1.61 2.08 2.06	<b>28</b>	0317 1108 SU 1755 ☉ 2152	2.63 1.20 2.58 3.25	<b>14</b>	0342 1140 SU 1926 ☉ 1908	2.39 1.52 2.31 2.88	<b>29</b>	0007 0428 MO 1215 1908	1.74 2.37 1.10 2.88	<b>15</b>	0031 0439 MO 1215 1947	2.05 2.29 1.38 2.55	<b>30</b>	0129 0616 TU 1310 1958	1.59 2.24 0.97 3.16	<b>31</b>	0225 0734 WE 1358 2036	1.40 2.25 0.85 3.38	<b>16</b>	0309 0823 TH 1439 2112	1.23 2.33 0.75 3.54	<b>31</b>	0231 0721 FR 1341 2034	1.53 2.27 0.92 3.30	<b>17</b>	0259 0802 SA 1422 2104	1.30 2.49 0.68 3.55	<b>18</b>	0423 0935 SA 1551 2217	1.04 2.49 0.69 3.61	<b>19</b>	0456 1006 SU 1621 ☉ 2248	1.04 2.52 0.75 3.54	<b>20</b>	0526 1034 MO 1647 2318	1.10 2.50 0.87 3.42	<b>21</b>	0553 1100 TU 1708 2346	1.20 2.44 1.02 3.25	<b>22</b>	0616 1124 WE 1727	1.32 2.36 1.19	<b>23</b>	0012 0635 TH 1148 1745	3.06 1.44 2.27 1.39	<b>24</b>	0033 0652 FR 1215 1802	2.85 1.52 2.19 1.60	<b>25</b>	0051 0713 SA 1257 1815	2.64 1.58 2.11 1.83	<b>26</b>	0106 0740 SU 1501 1636	2.45 1.62 2.06 2.05	<b>27</b>	0117 0906 MO 1930	2.27 1.64 2.31	<b>28</b>	1114 1928 TU 1928 ☉ 1928	1.55 2.55 2.55 3.25	<b>29</b>	0149 0421 WE 1213 1945	1.93 2.00 1.38 2.79	<b>30</b>	0208 0626 TH 1300 2007	1.74 2.08 1.16 3.05	<b>31</b>	0328 0903 SA 1506 2119	1.01 2.54 0.82 3.51																																																																																																																																																

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

◐ First Quarter

○ Full Moon

◑ Last Quarter

Caution: Predictions are of secondary quality

DARNLEY ISLAND BARGE – QUEENSLAND

LAT 9° 35' S LONG 143° 45' E

2024

Times and Heights of High and Low Waters

Local Time

Table with 4 main columns for months: SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. Each month column contains a grid of days (1-31) with time and height data for high and low tides. Includes moon phase symbols like ●, ○, and ⊙.

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Datum of Predictions is Lowest Astronomical Tide

Caution: Predictions are of secondary quality

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols ● New Moon ○ Full Moon ⊙ Last Quarter



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MEER ISLAND BARGE – QUEENSLAND

LAT 9° 54' S LONG 144° 2' E

Times and Heights of High and Low Waters

2024

Local Time

Table with columns for months (JANUARY, FEBRUARY, MARCH, APRIL) and days (1-31). Each entry includes Time, m (height), and Moon Phase Symbols (●, ○, ⊙).

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

⊙ First Quarter

○ Full Moon

⦿ Last Quarter

Caution: Predictions are of secondary quality



# MEER ISLAND BARGE – QUEENSLAND

LAT 9° 54' S LONG 144° 2' E

Times and Heights of High and Low Waters

# 2024

Local Time

MAY				JUNE				JULY				AUGUST			
Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m
<b>1</b> 0428	2.63	<b>16</b> 0533	2.58	<b>1</b> 0526	2.71	<b>16</b> 0009	1.60	<b>1</b> 0017	1.40	<b>16</b> 0116	1.66	<b>1</b> 0233	1.14	<b>16</b> 0153	1.35
1154	1.40	1246	1.19	1214	0.92	0540	2.23	0552	2.28	0515	1.90	0749	2.02	0648	1.94
WE 1654	1.83	TH 1848	2.02	SA 1826	2.31	SU 1232	1.10	MO 1231	0.76	TU 1213	1.05	TH 1350	0.65	FR 1300	0.79
☉ 2220	1.35					1927	2.19	1916	2.62	TU 1213	1.05	2032	3.03	FR 1957	2.80
<b>2</b> 0519	2.78	<b>17</b> 0003	1.45	<b>2</b> 0003	1.23	<b>17</b> 0054	1.57	<b>2</b> 0125	1.33	<b>17</b> 0143	1.56	<b>2</b> 0307	1.05	<b>17</b> 0215	1.19
1215	1.21	0610	2.57	0612	2.70	0609	2.19	0646	2.21	0605	1.92	0830	2.09	0730	2.12
TH 1749	2.06	FR 1303	1.14	SU 1248	0.76	MO 1249	0.99	TU 1312	0.65	WE 1244	0.90	FR 1428	0.61	SA 1340	0.59
2325	1.19	1915	2.15	1915	2.58	1951	2.36	2001	2.86	1957	2.54	2108	3.08	2029	3.00
<b>3</b> 0602	2.92	<b>18</b> 0039	1.41	<b>3</b> 0101	1.18	<b>18</b> 0130	1.53	<b>3</b> 0219	1.24	<b>18</b> 0205	1.45	<b>3</b> 0339	1.01	<b>18</b> 0245	1.02
1243	1.02	0639	2.55	0656	2.64	0638	2.17	0738	2.17	0651	1.98	0905	2.14	0812	2.30
FR 1834	2.32	SA 1316	1.08	MO 1325	0.62	TU 1311	0.87	WE 1352	0.57	TH 1318	0.75	SA 1502	0.60	SU 1420	0.41
		1940	2.28	2000	2.83	2016	2.53	2043	3.03	2023	2.73	2142	3.06	2102	3.17
<b>4</b> 0017	1.04	<b>19</b> 0110	1.39	<b>4</b> 0158	1.16	<b>19</b> 0205	1.48	<b>4</b> 0307	1.16	<b>19</b> 0233	1.33	<b>4</b> 0409	1.01	<b>19</b> 0320	0.88
0643	3.02	0703	2.52	0740	2.55	0709	2.16	0825	2.14	0735	2.07	0938	2.15	0853	2.45
SA 1313	0.84	SU 1329	1.00	TU 1401	0.53	WE 1338	0.75	TH 1432	0.54	FR 1355	0.60	SU 1534	0.65	MO 1501	0.31
1917	2.58	2005	2.41	2045	3.03	2042	2.68	2123	3.13	2053	2.90	☉ 2214	2.99	2140	3.25
<b>5</b> 0105	0.94	<b>20</b> 0139	1.38	<b>5</b> 0252	1.15	<b>20</b> 0241	1.43	<b>5</b> 0352	1.11	<b>20</b> 0307	1.21	<b>5</b> 0440	1.06	<b>20</b> 0359	0.79
0722	3.05	0724	2.47	0824	2.43	0744	2.16	0909	2.11	0819	2.17	1007	2.11	0937	2.53
SU 1346	0.68	MO 1345	0.92	WE 1441	0.50	TH 1409	0.66	FR 1513	0.56	SA 1434	0.48	MO 1602	0.74	TU 1545	0.32
2001	2.82	2030	2.53	2130	3.15	2112	2.81	2202	3.14	2128	3.04	2245	2.86	☉ 2219	3.23
<b>6</b> 0154	0.91	<b>21</b> 0211	1.40	<b>6</b> 0347	1.17	<b>21</b> 0318	1.37	<b>6</b> 0435	1.11	<b>21</b> 0345	1.10	<b>6</b> 0508	1.13	<b>21</b> 0441	0.76
0801	2.99	0745	2.42	0909	2.28	0823	2.17	0950	2.06	0903	2.25	1030	2.04	1023	2.53
MO 1422	0.57	TU 1406	0.83	TH 1522	0.55	FR 1444	0.60	SA 1551	0.64	SU 1516	0.41	TU 1626	0.88	WE 1629	0.45
2047	3.01	2056	2.64	☉ 2215	3.17	2145	2.91	☉ 2241	3.07	☉ 2205	3.13	2312	2.70	2300	3.09
<b>7</b> 0245	0.95	<b>22</b> 0245	1.42	<b>7</b> 0443	1.21	<b>22</b> 0400	1.32	<b>7</b> 0517	1.15	<b>22</b> 0427	1.03	<b>7</b> 0535	1.22	<b>22</b> 0526	0.79
0841	2.85	0809	2.37	0955	2.12	0905	2.16	1028	1.98	0948	2.28	1050	1.96	1113	2.46
TU 1500	0.53	WE 1430	0.77	FR 1603	0.67	SA 1522	0.58	SU 1627	0.76	MO 1600	0.40	WE 1643	1.03	TH 1716	0.70
2134	3.12	2123	2.73	2301	3.10	☉ 2223	2.96	2319	2.93	2246	3.14	2334	2.53	2342	2.83
<b>8</b> 0339	1.06	<b>23</b> 0321	1.45	<b>8</b> 0541	1.27	<b>23</b> 0445	1.29	<b>8</b> 0600	1.22	<b>23</b> 0512	1.00	<b>8</b> 0600	1.30	<b>23</b> 0614	0.87
0922	2.64	0836	2.31	1040	1.96	0951	2.12	1101	1.88	1035	2.26	1110	1.88	1211	2.34
WE 1540	0.58	TH 1456	0.74	SA 1645	0.83	SU 1604	0.61	MO 1658	0.91	TU 1644	0.49	TH 1654	1.20	FR 1812	1.03
☉ 2223	3.14	☉ 2155	2.78	2349	2.97	2306	2.97	2358	2.76	2330	3.07	2354	2.35		
<b>9</b> 0438	1.20	<b>24</b> 0401	1.48	<b>9</b> 0644	1.34	<b>24</b> 0537	1.28	<b>9</b> 0645	1.31	<b>24</b> 0601	1.01	<b>9</b> 0621	1.36	<b>24</b> 0028	2.50
1004	2.38	0909	2.23	1128	1.80	1040	2.06	1130	1.78	1126	2.18	1137	1.80	0709	0.99
TH 1621	0.72	FR 1524	0.76	SU 1727	1.02	MO 1650	0.69	TU 1721	1.07	WE 1730	0.66	FR 1702	1.37	SA 1328	2.22
2314	3.07	2232	2.80			2355	2.92					1929	1.38		
<b>10</b> 0544	1.36	<b>25</b> 0449	1.52	<b>10</b> 0039	2.79	<b>25</b> 0634	1.28	<b>10</b> 0034	2.58	<b>25</b> 0016	2.91	<b>10</b> 0012	2.17	<b>25</b> 0122	2.15
1049	2.10	0945	2.12	0755	1.39	1135	1.96	0732	1.39	0655	1.04	0641	1.40	0817	1.10
FR 1704	0.91	SA 1556	0.82	MO 1220	1.67	TU 1741	0.82	WE 1157	1.68	TH 1225	2.07	SA 1219	1.73	SU 1523	2.22
		2316	2.77	1807	1.22			1734	1.24	1822	0.92	1705	1.56	2200	1.57
<b>11</b> 0011	2.94	<b>26</b> 0545	1.55	<b>11</b> 0134	2.63	<b>26</b> 0047	2.83	<b>11</b> 0111	2.40	<b>26</b> 0106	2.68	<b>11</b> 0022	2.01	<b>26</b> 0249	1.85
0706	1.48	1030	1.99	0921	1.41	0739	1.27	0831	1.44	0756	1.08	0707	1.42	0950	1.14
SA 1142	1.84	SU 1636	0.92	TU 1343	1.57	WE 1240	1.86	TH 1236	1.60	FR 1342	1.98	SU 2230	1.90	MO 1713	2.39
1753	1.14			1852	1.39	1836	0.99	1739	1.40	1928	1.22	☉			
<b>12</b> 0115	2.78	<b>27</b> 0009	2.72	<b>12</b> 0233	2.49	<b>27</b> 0146	2.73	<b>12</b> 0149	2.24	<b>27</b> 0202	2.42	<b>12</b> 0855	1.41	<b>27</b> 0026	1.41
0905	1.49	0658	1.58	1045	1.38	0850	1.23	0943	1.44	0906	1.09	1948	1.98	0509	1.75
SU 1303	1.65	MO 1125	1.86	WE 1608	1.59	TH 1404	1.81	FR 1611	1.57	SA 1534	2.00	MO		TU 1122	1.08
1857	1.35	1727	1.05	2008	1.53	1945	1.18	1733	1.57	2108	1.48			1819	2.62
<b>13</b> 0231	2.66	<b>28</b> 0114	2.66	<b>13</b> 0331	2.39	<b>28</b> 0248	2.61	<b>13</b> 0233	2.11	<b>28</b> 0312	2.18	<b>13</b> 1044	1.32	<b>28</b> 0119	1.23
1054	1.39	0830	1.54	1136	1.32	1000	1.14	1046	1.39	1023	1.05	1855	2.16	0630	1.83
MO 1602	1.62	TU 1244	1.74	TH 1749	1.70	FR 1552	1.88	SA 2026	1.77	SU 1719	2.20	TU		WE 1224	0.97
2029	1.50	1837	1.19	2145	1.61	2113	1.35	2139	1.77	☉ 2334	1.52	☉		1904	2.79
<b>14</b> 0346	2.60	<b>29</b> 0228	2.65	<b>14</b> 0424	2.33	<b>29</b> 0352	2.49	<b>14</b> 0325	2.00	<b>29</b> 0439	2.00	<b>14</b> 0151	1.61	<b>29</b> 0155	1.10
1147	1.30	1002	1.41	1205	1.26	1100	1.02	1119	1.30	1131	0.95	0437	1.69	0716	1.95
TU 1751	1.76	WE 1432	1.71	FR 1831	1.85	SA 1722	2.08	SU 1904	1.95	MO 1828	2.47	WE 1139	1.18	TH 1308	0.86
2206	1.54	2010	1.29	☉ 2309	1.62	☉ 2251	1.43	☉				1908	2.37	1940	2.91
<b>15</b> 0447	2.59	<b>30</b> 0337	2.67	<b>15</b> 0506	2.27	<b>30</b> 0453	2.38	<b>15</b> 0026	1.74	<b>30</b> 0103	1.40	<b>15</b> 0147	1.50	<b>30</b> 0222	1.02
1221	1.24	1058	1.25	1221	1.19	1148	0.89	0420	1.93	0601	1.94	0558	1.78	0752	2.08
WE 1823	1.90	TH 1621	1.84	SA 1900	2.02	SU 1826	2.34	MO 1145	1.18	TU 1226	0.84	TH 1221	0.99	FR 1345	0.77
☉ 2316	1.50	2143	1.31					1915	2.15	1916	2.71	1930	2.58	2013	2.97
		<b>31</b> 0435	2.70												
		1138	1.09												
		FR 1731	2.05												
		☉ 2259	1.28												
								<b>31</b> 0155	1.25					<b>31</b> 0247	0.97
								0701	1.96					0823	2.18
								WE 1311	0.74					SA 1416	0.72
								1956	2.90					2044	2.99

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols

● New Moon

◐ First Quarter

○ Full Moon

◑ Last Quarter

Caution: Predictions are of secondary quality

MEER ISLAND BARGE – QUEENSLAND

LAT 9° 54' S LONG 144° 2' E

Times and Heights of High and Low Waters

2024

Local Time

Table with columns for months (SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER) and days (1-31). Each entry includes Time, m (height), and Moon Phase Symbols (New Moon, First Quarter, Full Moon, Last Quarter).

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Datum of Predictions is Lowest Astronomical Tide

Times are in local standard time (Time Zone UTC +10:00)

Moon Phase Symbols ● New Moon ○ Full Moon ● Last Quarter

Caution: Predictions are of secondary quality

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>MANAGEMENT OF WHITE TEATFISH</b>	<b>Agenda Item 10</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the discussions and recommendations at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting concerning the TAC for white teatfish (*Holothuria fuscogilva*). This will be discussed under **Agenda Item 8**;
  - b. **CONSIDER** the outcomes of the Beche-de-mer (BDM) Workshop held on 21-22 March 2023 regarding an industry proposal for the use of hookah gear to fish for white teatfish in the Torres Strait BDM Fishery (BDM Fishery) (**Attachment 10a**);
  - c. **DISCUSS** and **PROVIDE ADVICE** on the industry proposal, in particular:
    - i. proposed access to the TAC;
    - ii. diver safety requirements, noting information provided regarding current regulations;
    - iii. proposed change to boat length restrictions;
    - iv. proposed consultation process;
    - v. any other management considerations relevant to the industry proposal;
  - d. In providing this advice, **CONSIDER** the objectives of the *Torres Strait Fisheries Act 1984* (**Attachment 10b**) and any requirements under the BDM Fishery Harvest Strategy;
  - e. **NOTE** additional issues that will require further consideration by industry, HCRAAG, HCWG, PZJA agencies and the PZJA should the industry proposal proceed, including:
    - i. PZJA agency resourcing required to support the industry proposal should it proceed to a trial;
    - ii. surveillance and enforcement program required to support a trial;
    - iii. data and monitoring needs, required to support a trial;
    - iv. timing of a trial;
    - v. over catch arrangements;
  - f. **DISCUSS** and **PROVIDE ADVICE** on next steps.

## KEY ISSUES

2. Under the *Torres Strait Fisheries (Bêche-de-mer) Management Instrument 2022* (the Management Instrument), the use of underwater breathing apparatus (including hookah), to take BDM in the BDM Fishery is not permitted. Over a number of years, some participants in the fishery have proposed the prohibition be removed to allow more effective targeting of white teatfish, a commercially valuable species that is predominantly found in deeper waters largely inaccessible by free diving.

3. There has been extensive consultation on this issue to date, details provided in **Attachment 10c**. There have been divided views among stakeholders over time, though the most recent BDM Workshop saw industry participants put forward a proposal with the consensus of those industry participants in attendance.
4. The HCWG has had extensive discussions concerning this issue including on issues and management options. A summary of issues considered to date is provided at **Attachment 10d**. This includes details of steps that have been undertaken to address these, or better understand the issue. Management options previously canvassed include:
  - a. allowing the use of hookah to fish for white teatfish only;
  - b. allowing the use of hookah to fish for white teatfish only and in certain areas;
  - c. having a designated white teatfish hookah fishing season which may potentially involve closing fishing to all other BDM species;
  - d. trialling fishing for white teatfish using hookah with one fisher per community.

#### ***Industry proposal***

5. The BDM Workshop was held on 21-22 March 2023 on Ngurupai (Horn Island). A summary report for the BDM Workshop is provided at **Attachment 10a**.
6. A key focus of the Workshop was to seek broader industry views to better understand the benefits and impacts of different options for the utilisation of the under caught white teatfish TAC, including the use of hookah gear. Industry participants recommended the use of hookah gear to fish for white teatfish be permitted as follows:
  - a. increase to the TAC for white teatfish from 15 tonnes to 20 tonnes;
  - b. based on the area where white teatfish stock is concentrated (Meriam marine waters including the Cumberland Passage), the 20 tonnes TAC be accessed as follows:
    - i. based on historical catches of TIB licence holders, 5 tonnes be reserved for free diving within the Meriam marine waters, noting free diving for white teatfish is currently permitted;
    - ii. the remaining 15 t will be accessed by hookah gear by fishers from the Meriam, Kulkalgal, Guda Maluilgal, Maluilgal, Kauraraeg, Gudag/Yadaykenu and Angamuthi TIB licence holders within the Cumberland Passage area (pending community consultation);
    - iii. access does not include areas beyond 10 degrees 41 minutes latitude South from the tip of Cape York (accessing the recent claimed areas).
  - c. based on the area where white teatfish stock is concentrated (Meriam marine waters including the Cumberland Passage) and those islands that access this area, the islands of Ugar, Mer, Erub, Masig, Poruma and Warraber will be consulted on access to the 20 tonnes TAC;
  - d. TIB licence holders to hold an Australian Diving Course Certificate that meets all Australian standards and survey standards;
  - e. for improved safety, increase the current maximum boat length restriction from 7 metres to 20 metres;
  - f. do not permit the use of hookah gear for white teatfish during the annual black teatfish opening;
  - g. hookah use to be permitted for white teatfish only;
  - h. community consultation supported to endorse conditions for access to white teatfish using hookah gear.

7. The industry participants unanimously agreed that while this issue is of high importance to industry, it is also of high importance that the right process is followed including Traditional Owner and community consultation, to ensure the sustainability of the fishery is protected for this and future generations.
8. Industry participants requested AFMA to immediately introduce to the HCRA, HCWG, PZJA Standing Committee and PZJA, the required amendments to the Management Instrument and BDM Fishery Harvest Strategy, to enable the above.
9. Note with regards to paragraph 6(b)(iii), this area is south of the TSPZ and outside but near area, and not included in the area of the BDM Fishery. This area is however subject to a 2022 Native Title determination (Torres Strait Regional Seas Claims – Parts B and C).
10. HCWG advice is sought on the following elements of the proposal. In providing this advice the HCWG should consider the objectives of the Act and any requirements under the BDM Fishery Harvest Strategy. The HCWG should also raise any other management considerations relevant to the industry proposal.

#### ***Access to the TAC***

11. Concerns have previously been raised that the TAC for white teatfish is relatively small compared to the number of TIB licence holders. As at 1 July 2023, there were 149 TIB licences in the BDM Fishery. The limited TAC may not be able to sustain all fishers currently licensed to fish in the fishery if the use of hookah gear is permitted. Once the TAC is reached, fishing will need to cease.
12. The industry proposal includes a recommendation for the TAC to be split between free divers and hookah divers. The level afforded to free diving is set to account for current levels of catch by free diving. Since the PZJA decision in late 2014 regarding the buy-out of the last TVH licence in the fishery, annual catches of white teatfish by TIB licence holders in the fishery have ranged between 0.8-4.2 tonnes. Annual catches in the last five years (2018-2022) have averaged 1.9 tonnes (**Attachment 8c**).
13. Of note, the costs incurred by fishers to gain the competencies to use hookah gear as well as the costs of the hookah gear itself is likely to be a barrier to entry and limit uptake should the use of hookah gear be permitted.
14. HCWG advice is sought on whether the industry proposal adequately addresses previous concerns regarding sectoral access to the TAC, or whether additional management arrangements are needed.

#### ***Diver safety requirements***

15. Concerns have previously been raised that hookah diving at depths of greater than 20 metres in remote areas of the eastern Torres Strait could pose a safety risk. The nearest hyperbaric treatment centre is located in Townsville and would require air evacuation, in which the changes to air pressure and altitude would likely worsen the patient. Safety risks were considered as part of the original reasoning behind the prohibition on the use of hookah gear in the BDM Fishery, when the fishery was managed by the Queensland government (responsibility for the management of the BDM Fishery only transitioned to the PZJA in 1999).
16. The industry proposal includes a recommendation for TIB licence holders who are using hookah gear, to meet regulatory requirements. The regulation of commercial diving work (referred to as occupational diving work) falls under the Queensland government's *Work Health and Safety Act 2011* (the WHS Act) and *Work Health and Safety Regulation 2011* (the WHS Regulation) administered by Workplace Health and Safety Queensland (WHSQ). A summary of regulatory requirements are contained in WHSQ's Occupational Diving Work Code of Practice 2005 provided at **Attachment 10e**. This should be used as a guide only and more detailed information on regulatory requirements should be sought from WHSQ by individuals planning to undertake occupational diving work.

17. The Code of Practice covers both mandatory requirements under the WHS Act and Regulation as well as recommended requirements. The requirements cover anyone undertaking occupational diving work. Mandatory requirements under the WHS Act and Regulation include:
- a. Dive medical (Part 4.8 of the WHS Regulation):
    - i. current certificate of medical fitness to dive before carrying out general diving work. Must be conducted by a physician with experience in hyperbaric medicine and conducted as per AS2299.1 Appendix M. Dive medicals must be completed on an annual basis;
    - ii. any work carried out is within any limits stated in the certificate;
  - b. Competencies (e.g. qualifications and training) (Part 4.8 of the WHS Regulation):
    - i. proof of competency for all occupational diving work. This involves obtaining proof of competency through a recognised and accredited training course (e.g. commercial diving course, VET course (TAFE harvest diver course) or recreational Dive Master course);
  - c. Risk assessment (Part 4.8 of the WHS Regulation):
    - i. a risk assessment process be undertaken by a competent person prior to undertaking occupational diving work. This should include control measures for managing risk including having a bail out cylinder when diving to manage the risk of running out of air;
    - ii. the process must be carried out each time that there is a significant change to the occupational diving work, certain records are to be kept, some training is to be undertaken and the process is to be monitored and reviewed;
  - d. Record keeping (Part 4.8 of the WHS Regulation):
    - i. certain records be kept of the diving undertaken. This includes dive plans and safety logs.
  - e. First aid (Division 3 of Part 3.2 of the WHS Regulation):
    - i. includes the need to carry oxygen (the most effective treatment for most diving injuries – drowning and decompression sickness) and for (a sufficient number to manage any foreseeable emergency) workers to hold qualifications in first aid, CPR and oxygen provision;
  - f. Emergency Plans (Division 4 of Part 3.2 of the WHS Regulation):
    - i. these should incorporate not only the AMSA emergency plans (MOB, Collision or grounding, fire, loss of steering, incapacitated master) but must also include emergency plans relevant to diving – rescue of a diver, missing diver, first aid and evacuation;
  - g. Equipment (section 213 of Part 5 of the WHS Regulation):
    - i. requires that plant must be serviced as per manufacturer’s instructions – this includes the servicing of scuba equipment - regulators, cylinders, hookahs used to conduct occupational diving. Typically this is an annual requirement and must be completed by a competent person.
18. HCWG advice is sought on whether TIB licence holders currently meet regulatory requirements and what support, if any, is needed to meet requirements to enable the industry proposal. In providing this advice, it should be kept in mind that responsibility for meeting regulatory requirements sits with individuals and the regulatory requirements are administered by WHSQ.



**Boat length restrictions**

19. Changes to the current 7 metre boat length restriction in the BDM Fishery have been discussed for many years, including by the HCWG in 2011, 2015, 2018 and 2019. At these meetings, industry members have expressed their interest in increasing the boat length restriction to allow larger vessels to operate. This would make it feasible for primary/tender operations. Larger vessels would allow for more efficient fishing operations through being able to travel further to areas currently unable to be fished easily and safely. It would also support industry to better utilise TACs.
20. The industry proposal includes a recommendation, that for improved safety, the current maximum boat length restriction be increased from 7 metres to 20 metres.
21. Some concerns that have been raised in the past concerning this issue include:
  - a. sea cucumber species are vulnerable to overfishing;
  - b. increasing fishing efficiency may redistribute catches to fewer fishers under a competitive TAC and therefore may not be in line with the objectives of the Act;
  - c. both fishing and processor/carrier licences in the TIB sector are not currently limited entry. Allowing larger boats to tow tenders could significantly increase effort
22. This component of the industry proposal will require further assessment against the objectives of the Act, including the implications of any change for the sustainability and optimum utilisation of the traditional way of life and livelihood of traditional inhabitants, economic development and employment opportunities. HCWG advice is sought on management considerations relevant to this component of the industry proposal that should be taken into account when undertaking further analysis.

**Consultation**

23. As detailed above, the industry proposal includes a recommendation for the TAC to be split between free divers and hookah divers. The recommendation includes specific mention of the need for consultation on this element of the industry proposal, in particular, that based on where white teatfish stock is concentrated (Meriam marine waters including the Cumberland Passage) and those islands that access this area, the islands of Ugar, Mer, Erub, Masig, Poruma and Warraber are to be consulted on access to the TAC.
24. The industry proposal also includes a statement of support for further community consultation on the conditions to be placed on the use of hookah gear to fish for white teatfish.
25. Industry participants at the BDM Workshop unanimously agreed that while this issue is of high importance to industry, it is also of high importance that the right process is followed including Traditional Owner and community consultation, to ensure the sustainability of the fishery is protected for this and future generations.
26. HCWG advice is sought on the consultative process outlined in the industry proposal and any additional considerations or steps that should be taken into account when planning for consultation on the proposal. This includes advice on any additional work required by either PZJA agencies or industry prior to consultation being undertaken.

**Additional issues that will require further consideration**

27. The HCWG is invited to raise any other issues that will require further consideration by the HCWG, HCWG, PZJA agencies and the PZJA should the industry proposal proceed.
28. The HCWG is asked to note that there are number of additional issues that will require further consideration by industry, HCWG, HCWG, PZJA agencies and the PZJA should the industry proposal proceed, including:
  - a. PZJA agency resourcing required to support the industry proposal should it proceed to a trial – there will be significant resourcing demands associated with progressing the industry proposal which cannot be accommodated within existing operating budgets. PZJA agencies



need to consider this in line with existing priorities and demands on resources. It is expected that resourcing demands will be equivalent or higher to that required for re-opening black teatfish;

- b. Surveillance and enforcement program required to support a trial - there will be significant costs associated with implementing an effective surveillance and enforcement program for the proposed activity which cannot be accommodated within existing operating budgets. Such a program will be risk-based and AFMA will need to consider both the design and funding of such a program should the industry proposal proceed;
- c. Data and monitoring needs required to support a trial – additional data collection and monitoring requirements may be need to be implemented should the industry proposal proceed. If additional fine scale catch and effort and/or biological data is required, additional monitoring tools may need to be used, in addition to the existing Fish Receiver System. These tools could include mandatory logbook reporting, vessel monitoring system, data loggers or scientific observers. There are significant costs associated with this which cannot be accommodated within existing operating budgets. Advice will be sought from the HCWAG and HCWG on this at their next meetings;
- d. Timing of a trial – the timing of a trial needs to be considered. There are a range of operational (e.g. weather, tides, operations of other fisheries) and biological (e.g. spawning) considerations which would need to be taken into account. It is proposed that this issue will be discussed as part of the consultation process;
- e. Over catch arrangements – clarification of over catch requirements under the BDM Fishery Harvest Strategy may be required.

#### **Next steps**

29. Proposed next steps, should the industry proposal proceed:

- a. PZJA to be informed of progress on the industry proposal;
- b. AFMA, in consultation with the proponents of the industry proposal if required, to prepare a draft statement of arrangements to support a trial, inclusive of the elements outlined in the industry proposal. Advice from the HCWG at this meeting will also be reflected as relevant/appropriate;
- c. AFMA on behalf of the PZJA, to undertake consultation with relevant stakeholders, inclusive of those identified in the industry proposal;
- d. HCWAG and HCWG to consider the outcomes of consultation and recommend whether a trial should proceed, and if so what arrangements should apply;
- e. PZJA to make a decision concerning whether a trial should proceed, and if so what arrangements should apply;
- f. If endorsed by the PZJA, AFMA to implement arrangements for a trial. Full implementation of the industry proposal as it currently stands would require amendments to the Management Instrument, licence conditions, PZJA policy and administrative procedures. Implementation may also involve notification of Native Title bodies under the *Native Title Act 1993*;
- g. Trial undertaken;
- h. HCWAG and HCWG to review of data and information collected from a trial and develop strategies to mitigate any issues or risks that may have arisen in the course of the trial;

30. HCWG advice is sought on the proposed next steps including any changes or additional work required by either PZJA agencies or industry as part of the progressing the industry proposal as outlined.

**BACKGROUND**

31. The BDM Workshop was held on 21-22 March 2023 on Ngurupai (Horn Island). The Workshop was convened to seek broader industry views on future management arrangements for the Torres Strait Beche-de-mer Fishery (BDM Fishery), in particular to:
  - a. identify optimal timing for annual black teatfish openings;
  - b. identify potential options for the better utilisation of the under caught black teatfish TAC; and
  - c. understand the benefits and impacts of different options for the better utilisation of the under caught white teatfish TAC, including the use of hookah gear.
32. The matters for consideration at the BDM Workshop were identified by the HCWG.



**Australian Government**

**Australian Fisheries Management Authority**

# **Beche-de-mer (BDM) Workshop**

**21-22 March 2023**

**Ngurupai (Horn Island)**

**Summary report and outcomes**



*BDM Workshop participants, 22 March 2023*

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## Workshop Overview

The Torres Strait Beche-de-mer (BDM) Workshop was held on 21-22 March 2023 at the Wongai Beach Hotel, Ngurupai (Horn Island). The Workshop was convened to seek broader industry views on future management arrangements for the Torres Strait Beche-de-mer Fishery (BDM Fishery), in particular to:

- identify optimal timing for annual black teatfish openings;
- identify potential options for the better utilisation of the under caught black teatfish total allowable catch (TAC); and
- understand the benefits and impacts of different options for the better utilisation of the under caught white teatfish TAC, including the use of hookah gear.

The matters for consideration at the Workshop were identified by the Protected Zone Joint Authority (PZJA) Hand Collectables Working Group (HCWG). Views and advice provided at the Workshop will be considered by the HCWG and inform future advice to the PZJA.

The Workshop also provided an opportunity for industry participants to:

- express, listen to and understand the aspirations and views of other industry members in relation to the future management of the BDM Fishery;
- raise ideas and options that may not have been considered previously;
- consider, discuss, and assess potential benefits and/or impacts of any proposed changes to the management of the BDM Fishery and how they align with the objectives and policies of the fishery, and the aspirations of industry.

A complete list of Workshop participants is provided in **Attachment A**. Workshop participants were provided with the draft agenda at **Attachment B** to help guide discussions during the Workshop. Copies of presentations provided at the Workshop are at **Attachments C-F**.

## Introduction

The Workshop was opened in prayer at 0840 on 21 March 2023. An acknowledgement of country was made, and a minute of silence held to pay respect to the recent loss of a deeply respected Elder who was a pioneer in the Torres Strait fishing industry.

The Chair provided an overview of the purpose of the Workshop which was to seek broader industry views on key management issues pertaining to black teatfish and white teatfish, noting access rights to the BDM Fishery is 100% owned by Traditional Inhabitants. The Chair also provided an outline of the objectives of the *Torres Strait Fisheries Act 1984* (the Act) and noted that the potential benefits and impacts of any proposed changes will need to be considered carefully in providing views and advice.

## Black Teatfish

AFMA provided an overview of the 2021 and 2022 black teatfish openings, arrangements for the 2023 black teatfish opening and an introduction to the key issues for which advice from Workshop participants was being sought (**Attachment C**). The Workshop noted:

- the management framework for the BDM Fishery has undergone significant development since the 2014 and 2015 black teatfish openings where the TAC was significantly overcaught. Key developments include the BDM Fishery Harvest Strategy (2016-2019), implementation of the Fish Receiver System (2017), BDM Fishery survey and updated stock assessment (2019-2020);
- the 2021 and 2022 black teatfish openings were undertaken on a trial basis with a 20 t TAC. The 2021 opening was held from 30 April to 3 May 2021 (4 days) during which 17.6 t was caught. The 2022 opening was held from 9-12 May 2022 (3 ½ days) during which 17.1 t was caught;
- the arrangements for the 2023 opening will be similar to previous years, including a 20 t TAC, fishers and fish receivers must be licenced, daily catch reporting and cessation of fishing once a notice has been given;
- key issues for which advice from Workshop participants was being sought:
  - optimal timing for annual black teatfish openings, including 2023. Prior industry feedback on key factors affecting timing was summarised:
    - favourable weather – February to May;
    - favourable tides – neap;
    - 2022 – last half day fell on high tide, not good for fishing;
    - favourable markets – e.g. Chinese New Year;
    - not on Sabbath;
    - during TRL openings – season and hookah;
    - avoid spawning – June-July and December;
  - potential options for the better utilisation of the under caught black teatfish TAC, noting current constraints imposed by conditions on the Wildlife Trade Operation (WTO) approval for the BDM Fishery.

Workshop participants discussed at length the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) and its implications for the management of the BDM Fishery, in particular the limit placed on the catch of black teatfish (20 t) through conditions on the WTO approval for the fishery. The Workshop discussed and noted:

- Australia is a Party to CITES, an international agreement between governments that aims to ensure that the international trade in wildlife does not threaten wild populations of plants and animals;
- the import and export of species listed under CITES is regulated by governments under a permitting system to ensure the international movement of a listed species is both legal and sustainable;
- in Australia, the Department of Climate Change, Energy, the Environment and Water (DCCEE) has responsibility for implementing CITES requirements, given effect through the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). To export CITES listed species for commercial purposes, the species must come from an approved WTO;

- there are currently three species caught in the BDM Fishery that are listed under Appendix II of CITES – black teatfish, white teatfish and prickly redfish. As the majority of catch from the BDM Fishery is exported, the fishery must be assessed every three years to ensure it meets CITES requirements and for it to receive WTO approval;
- the WTO approval for the BDM Fishery expires on 30 November 2023. Currently, conditions placed on the WTO approval limit the catch of black teatfish (20 t) and white teatfish (15 t);
- the BDM Fishery will undergo re-assessment in 2023 and this will provide the opportunity to seek flexibility in the conditions placed on the WTO approval, to recognise the science-based TAC setting process in the BDM Fishery, remove fixed caps on TACs and introduce arrangements for under catch/over catch. Given the timing of the re-assessment process, this will not be able to occur prior to a 2023 black teatfish opening.

Industry participants recommended that PZJA agencies, Malu Lamar (Torres Strait Islander) Corporation RNTBC (Malu Lamar) and Gur A Baradharaw Kod Torres Strait Sea and Land Council (GBK) be involved in discussions and consulted during the WTO re-assessment. AFMA advised that public consultation is undertaken as part of the WTO re-assessment process and can provide further information on when this is likely to occur. AFMA has also suggested to the DCCEEW that they engage with Native Title bodies directly as part of the process.

Following a request from industry participants, CSIRO provided an overview of the results from the 2019-2020 BDM Fishery survey and 2022 size frequency sampling program (**Attachment D**). The Workshop discussed and noted:

- there are currently three species caught in the BDM Fishery that are listed under Appendix II of CITES – black teatfish (listed in 2019), white teatfish (listed in 2019) and prickly redfish (listed in 2022). These species can only be exported from Australia if they come from a fishery with WTO approval;
- the results of the 2019-2020 survey and 2022 size frequency sampling program supported the current CITES Non-Detriment Finding necessary for WTO approval for black teatfish and white teatfish. A CITES Non-Detriment Finding for prickly redfish will also be required;
- the BDM Fishery Harvest Strategy provides details of current management controls and decision rules for setting TACs. Recent stock assessment modelling, that took into account data from the 2019-2020 survey and 2022 size frequency sampling program, estimated 21 t of black teatfish can be removed from the BDM Fishery sustainably. The Hand Collectables Resource Assessment Group (HCRAAG) and HCWG recommended a 20 t TAC for the 2023 fishing season to provide a buffer from the risk of overfishing and closure;
- the estimated total stock biomass for black teatfish from the 2019-2020 survey was estimated to be 817 t. This includes animals of all size classes. The stock has been previously overfished and is still rebuilding;
- the size frequency sampling program was first undertaken during the 2022 black teatfish opening. Four AFMA Scientific Observers were stationed at Mer and Erub Islands to collect population size frequency data and morphometrics. Community involvement was voluntary. The HCRAAG and HCWG have recommended that this program be undertaken again during the 2023 black teatfish opening. AFMA and CSIRO will work with the relevant communities to make the appropriate arrangements;
- summary of key data from the 2021 and 2022 trial black teatfish openings:
  - voluntary data – 55% was left blank in 2021. 32% was left blank in 2022, good improvement;



- catch per day peaked on day 4 in 2021 (least on day 3 which was the Sabbath) and day 3 in 2022 (least on day 4 which was a half day);
- most of catch taken from Darnley, Cumberland, and Don Cay areas;
- approximately 10% of black teatfish caught during the 2022 opening was estimated to have been undersized (minimum legal size is 250 mm), taking into account shrinkage and evisceration. The age at maturity for black teatfish is estimated to be 10 years;
- in 2021 the majority of product was landed gutted and salted, compared to a greater diversity in 2022 which included whole, gutted, and gutted and salted;
- key outcomes from the 2021 and 2022 trial black teatfish openings:
  - no evidence of stockpiling;
  - no evidence of declining catch after a few days, which would indicate depletion;
  - cumulative catches tracked and adhered to TAC;
  - number of fishers participating in the fishery was a fraction of available fishing effort;
- ongoing length frequency time series data is important. This data will support understanding of size structure for black teatfish population, allow updates to modelling, indicate effects of fishing and support assessments under CITES.

Industry participants advised:

- this is the first time many industry participants had been made aware of CITES, the WTO process, and conditions placed on the BDM Fishery under the WTO approval;
- there needs to be further discussion on TACs at the Workshop, including options to increase them above the limits currently prescribed in the WTO conditions. AFMA clarified that the WTO conditions limit the total catch from the BDM Fishery, not just how much can be exported i.e. cannot take more than the limit set in the conditions to sell on the domestic market;
- more information is needed on how natural mortality is considered in assessing stocks and setting TACs;
- there needs to be an independent survey to update TACs in the BDM Fishery. AFMA noted that the last survey undertaken in 2019-2020 cost approximately \$420,000, including a \$120,000 co-contribution from CSIRO.

## Industry discussions on black teatfish issues

Industry participants requested that non-industry participants leave the room while the optimal timing for annual black teatfish openings and options for the better utilisation of the under caught black teatfish TAC were discussed. Following these discussions, the industry group then reported the outcomes to all Workshop participants. In summary, the group recommended:

- the optimal start date for the 2023 black teatfish opening is 15 May 2023;
- the TAC be increased to 22 t, noting that based on past catch trends less than 20 t will be caught;
- an independent survey be undertaken as a priority. Industry participants advised that they were unable to advise on the optimal timing for future black teatfish openings (i.e. beyond 2023), until this critical piece of research is undertaken. The survey needs to:
  - be independent;
  - be funded by PZJA agencies as a priority;

- identify where and when spawning of key species, including black teatfish, is occurring (e.g. cold water);
- collect the additional data needed to support a higher tier of assessment under the BDM Fishery Harvest Strategy;
- expand the areas it covers, to include waters covered by the 2022 Determination of the Torres Strait Regional Sea Claim, Barrier Reef, and areas south of the Torres Strait Protected Zone (TSPZ) border with Queensland;
- provide an opportunity for Traditional Owner and Traditional Inhabitant input into the design.

AFMA noted that the TAC for black teatfish for the 2023 fishing season has already been set by the PZJA, based on the available science and advice of the HCRA and HCWG. Industry participants requested a written response from the PZJA as to how the TAC was set and future opportunities for input into the TAC setting process.

Industry participants advised that it is the nature of the Torres Strait fisheries licencing system that is causing problems in the BDM Fishery. Native Title rights over sea country need to be recognised in this system and in the management of the fishery going forward.

Industry participants were asked to provide additional advice should an increase in the TAC to 22 t not be feasible. Industry participants again requested that non-industry participants leave the room while this was discussed. Following these discussions, the industry group then reported the outcomes to all Workshop participants. In summary, the group recommended:

- the optimal start date for the 2023 black teatfish opening remains 15 May 2023;
- an independent survey is undertaken prior to WTO approval expiry on 30 November 2023. Survey details as outlined above;
- WTO conditions to be updated to remove fixed caps on TACs and reflect latest science;
- the TAC to be increased to 22 t for the 2024 black teatfish opening;
- with regards to any remaining under caught TAC in 2023, re-open the fishery for the required period later in the year (e.g. one day in November). The remaining TAC will be held in trust by Zenadth Kes Fisheries Limited, who will then facilitate an agreement between Traditional Owners as to how it will be caught during the re-opening.

AFMA noted that the PZJA would need to consider the approach outlined above, including details of the agreement between Traditional Owners as to how any remaining under caught TAC will be accessed in 2023. PZJA agencies will also need to consider funding sources for an independent survey, noting the significant cost of such surveys and the current research budget being fully committed. TSRA confirmed they will work with AFMA and the Queensland Department of Agriculture and Fisheries (QDAF) to identify funding options.

AFMA acknowledged industry participants' frustration at the current WTO conditions, noting again that this is the first time many industry participants had been made aware of the conditions placed on the BDM Fishery through the WTO process. AFMA clarified that it is unusual for WTO conditions to prescribe a fixed TAC and AFMA would be seeking the removal of fixed caps on TACs as well as the ability to carry-over under catch/over catch to the next season, as part of the upcoming WTO re-assessment process. AFMA committed to provide additional information to Workshop participants on the WTO re-assessment process for the BDM Fishery, including opportunities to provide their views through the public consultation process.

Industry sought further advice on how sea claim determinations covering both the TSPZ and Queensland waters will be considered in the future management of the BDM Fishery, including whether the boundaries of the fishery/TSPZ will be expanded to reflect the areas covered by these sea claim determinations. AFMA advised that any movement of boundaries would require re-negotiation of the Treaty with PNG and agreements with Queensland, which would be a significant undertaking for governments.

With regards to the proposal to re-open the fishery later in the year to allow any remaining under caught TAC to be caught, AFMA suggested a pause day as part of the opening in May 2023 would be a more effective option. It was explained that re-opening the fishery for a second period would require additional funding and resources not currently allocated for in the administration of the 2023 black teatfish opening. Industry participants were supportive of exploring this option. Zenadth Kes Fisheries Limited committed to leading discussions with Traditional Owners and providing advice on who would access the remaining TAC and where. AFMA noted that it does not have the power to enforce access agreements between communities and such an approach entailed significant risk, particularly the risk that the TAC will be over caught. Notwithstanding this risk, AFMA and TSRA agreed to work with Zenadth Kes Fisheries Limited and would await advice on discussions with Traditional Owners. AFMA noted the timeframes that applied in the lead up to the 15 May season opening and the significant body of work and consultation required in a short period.

Industry participants requested the AFMA CEO and DCCEEW attend future workshops and HCWG meetings so that they can hear industry views and advice first hand. Industry participants further requested that PZJA agencies provide information to DCCEEW on the concerns and advice provided at the Workshop regarding the WTO process and conditions. GBK noted that they will be meeting with the AFMA CEO at a meeting at Saibai the following week and will raise these and other issues directly with them.

## Compliance Program

AFMA provided a brief overview of compliance arrangements for the 2023 black teatfish opening, noting that the Compliance presence will be similar to openings in 2021 and 2022. Fishers were reminded of licencing and boat marking requirements. Industry participants expressed concerns that the compliance approach during past openings was too intrusive. AFMA advised there will be a continued focus on education during the 2023 opening.

## White Teatfish

AFMA provided an overview of management arrangements for white teatfish, and consideration and consultation to date on the issue of the under caught white teatfish TAC (**Attachment E**). The Workshop noted:

- white teatfish is a commercially valuable species that is predominantly found in deeper waters largely inaccessible by free diving. Management arrangements for white teatfish include a 15 t TAC, no possession or use of hookah gear and a minimum size limit (320 mm). Only 2-3 t of the 15 t TAC is caught annually;

- similar to black teatfish, the WTO approval for the BDM Fishery currently places a limit on the catch of white teatfish (15 t);
- the 2019-2020 BDM Fishery survey was the first time a deep-water survey has been undertaken for white teatfish. The survey results have provided sufficient confidence for quantifying white teatfish stocks. The survey found ~50 per cent of white teatfish is found in deep-water strata. The survey trend for the shallow reef population has been fairly constant over time;
- the management framework for the BDM Fishery has undergone significant development since the 2011-2012 trial using hookah gear to fish for white teatfish. Key developments include a TVH licence buy-out (2014-2015), the BDM Fishery Harvest Strategy (2016-2019), implementation of the Fish Receiver System (2017), BDM Fishery survey (2019-2020) and updated stock assessment (due 2023);
- over many years, participants in the BDM Fishery have proposed the prohibition on the possession and use of hookah gear be removed to allow more effective targeting of white teatfish. However, the management framework needed further development to ensure the PZJA had the tools available to ensure any potential changes could be implemented effectively. There has been past community consultation on options, however responses have been divided.

The Workshop noted the AFMA recommended guidance for reviewing management controls, which included:

- reflecting on the objectives under Act and BDM Fishery policies (e.g. BDM Fishery Harvest Strategy);
- considering the long-term vision for the BDM Fishery;
- defining what the issue is, and what the options are;
- assessing the benefits and impacts of potential changes/options against objectives, policies, and vision; and
- considering how potential changes/options can be implemented and enforced.

Workshop participants noted the next steps for progressing options for the better utilisation of the under caught white teatfish TAC:

- report to the PZJA on the Workshop outcomes;
- HCRAG and HCWG to consider the outcomes of the Workshop and provide further advice on proposed changes that might be recommended for further development;
- broader community consultation;
- HCRAG and HCWG to consider the outcomes of community consultation;
- PZJA decision and amendments to fishery management instrument and licence conditions.

The Workshop further noted options considered by the HCWG at recent meetings:

- allowing the use of hookah to fish for white teatfish only;
- allowing the use of hookah to fish for white teatfish only and in certain areas;
- having a designated white teatfish hookah fishing season which may potentially involve closing fishing to all other BDM species;
- trialling fishing for white teatfish using hookah with one fisher per community.

Industry participants expressed their dissatisfaction at the licencing arrangements for the hookah gear trial undertaken in 2011-2012, which saw only two developmental permits issued and one of

those, a non-Traditional Inhabitant (TVH) permit holder, taking the entirety of the white teatfish TAC. Some industry participants suggested that fishing with the use of hookah gear should be permitted now using the same mechanism.

## Industry discussions on white teatfish issues

Industry participants requested that non-industry participants leave the room while the benefits and impacts of different options for the better utilisation of the under caught white teatfish TAC were discussed. Following these discussions, the industry group then reported the outcomes of to all Workshop participants (**Attachment F**). With regards to management options:

- the group identified the areas in which the white teatfish is heavily concentrated;
- the areas in which the group spoke openly and recognised to access is within the Torres Strait Protected Zone (TSPZ) within the Meriam marine estate including the Cumberland Passage;
- the group agreed in principle that due to access to the Cumberland Passage, the islands of Ugar, Mer, Erub, Masig, Poruma and Warraber will be consulted on access to the 20 t;
- the break-down of the 20 t is as follows:
  - based on historical catch rate of all Traditional Inhabitant Boat (TIB) operators in the past that they have agreed in principle for 5 t free dive within the Meriam marine waters. The free dive for white teatfish is open now;
  - the remaining 15 t will be accessed by hookah apparatus by our brothers from the Meriam, Kulkalgal, Guda Maluilgal, Maluilgal, Kauraraeg, Gudag/Yadaykenu and Angamuthi TIB licence holders within the Cumberland Passage area (pending community consultation);
  - this does not include accessing to the areas beyond 10 degrees 41 minutes latitude south from the tip of Cape York (accessing the recent claimed areas).

With regards to conditions to support industry's proposal, the group recommended:

- AFMA to immediately introduce to the HCRAAG, HCWG, PZJA Standing Committee and PZJA, a proposal to amend the Fisheries Management Notice and the BDM Fishery Harvest Strategy as follows:
  - to allow the use of hookah apparatus;
  - TIB operators to hold an Australian Diving Course Certificate that meets all Australian Standards and survey standards;
  - change of vessel length based on safety to be between 7 m to 20 m;
  - no use of hookah apparatus for white teatfish during black teatfish opening;
  - hookah use for white teatfish only.

The group further:

- recommended a change of the white teatfish tonnage from 15 t to 20 t;
- expressed support for community consultation to endorse conditions for access to the white teatfish fishery;
- unanimously agreed to use hookah apparatus as per community condition endorsement.

The group unanimously agreed that while this issue is of high importance to industry, it is also of high importance that the right process is followed including Traditional Owner and community consultation, to ensure the sustainability of the fishery is protected for this and future generations.

AFMA acknowledged the considerable deliberation supporting the proposal. AFMA noted they will need to work closely with industry after the Workshop to understand the finer details of the proposal. It was also noted that consultation with Traditional Owners and all communities will need to be undertaken as part of progressing the proposal. AFMA advised that they could not commit to a timeframe for progressing the proposal, including community consultation, given the need to work through the details of the proposal and to identify additional funding and resources to support the work involved. TSRA committed to work with AFMA on community consultation and would advise on timeframes once known.

With regards to the TAC, industry participants noted that there are more white teatfish in the water than are being estimated from the survey. AFMA advised that changes to TACs will need to be considered through the established process, noting an update to the stock assessment for white teatfish is due in 2023. This may allow the TAC to be revised and will be considered by the HCRA and HCWG at meetings later in 2023.

Industry participants emphasised that they would like to see progress on this issue, and do not want to revisit it year after year. Should there be significant delays in progressing industry's proposal, industry participants suggested that trial openings permitting the possession and use of hookah gear be facilitated through developmental permits in the short term.

Industry participants further emphasised that they want to progress this issue in the right way which will involve community consultation, HCRA and HCWG consideration, and a PZJA decision. Ultimately, industry want to protect the sustainability of the BDM Fishery for future generations.

Mr Passi closed the item by sharing a story of his experiences as a Torres Strait fisherman and his learning that private enterprise is the solution to a prosperous future for Torres Strait Islanders, not welfare. Industry is asking for a fair go. He will take the outcomes of the Workshop back to his community for agreement. Access rights to the BDM Fishery is a resource owned by Traditional Inhabitants, and as such the final decision on these issues needs to come from communities.

## Other Issues

During the Workshop, a range of additional issues were identified for discussion should time permit at the end of the meeting. These included:

- location agreements (including fees) between research providers/fishers and Traditional Owners of sea country;
- options for funding research needs, including the use of Torres Strait Finfish Fishery sunset licence revenue held in trust by the TSRA.

Due to time constraints, these issues were unable to be discussed further at the Workshop.

The Workshop was closed in prayer at 1515 on 22 March 2023.





## Attachment A – Workshop participants

Name	Position
Nicholas McClean	Workshop Chair
John Tabo	Traditional Inhabitant Member, Kemer Kemer Meriam
John Toshie Kris	Traditional Inhabitant Member, Maluiaigal
Nicholas Pearson	Traditional Inhabitant Member, Kulkalgal
Pabai Pabai	Traditional Inhabitant Member, Gudumalulgal
Graham Hirakawa	Traditional Inhabitant Member, Kaiwalagal
Sereako Stephen	Malu Lamar (Torres Strait Islander) Corporation Registered Native Title Body Corporate (RNTBC)
Falen Passi	Gur A Baradharaw Kod Torres Strait Sea and Land Council (GBK)
Rocky Stephen	TSRA Board member
Charles David	TSRA Board member
Yen Loban	TSRA Board member
Daniel Takai	Zenadth Kes Fisheries Limited Chief Executive Officer
Harry Nona	Zenadth Kes Fisheries Limited
Samuel Mye	TIB fisher
Amina Ghee	TIB fisher and fish receiver
Harry Ghee	TIB fisher and fish receiver
Arthur Naawi	TIB fisher and fish receiver
Simon Naawi	TIB fisher and fish receiver
Monty Naawi	TIB fisher
Dick Whittington Billy	TIB fisher
Maluwap Nona	TIB fisher and fish receiver
Meiwap Nona	TIB fisher
Michael Passi	TIB fisher and fish receiver
Wilfred (Dennis) Passi	TIB fisher and fish receiver
Joseph Billy	TIB fisher
William Stephen	TIB fisher
James Ahmat	TIB fisher
Peo Ahmat	TIB fisher
Tony Pearson	TIB fisher
Jack Pearson	TIB fisher
Daniel Stephen	TIB fisher
Emma Freeman	AFMA
Natalie Couchman	AFMA

Name	Position
Matilda Richardson	AFMA
Damian Miley	TSRA
Quinten Hirakawa	TSRA
Nicole Murphy	CSIRO

# Attachment B – Workshop agenda

## Beche-de-mer (BDM) Workshop

Tuesday 21 March 2023 (0830-1700) + Wednesday 22 March 2023 (0830-1500)

Wongai Beach Hotel (2 Wees Street, Ngurupai)

### Draft Agenda

Workshop Chair: Nicholas McClean

Day one – Tuesday 21 March 2023 – 0830-1700		
Agenda Item	Speaker	Time
Acknowledgement of country and opening prayer	TBA	0830
Welcome and introductions	Chair	0840
Overview of management arrangements for 2023 black teatfish opening	AFMA	0845
<b>Morning tea</b>		<b>1030-1045</b>
Overview of items for break-out group discussion: <ul style="list-style-type: none"><li>- Identify optimal timings for annual black teatfish openings (providing advice)</li><li>- Identify potential options for better utilisation of under caught black teatfish total allowable catch (TAC) (generating input)</li></ul>	AFMA	1045
Break-out group session 1	All attendees	1100
<b>Lunch</b>		<b>1200-1300</b>
Break-out group session 2	All attendees	1300
Industry presentations and discussion of break-out group sessions 1 and 2	All attendees	1330
<b>Afternoon tea</b>		<b>1500-1515</b>
Trial black teatfish openings for 2021 and 2022 – overview of catch data and size frequency sampling program	CSIRO	1515
Overview of the compliance program for the 2023 black teatfish opening	AFMA Compliance	1600
Recap and questions	AFMA	1645
Close in prayer	TBA	1700

## Day two – Wednesday 22 March 2023 – 0830-1500

Agenda Item	Speaker	Time
Opening prayer	TBA	0830
Industry feedback from day one	All attendees	0835
Overview of management arrangements for white teatfish, including past consultation	AFMA	0900
Overview of item for break-out group discussion: <ul style="list-style-type: none"> <li>- Understand the pros and cons of different options for addressing the under catch of white teatfish, including the use of hookah (generating input)</li> </ul>	AFMA	0915
Break-out group session 3	All attendees	930
Industry presentations and discussion of break-out group session 3	All attendees	1000
<b>Morning tea</b>		<b>1030-1045</b>
Break-out group session 4	All attendees	1045
Industry presentations and discussion of break-out group session 4	All attendees	1130
<b>Lunch</b>		<b>1215-1315</b>
Break-out group session 5	All attendees	1315
Industry presentations and discussion of break-out group session 5	All attendees	1400
Recap, next steps and questions	Chair, AFMA	1445
Close in prayer	TBA	1500

# Attachment C – Workshop presentation

# Beche-de-mer Workshop

21 March 2023

Ngurupai



Australian Government

Australian Fisheries Management Authority





# Who we are

- Chair – Nicholas McClean
- PZJA HCRAAG + HCWVG Traditional Inhabitant members
  - John Tabo – Kemer Kemer Meriam
  - John Toshie Kris – Maluialgal
  - Nicholas Pearson – Kulkaigal
  - Pabai Pabai – Gudumalulgal
  - Graham Hirakawa – Kaiwalagal
- AFMA – Emma Freeman, Natalie Couchman
- CSIRO - Nicole Murphy
- TSRA – Damian Miley, Quinten Hirakawa





# House keeping

## Breaks

- Morning tea (15 mins), lunch (1 hr) and afternoon tea (15 mins) provided

## Airport transfers

- Please confirm airport transfer with your hotel, for your return flight

## Ferry transfers

- Last ferry to TI departs 6:10pm daily, need to book – see Matilda

## Meals

- Meal allowance provided for meals not provided by AFMA – see Matilda

## Other travel

- See Matilda with any other travel queries

# Agenda

Day one – Tuesday 21 March 2023 – 0830-1700		
Agenda Item	Speaker	Time
Acknowledgement of country and opening prayer	TBA	0830
Welcome and introductions	Chair	0840
Overview of management arrangements for 2023 black teatfish opening	AFMA	0845
<b>Morning tea</b>		<b>1030-1045</b>
Overview of items for break-out group discussion: <ul style="list-style-type: none"> <li>- Identify optimal timings for annual black teatfish openings (providing advice)</li> <li>- Identify potential options for better utilisation of undercaught black teatfish total allowable catch (TAC) (generating input)</li> </ul>	AFMA	1045
Break-out group session 1	All attendees	1100
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Break-out group session 2	All attendees	1300
Industry presentations and discussion of break-out group sessions 1 and 2	All attendees	1330
<b>Afternoon tea</b>		<b>1500-1515</b>
Trial black teatfish openings for 2021 and 2022 – overview of catch data and size frequency sampling program	CSIRO	1515
Overview of the compliance program for the 2023 black teatfish opening	AFMA Compliance	1600
Recap and questions	AFMA	1645
Close in prayer	TBA	1700



# Why are we here today?

- Explain – arrangements for 2023 black teatfish opening
- Get your advice – future black teatfish openings
- Update – science and compliance programs



# How did we get here?

<b>2014 and 2015</b>	Trial black teatfish openings – overcatch
<b>2016-2019</b>	Beche-de-mer Harvest Strategy
<b>Dec 2017</b>	Fish Receiver System
<b>2019-2020</b>	Scientific beche-de-mer survey and stock assessment
<b>2021 and 2022</b>	Trial black teatfish openings
<b>2023</b>	Annual black teatfish openings



# Black teatfish openings

## 2021 and 2022 openings

- Trial
- 20t TAC
- 30 Apr-3 May 2021 (4 days) – 17.6t caught
- 9-12 May 2022 (3 ½ days) – 17.1t caught

## 2023 opening

- PZJA agreed to annual openings
- 20t TAC for 2023
- Opening date to be informed by this workshop



# Stocks are healthy – what else?

## Beche-de-mer Harvest Strategy

- We can't over-catch the TAC - 20t
- We need good catch reporting

## Export limits

- Export fishery
- Black teatfish and white teatfish are CITES Appendix II listed
- Export limits apply - 20t for black teatfish and 15t for white teatfish



# Same arrangements as for 2022

- Licenced
- All fishers to land black teatfish catches **daily** to a licenced fish receiver
- All fish receivers must submit reports of landed catches of black teatfish **daily** to AFMA
- Must stop fishing when notice given





# Other things to be aware of for 2023 black teatfish opening

- Further information to be provided at end of the day
  - Scientific size monitoring program
  - Refresh on black teatfish opening arrangements
  - Compliance program



# Break-out groups

## Session 1

- Annual timing of black teatfish openings – 2023 and future years

## Session 2

- Better utilisation of the black teatfish TAC



# Session 1 – timing – industry feedback so far

- Favourable weather – Feb-May
- Favourable tides
  - neap
  - 2022 – last half day fell on high tide, not good for fishing
- Favourable markets
  - Chinese New Year – new moon between 21 January and 20 February, 15 days of festivities
- Not on Sabbath
- During TRL openings – season and hookah
- Avoid spawning – Jun/Jul/Dec



# Session 1 – timing – other considerations for 2023

- Time for fishers and fish receivers to organise logistics
- Compliance availability



# Session 1 – timing – ?s for break-out groups

- What is the preferred timing for a black teatfish opening in:
  - 2023?
  - future years?



## Session 2 – better utilisation of the black teatfish TAC

- TAC under-caught in 2021 and 2022
- Under-catch and over-catch
  - no under-catch provisions in the Beche-de-mer Harvest Strategy
  - no over-catch due to 20t export limit
  - process to implement, including PZJA approval
  - would need to be supported by scientific evidence – HCRAAG
- Fishery to undergo export reassessment (WTO) in 2023 – provides opportunity to introduce flexibility if changes are to happen



## **Session 2 – better utilisation of the black teatfish TAC – ?s for break-out groups**

- How can we support the better utilisation of the TAC in terms of our on-the-water arrangements, noting work underway to implement over-catch and under-catch?



# Attachment D – Workshop presentation



## Black teatfish Fishery Trial Openings - 2021 & 2022



Black teatfish (*Holothuria whitmaei*) (source: CSIRO)

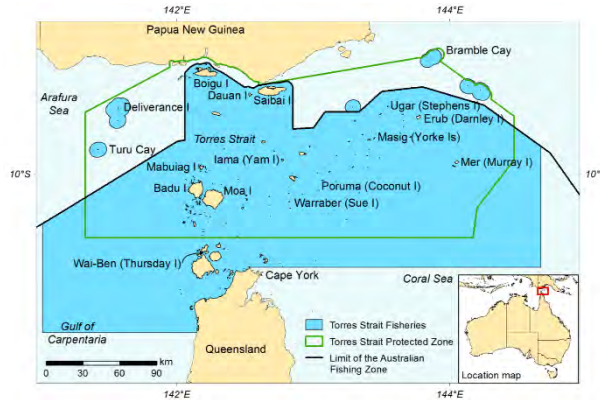
**Nicole Murphy** | March 2023  
Éva Pláganyi and Timothy Skewes

*CSIRO acknowledges the Traditional Owners of the land, sea and waters, of the area that we live and work on across Australia. We acknowledge their continuing connection to their culture and we pay our respects to their Elders past and present*



# Torres Strait Bêche-de-mer Fishery

- Fishery located in East Torres Strait
- Fished by Traditional Owners
- Wholly export
- 26 commercial species
- ~10 currently fished
- 1-4 species fished by a single fishing operation
- Sea cucumbers widely distributed but habitat specific
- Stock surveys: 1995/1996, 2002, 2005, 2009, 2019/2020
- **Black teatfish – closed 2003**
- **Trial openings 2014 & 2015 - overfished and closed again**

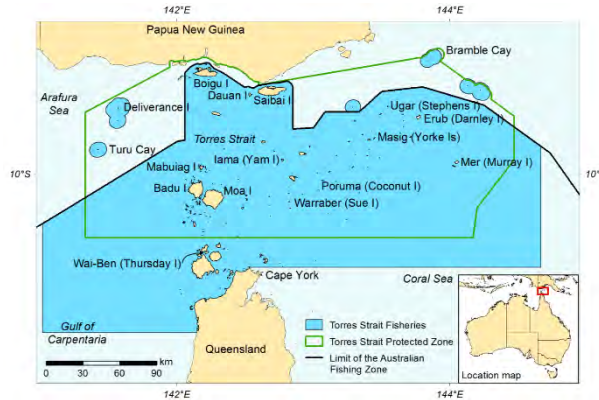


(Photo courtesy of Mr Mike Passi)



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- Sea cucumbers widely distributed but habitat specific
- Stock surveys: 1995/1996, 2002, 2005, 2009, 2019/2020
- **Black teatfish – closed 2003**
- **Trial openings 2014 & 2015 – overfished and closed again**



(Photo courtesy of Mr Mike Passi)





# Current concern - CITES

**CITES** - the Convention on International Trade in Endangered Species of Wild Fauna and Flora

- **Listing of Teatfish species on CITES Appendix II (2019)**
- **Listing of *Thelenota* species on CITES Appendix II (2022)** \*Prickly Redfish
- **Species can only be exported under a CITES export permit**

## IUCN Red List of Threatened Species:

- Species assessed as **Endangered** (a very high risk of extinction in the wild):
  - ***Holothuria lessoni*** (Golden Sandfish): Pop. decline 50%, trend: decreasing
  - ***Holothuria nobilis*** (Black Teatfish): Pop. trend: decreasing
  - ***Holothuria scabra*** (Sandfish): Pop. trend: decreasing
  - ***Holothuria whitmaei*** (Black Teatfish): Pop. Decline >70%, trend: decreasing
  - ***Thelenota ananas*** (Prickly Redfish): Pop. trend: decreasing
- Species assessed as **Vulnerable** (a high risk of extinction in the wild):
  - ***Actinopyga echinites*** (Deep Water Redfish): Pop. trend: decreasing
  - ***Actinopyga mauritiana*** (Surf Redfish): Pop. trend: decreasing
  - ***Actinopyga miliaris*** (Hairy Blackfish): Pop. trend: decreasing
  - ***Holothuria fuscoqilva*** (White teatfish): Pop. decline 30%-50%, trend decreasing
  - ***Stichopus herrmanni*** (Curryfish): Pop. Decline 30-40%, trend: decreasing





## CITES – Non detriment finding

### Results of the 2019/2020 survey:

- Supported the current CITES *Non-Detriment* finding for:
  - *Black teatfish* and *White teatfish* in the Torres Strait Bêche-de-mer Fishery
- Non-Detriment finding for *Prickly Redfish* also now required

### Torres Strait Bêche-de-mer Harvest Strategy:

- Key control of setting cap on total catch limits for species
- Other important controls:
  - Spreading of fishing effort
  - Limiting effort pulses
  - Mitigating localised depletion
  - Collection of valuable fishery and fishery-independent data
  - Carrying out catch monitoring and resource assessments as required



Traditional Owner & Fisher, Mr Genes Passi – Mer Island  
(Photo courtesy of Mr Mike Passi)



# Re-opening Black teatfish

## Torres Strait Beche-de-mer Harvest Strategy (2019)

*Re-opening Decision Rule* applies for species that have been:

- *Closed to fishing due to concerns of overfishing or stock depletion, significantly exceeding catches beyond the TAC, or in the absence of reported catches*
- Stock above  $B_{LIM}$  (limit reference point)
- Demonstrated by high quality survey data (BDM survey 2019/2020)
- Meets parameters of the Decision Rule - species to be opened with *Trial 15 t*
- Additional population modelling - 21 t can be removed sustainably
- Allows for higher opening TAC (Tier 3)
- Traditional Owner fishers decided on 20 t - allows for a buffer, so no risk of overfishing or Black teatfish closed



Traditional Owner & Fisher, Mr Warren Ghee – Mer Island  
(Photo courtesy of Mr Mike Passi)





# Trial opening - 2021

## **Trial opening: 30th April 2021 for 20 t**

- Closed 3rd May 2021
- 17.6 t caught as at 15:00 on 5th May 2021

<https://www.pzja.gov.au/2021-black-teatfish-trial-opening>

- The trial was deemed to be successful

### **Notes:**

- New catch reporting measures in place
  - CDR catch reporting - compulsory since 2017
- Fishers organised among themselves, previous times described as 'free for all'
- Went further out and worked in across days
- Came in early on fourth day in anticipation that nearing quota
- Were happy with how the fishing went



Traditional Owner & fisher, Mr Tristen Passi – Mer Island  
(Photo courtesy of Mr Mike Passi)



# Size frequency sampling program - 2022

## Undertaken during 2022 BTF trial opening

Collect population size frequency data and morphometrics – *Voluntary*

- Four AFMA *Observers* stationed at Mer and Erub Island
- Minimum of 1000 length and width measurements (mm) distributed across logbook zones (fishing areas)
- Record product form e.g. Whole (Live), Guttled & Salted
- Collect weights (gr)

## Outcomes:

- Update estimates for population modelling – 21 t sustainable
- Support analyses of recruitment rates and help identify indicators of fishing effect
- Support current CITES non detriment finding



Photo courtesy of AFMA



# Size frequency sampling program - 2022

## Measurements – Black teatfish

- Total of 1886 Length and Width (mm)
- Total of 1701 Weights (gr)
- Product form – Whole (Live), Guttled, Guttled & Salted

## Other species also measured:

Common name	Species
White teatfish	<i>Holothuria fuscogilva</i>
Curryfish common	<i>Stichopus herrmanni</i>
Curryfish vastus	<i>Stichopus vastus</i>
Prickly redfish	<i>Thelenota ananas</i>
Burrowing blackfish	<i>Actinopyga spinea</i>



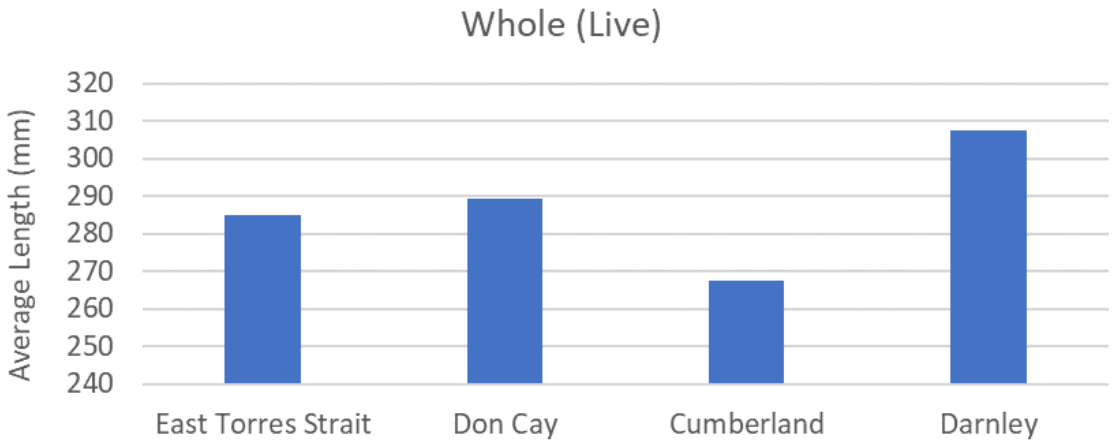
Photo courtesy of AFMA



# Size frequency sampling program - 2022

## Results

- Average size 285 mm
- Average size range: 267 mm to 307 mm
- Black teatfish from Darnley had largest Whole (Live) length, followed by Don Cay, then Cumberland





## Catch data – 2021 & 2022

### Results – Fishery opening 9<sup>th</sup> May 2022, 20 tonne TAC (Gutted)

- Black teatfish catch for 2022 was 17.05 t and for 2022 was 17.6 t - *below the TAC*
- Trial openings for both years were successfully managed
- 2021 – 55% of catch area/logbook zone ‘Unknown’ - left blank in catch reporting
- 2022 – Improvement for ‘Unknown’ reporting - 32% records left area/logbook zone blank

	Day	Warrior	GNE Channel	Darnley	Cumberland	Don Cay	Seven Reefs	Barrier	Unknown	Grand total
2021	30-Apr	-	119.78	41.24	468.95	311.13	-	-	3075.51	4016.62
2021	1-May	-	141.19	551.31	1392.45	-	-	-	2820.29	4905.24
2021	2-May	-	67.14	276.20	1030.81	-	-	-	166.42	1540.57
2021	3-May	-	-	1010.19	2210.87	145.56	-	-	3553.51	7022.03
<b>Total</b>		-	328.12	1878.94	5154.03	456.69	-	-	<b>9797.69</b>	<b>17615.47</b>
	Day	Warrior	GNE Channel	Darnley	Cumberland	Don Cay	Seven Reefs	Barrier	Unknown	Grand total
2022	9-May	-	-	985.82	1768.25	1229.02	-	-	210.75	4193.85
2022	10-May	-	331.00	1379.75	1948.39	631.25	324.11	-	873.56	5488.07
2022	11-May	-	-	1065.44	4024.48	641.80	270.01	185.23	-	6186.96
2022	12-May	-	-	335.02	397.09	371.24	--	-	83.54	1186.90
<b>Total</b>		-	331.00	3766.03	8138.22	594.13	2873.30	185.23	<b>1167.85</b>	<b>17055.76</b>





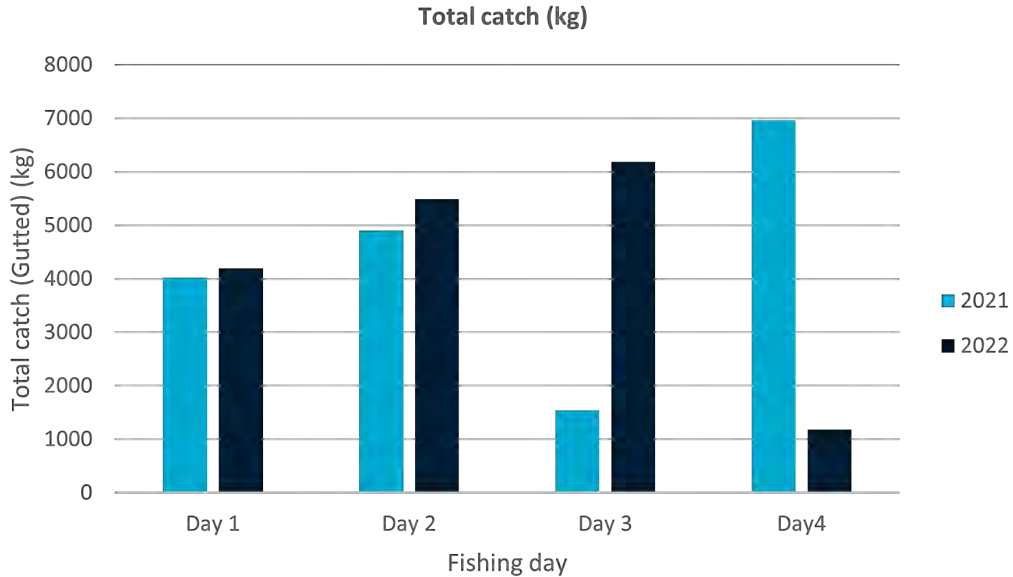
# Catch data – 2021 & 2022



Photo courtesy of AFMA

## Catch per day

- 2021 - largest catch was taken on day 4 and the least on day 3 (Sabbath)
- 2022 - largest catch was taken on day 3 and the least on day 4 (half day)





# Catch data – 2021 & 2022

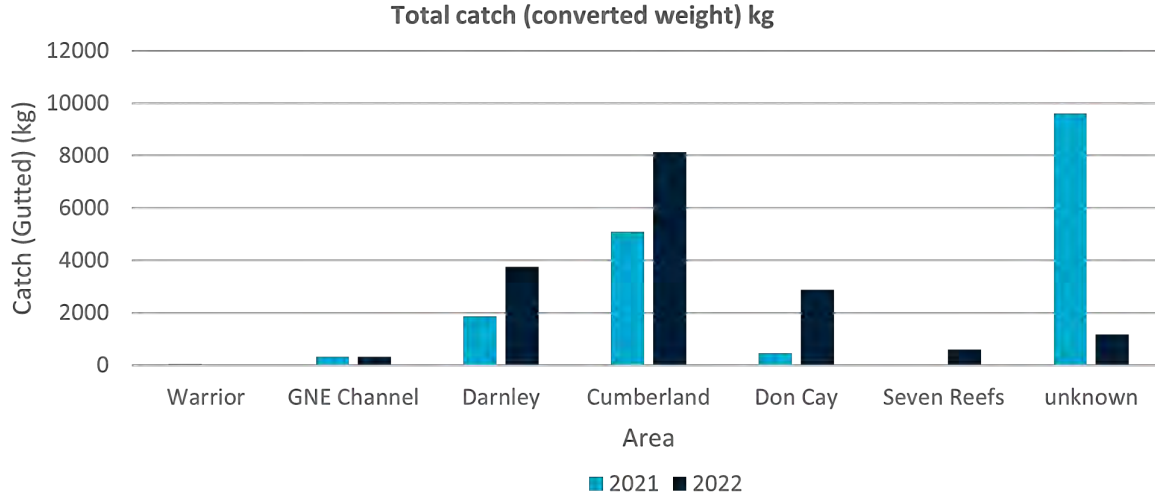


Photo courtesy of AFMA

## Catch per area fished

### 2022:

- Darnley, Cumberland and Don Cay received more effort - these areas may have contributed to the 'Unknown' area data in 2021 catch reporting
- Seven Reefs fished - not fished in 2021
  - Further information why zones fished would help understanding of fishing e.g. Phone reception, location of catch landing points, fuel costs, *other*?







# Size frequency sampling program - 2022

## Minimum Legal Size - MLS

### Black teatfish: 250 mm

➤ Definition under the instrument:

*Measurement in water, undisturbed state*

➤ Survey – collected, taken to boat and measured

➤ Observer – collected, stored, transported, then measured

➤ Need to determine the correction for shrinking

- Shrinkage factor

## 2022 - Size frequency data

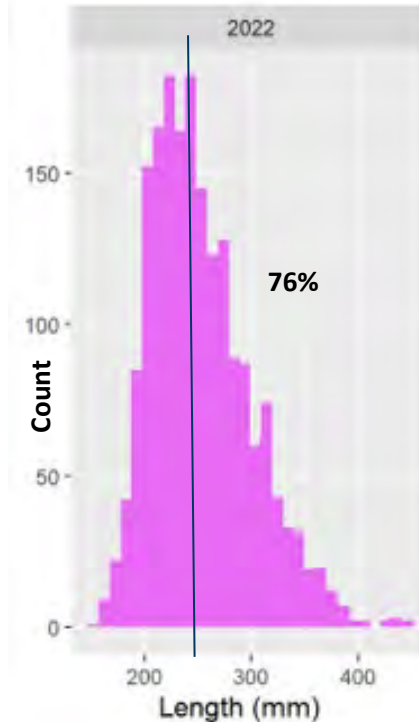


Photo courtesy of AFMA



# Size frequency sampling program - 2022

## Minimum Legal Size (MLS)

**Black teatfish: 250 mm**

- From 552 Whole (Live) measurements:  
76% of measurements above MLS

## Shrinkage factor:

- 24% below fishery size limit:
  - Half value applied e.g. water loss – 12%
- Possible evisceration (expelling guts)?
  - Studies show ~60% decrease from Whole (Live) to Gutted (Purcell et. al 2009)
- Loss of approximately two thirds – 9%
- Overall probably ~10% undersized

## 2022 – Size frequency data

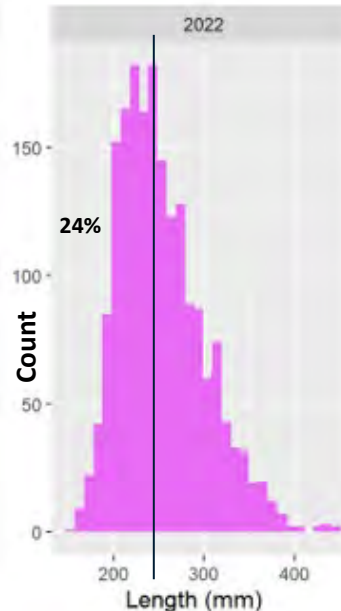


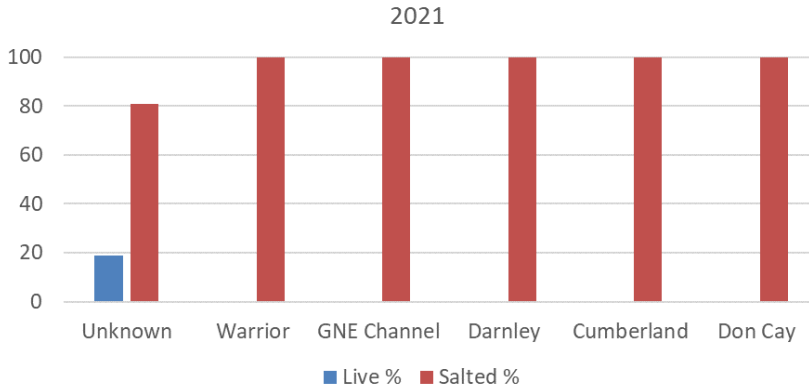
Photo courtesy of AFMA



# Catch data 2021 & 2022

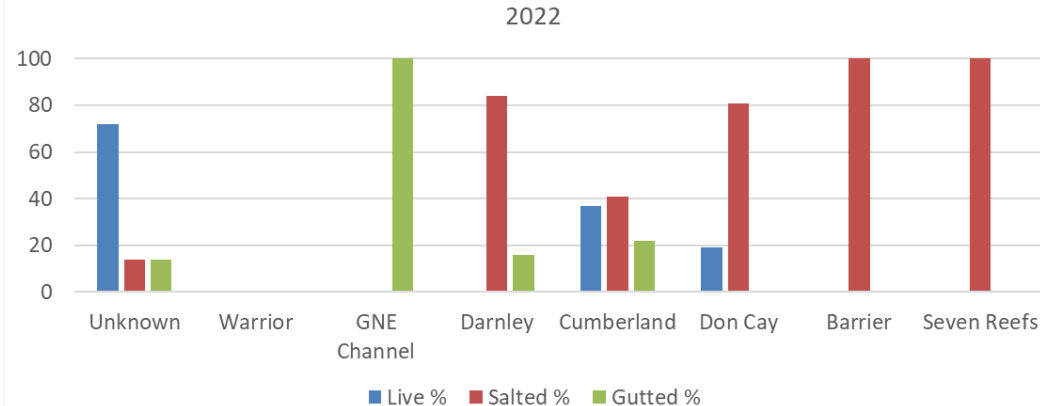


Photo courtesy of AFMA



## Product state: 2021

- Majority of product landed – Gutted & Salted



## Product State: 2022

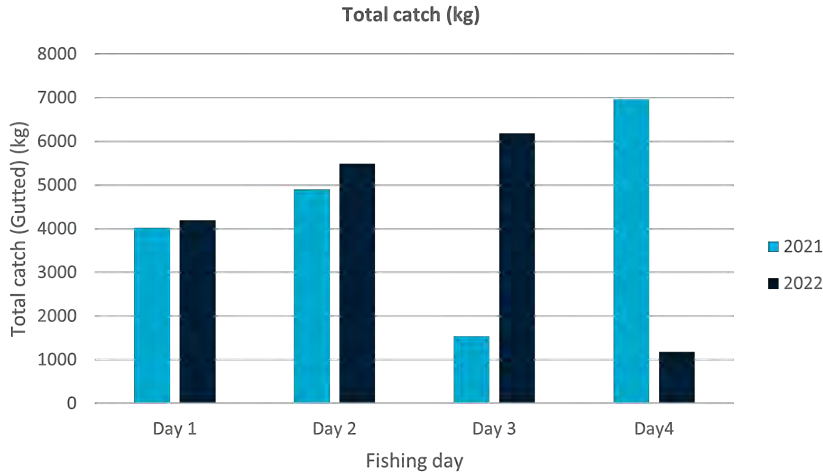
- More product types landed – Whole (Live), Gutted, Gutted & Salted



# Black teatfish - Observer and Catch data

## Outcomes:

- No evidence of stockpiling
- No evidence of declining catch after a few days, which would indicate depletion
- Cumulative catches tracked and adhered to TAC
- Number of fishers participating in the fishery was a fraction of available fishing effort





# Black teatfish - Observer and Catch data

## Note:

- Importance of Minimum Legal Size:
  - Spawning
  - CITES
- Area caught:
  - Important to note Log book zone in catch recording
- Check species of Teatfish:
  - White teatfish?







# Black teatfish - Observer and Catch data

## Future:

- Importance of ongoing length frequency, time series data:
  - Surveys are expensive
- Length frequency data will inform on:
  - Size structure for Black teatfish population
  - Update modelling
  - Indicate effects of fishing
  - CITES
- Importance of anecdotal information from fishers and Observers
- Loggers on boats or fishers:
  - Catch per unit effort
  - Indicate effects of fishing



East Torres Strait BDM survey 2019/2020



'Esso'

## Thank you and appreciation to:

Torres Strait Bêche-de-mer fishers for providing their fishery data

AFMA Thursday Island

AFMA Observers - Tamre Sarhan, Ben Lidell, David Schubert, Henry Oak and Stephen Hall

Funding: AFMA, CSIRO

### **CSIRO OCEANS & ATMOSPHERE**

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**w** [www.csiro.au](http://www.csiro.au)

Australia's National Science Agency



Photo courtesy of AFMA



# Attachment E – Workshop presentation

# Beche-de-mer Workshop

22 March 2023

Ngurupai



Australian Government

Australian Fisheries Management Authority





# Agenda

Day two – Wednesday 22 March 2023 – 0830-1500		
Agenda Item	Speaker	Time
Opening prayer	TBA	0830
Industry feedback from day one	All attendees	0835
Overview of management arrangements for white teatfish, including past consultation	AFMA	0900
Overview of item for break-out group discussion: <ul style="list-style-type: none"><li>- Understand the pros and cons of different options for addressing the undercatch of white teatfish, including the use of hookah (generating input)</li></ul>	AFMA	0915
Break-out group session 3	All attendees	930
Industry presentations and discussion of break-out group session 3	All attendees	1000
<b>Morning tea</b>		<b>1030-1045</b>
Break-out group session 4	All attendees	1045
Industry presentations and discussion of break-out group session 4	All attendees	1130
<b>Lunch</b>		<b>1215-1315</b>
Break-out group session 5	All attendees	1315
Industry presentations and discussion of break-out group session 5	All attendees	1400
Recap, next <u>steps</u> and questions	Chair, AFMA	1445
Close in prayer	TBA	1500



# Why are we here today?

- Understand – industry views
- Get your input – options to better utilise the white teatfish TAC (e.g. use of hookah)



# Current management of white teatfish – management controls

- 15t TAC – only ~2-3t caught per year
- No possession or use of hookah gear
- Minimum size limit – 32cm



# Current management of white teatfish – what else?

## Beche-de-mer Harvest Strategy

- We can't over-catch the TAC - 15t
- We need good catch reporting

## Export limits

- Export fishery
- Black teatfish and white teatfish are CITES Appendix II listed
- Export limits apply - 20t for black teatfish and 15t for white teatfish



# Current management of white teatfish – health of the stock

- 2019-2020 scientific beche-de-mer survey - first time deep water survey undertaken. Survey results have provided sufficient confidence for quantifying white teatfish stocks
- Survey found ~50 per cent of white teatfish is found in the deep water strata. None found beyond 36m
- Survey trend for shallow reef population fairly constant over time
- Review TAC – potential to increase, however additional population modelling and/or fishery dependent data required





# How did we get here?

<b>2011-2012</b>	Trial opening using hookah
<b>2014-2015</b>	TVH licence buy-out
<b>2016-2019</b>	Beche-de-mer Harvest Strategy
<b>Dec 2017</b>	Fish Receiver System
<b>2019-2020</b>	Scientific beche-de-mer survey
<b>2023</b>	Updated stock assessment



# How did we get here?

**Since 2010**

HCWG discussions

**2017-2020**

Community consultation – divided views

**2022**

Priority issue for HCWG

**Today**

Industry workshop



# Why are we here?

- Advice (no decision making)
- Seeking industry views
  - What are your aspirations for the fishery
  - What do the changes mean for you / your community / your fishery
  - Could there be any unintended consequences if the rules are changed
- Opportunity for industry to
  - Express, listen to and understand the aspirations and views of other industry members
  - Raise options that may not have been considered previously
  - Consider potential benefits and / or impacts
  - Consider how changes may be implemented and / or enforced



# What happens after this workshop?

- Report to PZJA on workshop outcomes
- Hand Collectables Resource Assessment Group (HCRAAG) and Working Group (HCWG) will consider the outcomes of this workshop and provide further advice on the proposed changes that might be recommended for further development
- May involve broader community consultation
- HCRAAG and HCWG will need to consider the outcomes of any community consultation
- PZJA decision and amendments to fishery management instrument and licence conditions



# So, what's the plan for today?

- Guidance for discussing management changes (key steps)
  - Reflect on fishery objectives and policies
  - What is your long term vision for the fishery
  - What's the issue and what are some solutions
  - What are the benefits and impacts
  - Can the changes be implemented and enforced
- Small group breakout discussions on key questions
- Report back to the workshop on key points



# Fishery objectives and policies

## *Torres Strait Fisheries Act 1984*

- Traditional way of life and livelihoods
- Protecting the environment
- Giving effect to the Torres Strait Treaty
- Optimum utilisation
- Economic opportunity for Traditional Inhabitants



# Fishery objectives and policies

## Beche-de-mer Harvest Strategy

- Long-term sustainable use including for future generations
- Develop BDM stocks for the benefit of Traditional Inhabitants
- Acknowledge area-specific issues
- Ecosystem approach to reduce impacts on/optimize interactions with other harvested and dependent species
- Where needed, develop long-term recovery strategies for species





# What is your long term vision for the fishery?

- What do you want out of the fishery?
- What do you want the fishery to look like in 5, 10, 50 years time?



# What is the actual issue?

- Considering the objectives and industry's vision for the fishery...
  - Be clear on what the issue is e.g. under-utilisation of the white teatfish TAC
  - What are you trying to change? (e.g. use of hookah) Why?
  - What are the options / solutions? Opportunity to raise options / solutions that may not have been considered previously



# What are the benefits and impacts?

- Benefits / impacts might be obvious
- Some might not be realised until later – unintended
- Are the proposed changes consistent with the objectives of the Act and fishery, or the long term aspirations (vision) of industry?



# What are the benefits and impacts?

- What are the benefits for and impacts on the sustainability of the fishery?
  - Optimum utilisation, improved data
  - BDM is vulnerable to over-exploitation, localised depletion
  - Impacts of increased effort on other species (both shallower and deeper waters)
- What are the benefits for and impacts on fishers, communities and the fishery?
  - Economic opportunity for Traditional Inhabitants, support the traditional way of life and livelihoods of Traditional Inhabitants
  - Some changes to the rules may only benefit some individuals, or one sector of the fishery, while disadvantaging others
  - Limited TAC cannot sustain all licenced fishers. What happens when the TAC is reached
- What are the implications for safety?



# Can the changes be implemented and enforced?

- What do the changes mean for the TAC?
- Do the changes mean we need
  - Additional reporting
  - Extra monitoring
- Are the changes to the rules going to be enforceable?
- Do the changes create compliance risks?
  - Misreporting
  - Illegal fishing e.g. stockpiling, taking of prohibited species, unlicensed, use of prohibited gear
  - What happens if the TAC is exceeded



# Break-out groups

## Session 3

- How can the white teatfish TAC be better utilised? (e.g. use of hookah)

## Sessions 4 and 5

- Consideration of different management options



# Management options

- Options discussed by HCWG
  - Allowing the use of hookah to fish for white teatfish only
  - Allowing the use of hookah to fish for white teatfish only and in certain areas
  - Having a designated white teatfish hookah fishing season which may potentially involve closing fishing to all other BDM species
  - Trialling fishing for white teatfish using hookah with one fisher per community





## Session 3 – vision and options – ?s for break-out groups

- How can the white teatfish TAC be better utilised?
  - Considering the objectives and industry’s vision for the fishery...what is the issue?
  - What are the options / solutions? (e.g. use of hookah)



# Sessions 4 and 5 – management options – ?s for break-out groups

- Consideration of different management options
  - What are your views on each management option?
  - How do you think the proposed changes could benefit/impact you and your fishing operation (positively and/or negatively)?
  - How do you think the proposed changes could benefit/impact communities (positively and/or negatively)?
  - How do you think the proposed changes could benefit/impact the fishery as a whole (positively and/or negatively)?
  - Can the changes be implemented and enforced?

# Attachment F – Workshop presentation



# **BDM WORKSHOP**

**NGURUPAY GAGAITH  
KAURAREG NATION**

**21 -22 MARCH 2023**



# Management Options

- The group identified the areas in which the White Teatfish is heavily concentrated.
- The areas in which the group spoke openly and recognised to access is within the TSPZ within the Meriam marine estate including the Cumberland Passage.
- The group agreed in principle that due to access to the Cumberland Passage, the islands of Ugar, Mer, Erub, Masig, Poruma and Warraber will be consulted on access the 20t.
- The break down of the 20t is as follows;
- Based on historical catch rate of all TIB operators in the past that they have agreed in principle for 5t free dive within the Meriam marine waters. The free dive for white teatfish is open now.
- The remaining 15t will be accessed by hookah apparatus by our brothers from the Meriam, Kulkalgal, Guda Maluilgal, Maluilgal, Kauraraeg, Gudag/Yadaykenu and Angamuthi TIB licence holders within the Cumberland Passage area (pending community consultation).
- This does not include accessing to the areas beyond 10 degrees 41 minutes latitude south from the tip of Cape York (accessing the recent claimed areas).



# CONDITIONS

- That AFMA immediately introduced to the RAG, HCWG, the PZJA Standing Committee to PZJA to amend the Fisheries Management Notice and the BDM Harvest Strategy, the following amendments;
- Use of hookah apparatus.
- TIB fisher operators to hold an Australian Diving Course Certificate that meets all Australian Standards and survey standards.
- Change of vessel length based on safety to be between 7m to 20m.
- No use of hookah apparatus for white teatfish during black teatfish opening.
- Use for white teatfish only.



# ISSUES

- Change of the white teatfish tonnage from 15t to 20t.
- Support for community consultation to endorse conditions for access to the white teatfish fishery.
- The group have unanimously agreed to use hookah apparatus as per community condition endorsement.





The group unanimously agreed that while this issue is of high importance to industry, it is also of high importance that the right process is followed including Traditional Owner and community consultation, to ensure the sustainability of the fishery is protected for this and future generations

**Objectives to be pursued under section 8 of the *Torres Strait Fisheries Act 1984*****8 Objectives to be pursued**

In the administration of this Act, regard shall be had to the rights and obligations conferred on Australia by the Torres Strait Treaty and in particular to 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.

## Previous consideration of hookah use for white teatfish in the BDM Fishery

Date	Event	Summary	Background
1999		Introduction of limited entry	Entry to BDM Fishery limited to Traditional Inhabitants only, with exception to one non-Traditional Inhabitant (TVH) licence holder, who was active in The Fishery before the introduction of limited entry.
2002	<b>Fisheries Management Notice No. 64</b>	Prohibition on taking sea cucumbers, in particular gear, size and possession limits	The use of any underwater breathing apparatus or by any method other than collection by hand, is prohibited. Size limits also implemented.
2006	<b>PZJA 19</b>	PZJA agreed to implement new precautionary species-based total allowable catch (TAC) limits	15 tonnes for white teatfish.
2011-2012	<b>Developmental permits</b>	Developmental permits were issued allowing the use of hookah for harvesting white teatfish	In 2011, two developmental permits were issued to one TIB licence holder and one TVH licence holder. The 15 tonne TAC was harvested in first month by the TVH licence holder.
<b>October 2013</b>	<b>HCWG 7</b>	Consideration of trial use of hookah for white teatfish	AFMA will work with QLD Fisheries to document key management issues and criteria for permitting hookah to collect White Teatfish. TSRA will then advise if they will take the lead on this issue. If no one agency wants to lead the issue of the use of hookah for White Teatfish, then the HCWG will recommend that the Torres Strait Scientific Advisory Committee (TSSAC) fund a BDM MSE focused on hookah use.
2014-2015	<b>Buy-out</b>	TSRA buy-out of TVH licence	Use of the TVH licence may only occur with future approval from the PZJA.

<b>April 2015</b>	<b>HCWG 8</b>	Consideration of trial use of hookah for white teatfish	Malu Lamar, AFMA, TSRA and Fisheries Queensland convene out-of-session to develop options for conducting a trial of using hookah gear to target white teatfish and report back to the Working Group at its next meeting.
<b>November 2016</b>	<b>HCWG 10</b>	Consideration of trial use of hookah for white teatfish	Industry proposal concerning a trial to allow a limited number of fishers to use hookah to fish for white teatfish. The objective of the trial being to provide an economic opportunity for fishers and in doing so reduce fishing pressure on other species. The HCWG recommended that a written survey be circulated to all BDM Fishery licence holders to canvass preliminary 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.
<b>March 2017</b>	<b>Consultation with licence holders</b>	Consultation on current prohibition on use of hookah	Licence holder views sought on amending the hookah ban for a limited number of fishers to target white teatfish. Two responses, trial not supported.
<b>June 2017</b>	<b>HCWG 11</b>	Consideration of trial use of hookah for white teatfish	The HCWG noted: <ul style="list-style-type: none"> <li>- general support from industry members and meeting observers for Mer fishers to pursue flexibility to use hookah in their waters to fish white teatfish;</li> <li>- that the Mer proposal includes the observation of cultural protocols according to Malo's law of other communities (e.g. if a Mer fisher was to fish in Erub waters they would remove hookah gear and free dive) and must ultimately be approved by Mer elders;</li> <li>- that broader stakeholder consultation would be required for the PZJA to consider options to formally support the proposal with management regulation. In particular, defining areas of waters and catch shares; and</li> <li>- that AFMA would seek PZJA approval to commence formal consultation on the Mer proposal.</li> </ul>

<b>July 2018</b>	<b>HCWG 13</b>	Consideration of trial use of hookah for white teatfish	The HCWG agreed the 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.
<b>August 2019</b>	<b>HCWG 15</b>	Consideration of trial use of hookah for white teatfish	The HCWG agreed for TSRA and AFMA to develop a discussion paper outlining suggested management arrangements, based on HCWG discussions for pursuing the use of hookah to fish for white teatfish, for further consultation with communities and consideration by the HCWG and the PZJA.
<b>October 2019-February 2020</b>	<b>Community consultation</b>	Community consultation on current prohibition on use of hookah	HCWG 15 recommended the PZJA Traditional Inhabitant members use the PZJA Traditional Inhabitant Members Cluster Consultations as an opportunity to seek industry and community feedback on the proposed black teatfish trial opening and the current prohibition on hookah. Views expressed during this consultation varied. Outcomes provided at <b>Attachment 10f</b> .
<b>February 2020</b>	<b>HCWG 16</b>	Consideration of trial use of hookah for white teatfish	Malu Lamar to discuss the review of the hookah prohibition at the stakeholder workshop with a view to developing management recommendations. The stakeholder workshop was initially planned to take place on 7-8 April 2020 but had to be postponed due to the COVID-19 emergency and resulting restrictions. A further workshop was scheduled for the 4-5 August 2020, but also did not proceed. TSRA advise that a series of meetings in communities may now be pursued.
<b>October 2021</b>	<b>HCWG 18</b>	Consideration of trial use of hookah for white teatfish	The HCWG recommended an industry workshop be held to enable industry to develop its preferred management options while acknowledging the need for AFMA's assessment of the administrative feasibility of the preferred management option(s).

Issues previously raised concerning hookah use for white teatfish in the BDM Fishery

Consideration	Actions taken/proposed actions
<b>Sustainability</b>	
<p>BDM are considered particularly vulnerable to over exploitation due to limited dispersal, patchy distribution, ease of collection, slow recovery from over-fishing and the limited available information on biological and spatial distribution. Their relatively restricted mobility make them inherently vulnerable to localised depletion</p>	<ul style="list-style-type: none"> <li>- In addition to the existing Fish Receiver System (FRS), implement monitoring tools to collect fine scale catch and effort as well as biological data. These tools could include mandatory logbook reporting, vessel monitoring system, data loggers or scientific observers. There are significant costs associated with this which cannot be accommodated within existing operating budgets – this is not included in the industry proposal and requires further consideration</li> <li>- Survey and assess the status of the white teatfish stock regularly – a survey was undertaken in 2019/20 (AFMA project 2019/0826). Additional stock assessment modelling for white teatfish has also been undertaken (AFMA project 2021/0815)</li> <li>- Implement an effective surveillance and enforcement regime. There are significant costs associated with this which cannot be accommodated within existing operating budgets – to be considered further</li> </ul>
<p>The stock status of white teatfish deeper than 20 m is not well understood as the species has never been surveyed past those depths</p>	<ul style="list-style-type: none"> <li>- Survey and assess the status of the white teatfish stock regularly – a survey was undertaken in 2019/20 (AFMA project 2019/0826). Additional stock assessment modelling for white teatfish has also been undertaken (AFMA project 2021/0815)</li> </ul>
<p>The potential impacts of increased effort on other species (other than white teatfish) found in the deeper waters to be accessed by hookah are unknown</p>	<ul style="list-style-type: none"> <li>- Survey and assess the status of the white teatfish and other sea cucumber stocks regularly – a survey was undertaken in 2019/20 (AFMA project 2019/0826) and will be repeated regularly</li> <li>- Only permit fishing for white teatfish using hookah – this measure is included in the industry proposal</li> <li>- Implement an effective surveillance and enforcement regime. There are significant costs associated with this which cannot be accommodated within existing operating budgets – to be considered further</li> </ul>
<p>If shallower waters are also to be accessed by hookah, the potential impacts of increased effort on both white teatfish and other species are unknown</p>	<ul style="list-style-type: none"> <li>- Survey and assess the status of the white teatfish and other sea cucumber stocks regularly – a survey was undertaken in</li> </ul>

	<p>2019/20 (AFMA project 2019/0826) and will be repeated regularly</p> <ul style="list-style-type: none"> <li>- Only permit fishing for white teatfish using hookah – this measure is included in the industry proposal</li> <li>- Implement an effective surveillance and enforcement regime. There are significant costs associated with this which cannot be accommodated within existing operating budgets – to be considered further</li> </ul>
<p><b><i>Economics and social</i></b></p>	
<p>The TAC for white teatfish is 15 tonnes and there are currently ~115 licences in the BDM Fishery. The limited TAC cannot sustain all fishers currently licensed to fish in the fishery</p>	<ul style="list-style-type: none"> <li>- Undertake a trial to assess feasibility of ongoing use of hookah gear, noting the costs incurred by fishers to gain the competencies to use hookah gear as well as the costs of the hookah gear itself is likely to be a barrier to entry and limit uptake – industry proposal would allow this to be assessed</li> </ul>
<p>Fishing is currently permitted for free divers and once the overall TAC is reached, fishing will need to cease</p>	<ul style="list-style-type: none"> <li>- Allocate a component of the 15 t white teatfish TAC to the trial – this measure is included in the industry proposal</li> </ul>
<p>Consideration should also be given to cultural laws and community agreements with respect to who can fish where</p>	<ul style="list-style-type: none"> <li>- Undertake community consultation on possible options and provide advice to the PZJA – this measure is included in the industry proposal</li> </ul>
<p>The timing of a trial needs to be considered. There are a range of operational (weather, tides, operations of other fisheries etc) and biological (spawning) considerations which would need to be taken into account</p>	<ul style="list-style-type: none"> <li>- Undertake community consultation on possible options and provide advice to the PZJA – this is not included in the industry proposal and requires further consideration</li> </ul>
<p><b><i>Monitoring, control, surveillance and enforcement</i></b></p>	
<p>Accurate and timely (e.g. daily) catch and effort reporting is critical to assessing affected species and ensuring TACs are not exceeded. The use of hookah would need to be effectively monitored</p>	<ul style="list-style-type: none"> <li>- In addition to the existing FRS, implement monitoring tools to collect fine scale catch and effort as well as biological data. These tools could include mandatory logbook reporting, vessel monitoring system, data loggers or scientific observers. There are significant costs associated with this which cannot be accommodated within existing operating budgets – this is not included in the industry proposal and requires further consideration</li> <li>- Implement an effective surveillance and enforcement regime. There are significant costs associated with this which cannot be accommodated within existing operating budgets – to be considered further</li> </ul>



	<ul style="list-style-type: none"> <li>- Implement arrangements should the TAC be exceeded – this is not included in the industry proposal and requires further consideration</li> </ul>
Implementing effective surveillance and enforcement regimes for a single species is resource intensive and expensive	<ul style="list-style-type: none"> <li>- Implement an effective surveillance and enforcement regime. There are significant costs associated with this which cannot be accommodated within existing operating budgets – to be considered further</li> </ul>
<b>Safety</b>	
Hookah diving at depths of greater than 20 m in remote areas of the Eastern Torres Strait could pose a safety risk. The nearest hyperbaric treatment centre is located in Townsville and would require air evacuation, in which the changes to air pressure and altitude would likely worsen the patient. This was a component of the reason for the original prohibition on the use of hookah gear in the BDM Fishery	<ul style="list-style-type: none"> <li>- Require fishers that use hookah gear to meet regulatory requirements – this is included in the industry proposal. Advice has been sought from Maritime Safety Queensland (MSQ) regarding regulatory requirements, details provided in this paper</li> <li>- Increase the maximum boat length restriction - this is included in the industry proposal</li> </ul>

# Occupational diving work

Code of Practice 2005

This Queensland code of practice was preserved as a code of practice under section 284 of the *Work Health and Safety Act 2011*.

This code was varied by the Minister for Education and Industrial Relations on 27 November 2011 and published in the Queensland Government Gazette on 2 December 2011.

This preserved code commenced on 1 January 2012.

This code was varied by the Minister for Education and Industrial Relations on 1 July 2018.

PN11181

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# Introduction

The *Occupational diving work Code of Practice* is an approved code of practice under section 274 of the *Work Health and Safety Act 2011* (the WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the *Work Health and Safety Regulation 2011* (the WHS Regulation).

From 1 July 2018 duty holders are required to comply either with an approved code of practice under the WHS Act or follow another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety to the standard required in the code.

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks which may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

Codes of practice are admissible in court proceedings under the WHS Act and WHS Regulation. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice. This may include issuing an improvement notice for failure to comply with a code of practice where equivalent or higher standards of work health and safety have not been demonstrated.

## How is the code organised

In providing guidance, the word 'should' is used in this code to indicate a recommended course of action, while 'may' is used to indicate an optional course of action.

This code also includes various references to provisions of the WHS Act and WHS Regulation which set out the legal requirements. These references are not exhaustive. The words 'must', 'requires' or 'mandatory' indicate that a legal requirement exists and must be complied with.

## Who has duties?

A **person conducting a business or undertaking** has the primary duty under the WHS Act to ensure, as far as reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

**Officers**, such as company directors, have a duty to exercise due diligence to ensure that the business or undertaking complies with the WHS Act and WHS Regulation. This includes taking reasonable steps to ensure that the business or undertaking has and uses appropriate resources and processes to provide and maintain a safe work environment.

**Workers** have a duty to take reasonable care for their own health and safety and that they do not adversely affect the health and safety of other persons. Workers must comply with any reasonable instruction and cooperate with any reasonable policy or procedure relating to health and safety at the workplace.

**Consulting workers**

Consultation involves sharing of information, giving workers a reasonable opportunity to express views and taking those views into account before making decisions on health and safety matters.

The Act requires that you consult, so far as is reasonably practicable, with workers who carry out work for you who are (or are likely to be) directly affected by a work health and safety matter.

If the workers are represented by a health and safety representative, the consultation must involve that representative.

You must consult your workers when proposing any changes to the work that may affect their health and safety.

**Consulting, cooperating and coordinating activities with other duty holders**

The Act requires that you consult, cooperate and coordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable.

Sometimes you may share responsibility for a health and safety matter with other business operators who are involved in the same activities or who share the same workplace. In these situations, you should exchange information to find out who is doing what and work together in a cooperative and coordinated way so that all risks are eliminated or minimised as far as reasonably practicable.

Further guidance on consultation is in the *Work health and safety consultation, co-ordination and co-operation Code of Practice*.

## 1. Risk from certain medical conditions

The *Work Health and Safety Regulation 2011* (WHS Regulation) requires a person conducting a business or undertaking (PCBU), or someone on their behalf, to ensure a worker has a current certificate of medical fitness to dive before carrying out general diving work. The PCBU must ensure any work carried out by the worker is within any limits stated in the certificate. A PCBU doing underwater diving work must have a current certificate of medical fitness to dive and any work carried out by the person must be within any limits stated in the certificate.

PCBUs who perform higher risk diving profiles should ensure that the diving medical practitioner is aware of these profiles. The dive medical practitioner may recommend higher levels of screening in these cases.

Examples of higher risk diving profiles include profiles that routinely involve:

- decompression stop diving
- multiple ascents
- dives below 30m
- decompression using gases other than air.

PCBUs should request that workers advise them of any conditions which are contraindications to diving. PCBUs and workers with these conditions should not dive. Examples of contraindicated conditions are colds, hay fever, ear infections and hangovers.

## 2. Competence to perform occupational diving work and undertake the risk assessment process

The WHS Regulation defines different ways in which competence must be demonstrated for a diver to undertake occupational diving work and to undertake the risk assessment process.

In determining the most appropriate competency option, the PCBU should review the occupational diving work and ensure that the competency option selected is relevant to the work. Issues to consider should include:

- the diving environment
- the diving equipment and breathing gas to be used
- the decompression schedule to be used
- the tasks to be undertaken
- any tools to be used
- any other hazards associated with the task.

## 3. Proof of competency for underwater diving work

The WHS Regulation requires proof of competency for all occupational diving work.

## 4. Risk assessment process to be carried out for all occupational diving

The WHS Regulation requires that a risk assessment process be undertaken by a competent person prior to undertaking occupational diving work.

The factors mentioned in AS/NZS 2299, part 1, appendix D 3.4 form a list of hazards that may or may not be present. Each factor should be considered, and an assessment made of the risk. The list is not exclusive and all other hazards not otherwise identified should be considered in the risk assessment.

The process of risk assessment is described in more detail in the *How to manage work health and safety Risks Code of Practice*.

The factors mentioned in AS/NZS 2299, part 1, Appendix D paragraph 3.4 are:

- **Environmental conditions:** certain parameters should be examined for their effects on the dive from the perspective of operations both on the surface and below, including, but not limited to:
  - strength and direction of wind and the degree of influence that it may have on the diving operation and emergency response capability
  - current and tide
  - visibility
  - entrapment hazards
  - depth at worksite
  - water temperature
  - time of day
  - underwater terrain
  - atmospheric temperature and humidity



- contaminants
- isolation of the dive site.
- **Task related factors:** the complexity of the diving task or the presence of a component which is non-routine in nature may increase the level of risk associated with a diving operation.
- **Hyperbaric/physiological factors:** hyperbaric and physiological factors include:
  - frequency of diving, including repetitive diving, multi-day diving
  - depth of dive
  - duration of dive
  - breathing gas
  - exertion required to reach dive site or conduct task
  - excessive noise
  - immediate pre-dive fitness (prior dives, prior physical exertion, fatigue, recent illness)
  - altitude exposure.
- **Associated activity factors:** the effects of associated activity factors should be assessed. These associated activities include:
  - manual handling
  - boat handling
  - dive platforms
  - crane operation
  - rigging.
- **Other hazards:** presence of other hazards such as the following should be taken into account:
  - dangerous marine animals
  - shipping movements
  - water inlets
  - hazards peculiar to the dive locations
  - use or presence of hazardous chemicals, biological pollutants or explosives.
- **Emergency response factors:** there should be an assessment of what would be required in case of an emergency. The assessment should include consideration of:
  - the location and availability of appropriate emergency systems
  - emergency response procedures.

Once the risks have been assessed, the competent person should decide on and implement control measures to prevent or minimise the level of exposure to the risks. In deciding on the control measures, the hierarchy of control measures mentioned in AS/NZS 2299, part 1, Appendix D paragraph 4.2 should be taken into account.

This Appendix states:

Appropriate control measures should be applied to risks, using the hierarchy of controls in the following order:

- **Elimination:** where the level of risk cannot be controlled to an acceptable level, no diving should take place.
- **Substitution:** where the risk can be controlled by performing the task using alternative methods of diving, consideration should be given to using these alternative methods.
- **Design:** plant and procedures should be designed to minimize risk.
- **Isolation:** persons should be isolated from the identified hazards.
- **Administrative:** every dive plan should seek to minimize the degree and duration of the diver's exposure to risk.

Note: Almost every aspect of dive planning falls into this administrative category.

Administrative controls include:

- training, supervision, experience and selection of employees, including staffing levels

- provision of an appropriate diving operations manual
- organisation and planning before, during and after the dive
- selection of appropriate plant
- selection of the appropriate form and level of communication.
- **Personal protective equipment:** appropriately designed and sized personal protective equipment should be provided, used and maintained. The limitations of all equipment used should be identified as part of the risk assessment process. Information from manufacturers and from records of prior experience should be used to identify limitations.

Examples of appropriate standards that describe control measures in detail include:

- AS/NZS 2299.1 [Occupational diving operations - Standard operational practice](#)
- AS/NZS 2299.2 Occupational diving operations - Scientific diving
- AS 3848.2 [Filling of portable gas cylinders - Filling of portable cylinders for self-contained underwater breathing apparatus \(SCUBA\) and non-underwater self-contained breathing apparatus \(SCBA\) - Safe procedures](#).

The following are specific controls measures for certain risk areas associated with occupational diving, which should be adopted and followed by PCBUs engaged in occupational diving work.

## 4.1 Risk to divers from vessels that are underway

Divers associated with vessels that are underway are at risk, both of injury and damaging their equipment. This risk is highest for divers using surface supply breathing apparatus. A PCBU should prevent or minimise this risk by adopting appropriate control measures.



Examples of control measures are:

- propeller guards for relevant vessels
- ensuring the master and relevant crew of any vessel are appropriately qualified and experienced
- ensuring divers are equipped with appropriate emergency breathing supplies and knives
- using buoys or markers to separate diving activity from vessel activity
- using appropriately sized and displayed flags to indicate diving activity and appropriate lights at night (Note: this control measure is only effective where the flag or lights are displayed where diving is taking place, not just in the vicinity)
- ensuring relevant surface workers maintain a watch for approaching vessels and are part of a communications system to allow contact to be made with the approaching vessel in a timely manner

- adopting systems of work to minimise or eliminate the chances of these injuries occurring.

## 4.2 Equipment required for occupational diving

PCBUs for occupational diving work should use appropriate standards in the selection and use of equipment for occupational diving.

An appropriate standard for equipment for occupational diving work should be selected and used. Appropriate standards for other occupational diving work are:

- AS/NZS 2299.1 Occupational diving operations - Standard operational practice
- AS/NZS 2299.2 Occupational diving operations - Scientific diving
- *Pearl Diving Industry Code of Practice* - Pearl Producers Association of WA.

## 4.3 Breathing gas quality

PCBUs for occupational diving work should use appropriate standards to ensure breathing gas quality for occupational diving.

The appropriate standard for breathing gas quality for occupational diving work is AS/NZS 2299 Occupational Diving Operations - Part 1 Standard Operational Practice.

## 4.4 Decompression management

PCBUs for occupational diving work should use appropriate standards to manage the risk of decompression illness for occupational diving.

An appropriate standard to manage the risk of decompression illness for occupational diving work should be selected and used consistently and conservatively. Appropriate standards for other occupational diving work are:

- AS/NZS 2299.1 [Occupational diving operations - Standard operational practice](#)
- AS/NZS 2299.2 Occupational diving operations - Scientific diving
- where the level of risk is similar to that of recreational diving or recreational technical diving, then any dive tables approved by a scuba training organisation
- any dive computer used in accordance with the manufacturers instructions.

PCBUs for occupational diving work should ensure that factors that may predispose a diver to developing decompression illness are minimised. The factors are:

- severe exercise during or after decompression
- poor physical fitness and obesity
- water temperature, for example cold water and hot showers
- dehydration
- increased carbon dioxide pressures
- alcohol intake
- physical injury
- dive profiles
- rapid and multiple ascents
- repetitive and multi day diving
- altitude exposure.

## 4.5 Emergency plans

PCBUs should ensure dive sites have a written emergency plan to deal with emergency situations. These emergency plans should be made readily available to all relevant workers who should be familiar with these plans. Situations covered by written emergency plans should include:

- first aid
- rescue
- evacuation, including evacuation to the nearest recompression facility
- missing persons.

## 4.6 Rescue of a diver

PCBUs should ensure effective and efficient rescue and resuscitation procedures have been developed. In the development of these procedures, consideration should be given to the following factors:

- Size, type and location of the dive site.
- Appropriateness of rescue procedures to the dive site.
- Adequacy of the communication system so that clear messages and information can be relayed to the appropriate personnel, with the minimum of delay.
- Location of rescuers and their skills and fitness levels. Rescuers should have knowledge and skills in diving and in the management of diving related incidents, injuries and illness. They should also have a level of fitness so their own health and safety are not compromised, and be dressed and equipped so they are ready to enter the water quickly.
- Availability, locality and appropriateness of any rescue equipment such as rescue boards, tenders, flotation devices and ropes. Any rescue vessels or equipment should be maintained in a ready condition and positioned so they can be used to reach a diver in distress with the minimum of delay.

## 4.7 First aid and oxygen provision

Persons conducting a business or undertaking should ensure:

- A first aid kit is available at the dive site. The contents of this kit should be sufficient to cater for the injuries that may occur. Consideration also should be given to the number of divers, distance from emergency services and the nature and type of underwater diving which is being undertaken.
- A person on the surface at the dive site should hold current training in diving first aid.
- An oxygen system capable of providing a spontaneously breathing person with an inspired oxygen concentration of as near as possible to 100% is available at the dive site. The equipment should also facilitate oxygen enriched artificial ventilation of a non-breathing person. The person/s administering the oxygen should have received training in the correct use of the system.
- Oxygen equipment and oxygen levels are checked daily by a person who has received training to carry out the checks correctly. Any other maintenance of the oxygen system should be carried out by an authorised service agent.
- Sufficient oxygen is available to supply the injured person, taking into account the location of the dive site and access to medical facilities.

# 5. Administration of the risk assessment process

The WHS Regulation requires certain administration of the risk assessment process (the process). The process must be carried out each time that there is a significant change to the occupational diving work, certain records are to be kept, some training is to be undertaken and the process is to be monitored and reviewed.

The PCBU should ensure that there is adequate supervision to ensure control measures are implemented and kept in place.

## 6. Training of workers about the risk assessment process

All relevant workers, including non-divers associated with the occupational diving such as vessel masters, should understand the control measures decided upon before diving commences.

Developing documented work procedures that incorporate the control measures will assist in this process. This should take the form of an appropriate operations manual. However separate work procedures may be needed for specific tasks, equipment or conditions.

AS/NZS 2299.1 Appendix E provides advice on the structure of a diving operations manual.

To assist the understanding of workers, a system of training should be developed.

For occupational diving, a training program should include:

- induction training for new workers
- site and/or task specific training (a dive site brief to reinforce key risks and control measures)
- ongoing review and training (to assess and maintain worker's understanding).

The nature of occupational diving work lends itself to practical as well as theoretical training, for example rescue drills.

Appropriate records should be made of training that includes the date, the training undertaken, the trainer and trainee's names.

## 7. Dive safety logs

The WHS Regulation requires that certain records be kept of the diving undertaken. These records assist in decompression management and provide a tool to monitor and review the occupational diving work.

## 8. Diver's log

Occupational divers should complete a divers log for their own records. The divers log should include:

- date of dive
- operation number of the dive, that is sequential numbering of each of the dives for any one day
- location and nature of dive site, for example boat or shore diving
- environmental conditions at the dive site
- time in
- time out
- maximum depth of the dive
- bottom time
- the decompression tables followed by the diver
- any emergency or incident of special note which occurred during the dive, for example failure of diving equipment or emergency decompression
- any discomfort or injury suffered by the diver
- depth and duration of safety stop.

## 9. High risk diving work

A PCBU at a workplace where high risk diving work is carried out must ensure that the following are in accordance with AS/NZS 2299.1 (Occupational diving operations—Standard operational practice)—

- (a) the fitness of persons carrying out the work
- (b) the competence of persons carrying out the work
- (c) the carrying out of the work.

A person must not carry out high risk diving work unless the person has the qualifications, knowledge, skills and experience required by AS/NZS 2299.1 (Occupational diving operations—Standard operational practice) for work of the kind to be carried out by the person.

**high risk diving work** means work—

- (a) carried out in or under water or any other liquid while breathing compressed gas; and
- (b) involving one or more of the following—
  - (i) construction work
  - (ii) testing, maintenance or repair work of a minor nature carried out in connection with a structure
  - (iii) inspection work carried out in order to determine whether or not work described in subparagraph (i) or (ii) is necessary
  - (iv) the recovery or salvage of a large structure or large item of plant for commercial purposes

but does not include minor work carried out in the sea or the waters of a bay or inlet or a marina that involves cleaning, inspecting, maintaining or searching for a vessel or mooring.

## Appendix 1: Dictionary

**Bottom time:** The time between a diver leaving the surface at the start of a dive and starting the final ascent.

**Dive time:** The time between a diver leaving the surface at the start of a dive and surfacing at the end of the dive.

**Diving first aid:** A current qualification received for training in:

- first aid and emergency oxygen administration to injured divers
- training in diving accident management
- field clinical assessment.

**Repetitive dive group/pressure group** means a letter of the alphabet, given by dive tables, that represents an estimate of the amount of residual nitrogen in a diver's tissues immediately on surfacing at the end of a dive.

**Repetitive factor/pressure group at end of surface interval:** A letter of the alphabet, given by dive tables, that represents an estimate of the amount of residual nitrogen in a diver's tissues as determined by the repetitive dive group and the surface interval.

**Residual nitrogen:** Nitrogen in excess of the amount normally present in a person's tissues that is dissolved in the person's tissues.

**Surface interval:** The time a diver spends at the surface between dives.

**Time in:** The time a diver leaves the surface at the start of a dive.

**Time out:** The time a diver surfaces at the end of a dive.



## PZJA Traditional Inhabitant Members Cluster Consultations 2019/20

### Meetings Summary for Hand Collectables Working Group

Traditional Inhabitant members of PZJA advisory committees recently undertook community and industry consultations to report on activities related to PZJA fisheries over the last 12 months and seek input on key issues for the management of fisheries in the Torres Strait. The meetings were led by the PZJA Traditional Inhabitant Members, with support provided by TSRA and AFMA.

The Hand Collectables Working Group (HCWG) Meeting #15 recommended the PZJA Traditional Inhabitant Members use these meetings as an opportunity to seek industry and community feedback on the proposed black teatfish trial opening and the current prohibition on hookah.

The meetings were delivered as outlined in the Table 1 below:

Table 1. PZJA Traditional Inhabitant Members consultation schedule

Community	Date	Presenters
Erub	16 October 2019	Michael Passi (HC), Les Pitt (TRL), John Tabo (Finfish)
Mer	17 October 2019	Support: Liz McCrudden (TSRA), Neville Johnston (TSRA), Georgia Langdon (AFMA)
Ugar	5 February 2020	Michael Passi (BDM), Les Pitt (TRL), John Tabo (Finfish) Rocky Stephen (SAC and Finfish), William Stephen (PMAC)  Support: Neville Johnston (TSRA)
Boigu	22 October 2019	Maluwap Nona (HC, SAC), Aaron Tom (TRL), Tenny Elisala (Finfish)
Saibai	23 October 2019	
Dauan	24 October 2019	Support: Liz McCrudden (TSRA), Natalie Couchman (AFMA)
Masig	5 November 2019	Hilda Mosby (Finfish), Gavin Mosby (SAC, PMAC), James Billy (TRL), Patrick Bonner (HC),  Paul Lowatta (Finfish) – Masig only Mark David (TRL) – Iama only Francis Pearson (PMAC) -Poruma only
Iama	6 November 2019	
Pourma	7 November 2019	
Warraber	8 November 2019	Support: Liz McCrudden (TSRA), Andrew Trappett (AFMA)
Badu	22 November 2019	James Ahmat (TRL), Frank Loban (Finfish, HC, SAC)
Mabuiag	23 November 2019	
Kubin	25 November 2019	
St Pauls	26 November 2019	Support: Liz McCrudden (TSRA), Neville Johnston (TSRA), Georgia Langdon (AFMA)
Thursday Island	21 January 2020	Patrick Mills (TRL, SAC), Tony Salam (HC), Harry Nona (Finfish, TRL).  Support: Liz McCrudden (TSRA), Neville Johnston (TSRA), Georgia Langdon (AFMA)

Table 2 below provides an overview of the key discussion points, feedback and recommendations relevant to the HCWG from all consultations.

Table 2. Summary of discussions – Beche-de-mer fishery – Cluster visits 2019/20

Kemer Kemer Meriam - 15-17 October 2019 and 5 February 2020		
Presenter – Michael Passi		
Black teatfish proposed trial opening	Hookah for harvesting white teatfish	Other discussion
<ul style="list-style-type: none"> <li>• Mer and Erub indicated support for the black teatfish trial opening to be driven using a cultural lore framework.</li> <li>• PBC and councils to be leaders in the process</li> <li>• AFMA and the TSRA should seek engagement and input from GBK and Malu Lamar</li> <li>• AFMA will not regulate access, rather the PBC's will take a leadership role in facilitating discussions and access arrangements</li> <li>• Meeting participants generally noted that if black teatfish is opened, everyone is going to fish it – what does this mean for the full time slug operators? There needs to be a decision about who can access it, and people need to respect that. It was agreed the decision needs to be made by the communities, and not by AFMA/TSRA.</li> <li>• Meeting participants at Erub noted community concerned about going over the black teatfish limit again and also with increased catches of giant clams. There are claims that last time lots of people came over from the West and over-harvested giant clams during the black teatfish opening.</li> </ul>	<ul style="list-style-type: none"> <li>• At Mer it was suggested that if a trial for hookah to target white teatfish was allowed then all other BDM species should be closed.</li> <li>• Generally the use of hookah for white teatfish was not supported by Ugar due to fear of over fishing and targeting other species.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased investment and support for fishers is needed to improve the value of catch – e.g. drying facilities on islands for BDM.</li> <li>• Suggestion to have one central fish receiver in each community. AFMA agreed that is a good idea that communities can arrange amongst themselves, as long as the product is landed, weighed and recorded to a licenced fish receiver as per licence conditions.</li> </ul>

Gudumalulgal – 21-24 October 2019		
Presenter – Maluwap Nona		
Black teatfish proposed trial opening	Hookah for harvesting white teatfish	Other discussion
<ul style="list-style-type: none"> <li>• Across each community there was general support for the black teatfish trial opening to be run through traditional law/lore. Noting that fishers have the right to access any part of a fishery under the current TIB licence conditions.</li> <li>• There is no black teatfish habitat in Gudumalulgal waters so there is some concern that access to the trial will be limited for Gudumalulgal industry members.</li> <li>• Native title bodies must be involved in the trial opening.</li> </ul>	<ul style="list-style-type: none"> <li>• Broadly Traditional Owners present at the Gudumalulgal meetings recommend opening hookah to access white teatfish <i>only</i>. Other species cannot be taken by hookah. This is an important economic opportunity which can be managed under the TAC and compliance measures.</li> <li>• Ensure white teatfish is included in the BDM survey.</li> </ul>	<ul style="list-style-type: none"> <li>• Suggestion the PZJA should review options for spatial opening and closures – like rotational grazing to increase the sustainability of the fishery.</li> <li>• There was discussion regarding the current Class C licence conditions. It is recommended these should be reviewed to enable primary vessels to tow other TIB licence holders to finishing grounds and provide resources.</li> </ul>

Kulkalgal – 4-8 November 2019		
Presenter – Patrick Bonner		
Black teatfish proposed trial opening	Hookah for harvesting white teatfish	Other discussion
<ul style="list-style-type: none"> <li>• Masig industry members suggested the black teatfish trial opening should occur in February as it aligns with the opening of the TRL hookah season. Concerns were raised regarding the spawning time and the proposed mid-year opening.</li> <li>• Noted it was important for communities, managers and scientists to know timing of spawning for all species. There is a strong need to feed this information back to communities - ground truth the scientific understanding.</li> </ul>	<ul style="list-style-type: none"> <li>• Masig meeting participants provided mixed support for opening hookah for white teatfish <ul style="list-style-type: none"> <li>○ It was noted that if white teatfish was opened for hookah access then the fishermen would not be able to target or collect any other species (this is not maximising a fisherman's effort in the fishery)</li> <li>○ Compliance was recognised as a significant challenge</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Recommendation for AFMA to develop online/app catch reporting tool.</li> <li>• Recommendation should be made to PZJA, Commonwealth &amp; State Ministers and TSRA for the regulation of the fisheries to acknowledge traditional lore.</li> <li>• The collection of spatial data in logbooks should become compulsory for all fisheries.</li> <li>• The PZJA to support training opportunities on island for fisheries to develop skills in processing, harvesting and transporting and local industry champions could be supported to train fisheries across Kulkalgal islands.</li> </ul>

<ul style="list-style-type: none"> <li>• Recommendation for CSIRO to provide spawning time for each BDM species</li> <li>• It was noted most communities in the east have adjacent black teatfish habitat (Masig eastwards).</li> <li>• Poruma, lama and Warraber agreed on the following recommendations for the Black teatfish trial opening: <ul style="list-style-type: none"> <li>○ The trial should only be opened for the five communities where black teatfish is abundant – Ugar, Erub, Mer, Masig and Poruma</li> <li>○ The access to the trial must be led by PBC and community leaders <ul style="list-style-type: none"> <li>▪ PBCs should provide letters of support for HCWG members to take to the next meeting to ensure PZJA members are speaking with the correct authority</li> </ul> </li> <li>○ Malu Lamar and GBK must be involved from the start of the trial development</li> <li>○ Traditional lore needs to be recognised in the policy/management plan for the trial opening</li> </ul> </li> <li>• The trial opening should take into consideration the spawning time of BDM</li> </ul>	<ul style="list-style-type: none"> <li>○ The majority from all clusters need to be in support for hookah to be allowed</li> <li>○ A full management plan would need to be driven by PBC and fishermen (not just those targeting white teatfish).</li> <li>○ It was noted outside the meeting that support for hookah varies across Masig industry members</li> <li>• At Poruma, lama and Warraber strong advice received that hookah should not be allowed for the take of any BDM species, including white teatfish, due to the potential impacts on the sustainability of the fishery and issues in regulation/compliance.</li> <li>• Recommendation that TSRA should support someone from Central islands to go to Masig Island to inform the industry on what the challenges and impacts are of having both hookah and free divers operating in the same region.</li> </ul>	<ul style="list-style-type: none"> <li>• Kulkalgal industry should have employment opportunities during the BDM survey on Warrior Reef and hold community information sessions prior to the survey to gain insight from industry.</li> <li>• Kulkalgal research must utilise local knowledge and engage local people before the research.</li> <li>• The meeting participants at lama, Poruma and Warraber agreed on the proposed development of a Community Management Plan as a priority: <ul style="list-style-type: none"> <li>○ Now the TRL and BDM harvest strategies are in place, it is the right time to develop a community management plan that recognises cultural protocols.</li> <li>○ The TSRA should prioritise their development to work alongside the current PZJA management plans and harvest strategies</li> <li>○ The community management plans should provide guidance on: <ul style="list-style-type: none"> <li>▪ Spatial closures</li> <li>▪ Rotational reef harvesting</li> <li>▪ Depth regulations</li> <li>▪ Tide regulations</li> <li>▪ Cultural practices</li> <li>▪ Anchorage regulations on reefs and in cultural fishing sites</li> </ul> </li> <li>○ Each Nation should create their own community management plan suitable for their cultural protocols, reefs and industry</li> </ul> </li> </ul>
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		<ul style="list-style-type: none"> <li>• They should be e collaborative between the PBCs, TSRA and the PZJA</li> </ul>
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<b>Maluiligal – 21-26 November 2019</b>		
Presenter – Frank Loban		
<b>Black teatfish proposed trial opening</b>	<b>Hookah for harvesting white teatfish</b>	<b>Other discussion</b>
<ul style="list-style-type: none"> <li>• Meeting participants at Badu indicated the black teatfish access should be through partnerships with PBCs. However, concern was raised with having to potentially ask eastern communities for permission, where the majority of the black teatfish habitat is located. It was suggested perhaps permission should be reciprocal for kaiar for eastern fishers coming to the west.</li> <li>• At St Pauls and Kubin there was limited support for the proposed black teatfish opening using traditional lore to regulate access. Attendees noted that if fishers from the east want come work kaiar they don't need permission, so why should western fishers need to seek permission. Even though that is the respectable thing to do, it needs to work both ways. Attendees agreed that the proposal needs more discussion on that matter with community elders and industry outside of this meeting.</li> <li>• At Mabuia meeting participants indicated the black teatfish access should be through partnerships through PBCs. There was general consensus that traditional lore should be followed, noting there was an</li> </ul>	<ul style="list-style-type: none"> <li>• There was limited discussion regarding the use of hookah for white teatfish at Badu. One meeting participant indicated support, however a broad consensus was not voiced.</li> <li>• At St Pauls and Kubin there was general support for the use of hookah to collect white teatfish was mixed. This issue requires more discussion with industry to fully understand the benefits and risks.</li> <li>• Mabuia indicated support for the use of hookah to collect white teatfish. It was strongly expressed that hookah should not be used for other species, which presents compliance issues which would need to be worked through.</li> </ul>	<ul style="list-style-type: none"> <li>• The long term vision of the BDM fishery must consider the following: <ul style="list-style-type: none"> <li>○ Risk of overfishing (citing international examples).</li> <li>○ Review the option of having season opening and closures for specific species.</li> <li>○ Review options of implementing quota systems in the future.</li> </ul> </li> <li>• The collection of spatial data in logbooks becoming compulsory for all fisheries, however must ensure confidentially and privacy of fishing locations.</li> <li>• CSIRO should hold a meeting on Badu in the future to discuss the science and survey with fishers to increase understanding.</li> <li>• Discussions on minimum size limits (MSL) – compliance. AFMA explained how the MSL are measured but above all (i.e. undisturbed from tip to tip), the limits are in place as an added layer of protection to ensure the animals can reach a size to breed first and that AFMA will be making waterproof rulers available when new MSL come in to effect.</li> </ul>

<p>understanding that permission would need to be sought from eastern communities where black teatfish is present. It was acknowledged that there is a lot of detail to be worked through, but this approach at a high level was supported.</p>		<ul style="list-style-type: none"> <li>• A pilot project on re-seeding of sandfish at Ugar was discussed, including the potential for expansion in the future.</li> </ul>
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Kaiwalagal – 21 January 2020		
Presenter – Maluwap Nona (as proxy for Tony Salam)		
Black teatfish proposed trial opening	Hookah for harvesting white teatfish	Other discussion
<ul style="list-style-type: none"> <li>• General support from the Kaiwalagal meeting participants for cultural lore to be used in the trial black teatfish opening to guide who has access to the trial at certain times.</li> <li>• It was suggested the timing of the opening should take into consideration limiting effort - for example open the trial during a hookah opening when a number of fishers will be targeting TRL.</li> <li>• Suggestion for the inclusion of triggers during the opening, which would control who can access the trial. For example when 10% of the TAC is remaining only local fishers to those waters should have access. Fisheries from other areas should leave.</li> <li>• Recommendation for a BDM industry meeting to discuss the strategic management plan and individual community needs, including trial openings.</li> </ul>	<ul style="list-style-type: none"> <li>• General support from meeting participants for the use of hookah for white teatfish noting that they were mostly not BDM fishers and would take the advice from those who are on the most appropriate management arrangements.</li> </ul>	<ul style="list-style-type: none"> <li>• Traditional spatial closures are currently encouraged by fishers to improve the sustainable management of the fishery.</li> <li>• Surveys to open a fishery must involve and take direction from Traditional Owners. They have a wealth of industry and environmental knowledge which is beneficial to scientific surveys. The involvement of local industry and community provides training opportunities.</li> <li>• Advice from TIB Fisherman that the PZJA agencies seek advice from fulltime operators in the industry regarding management arrangements and plans for the BDM fishery going forward.</li> </ul>

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>Research priorities for 2025/26</b>	<b>Agenda Item 11</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the discussions and recommendations at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting, concerning research priorities for proposed funding in 2025/26 for inclusion in the draft Five-Year Research Plan for Hand Collectables Fisheries for 2025/26 to 2029/30 (**Attachment 11a**);
  - b. **NOTE** the status of currently funded research projects relevant to hand collectables fisheries, as detailed in the draft Five-Year Research Plan for Hand Collectables Fisheries for 2025/26 to 2029/30;
  - c. Having **CONSIDERED** the HCRAAG advice, **DISCUSS** and **PROVIDE ADVICE** regarding research priorities for proposed funding in 2025/26 for inclusion in the draft Five-Year Research Plan for Hand Collectables Fisheries for 2025/26 to 2029/30. The draft plan will be updated with HCRAAG discussions and recommendations during the preceding meeting and will be presented at the HCWG meeting for further advice;
  - d. **NOTE** the update concerning the Torres Strait Research Advisory Committee's (TSSAC) 2024/25 call for research and **PROVIDE ADVICE** regarding the scope, Collecting data on socio-economic indicators in the Torres Strait Beche de mer Fishery (BDM Fishery):
    - i. this scope was not included in the call for research, further guidance is sought on what the social and economic data and information needs are for the BDM Fishery, including the purpose/objectives for collecting it, how it is to be used and the frequency of collection. A presentation will be provided by Steven Purcell at the meeting which will provide further information to inform the development of the scope.

## KEY ISSUES

### *Current research projects*

2. There are currently three research projects that have been recently completed or are underway that are relevant to Torres Strait hand collectables fisheries:
  - a. Research to support Beche-de-mer fisheries in Torres Strait (AFMA project 2021-0815) – this project has been completed, the outcomes from this project will be considered at the preceding HCRAAG meeting;
  - b. Black teatfish size sampling and stock assessment update (AFMA project 2023-0800) – this project is underway, the outcomes from this project will be considered at the preceding HCRAAG meeting;
  - c. Modelling climate change impacts on key fisheries resources in the Torres Strait to co-develop adaptation and mitigation strategies – this project is pending final funding approval and contract. Further information on this project will be provided to the preceding HCRAAG meeting.



**Research priorities for 2025/26**

3. A draft Five-Year Research Plan for Hand Collectables Fisheries for 2025/26 to 2029/30 is provided at **Attachment 11a**. HCWG advice is sought on research priorities for inclusion in the draft plan for proposed funding in the next funding round in 2025/26. Advice should include consideration of the priority (essential/desirable), feasibility, timing and indicative costing of each identified research priority to inform consideration of research priorities by the Torres Strait Research Advisory Committee (TSSAC). The draft plan will be updated with HCWG discussions and recommendations during the preceding meeting and will be presented at the HCWG meeting for further advice.

**TSSAC 2024/25 call for research**

4. TSSAC met on 22-23 August 2023 to consider research priorities for Torres Strait fisheries for inclusion in the TSSAC 2024/25 call for research. The Five-Year Research Plan for Hand Collectables Fisheries for 2024/25 to 2028/29, and associated scopes (**Attachment 11b**) for three research priorities identified as essential were submitted for consideration. TSSAC included two of the three scopes in their 2024/25 call for research released on 8 September 2023:
  - a. Scientific stock survey of sandfish and other sea cucumber species on Warrior Reef; and
  - b. Management Strategy Evaluation of the BDM Fishery Harvest Strategy.
5. At their meeting, TSSAC sought additional advice from the HCWG regarding the following:
  - a. Collecting data on socio-economic indicators in the BDM Fishery – this scope was not included in the call for research, further guidance is sought on what the social and economic data and information needs are for the BDM Fishery, including the purpose/objectives for collecting it, how it is to be used and the frequency of collection. A presentation will be provided by Steven Purcell at the HCWG meeting which will provide further information to inform the development of the scope.
6. Research pre-proposals are due to the TSSAC secretariat by 30 October 2023. The HCWG and HCWG will be consulted out-of-session on any proposals received relevant to hand collectables fisheries. Applicants will be advised by February 2024 whether a conditional approval has been given for their proposal, whether community engagement is required, and/or any changes to the proposal should be made.

**BACKGROUND**

7. TSSAC operates under a Strategic Research Plan (SRP) which guides priority setting for research in Torres Strait fisheries over a five-year period. The SRP specifies the research priorities and strategies (summarised in **Attachment 11c**) 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.
8. There are 3 research themes within the SRP, under which RAGs and Working Groups can identify research priorities. There are several strategies under each theme and suggested ideas to help RAGs and Working Groups to think about the sorts of projects which may fit within these themes and strategies.
9. The TSSAC requires each fishery to develop a rolling five-year research plan, which fits into the themes identified in this SRP.
10. The TSSAC has an annual research cycle, which fits with the AFMA budgeting cycle (**Attachment 11d**).

### Torres Strait fisheries strategic research themes, strategies and research activities

<b>Theme 1: Protecting the Torres Strait marine environment for the benefit of Traditional Inhabitants</b>	
<b>Aim:</b> 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	<p>Possible research activities under this theme may include:</p> <ol style="list-style-type: none"> <li>Stock assessment and fishery harvest strategies for key commercial species.</li> <li>Ecological risk assessments and management strategies for fisheries.</li> <li>Minimising marine debris in the Torres Strait.</li> <li>Addressing the effects of climate change on Torres Strait fisheries through adaptation pathways for management, the fishing industry and communities.</li> <li>Incorporating Traditional Ecological Knowledge into fisheries management.</li> <li>Methods for estimating traditional and recreational catch to improve fisheries sustainability.</li> </ol>
Strategy 1b – Catch sharing with Papua New Guinea	<p>Possible research activities under this theme may include:</p> <ol style="list-style-type: none"> <li>Status of commercial stocks and catches by all sectors within PNG jurisdiction of the TSPZ.</li> <li>Good cross-jurisdictional fisheries management through better monitoring and use of technology.</li> </ol>
<b>Theme 2: Social and Economic Benefits</b>	
<b>Aim:</b> 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	<p>Possible research activities under this theme may include:</p> <ol style="list-style-type: none"> <li>Models for managing/administering Traditional Inhabitant quota</li> <li>Understanding what influences participation in commercial fishing by Traditional Inhabitants.</li> <li>Understanding the role and contribution of women in fisheries.</li> <li>Capacity building for the governance of industry representative bodies</li> <li>Methods for valuing social outcomes for participation in Torres Strait fisheries.</li> <li>Identifying opportunities and take-up strategies to increase economic benefits from Torres Strait fisheries.</li> </ol>
<b>Theme 3: Technology and Innovation</b>	
<b>Aim:</b> 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.	<p>Possible research activities under this theme may include:</p> <ol style="list-style-type: none"> <li>Electronic reporting and monitoring in the Torres Strait, including for small craft.</li> <li>Technologies or systems that support more efficient and effective fisheries management and fishing industry operations.</li> </ol>

## TSSAC research cycle timeline

<b>TSSAC PROCESS</b>	
<b>July (START)</b>	July - RAGs, WGs and MACs to update five year rolling research plan and specify their priority research needs for funding in the next financial year (12 months time). <b>Provide to TSSAC EO by end July.</b>
August	Start to mid-August, Annual Research Statement (ARS) and TSSAC papers sent for consideration before end August meeting. <b>Late August - TSSAC meets</b> (face to face or via teleconference) to finalise the PZJA ARS and agree on priorities/ scopes for the TSSACs call for research proposals.
September	<b>Early sept - call for research opens</b> (6-8 weeks given due to more complex proposal for Torres Strait research).
October	<b>end October - proposals due.</b>
November	AFMA draft budgets due.
December	Mid December - RAG comments due on proposals (6 weeks).
January	TSSAC papers sent ahead of meeting.
February	<b>Early February- TSSAC meet face to face</b> to recommend research proposals for funding (pending community pre-consultation). Mid-Feb – researchers notified of conditional support for project, which requires community pre-consultation before final support. Researchers to develop and provide pre-consultation package to TSSAC EO (2 weeks). TSSAC EO to send pre-consultation packages to relevant PBC, councillors and fishers associations (for relevant projects). PIs to follow up with phone calls (2 weeks). <b>NOTE AFMA budgets finalised mid to late Feb, hence timings for this meeting.</b>
March	Late March – researchers submit a summary of feedback from pre-consultation to TSSAC EO.
Early April	<b>TSSAC meet via teleconference to discuss outcomes of pre-consultation.</b> If no / minimal and supportive comments received only, then send out of session for consideration instead of teleconference. Mid-April – researchers notified of final endorsement of project and process for contracting. EO to work with research team to arrange drafting of contracts.



# Five-year Research Plan 2025/26 – 2029/30

## Torres Strait Hand Collectables Fisheries

Beche-de-mer  
Pearl shell  
Crab  
Trochus



**COMPILED BASED ON ADVICE FROM THE HAND COLLECTABLES  
RESOURCE ASSESSMENT (HCRA) AND WORKING GROUPS  
(HCWG)**

**[Insert date]**

## 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 2025/26 to 2029/30. This template is to be used by the relevant advisory body to complete their five-year plan. The plans are to be developed in conjunction with the TSSAC Five-year Strategic Research Plan (SRP) with a focus on the three research themes and associated strategies within the SRP.

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

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

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

Table 1. Research priorities for Torres Strait Hand Collectable Fisheries for 2025/26 – 2029/30.

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost					Notes on project timings	Other funding bodies	Evaluation		
		2025/26	2026/27	2027/28	2028/29	2029/30			Priority essential / desirable	Priority ranking (1-5)	Theme
<b>APPROVED RESEARCH (RECENTLY COMPLETED OR UNDERWAY)</b>											
Research to support Beche-de-mer fisheries in Torres Strait (AFMA project 2021-0815)	<ol style="list-style-type: none"> <li>Undertake new stock assessment modelling for white teatfish to allow species TAC to be reviewed under the Torres Strait Beche-de-mer Harvest Strategy.</li> <li>Develop processing conversion ratios for curryfish, with industry to undertake the sampling process.</li> </ol>	-	-	-	-	-	Completed June 2023.	CSIRO in-kind	Essential		1
Black teatfish size sampling and stock assessment update (AFMA project 2023-0800)	<ol style="list-style-type: none"> <li>Advise on size frequency sampling program for black teatfish during the 2023 fishery opening.</li> <li>Re-run black teatfish model using updated data: new data (size frequency), historical size frequency (survey) data and fishery catch data.</li> </ol>	-	-	-	-	-	Scheduled for completion by June 2024.  In support of this project, the AFMA observer program collected the required size-frequency data during the 2023 black teatfish opening.	CSIRO in-kind	Essential		1
Modelling climate change impacts on key fisheries resources in the Torres Strait to co-develop	<ol style="list-style-type: none"> <li>Provide up-to-date evidence-based information to fishers and managers about current and future risks to fisheries associated with climate change.</li> <li>Investigate the impacts of climate change scenarios on fisheries/species in the short</li> </ol>	TBC	-	-	-	-	Pending final funding approval / contract		Essential		1

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost					Notes on project timings	Other funding bodies	Evaluation		
		2025/26	2026/27	2027/28	2028/29	2029/30			Priority essential / desirable	Priority ranking (1-5)	Theme
adaptation and mitigation strategies	(2 year), medium (5 year) and long-term (20 years), also considering socio-economic and livelihood metrics. 3. Scientific results will be used to inform stakeholders and co-develop adaptation strategies via workshops.										
<b>RESEARCH NEEDS FOR 2025/26</b>											
Black teatfish sampling	1. Representative sampling to collect size and weight frequencies during the black teatfish openings.						Annual sampling to be undertaken by the AFMA observer program, in partnership with communities.	Funding to be sought from the AFMA fisheries budget	Essential	1	1
Sandfish stock survey	1. Undertake a survey of sea cucumber stocks on Warrior Reef area with a focus on sandfish and other commercially important sea cucumber species (e.g. deepwater redfish and hairy blackfish). Observations on other commercially relevant hand collectable species known to occur on Warrior Reef (e.g. trochus, pearl shell) should also be collected where possible. Survey outputs are to be available in a form suitable for use under the BDM Fishery Harvest Strategy.						Subject to confirmation of support from lama and Tudu Island Traditional Owners, GBK, fishers and other relevant stakeholders. Initial engagement to be led by the TSRA regarding support for the project to be followed by	Co-funding to be sought from the PNG NFA  Researcher in-kind	Essential	1	1

**Commented [CN1]:** Pending consideration as part of TSSAC 2024/25 call for research HCRAg advice sought on scope



Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost					Evaluation				
		2025/26	2026/27	2027/28	2028/29	2029/30	Notes on project timings	Other funding bodies	Priority essential / desirable	Priority ranking (1-5)	Theme
	<ol style="list-style-type: none"> <li>2. Seek to collaborate with the PNG National Fisheries Authority to undertake a full-scale survey, to include the proportion of the sandfish stock found on Warrior Reef in the PNG sea cucumber fishery.</li> <li>3. Produce stock size estimates and distribution data, and assess the fishery status for each sea cucumber stock on Warrior Reef.</li> <li>4. Use survey data and apply the BDM Fishery Harvest Strategy to make recommendations on total allowable catches and re-opening of closed species.</li> <li>5. Map important habitat variables, especially those relevant to fishery production.</li> <li>6. Seek to engage Torres Strait Islanders directly in the project, including providing for economic opportunities (e.g. employment).</li> </ol>						subsequent consultation by AFMA on the draft project scope and potentially proposal following HCRCAG review.				
Management Strategy Evaluation (MSE) of the Torres Strait Beche-de-mer Fishery (BDM Fishery) Harvest Strategy (HS)	<ol style="list-style-type: none"> <li>1. Collate all data and biological information.</li> <li>2. If sufficient information is available, define species-specific reference points for key species and determine the current status of stocks in relation to those species-specific reference points.</li> <li>3. Revise and update the spatial multi-species operating model developed for earlier projects (or construct a new model).</li> </ol>						Requires 3-5 years of BDM HS implementation	Researcher in-kind	Essential	3	1, 2

**Commented [CN2]:** Pending consideration as part of TSSAC 2024/25 call for research

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost							Evaluation		
		2025/26	2026/27	2027/28	2028/29	2029/30	Notes on project timings	Other funding bodies	Priority essential / desirable	Priority ranking (1-5)	Theme
	<p>4. Use MSE to evaluate how well the BDM Fishery Harvest Strategy achieves the pre-specified objectives, including performance against the new species-specific reference points as appropriate.</p> <p>5. In consultation with stakeholders, use the MSE framework to investigate ways to improve the current BDM Fishery Harvest Strategy. For example, investigate options for BDM Fishery licence holders to make arrangements for a process that would allow the under-catch of the black teatfish TAC each year to be harvested in a way that disseminates benefits broadly, while safeguarding against an over-catch of the TAC.</p>										
Socio-economic metrics	<p>1. In consultation with the HCRAG and HCWG, determine the key social and economic data and information needs for the BDM Fishery, including the purpose/objectives for collecting it, how it is to be used and the frequency of collection.</p> <p>2. Design a practical and cost-effective data collection method (e.g. interview-based survey of fishers and fishery workers), to collect the social and economic data and</p>						Project may fall within the remit of ARC.	Researcher in-kind	Essential	2	2

**Commented [CN3]:** HCRAG and HCWG advice sought on scope

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost					Evaluation				
		2025/26	2026/27	2027/28	2028/29	2029/30	Notes on project timings	Other funding bodies	Priority essential / desirable	Priority ranking (1-5)	Theme
	information needs identified for the BDM Fishery. 3. Collect the identified social and economic data and information using the designed method. 4. Provide a report on the outcomes of the data collection program, including: a. analyses of the collected data and information. For example, an analysis of differences in key socio-economic indicators (e.g. dependency, fishery income, target species and catch rates) among fisher types and locations within the fishery. Analyses to be undertaken to be informed by advice from the HCRAG and HCWG; b. an assessment of how the data collection method met the objectives; c. how the social and economic data and information collected is to be used/applied; d. recommendations for further extension (e.g. incorporation into the management framework for the BDM Fishery); e. future data collection needs.										
Stock status survey	1. Undertake a survey of sea cucumber stocks in the eastern region of the BDM Fishery. The survey is to focus on commercially important species, including prickly redfish, curryfish						Timing to be to be discussed further at HCRAG 03 and HCWG 20	Researcher in-kind	Not assigned, to be discussed further at HCRAG	Not assigned, to be discussed further at HCRAG	1

**Commented [CN4]:** HCRAG advice sought on timing and need for updated stock assessment modelling for key species (e.g. black teatfish, white teatfish)

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost					Notes on project timings	Other funding bodies	Evaluation		
		2025/26	2026/27	2027/28	2028/29	2029/30			Priority essential / desirable	Priority ranking (1-5)	Theme
	<p>species, black teatfish, surf redfish and white teatfish. The survey is to include deep-water habitats (&gt;20 metres). Survey outputs are to be available in a form suitable for use under the BDM Fishery Harvest Strategy.</p> <p>2. Produce stock size estimates and distribution data, and assess the fishery status for each sea cucumber stock in the eastern region of the BDM Fishery.</p> <p>3. Use survey data and apply the BDM Fishery Harvest Strategy to make recommendations on total allowable catches and re-opening of closed species.</p> <p>4. Map important habitat variables, especially those relevant to fishery production.</p>								03 and HCWG 20	03 and HCWG 20	
Understanding biological parameters of BDM species, including growth, mortality, size and breeding seasonality	<p>1. Fill identified gaps in knowledge of biological parameters of sea cucumber species and investigate options for collaborative research. The MSE research project (listed above), if undertaken, will inform the parameters that are a priority.</p>						To be addressed as the need arises. Conservative proxies currently in use. Research need is best addressed through other avenues such as PhD projects and through QLDRAC given		Desirable	3	1

Proposed Project	Objectives and component tasks	Year project to be carried out and indicative cost					Notes on project timings	Other funding bodies	Evaluation		
		2025/26	2026/27	2027/28	2028/29	2029/30			Priority essential / desirable	Priority ranking (1-5)	Theme
							similar projects were recently funded by FRDC for finfish species in Queensland. Recent research undertaken on some parameters, to be considered further by HCRAAG.				
Supply chain	1. Better understanding of the value chains of sea cucumbers and sea cucumber products from Torres Strait and opportunities for improving economic returns to fishers.								Desirable	Not assigned	2
Ecological Risk Assessment (ERA) – Torres Strait Pearl Shell Fishery (TSPF)	1. Conduct an ERA for the TSPF.						Only needed when effort in the TSPF increases above negligible levels. There is some information on pearl shell stock estimates from Tropical Rock Lobster surveys.		Desirable (once TSPF is active)	Not assigned	1



## Torres Strait Bêche-de-mer Fishery: Scientific stock survey of sandfish and other sea cucumber species on Warrior Reef

### Project need:

Scientific stock surveys of sea cucumber stocks in the Torres Strait Bêche-de-mer Fishery (BDM Fishery) have been undertaken since 1995. There are strong spatial patterns in sea cucumber distribution in the BDM Fishery. Generally, sandfish (*Holothuria scabra*) is restricted to Warrior Reef (with some small extension to reefs south and east), and most other species are found east of Warrior Reef, in the eastern region of the Torres Strait. There are some species found in both areas, but there is usually only minor overlap. The Papua New Guinea (PNG) sea cucumber fishery, which is primarily carried out on the northern Warrior Reef, is mostly sandfish.

Due to this spatial species pattern, for research purposes, the BDM Fishery has often been considered as two fishery areas – Warrior Reef (mostly based on sandfish); and the eastern Torres Strait that includes all reefs east of Warrior Reef and is based on a range of species.

Warrior Reef sandfish population surveys have been carried out in 1995, 1998, 2000, 2002, 2004 and 2010. In addition, to further assess the recovery of the sandfish population on Warrior Reef and investigate the feasibility of experimental fishing to monitor the fishery, a small experimental fishing exercise was undertaken in 2012.

Fishing for sandfish was closed in 1998 due to sustainability concerns following a considerable decline in abundance. The most recent full scale survey in 2019/20 did not cover the Warrior Reef complex so did not provide an update on the status of the sandfish stock. The last survey of sandfish in the Torres Strait was in 2010<sup>1</sup>. From this survey, densities were estimated to be around 80% lower than in 1995, when the stock was already considered to be depleted. The mean density at 41 repeated sites ( $\pm$  standard error) in 2010 was  $94 \pm 50$  sandfish per hectare, which was similar to the 2004 estimate ( $94 \pm 25$  sandfish per hectare), suggesting that there had been no recovery up to the time of the 2010 survey. A separate study estimated that a density of 1,600 sandfish per hectare would have been required to enable the 1,200 tonne harvested in 1995<sup>2</sup>. Densities reported from surveys in 2004 and 2010 were less than 6% of that level. This indicates that the stock was substantially reduced and likely below the limit reference point. Illegal fishing is thought to be a factor in this.

There is a need under the BDM Fishery Harvest Strategy (November 2019) to monitor the recovery of overfished species. In considering whether to re-open fishing for a closed species, the Harvest Strategy requires the collection of the necessary data (e.g. through a stock survey) to first establish that the stock is above a limit reference point level and subsequently to inform the setting of an appropriately conservative total allowable catch limit for a trial re-opening. Noting the sandfish stock has not been

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<sup>1</sup> Murphy, N.E., Skewes, T.D., Filewood, F., David, C., Seden, P., Jones, A. 2011. The Recovery of the *Holothuria scabra* (sandfish) population on Warrior Reef, Torres Strait. CSIRO Wealth from Oceans Flagship. Final Report, CMAR Cleveland. 44 pp.

<sup>2</sup> Skewes, T.D., Taylor, S., Dennis, D., Haywood, M., Donovan, D. 2006. Sustainability assessment of the Torres Strait Sea Cucumber Fishery, CRC-TS Project task number T1.4, CSIRO Marine and Atmospheric Research, Cleveland, Queensland.



surveyed since 2010, a new survey is required to assess the status of the stock and to inform the consideration of a re-opening.

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 BDM Fishery Harvest Strategy. 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.

**Desired outcomes:**

Guided by requirements under the BDM Fishery Harvest Strategy, the project is required to:

1. Undertake a survey of sea cucumber stocks on Warrior Reef area with a focus on sandfish and other commercially important sea cucumber species (e.g. deepwater redfish and hairy blackfish). Observations on other commercially relevant hand collectable species known to occur on Warrior Reef (e.g. trochus, pearl shell) should also to be collected where possible. Survey outputs are to be available in a form suitable for use under the BDM Fishery Harvest Strategy.
2. Seek to collaborate with the PNG National Fisheries Authority to undertake a full-scale survey, to include the proportion of the sandfish stock found on Warrior Reef in the PNG sea cucumber fishery.
3. Produce stock size estimates and distribution data, and assess the fishery status for each sea cucumber stock on Warrior Reef.
4. Use survey data and apply the BDM Fishery Harvest Strategy to make recommendations on total allowable catches and re-opening of closed species.
5. Map important habitat variables, especially those relevant to fishery production.

Information from the project is to be provided to AFMA and other Torres Strait stakeholders in the form of formal final reports and a plain English summary document. Special consideration is to be taken with Traditional Knowledge (TK).

Please note, the scope of this project may change, pending final advice from the HCRAAG and HCWG at meetings in October 2023 on whether an abbreviated vs. full scale survey is needed for the purposes of management. The objectives above are with reference to a full scale survey. Pending advice, budget costings for both an abbreviated and full scale survey should be provided as part of proposals. For details on the outcomes of these discussions, please contact AFMA on the contacts below.

Applicants wishing to submit a proposal can contact AFMA for further information.

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## **Torres Strait Bêche-de-mer Fishery: Collecting data on socio-economic indicators in the Torres Strait Bêche-de-mer Fishery**

### **Project need:**

The Commonwealth Fisheries Harvest Strategy Policy (2018) (the Harvest Strategy Policy) provides a framework for the development of harvest strategies for Commonwealth managed fisheries. A harvest strategy sets out a decision framework necessary to achieve defined biological and economic objectives for commercial fish stocks in a given fishery. This includes processes for monitoring and assessing the biological and economic conditions of commercial fish species within a fishery against fishery-specific reference levels, as well as decision rules that control fishing activity according to the biological and economic conditions of the fishery.

A harvest strategy for the Torres Strait Bêche-de-mer Fishery (BDM Fishery), was developed over a number of years, from 2017-2019, in close consultation with fishery stakeholders. The final harvest strategy (BDM Fishery Harvest Strategy) was adopted by the Protected Zone Joint Authority (PZJA) in November 2019 and implemented for the 2020 fishing season. The BDM Fishery Harvest recognises that data and information pertaining to the economic and social aspects of the fishery, complements that biological data currently used, to better understand the dynamics of the fishery and inform management decisions.

Social and economic data and information can be collected through a range of methods including, but not limited to, semi-structured interview-based surveys of fishers and fishery workers. Data and information that can be obtained are diverse and can include fishing effort, fishing activities, fishing income, motivations of fishers, economic importance and dependence, fishing costs, supply chain and value chain issues and opportunities, trade issues, cultural issues, perceptions of fishers (e.g. about stocks and management), changes in fishing strategies, and fishing gear use. In relation to data and information that would be useful to inform management of the BDM Fishery, these include:

- prices per species, which would both help understand demand drivers for the fishery, and support fishers planning their operations;
- mapping and analysis of value and supply chains, which would be useful to identify critical elements, strengthen the resilience of the supply chain and identify opportunities for value adding;
- characterisation of participants in the fishery;
- participants' vision for the fishery, to inform fishery management objectives;
- preferred management mechanisms, including incorporation of community-led management;
- perceptions of resource and habitat health.

Fishery dependent data currently collected by AFMA through the TBD02 catch disposal record (CDR) can provide an overview of the nature and extent of participation in the fishery by fishers across the region and should be used to inform the design of a project to collect economic and social data and information. The project will require close consultation with the HCRA, HCWG and other relevant fishery stakeholders at each stage of the project.

### **Desired outcomes:**

In close consultation with the HCRAAG, HCWG and other relevant fishery stakeholders at each stage of the project, the project is required to:

1. In consultation with the HCRAAG and HCWG, determine the key social and economic data and information needs for the BDM Fishery, including the purpose/objectives for collecting it, how it is to be used and the frequency of collection.
2. Design a practical and cost-effective data collection method (e.g. interview-based survey of fishers and fishery workers), to collect the social and economic data and information needs identified for the BDM Fishery.
3. Collect the identified social and economic data and information using the designed method.
4. Provide a report on the outcomes of the data collection program, including:
  - a. analyses of the collected data and information. For example, an analysis of differences in key socio-economic indicators (e.g. dependency, fishery income, target species and catch rates) among fisher types and locations within the fishery. Analyses to be undertaken to be informed by advice from the HCRAAG and HCWG;
  - b. an assessment of how the data collection method met the objectives;
  - c. how the social and economic data and information collected is to be used/applied;
  - d. recommendations for further extension (e.g. incorporation into the management framework for the BDM Fishery);
  - e. future data collection needs.

The report is to only include aggregated data that cannot be linked to individual fishers or businesses<sup>3</sup>.

Please note, the scope of this project may change, pending final advice from the HCRAAG and HCWG at meetings in October 2023 on data and information needs and objectives. Depending on the outcomes of this discussion, any proposals submitted in response to this scope may need amendment. For details on the outcomes of these discussions, please contact AFMA on the contacts below.

Applicants wishing to submit a proposal can contact AFMA for further information.

**Contacts:**

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Torres Strait Scientific Advisory Committee  
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<sup>3</sup> Report must be compliant with requirements under AFMA's Information Disclosure policy.

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## Torres Strait Bêche-de-mer Fishery: Management Strategy Evaluation of the Torres Strait Bêche-de-mer Fishery Harvest Strategy

### Project need:

The Commonwealth Fisheries Harvest Strategy Policy (2018) (the Harvest Strategy Policy) requires that harvest strategies be formally tested to demonstrate that they are highly likely to meet the objectives of the Harvest Strategy Policy. Where appropriate, such testing should be conducted using methods such as Management Strategy Evaluation (MSE). MSE is a procedure whereby alternative management strategies are tested and compared using simulations of stock and fishery dynamics. MSE testing should be conducted as part of the development of new or updated harvest strategies to ensure that, before any such strategies are adopted, they have a high probability of achieving the objectives of the policy. Harvest strategy testing should identify conditions or circumstances under which the harvest strategy should be subject to review, revision and re-evaluation, including when MSE testing should be redone.

A harvest strategy for the Torres Strait Bêche-de-mer Fishery (BDM Fishery), was developed over a number of years, from 2017-2019, in close consultation with fishery stakeholders. The final harvest strategy (BDM Fishery Harvest Strategy) was adopted by the Protected Zone Joint Authority (PZJA) in November 2019 and implemented for the 2020 fishing season. In relation to Harvest Strategy Policy requirements, the development of the BDM Fishery Harvest Strategy was informed by MSE used to evaluate management procedures for several other bêche de mer fisheries in Australia<sup>456</sup>.

The Harvest Strategy Policy recommends an early review of a harvest strategy (i.e. earlier than the five year standard) if it is implemented without formal testing or evaluation using methods such as MSE. MSE should also be undertaken to test the effect of changing reference points on the performance of future harvest strategies. After three fishing seasons in operation, it is timely for the BDM Fishery Harvest Strategy to undergo formal MSE testing. The PZJA's Hand Collectables Resource Assessment Group and Hand Collectables Working group have also identified the development of species-specific reference points for key species as a priority, and which will require MSE testing.

### Desired outcomes:

The project is required to:

1. Collate all data and biological information.
2. If sufficient information is available, define species-specific reference points for key species and determine the current status of stocks in relation to those species-specific reference points.
3. Revise and update the spatial multi-species operating model developed for earlier projects<sup>456</sup> (or construct a new model).

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<sup>4</sup> Plagányi, É., Skewes, T., Dowling, N., and Haddon, M. 2011. Evaluating management strategies for data-poor bêche de mer species in Torres Strait. CSIRO/DAFF Report, Brisbane, Australia.

<sup>5</sup> Plaganyi, E.E., Skewes, T.D., Dowling, N.A., and Haddon, M. 2013. Risk management tools for sustainable fisheries management under changing climate: a sea cucumber example. *Climatic Change* 119(1): 181-197. doi:DOI 10.1007/s10584-012-0596-0.

<sup>6</sup> Plaganyi, E.E., Skewes, T., Murphy, N., Pascual, R., and Fischer, M. 2015. Crop rotations in the sea: Increasing returns and reducing risk of collapse in sea cucumber fisheries. *P Natl Acad Sci USA* 112(21): 6760-6765. doi:10.1073/pnas.1406689112.

4. Use MSE to evaluate how well the BDM Fishery Harvest Strategy achieves the pre-specified objectives, including performance against the new species-specific reference points as appropriate.
5. In consultation with stakeholders, use the MSE framework to investigate ways to improve the current BDM Fishery Harvest Strategy. For example, investigate options for BDM Fishery licence holders to make arrangements for a process that would allow the under-catch of the black teatfish TAC each year to be harvested in a way that disseminates benefits broadly, while safeguarding against an over-catch of the TAC.

Applicants wishing to submit a proposal can contact AFMA for further information.

**Contacts:**

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<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>UPDATES ON OTHER HAND COLLECTABLE FISHERIES</b> <b>Pearl shell</b>	<b>Agenda Item 12.1</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the discussions and recommendations at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting, concerning the proposed changes to size limits for gold-lipped pearl shell (*Pinctada maxima*) and how pearl shell are reported in the TDB02 Catch Disposal Record (CDR);
  - b. **DISCUSS** and **PROVIDE FURTHER ADVICE** on the proposed changes to size limits for gold-lipped pearl shell (*P. maxima*);
  - c. **NOTE** updates concerning the Torres Strait Pearl Shell Fishery (the Pearl Shell Fishery) and **RAISE** any other management issues for discussion.

## KEY ISSUES

### *Catch and effort summary*

2. AFMA understands the fishery to have very little fishing activity in recent years (**Table 1**).

**Table 1. Reported annual catches of pearl shell (*Pinctada* spp.) in the Torres Strait Pearl Shell Fishery from 2018-2023 (source: TDB02 Catch Disposal Records).**

Year	Reported catches (kg)	Reported catches (numbers of individuals)
2018	-	75
2019	0.5	-
2020	-	159
2021	-	137
2022	-	262
2023 (as at 5 October 2023)	-	-

3. The following number of licences had pearl shell (PL) fishery entries over the period 2021-2023 (**Table 2**). Licence numbers are provided for both TIB licences and TVH licences.

**Table 2. Number of licences with a pearl shell (PL) fishery entry, as at 1 July each year.**

Year	Number of TIB licences	Number of TVH licences
2021	3 primary/tender packages 55 individual licences	4 primary/tender packages 3 individual licences 6 held in trust by the TSRA
2022	3 primary/tender packages 49 individual licences	4 primary/tender packages 3 individual licences

		6 held in trust by the TSRA
2023	4 primary/tender packages 38 individual licences	4 primary/tender packages 3 individual licences 6 held in trust by the TSRA

**Proposed changes to minimum size limits**

4. At their meeting in April 2015 (HCWG 8), the HCWG considered an industry proposal for the grant of developmental permits under section 12 of the *Torres Strait Fisheries Act 1984* (the Act), to take gold-lipped pearl shell (*P. maxima*) sized between 100-130 mm. The objective of proposal was to support revitalisation of the Torres Strait pearl farming industry by developing a commercial trial to investigate whether using smaller shell for seeding and culture could increase the overall productivity of pearl farming. At the time, industry considered that smaller shell enabled them to maximise their seeding cycle potential due to more cycles, with the later seeding cycles producing larger and more valuable pearls.
5. To support the HCWG's consideration of this proposal, AFMA prepared a report titled '*Options for changing the size limits for P. maxima in the Torres Strait Pearl Shell Fishery*' (**Attachment 12.1a**) to evaluate the likely impacts of changes to size restrictions. Taking this analysis into consideration, the HCWG recommended that:
  - a. developmental permits be granted to allow commercial assessment of the viability of using smaller pearl shell in pearl farming. Developmental permits should only be granted to existing licence holders with no more than 2,000 pearl shell sized between 100-130 mm to be taken in the fishery;
  - b. the minimum size limit should not be amended permanently until:
    - i. results from the trial assessing the impacts of reduced size limits for the Western Australian Pearl Fishery, can be considered; and
    - ii. further consideration to any data requirements needed to support a change is made.
6. Following the recommendation from the HCWG in 2015, in August 2015 the PZJA agreed to issue developmental permits to existing licence holders for the taking of undersized gold-lipped pearl shell (*P. maxima*). In providing this approval, the PZJA agreed that permanent changes to size limits would not be made until more information on the status of stocks and likely impacts on the stocks is known.
7. Eight existing licence holders were subsequently issued developmental permits in March 2016 with a competitive total allowable catch set of no more than 2,000 undersize pearl shell sized between 100-130 mm to be taken within the allocated period of one year. Mandatory catch reporting of harvested pearl shell was a condition of the permit. Only two of the eight permits issued were active during the trial.
8. In 2017, AFMA undertook a review of the developmental permit trial in an effort to understand the low uptake of developmental permits that were issued. Through interviews with permit holders and buyers, AFMA understands that:
  - a. approximately 800 pearl shell was reported to have been harvested during the permit period, with roughly 15-20% comprised of shell between 100-130 mm;
  - b. the pearl shells harvested were used for seeding in aquaculture but due to the low level of undersize pearl shell harvested, any benefits to the aquaculture sector in relation to any improvement in profitability could not be determined;
  - c. the primary reason as to why there is little interest in fishing the Pearl Shell Fishery by both TIB and TVH fishers is due to more lucrative opportunities in other Torres Strait fisheries (e.g. Tropical Rock Lobster).

9. At their meeting in October 2017 (HCWG 11), the HCWG considered the outcomes of the trial. No further recommendations were made.
10. There remains interest in the harvest of undersized gold-lipped pearl shell (e.g. <130 mm) by operators in the pearl farming industry, as the harvest of smaller pearl shell maximises the seeding potential of the shell (i.e. enables the shell to be used for four seeding cycles). This has economic importance as the pearls produced in the third and fourth seeding cycles are larger and more valuable.
11. Advice is sought from the HCWG on any management considerations relevant to a permanent change to size limits, noting previous HCWG recommendations and PZJA decisions.
12. With reference to the recommendations from HCWG 8, following is an update on Western Australia's trial of reduced size limits as well as a description of size limits in place in other Australian fisheries:
  - a. Western Australia – the minimum size for wild stock collected *P. maxima* is 120 mm shell length (measured dorso-ventrally) however, a minimum legal size of 100 mm (restricted to 15% of the total catch) has been trialled since 2011. The 100 mm trial was approved by the CEO at the request of the pearling industry to ascertain the suitability of smaller wild pearl oysters for seeding, noting that the 120 mm size had been in place for many years and that seeding techniques had progressed over time. The trial began in 2011 for three years and has now been approved to continue until 31 December 2022;
  - b. Northern Territory – nil;
  - c. Queensland – not less than 130 mm or greater than 230 mm length.
13. With reference to PZJA decision regarding the status of the pearl shell stock, the Pearl Shell Fishery has not been formally assessed since 1989<sup>1</sup>. Limited information on pearl shell abundance and distribution is collected during TRL surveys. The value of this data in determining the status of the stock and likely impacts of the change would need to be determined.
14. This proposal will need to be considered against the objectives of the Act and regard given to other priorities for hand collectables fisheries and available resourcing. Any changes to pearl shell size limits will require amendments to the *Torres Strait Fisheries (Pearl Shell) Instrument 2020* (the Pearl Shell Instrument) and/or licence conditions.

#### **Reporting in TDB02 Catch Disposal Records**

15. Currently catches of pearl shell are reported in TDB02 CDRs as numbers of individuals. There has been feedback from industry that weighing pearl shell is not practical.
16. Advice will be sought from the HCRAG at the preceding meeting on whether the reporting of pearl shell in numbers of individuals, as opposed to kg, has implications for future monitoring and assessment of the status of the pearl shell stock, noting the largely inactive nature of the Pearl Shell Fishery. HCWG advice on this issue is not required at this time.
17. In other Australian fisheries, catches of pearl shell are reported as follows:
  - a. Western Australia – numbers of individuals (TAC measured in numbers of individuals);
  - b. Northern Territory – numbers of individuals (TAC measured in numbers of individuals);
  - c. Queensland – both kg and numbers of individuals (no TAC).
18. The TDB02 CDR currently requires reporting of pearl shell catches in kg, though there is a field providing for numbers of individuals to be reported (currently for use for live finfish only). Any

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<sup>1</sup> Colgan K, Reichelt RE (1991) Torres Strait pearl bed survey 1989. Bureau of Rural Resources. Report to the Torres Strait Fishing Industry and Islanders Consultative Committee and Torres Strait Fisheries Management Committee. May 1991.

change to how pearl shell are to be reported will require amendment to the CDR and/or licence conditions.

#### **ABARES Fishery Status Reports**

19. The Pearl Shell Fishery has not been assessed by ABARES.

#### **2023 Australia-PNG bilateral meetings**

20. Australia-PNG bilateral meetings that were held in PNG from 25-28 July 2023. With regards to the Pearl Shell Fishery, Australia and PNG declined to enter into catch sharing arrangements for the 2024 fishing season.

## **BACKGROUND**

### **Management arrangements**

21. The gold-lipped pearl shell (*P. maxima*) and to a lesser extent the black-lipped pearl shell (*P. margaritifera*) are the main species targeted in the Torres Strait. Pearl shell is collected live for pearl culture farms by divers free diving or using hookah diving equipment. Pearl farming is regulated by the Queensland Department of Agriculture and Fisheries.
22. The Pearl Shell Fishery is primarily managed under the Pearl Shell Instrument. Key management arrangements in place for the Pearl Shell Fishery include:
  - a. a prohibition on the take of dead gold-lipped pearl shell;
  - b. minimum and maximum size limits for gold-lipped pearl shell and black-lipped pearl shell (not less than 130 mm or greater than 230 mm length; and greater than 90 mm length, respectively), which are aimed at ensuring the most suitable shells are taken for farming while protecting young shell and spawning stocks; and
  - c. banning the taking of shell by any method other than diving or collecting by hand.



Australian Government

Australian Fisheries Management Authority



# Options for changing the size limits for *Pinctada maxima* in the Torres Strait Pearl Shell Fishery

AND OTHER RECOMMENDATIONS FOR MANAGEMENT

PREPARED BY AFMA FOR THE TORRES STRAIT  
HAND COLLECTABLES WORKING GROUP

LISA STEVENSON  
NOVEMBER 2014



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## ***List of Acronyms***

AFMA	Australian Fisheries Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organization
DFWA	Department of Fisheries Western Australia
DVM	Dorsoventral Measurement
ECPF	East Coast Pearl Fishery
FMN	Fisheries Management Notice
FMI	Fisheries Management Instrument
HCWG	Hand Collectables Working Group
ITQ	Individually Transferable Quota
OOS	Out of Session
PNG	Papua New Guinea
PZJA	Protected Zone Joint Authority
QAIF	Queensland Aquaculture Industries Federation
QDAFF	Queensland Department of Agriculture, Fisheries and Forestry
QDPI	Queensland Department of Primary Industries
TAC	Total Allowable Catch
TIB	Traditional Inhabitant Boat Licence
TRL	Tropical Rock Lobster
TSFIICC	Torres Strait Fishing Industry and Islanders' Consultative Committee
TSFMAC	Torres Strait Fisheries Management Advisory Committee
TSFMC	Torres Strait Fisheries Management Committee
TSFSAC	Torres Strait Fisheries Scientific Advisory Committee
TSPSF	Torres Strait Pearl Shell Fishery
TVH	Transferable Vessel Holder Licence





## 2 Executive summary

This report was commissioned to review a proposal to change the size limits for the gold-lipped pearl oyster (*Pinctada maxima*) from 130–230mm to 100–200mm in the Torres Strait Pearl Shell Fishery (TSPSF). The proposal was introduced as a potential option for revitalising the fishery and the associated pearl industry. The review included evaluation of the effectiveness of management arrangements for the fishery in the context of the biology of the oyster, the history of the fishery, current stock status and feedback from the pearl industry, biologists and fishery managers in other jurisdictions (e.g. the Western Australia and Queensland pearl oyster fisheries). The evaluation formed the basis of additional recommendations regarding the overall management of the fishery.

The report concludes that reducing the size limits would benefit the long-term sustainability of the pearl shell resource, as well as the viability and revitalization of the Torres Strait pearl industry. It would subsequently align with the objectives of *Torres Strait Fisheries Act 1984*. As part of any proposal to review size limits, consideration would need to be given to the implementation and feasibility of interim measures to ensure continued supply to pearl farms while the transition to the new management arrangements occurs. A community education and extension program regarding the change may be required to enhance awareness and compliance.

The report additionally concluded that current management arrangements for the TSPSF are ineffective. Ineffectiveness can be attributed to lack of change in response to reports of stock depletion throughout the past 100 years, lack of information with which to make management decisions, and the biological characteristics of the pearl oyster (e.g. reproductive and recruitment strategy, the gender-size relationship, size at sexual maturity). However the low levels of activity in the fishery mean that review of and subsequent changes to management arrangements are not a priority. The resulting additional recommendations comprise:

1. Acknowledgement of the need for revised management arrangements in the TSPSF
2. Completion of a formal stock assessment of the TSPSF
3. Enforcement of size limits for all participants in the TSPSF
4. Small-scale area closures to enhance stock rejuvenation
5. Inter-jurisdictional consistency with Queensland.

These additional recommendations would need to be considered in order to determine what 'good fisheries management' in the TSPSF looks like, particularly if its participants desire to maximise the long term sustainability of the pearl shell resource and establish an economically viable niche market for Torres Strait pearls.



### 3 Purpose

This report was produced in response to a request from the Torres Strait Hand Collectables Working Group (HCWG) in October 2013 to review a proposal to change the size limits for the gold-lipped pearl oyster (*Pinctada maxima*) from 130–230mm to 100–200mm<sup>1</sup>. The proposal was introduced as a potential option for revitalising the Torres Strait Pearl Shell Fishery (TSPSF) and the Torres Strait pearl industry.

The main focus of this report is to assist the HCWG in making informed recommendations as to the viability of changing the current size limits. The review included evaluation of the effectiveness of current management arrangements for the fishery in the context of the biology of the oyster, the history of the fishery, current stock status and feedback from the pearl industry, biologists and fishery managers in other jurisdictions (e.g. the Western Australia and Queensland pearl oyster fisheries).

The evaluation also formed the basis of additional recommendations regarding the overall management of the fishery. The additional recommendations would need to be considered to determine what ‘good fisheries management’ for the TSPSF looks like, which would be necessary if its participants desire to maximise the long term sustainability of the pearl shell resource and establish an economically viable niche market for Torres Strait pearls.

Where applicable the scientific/management basis of the recommendations for the HCWG is discussed in full detail as *Supporting Information*. An additional issue raised at a previous HCWG meeting regarding the accuracy of shell size as an indicator of age is addressed in the *Addendum*.

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<sup>1</sup> Shell size (e.g. 130–230mm) in this report is equivalent to ‘dorsoventral measurement’ (DVM), which is the greatest dimension of the oyster measured at right angles to the hinge line (refer to Figure 5 on pg 28) (Chellam 1978).



## 4 Proposal for change in size restrictions

The current size limits for the gold-lipped pearl oyster *Pinctada maxima* (*P. maxima*) is 130–230mm. Mr Rusty Tully, of Torres Pearls, through the HCWG has recommended that the size limits be changed to 100–200mm.

The proposed change in the size limits for pearl oyster shell in the Torres Strait will:

### 1) Allow smaller, faster growing oysters to be harvested

The harvest of smaller oysters will maximise the seeding potential of shell (i.e. enable shell to be used for four seeding cycles). This has economic importance to the pearl culture industry as the pearls produced in the third and fourth seeding cycles are larger and more valuable.

*See Biology: Pinctada maxima (pg 12)*

### 2) Protect breeding stock and support the long-term sustainability of the pearl shell resource

The current status of pearl oyster stocks in the Torres Strait is uncertain. However the fishery is historically described as suffering chronic depletion and current management arrangements are ineffective in ensuring the sustainability of the fishery. The proposed size limits align more closely to the precautionary size limits in other jurisdictions and align with previous recommendations by management for more precautionary maximum size limits (AFMA 2006).

*See Biology: Pinctada maxima (pg 11), Current management arrangements (pg 16), Effectiveness of current management arrangements (pg 19), Issues for management (pg 20)*

### 3) Support the revitalisation of the Torres Strait pearl farming industry

Torres Strait pearls have superior lustre and thick nacre (mother-of-pearl) in comparison to other regions, making the Torres Strait ideal for the establishment of a niche market<sup>2</sup>. There is also potential for secondary markets in mother-of-pearl and pearl meat. Interest in revitalisation has previously been expressed at management meetings (e.g. HCWG/1, /3) but no action has ever eventuated. Previous assessments note that the TSPSF could probably sustain a small amount of wild shell harvest under effective management arrangements (Colgan & Reichelt 1991; TSFMAC/1). Plans to revitalise the industry would need to take into consideration the objectives of Commonwealth and Torres Strait fisheries legislation.

*See Issues for management (pg 20)*

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<sup>2</sup> Refer to QDPI (1994) for a detailed description of strengths and opportunities in the TSPSF.



## 4.1 Implementation

If the proposal is supported by the HCWG a recommendation will be made to the PZJA seeking to amend the *Torres Strait Fisheries Management Instrument No. 7*. An estimation of the costs for the process of a change in size limits would need to be developed. Plans for the implementation of the amendment would additionally need to be approved.

A five-year transition period has been recommended. During this time licence holders would be entitled to collect/purchase up to 500 large shell (200–230mm) to ensure supply, as well as being allowed to collect smaller shell (i.e. from the 100mm minimum size limit). The proposed interim measure is based on limited exploratory surveys conducted by a licence holder in late 2014. The surveys noted that it may currently be difficult to acquire sufficient amounts of 100–200mm shell due to uncertainty regarding the location of existing shell beds and the potentially depleted status of stocks (R Tully, 2014, pers. comm., September 24). The feasibility of the proposed transition period for management would need to be considered by the HCWG. Any decision would need to be made in consultation with the pearl industry.

Potential changes in size limits would additionally need to be discussed with the traditional community, in terms of community support or opposition, and the cultural significance of the pearl oyster. If the reduction in size limits is implemented efforts in community education and public awareness may need to be refreshed. Previous discussions with industry at working group meetings have suggested that both the catching sector and farm operators have little knowledge of the legislation in relation to size limits on pearl shell (AFMA 2006). Any community education program should particularly promote leaving larger shell (i.e. broodstock) alone.

## 4.2 Support for a reduction in size limits

- **Management:** The proposed change in size limits would align more closely with previous recommendations for more precautionary size limits. The minor catches predicted under these restrictions are regarded as unlikely to negatively impact the fishery if effective management strategies are in place (HCWG/1; R Moore 2014, pers. comm., 13 October).<sup>3</sup>

*See Evaluation of size limits (pg 20)*

- **Industry:** While the pearl industry does not directly acknowledge that depletion may be a major issue for the TSPSF, there appears to be a consensus that more efforts need to be made to protect broodstock and encourage stock recovery.
- **Industry:** A minimum size limit of 100mm would prevent attempted sale of 'bastard shell' (*P. albina*) to pearl farms. *P. albina* is common in the surface layers of water in

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<sup>3</sup> Pearl farms have previously reported that they require a consistent supply of 2000–3000 shell per year to remain viable. However it has been suggested that a farm can remain viable on <2000 shell per year if required and that all pearl farming operations in the Torres Strait would require a total of <6000 shell per year (R Tully 2014, pers. comm., 03 September). These numbers are thought to have little impact on a population of several million (T Skewes [CSIRO] 2014, pers. comm., 14 October).



the Torres Strait and can sometimes be mistaken for juvenile *P. maxima* by fishermen unfamiliar with oysters. It can be distinguished in that it reaches a maximum size of approximately 90mm and is only suitable for mabe ('half pearls').

- **Cross-jurisdictional:** The Department of Fisheries Western Australia (DFWA) initiated a trial to reduce the legal minimum size limit for pearl oyster collection in Western Australia from 120mm to 100mm for 15 per cent of wildstock quota. The trial for the reduction in size limit was conducted in Zones 2 and 3 (see Appendix C). This was to assess the suitability of smaller shell for pearl culturing. The trial was due for completion in 2012-13 but has now been extended until 2016 (R Jones [DFWA], pers. comm., 30 September).

The Department's Research Division reported that there were no perceived sustainability issues relating to reducing the size limit (DFWA 2013). No formal interim reports have been published or made publically available.

It should be noted that while the reduction of the minimum size limit in Western Australia has not negatively affected the local stocks, the fishery is managed very differently to the TSPSF.

*See Current management arrangements (pg 16)*

### 4.3 Opposition to a reduction in size limits

- **Management:** It is possible to argue for the closure of the TSPSF based on the objectives of the *Fisheries Management Act 1991*. The fishery remains open due to the different priorities of the *Torres Strait Fisheries Act 1984*. However some believe that size limits are irrelevant and favour indefinite closure based on the uncertain status of stocks and possible failure of recruitment, to prevent continued exploitation of what is regarded as a depleted stock.

*See Issues for management (pg 20)*

- **Industry:** A maximum size limit of 200mm was previously reported as causing pearl farms to reject approximately 60 per cent of shell presented for sale (TSFIICC/7). This was the initial impetus for increasing the maximum size limit to 230mm. Statements from some in the pearl industry at the time (i.e. 1989) that the increased size limit would be effective in protecting broodstock have not necessarily been demonstrated or confirmed by research.
- **Industry:** One pearl farm in the Torres Strait expressed concern that shell collected at 100mm would be too delicate to harvest without causing damage.



#### **4.4 Additional recommendations for management**

A number of additional management recommendations have been produced based on evaluation of current arrangements and the status of pearl shell stocks:

##### **1) Acknowledgement of the need for revised management arrangements in the TSPSF**

Despite a history of severe exploitation and depletion, management arrangements have remained relatively unchanged since the late 1800s. Change has been repeatedly deferred due to a lack of information with which to make informed decisions (HCWG/2).

This report identifies the ineffectiveness of current management arrangements for the TSPSF and presents sufficient evidence for informed decisions to be made on the future management of the fishery.

*See History of the TSPSF (pg 15), Current management arrangements (pg 16), Effectiveness of current management arrangements (pg 19), Issues for management (pg 20)*

##### **2) Completion of a formal stock assessment of the TSPSF**

The fishery has not been formally assessed since 1989 and the current status of stocks is uncertain. While there have been low levels of activity over more recent decades, lack of a formal stock assessment precludes the rational management of the TSPSF. A comprehensive stock survey (estimated at approximately \$448 000 based on costs for TRL surveys) is required to:

- Fully understand the potential implications of pearl oyster biology (e.g. reproductive and recruitment strategy, the gender-size relationship, size at sexual maturity) and the effects of the pearl farm environment (e.g. overwhelming bias towards maleness and potential reproductive infertility) on wildstock.
- Implement effective management arrangements that fulfil the management objectives of the fishery and maximise its use in accordance with the *Torres Strait Fisheries Act 1984* and the Torres Strait Treaty.

*See Biology: Pinctada maxima (pg 10), History of the TSPSF (pg 15), Current management arrangements (pg 16), Effectiveness of current management arrangements (pg 19), Issues for management (pg 20)*



### 3) Enforcement of size limits for all participants in the TSPSF

Traditional inhabitants do not currently require a licence and are exempt from the size limits imposed on other participants in the TSPSF when fishing for traditional purposes (i.e. not for commercial sale). Those licenced as community fishers are also exempt from the size limits if their boat is <6m in length. These exemptions were first introduced in management notices in 1997 (see *FMN No. 36*). There are concerns that the lack of size limits for traditional and community fishing enables shell beds to be stripped of shell, with legally sized oysters being sold on to pearl farms and under-/over-sized shell being retained for personal use.

While likely to be a contentious issue, it is suggested that size limits be introduced for traditional and community fishing and enforced across all sectors of the fishery. It is important that the issue is addressed in consultation with indigenous communities within the Torres Strait in the context of the sustainability of the fishery and traditional practices. More information may also be needed to clarify why the exemptions were initially introduced. A consultative approach is essential to address potential negative perceptions of the enforcement of size limits and improve methods to enhance the sustainability of the fishery.

*See Biology: Pinctada maxima (pg 10), Current management arrangements (pg 16), Effectiveness of current management arrangements (pg 19), Issues for management (pg 20)*

### 4) Small-scale area closures to enhance stock rejuvenation

Closure of the fishery has been suggested repeatedly throughout the history of the TSPSF and has been a matter of concern to the pearl industry since at least 1987 (TSFIICC/5). The topic has been a reoccurring feature of proposed management options since it was first raised in 1901. Indefinite closure of the fishery was identified by AFMA's TSPSF Discussion Paper (2006) as the preferred option for future management, and was discussed again in 2007 (HCWG/1) and at the Australia-PNG Bilateral Fishery Talks in 2012.

A more palatable alternative to indefinite closure is a number of small localised closures for areas where large areas of shell are known to occur. These closures would be similar to the Conservation (Yellow) Zones in the Great Barrier Reef Marine Park in their intent to protect broodstock, boost recruitment and support the long term sustainability of the population. Localised closures would be in line with the objectives of the TSPSF to conserve stock while maximising access for traditional inhabitants. The location of closed areas and options for enforcement would need to be agreed in consultation with fishermen, researchers and managers.





An additional suggestion complementary to the implementation of localised closures is to allow for 'old shell' from pearl farms that are no longer suitable for pearl production to be returned into closed areas to boost broodstock and enhance population recruitment.<sup>4</sup> However return of shell to wild stock after use in pearl farms would need to be assessed in the context of biosecurity risks.

*See Biology: Pinctada maxima (pg 10), Current management arrangements (pg 16), Effectiveness of current management arrangements (pg 19), Issues for management (pg 20)*

## 5) Inter-jurisdictional consistency with Queensland

Management arrangements are consistent between the Torres Strait and Queensland pearl shell fisheries, except in that recreational fishing is permitted under Queensland regulations. Pearl oysters collected recreationally are exempt from the bag limit of 50 that applies to all other molluscs. This is because recreational harvest activity in Queensland is thought to be negligible, meaning that size limits alone are considered sufficient to protect stocks (J Webley [QDAFF] 2014, pers. comm., 21 November). Commercial harvest activity is also considered to be minimal, with the annual catch of *P. maxima* being <1000 shell since 2002-03 (QDEEDI 2012).

It is not expected that there would be any effects on the Queensland oyster population if size limits were reduced in the Torres Strait (J Webley [QDAFF] 2014, pers. comm., 21 November). It is unknown whether the small number of Queensland commercial licence holders are aware of the differences between Queensland and Torres Strait regulations.

However, the viability of the TSPSF may be affected by the productivity of the Queensland oyster stocks (QDPI 2004). It is therefore recommended that:

- a) Action is taken to encourage consistency between the Queensland and Torres Strait jurisdictions
- b) An education program is initiated to generate awareness of Torres Strait regulations in Queensland.

If the reduced size limits for the gold-lipped pearl oyster are implemented there would need to be consultation with the relevant branch of Fisheries Queensland regarding their ability to enforce a change in regulations.

*See Management of the TSPSF (pg 14), Current management arrangements (pg 16)*

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<sup>4</sup> A similar suggestion was made in 2007 to relocate stocks closer together to increase chances of successful fertilization and stock recovery (HCWG/7).





## 5 Supporting material



## 5.1 Biology: *Pinctada maxima*

### Species description

*P. maxima*<sup>5</sup> are the most abundant of the seven species of the pearl oyster genus *Pinctada* found in the Torres Strait (Colgan & Reichelt 1991). It is the largest species of its genus (Hynd 1955; Rose & Baker 1994), with average maximum shell size being 200–250mm (Gervis & Sims 1992).

The oyster is characterized by a long straight hinge (Gervis & Sims 1992). The external shell is a light fawn colour; it is distinguished from other species by its lack of both radial markings and internal hinge teeth (Hynd 1955; Gervis & Sims 1992). The adult colour morph is usually established by approximately 120mm, with traces of the juvenile colour morphs of green, purple-black, yellow, cream, grey and brown retained only in the umbo region (Gervis & Sims 1992). *P. maxima* are known for the rich lustre of its nacre and the gold or silver band on the internal lip (Figure 1). This is the source of its common names: the gold or silver-lipped pearl oyster. Torres Strait specimens are known for having a wider and more conspicuous lip than specimens from Western Australia and the Northern Territory (Hynd 1955). Shell taken in Torres Strait and PNG waters has previously been reported as containing >50% of gold-lipped shells; discussions with Torres Pearls suggest that the different morphs may now be represented in approximately equal proportions.



Figure 1: Outer and inner shell of *Pinctada maxima* (gold-lipped specimen)

<sup>5</sup> *P. maxima* is currently regarded as the accepted name for the species. However, the earlier name *P. anomioides* (Reeve 1857) has been put forward as the more valid nomenclature (Tëmkin 2014). It should be kept in mind that while not in current usage *P. anomioides* still appears in some of the older literature.



## Distribution

The range of *P. maxima* spans across the subtropical and tropical coastal waters of south-east Asia and Northern Australia (Hynd 1955). This extends from Hainan off the coast of China, down to the west coast of Australia (approximately 20°S) and across to the east coast of Australia (approximately 25°S) (Gervis & Sims 1992; Yukihiro et al 2006), including the Solomon Islands, Burma and the Philippines (O'Brien & Colgan 1995).

*P. maxima* can tolerate a broad range of environmental conditions and habitats. It is often found in turbid environments and strong currents (Yukihiro et al 2006; Gervis & Sims 1992) and tolerates a wide range of salinities (Gervis & Sims 1992). Australian populations experience temperatures between 19–32°C (Gervis & Sims 1992) although optimal temperature for growth occurs at 23–28°C (Yukihiro et al 2006). Distribution is limited by the availability of hard substrate on which spat can settle, although adult specimens also occur on mud/sand or in association with seagrass beds (Gervis & Sims 1992). They have a depth limit of approximately 80m but are most predominately found at depths down to 50m (Hynd 1955; Rose & Baker 1994).

Within the Torres Strait the density of *P. maxima* populations shows some significant differences with habitat type (Pitcher et al 1992). The four major habitat types are described as 'mud substrates', 'sand substrates', 'deep reef substrates' and 'gravel substrates' (O'Brien & Colgan 1995). Greater population density was recorded in association with high densities of epibenthic fauna, however habitat type itself is not necessarily a good predictor of population density overall (Pitcher et al 1992).

## Lifecycle

*P. maxima* are protandrous hermaphrodites (beginning as male and later changing to female). Age and size are significant factors in determining the number of males and females in the population, with males present at smaller sizes and females only occurring in the larger size groups (Lee 2010). Gender is not externally obvious but can be distinguished using gonad colouration (white in males and yellow in females) (Rose et al 1990; Lee 2010). In general:

- Males are predominant between 80–170mm (Lee 2010)
- Females rarely occur until shell size >140mm (Lee 2010)
- The ratio of females to males increases with size (from approximately 150mm) and reaches 1:1 amongst individuals >170mm (Rose & Baker 1994)<sup>6</sup>
- Reproductive maturity occurs in males at approximately 110mm, and at approximately 170–180mm in females (Rose et al 1990)
- Individuals of indeterminate gender occur across the entire age and size range

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<sup>6</sup> Hynd (1957) reported that wild populations in the Torres Strait only attained 1:1 sex ratio at approximately 200mm. A 1:1 sex ratio at a shell size of approximately 200mm was also reported by Lee (2010) in Indonesia.



- Sex reversal from female back to male can occur under stress (Rose et al 1990).

Data from Western Australia suggest that individuals reach approximately 120mm in the third year of life and that large oysters (approximately 200mm) can be 15–20 years old (Joll 1996).

Like most marine molluscs *P. maxima* is a broadcast spawner. Successful fertilization is density dependent (i.e. increasing distance between spawning individuals reduces the probability of successful fertilization) (Rose et al 1990). The maximum distance at which successful fertilisation can occur in pearl oysters is unknown, but densities must remain high enough to ensure that when eggs and sperm are released they are close enough to enable successful fertilisation. Spawning is thought to be triggered by temperature changes or sudden changes in environmental conditions. It has been suggested that high recruitment corresponds with El Niño conditions (Hart et al 1990). Shell size is not thought to be related to fecundity.

The proportion of mature gametes in the population is highest during the warmer months (Gervis & Sims 1992). Reproductive seasonality is therefore best considered as 'relative breeding intensities' with a 'major breeding season' rather than discrete spawning periods (Tranter 1958b). The breeding season in northern Australia spans September–October to March–April, with a primary spawning peak at the start of the season and a secondary peak at the end (Rose et al 1990). The larval period ranges from 25–35 days. Spat generally settle in small aggregations of 2–8 individuals (Rose & Baker 1994). Larvae and spat experience high rates of natural mortality due to predation by fishes, rays, octopus, starfish, crustaceans and other molluscs.

### ***Pinctada maxima* in pearl culture**

Shell size is the primary criterion used in collecting oysters for pearl culture. Oysters must be large enough for pearl nucleus implantation, with *P. maxima* reportedly requiring a minimum shell size of 120mm (Gervis & Sims 1992). Population modelling in Western Australia found that oysters reach 120mm at approximately three years of age (Joll 1996). Older age groups are not regarded as suitable for round pearl culture because growth processes slow with age (Baker & Rose 1994); oysters >160–170mm (6–7 years old) are generally considered too old to be collected for pearl culture (Joll 1996).



**Box 1: Use of pearl shell on a pearl farm (acquisition, pearl culture and lifespan)***Acquisition of pearl oysters ('shell') for culture*

Wild shell is bought from licenced fishermen for approximately \$20 per shell. Collection and purchase of shell generally occurs around November–February when the TRL season has finished and divers are available to collect pearl shell; shell could theoretically be collected at any time of the year in suitable conditions (R Tully 2014, pers. comm., 19 November). Shell is also collected by those fishing for TRL and trochus however current effort levels are considered to be very low. O'Brien & Colgan (1995) reported collection around neap tides in October–March. Once shell is purchased they are usually left in hanging baskets for up to six months to acclimatise to the pearl farm environment prior to seeding.

*The pearl culture cycle***1. Pearl seeding (pearl nucleus implantation)**

Although Gervis and Sims (1992) recommend that pearl nucleus implantation should be done at  $<26^{\circ}\text{C}$ , seeding can occur at any time of the year. To initiate the process, one good-quality healthy shell (the donor) is 'sacrificed' and the mantle is cut into pieces. The mantle is a layer of tissue that secretes nacre ('mother of pearl').

The piece of mantle is inserted next to the gonads of another 'virgin' oyster, with a pearl nucleus (a small ball made from Mississippi mussel shell) being implanted within it. The use of the mantle is similar to the concept of a tissue graft and facilitates the formation of the pearl sac around the nucleus.

**2. Monitoring pearl growth**

After seeding shell are placed in mesh panels and returned to the water for the 'grow out' phase. The shell is cleaned after approximately two months, and then cleaned again and x-rayed approximately four months after seeding.

X-ray enables pearl farms to check that the nuclei have successfully established. When a nucleus does not establish it is referred to as a 'vomit'. Up to 20 per cent of newly seeded oysters can vomit if environmental conditions are unfavourable (e.g. during storms). Shell where vomits have occurred can be immediately re-seeded.

**3. Pearl harvest**

It takes two years for the pearl to develop. Harvest is best done in the colder months (June–August) due to the gonads being retracted. This results in a tighter lay of nacre and better quality pearls. A slit is cut into the pearl sac and the pearl is removed. The shell is then re-seeded with another nucleus of a similar size to the removed pearl.

An individual oyster can be used for up to four pearl culture cycles. Each cycle produces a sequentially larger pearl; third and fourth cycle pearls are the largest and the most valuable.

Not all oysters will reach the fourth cycle. For example, if 100 shell are seeded for Cycle 1, approximately 75–85 per cent will be reseeded for Cycle 2. 50–60 per cent of the original number will be reseeded for Cycle 3, and only 30–40 per cent of the original number will reach Cycle 4.

Conventional literature defines 120mm as the minimum shell size required for pearl nucleus implantation (Gervis & Sims 1992). However, 100–120mm has been suggested as the best starting size for Cycle 1 depending on the thickness and condition of the shell (R Tully 2014, pers. comm., 05 November). Large scale commercial hatcheries reportedly start seeding shell at 80–90mm, presumably to maximize the number of shell reaching Cycle 4.

When shell becomes 'too old' or otherwise unsuitable for seeding it can be used for 'mabe' (half/blister pearls). Mabe take one year to develop and can then be sold as ornaments or turned into jewellery. Harvesting mabe kills the oyster. Oysters can thus have a life of up to nine years in the pearl culture environment.





## 6 Management of the TSPSF

The TSPSF is managed by the Protected Zone Joint Authority (PZJA). The TSPSF boundary extends into PNG waters. It also includes the Australian waters within the Torres Strait Projected Zone and the 'outside but near' areas defined in the *Torres Strait Fisheries Act 1984* (Figure 2). The *Torres Strait Fisheries Act 1984* also gives effect to the fisheries elements of the Torres Strait Treaty, which includes the TSPSF.

The Torres Strait Treaty requires cooperative conservation, management and optimal utilization of resources, the protection of traditional fisheries and catching sharing arrangements between PNG and Australia under Articles 20–23. Catch sharing arrangements are negotiated at annual Australia-PNG fisheries bilateral meetings.

AFMA is responsible for the day to day management of the Torres Strait fisheries on behalf of the PZJA. Management arrangements for the TSPSF are discussed at the Torres Strait Hand Collectables Working Group (HCWG) meetings, with secretariat services for the HCWG being provided by AFMA.

The management of licensing, enforcement, and pearl farms falls under the jurisdiction of the Queensland Government. Pearl farming is considered part of the Queensland aquaculture industry. Differences between Queensland state and Torres Strait regulations for pearl oyster fisheries are detailed in *Box 2*.

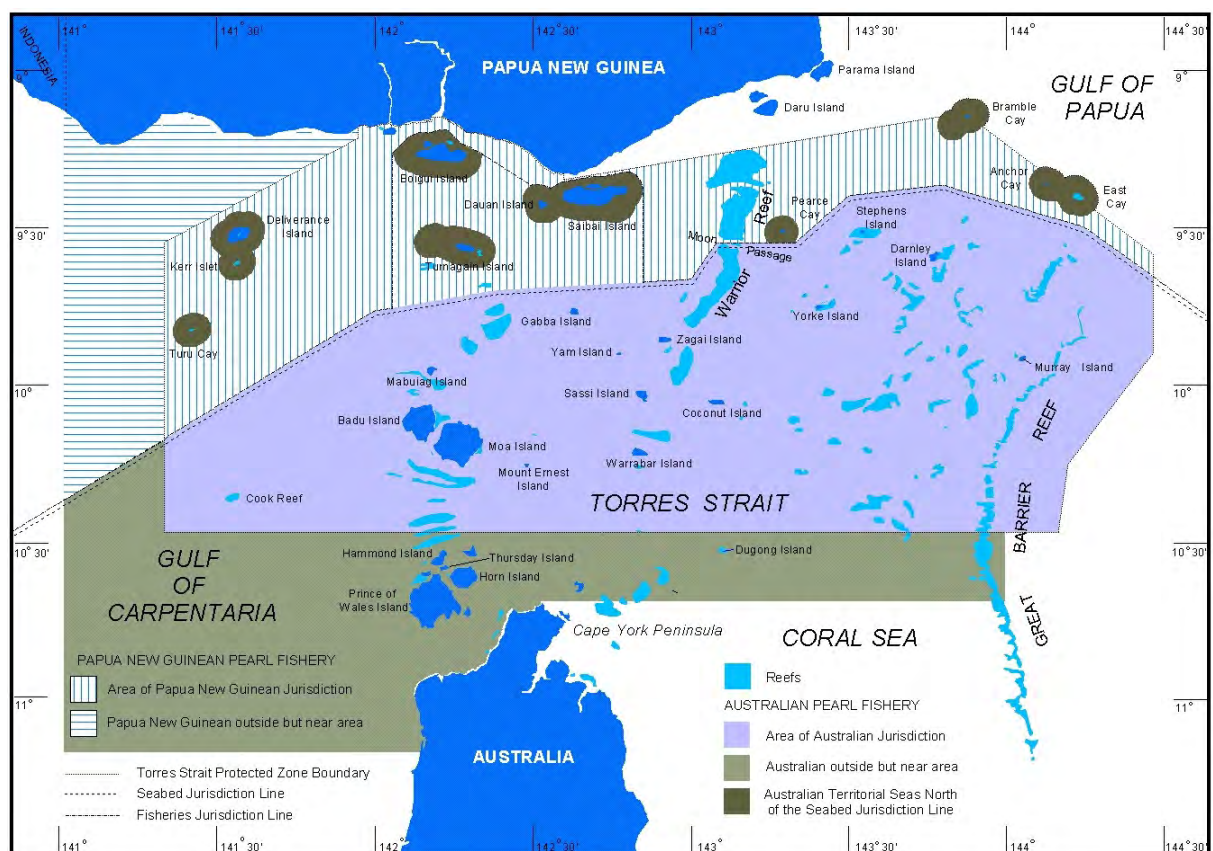


Figure 2: Map of the Torres Strait Pearl Shell Fishery



## 6.1 History of the TSPSF

Pearl oysters were first discovered in the Torres Strait in 1868. The establishment of Thursday Island as a port was entirely dependent on the pearl shell industry. Thursday Island was the centre for the pearl shell industry in the Torres Strait from 1900-1960 (Bach 1955).

O'Brien and Colgan (1995) describe two main pearl shell grounds, these being the 'Old Ground' (discovered 1881; Bach 1955) and the 'New Ground' to the west and north-west of Thursday Island. The pearl shell grounds historically extend north to PNG and east to Darnley Island (Figure 3). For a more comprehensive summary of the history and management of the TSPSF see Attachment A.<sup>7</sup>

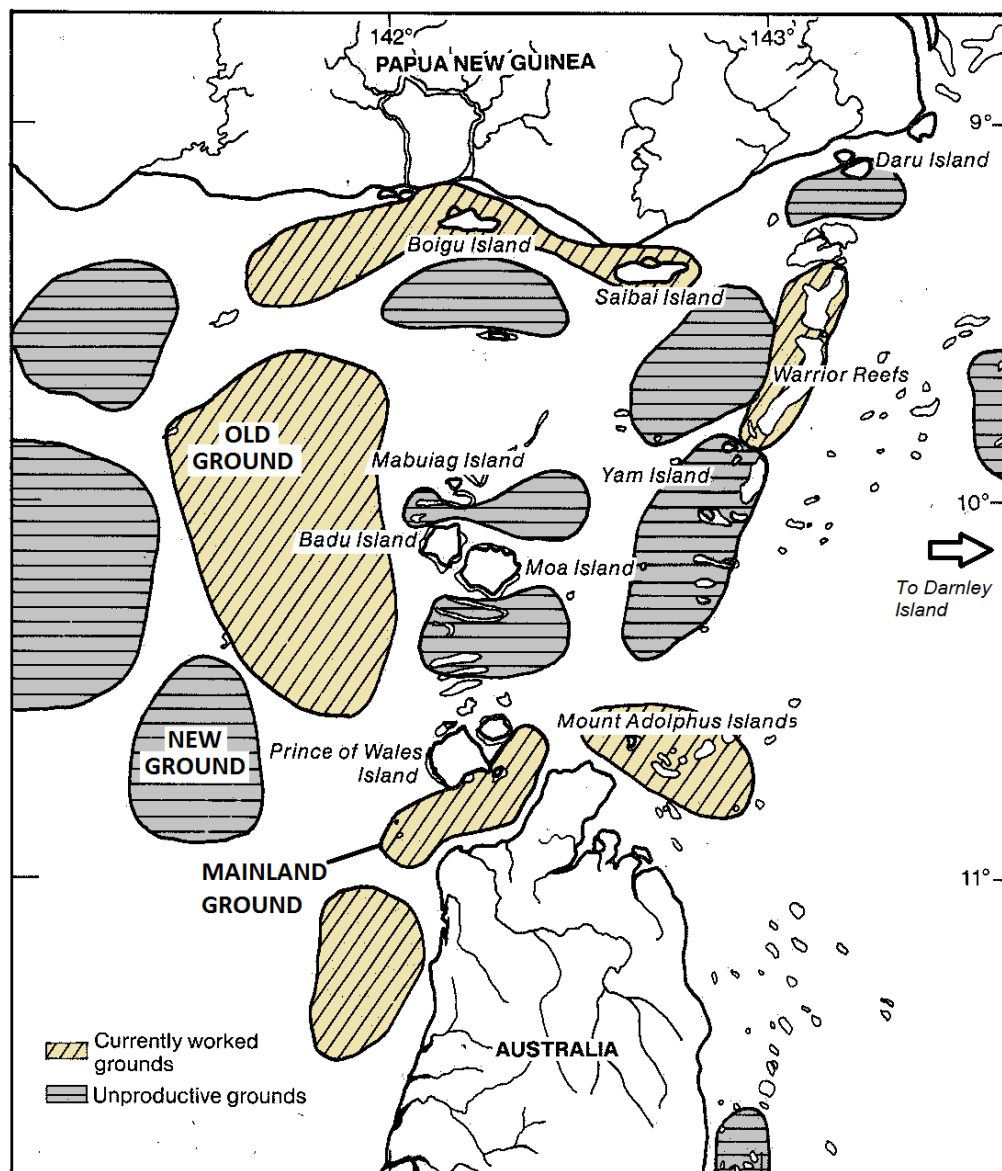


Figure 3: Map of pearl grounds and active/non-active status (Yamashita 1986); private exploratory surveys by a licence holder in late 2014 suggest the map is outdated

<sup>7</sup> See Bach (1955) for a detailed overview of the Torres Strait pearl industry.



## 6.2 Current management arrangements

Current management arrangements for the TSPSF are defined by the *Torres Strait Fisheries Management Instrument No. 7*. They have remained largely unchanged since the late 1800s. The majority of changes have been in relation to size limits. Restrictions are aimed at promoting the taking of pearl shell for farming purposes. The restrictions:

- Prohibit the taking, processing or carrying of live or dead *P. maxima* in the TSPSF without the appropriate licence
- Prohibit the taking of *P. maxima* outside the size range of 130–230mm
- Exempt a person engaged in community fishing from the prohibition to take pearl shell if their boat is <6m in length<sup>8</sup>
- Exempt a person engaged in traditional fishing from both the prohibition on the taking, processing or carrying of *P. maxima* and the associated size restrictions
- Prohibit the taking of shell by any other method than by diving or collection by hand.

The overall objectives of the TSPSF are to:

- Conserve the stock of pearl shell and achieve optimum utilisation
- Maximise opportunities for traditional inhabitants of Australia and PNG to participate and benefit from the Torres Strait pearl fishery by limiting access for the non-indigenous sector through boat restrictions and licensing
- Provide for catch sharing to occur between Australian and PNG.

The management objectives for PNG and Australia under the Torres Strait Treaty are:

- To conserve the stock of pearl shell so as to achieve its optimum utilisation
- To maximise opportunities for traditional inhabitants of both countries to participate in the fishery.

The TSPSF Fisheries Assessment Report (1995) also makes reference to an agreement prohibiting the transportation of shell in or out of Queensland in order to reduce potential spread of disease. Such an agreement does not appear to be widely documented, although current translocation protocols require all live aquatic animals to receive approval from Fisheries Queensland prior to translocation (QDAFF 2013). Similar restrictions are documented in the *WA Pearl Oyster Translocation Protocol (2009)* for hatchery-produced spat and farmed oysters in Western Australia.

The exemptions for community and traditional fishing first appear in *FMN No. 46* in 1997.

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<sup>8</sup> A licence for community fishing is still required under the *Torres Strait Community Fishing Notice No. 1*.





### **Box 2: Pearl oyster fishery regulations in other jurisdictions**

*Queensland:* The *Queensland Fisheries Act 1994* has limited relevance to the Torres Strait Fisheries (PZJA/11). However, there is overlap in size limits, requirement for license, gear restrictions, and exemptions for indigenous communities in the East Coast Pearl Oyster Fishery (ECPF) (see *Attachment B*) under the *Fisheries Regulation 2008*. Unlike the TSPSF recreational fishers are allowed to collect pearl oysters (Young 2004). Pearl oysters are exempt from the bag limit of 50 that applies to other molluscs collected recreationally under state regulations.

*Northern Territory:* The pearl oyster industry is managed under the state *Northern Territory Fisheries Regulations 1993*. The regulations are laid out in the *Pearl Oyster Culture Industry Management Plan*. The fishery works on the allocation of pearl oyster fishing units being assigned to licence holders based on a total allowable catch (TAC). TACs are determined on a yearly basis. A maximum of 120 fishery units can be allocated to the fishery; one quota unit equates to 1150 oysters. Licences are renewed annually. Wildstock must be collected by hand.

*Western Australia:* The pearl oyster fishery is regulated by a number of legislative instruments include the *Pearling Act 1990* (currently under revision; DFWA 2013), the *Pearling (General) Regulations 1991*, and the *Pearling (Pearl Oyster Shell Size) Notice 1997*. Collection of pearl shell is prohibited if shell is <120mm; divers tend to target shell 120-165mm. A maximum size limit of 160mm is enforced only in the Exmouth Gulf. The maximum size limit in the Exmouth Gulf was introduced to protect broodstock some time ago following a period of low recruitment in the zone (Fletcher et al 2006).

The fishery is divided into four zones to allow for management arrangements to be tailored according to the differences (i.e. environmental conditions, recruitment variability) in each (Fletcher et al 2006) (see *Attachment C*).

The fishery works under a predictive quota system based on annual surveys (A Hart [DFWA] 2014, pers. comm., 19 September). A total allowable catch (TAC) is divided into individually transferable quota units (ITQs) and allocated among 14 licence holders. The fishery is limited entry, with no new licences currently being issued. One quota unit equates to 1000 oysters. Wildstock must be collected by hand.

Fishing did not occur in Zones 1 and 3 for economic reasons from 2008 despite TAC allocations but recommenced in 2014; Zone 4 has a continuing arrangement of zero TAC (R Jones [DFWA] 2014, pers. comm., 17 November).

*Papua New Guinea:* Pearl oysters are managed under the *Fisheries Management Act 1998* and the *Fisheries Regulations 2005* as a 'sedentary organism'. Harvest and export of pearl shell is prohibited unless the oyster is 130–230mm. Harvesting at night prohibited. Buyers of shell require a licence. Details of regulations and licence restrictions are published in the National Gazette Number G57 (4 April 2002) (inaccessible for this report).



**Pearl oyster fishery regulations in other jurisdictions cont.****Table 1: Comparison of size limits and other regulations (as of 2014) for *Pinctada maxima* across state jurisdictions**

Regions	Minimum (mm)	Maximum (mm)	Other notes
Torres Strait	130	230	Limited to those with licences or traditional rights; boat size, licensing and gear restrictions.
Queensland	130	230	Limited to those with licences if for commercial purposes; licensing and gear restrictions. No quota limit for recreational fishers.
Northern Territory	120	200	Size limits rescinded in 1989 in favour of quotas. Limited to those with licences; licensing and gear restrictions.
Western Australia	120	160 (Exmouth Gulf only)	Limited to those with licences; licensing and gear restrictions. Quotas based on annual surveys. Trial for reducing size limit to 100mm for 15 per cent of catch 2012-13; extended to 2014-16.
Papua New Guinea	130	230	Night harvest prohibited; licensing restrictions (details inaccessible).

**6.3 Recent catch trends and licensing**

Collection of pearl shell has fluctuated substantially over time. Records show that catches of pearl shell declined drastically after 1970 (O'Brien & Colgan 1995). There have been insignificant amounts of pearl shell harvested since at least 2006. Australia-PNG catch share arrangements under the Torres Strait Treaty have been largely unutilized since 2001; Australia withdrew from negotiations because of the lack of information on stock (TSFMAC/1).

The number of fishing licences for the fishery has declined over time. The number of licences reached its peak in 1904 with 378 boats operating in the fishery. A total of 48 licences (21 TIB and 27 TVH) were active in 2014; this number has been relatively constant since at least 2009. Most licences are obtained in association with multiple endorsements for other fisheries. Expansion of licence numbers in the TSPSF is limited to traditional inhabitants in order to maximize their opportunities. Provisions applying to non-traditional inhabitants include strict boat replacement policies and the linking of tender boats with specific primary boats. Latent effort in the fishery has been substantially reduced.

Low levels of activity in the TSPSF mean that pearl farms in the Torres Strait have a history of struggling to keep farms fully stocked (TSFMC/13; HCWG/1).



#### 6.4 Effectiveness of current management arrangements

The history of the TSPSF suggests that management arrangements have been ineffective. The fishery is historically described as suffering chronic depletion, with reports of overfishing and temporary collapses of stock dating back to at least 1883 (Bach 1955).<sup>9</sup> In spite of this there have been no major changes in the way the fishery is managed for over 100 years (see *Attachment A*).

Existing management arrangements have been identified as being unlikely to meet the requirements of guidelines for the ecologically sustainable management of fisheries (PZJA/OOS 2003). TSFMAC has additionally acknowledged that TSPSF management arrangements 'fall well short of ensuring the sustainability of the resource and are not effective at controlling effort (and catch)' (TSFMAC/4).

Management groups have expressed concern that:

- the maximum size limit of 230mm appears to be ineffective at protecting adult breeding stock (HCWG/7, 8)
- stocks have failed to regenerate (TSFMC/13).

Current management arrangements have additionally failed to fulfil the conservation objectives of the TSPSF. The 'immediate objective' detailed in the TSPSF Fisheries Assessment Report (1995) to establish the sustainable level of harvest for the fishery through stock assessments and effective enforcement of size limits remains incomplete.

Where current arrangements have succeeded is in maximizing the opportunities for traditional inhabitants of Australia and PNG to participate in the fishery. However, the continued prioritisation of this area without some form of review may ultimately be detrimental to the long-term sustainability of the fishery as the exemptions in place for traditional and community fishing could potentially enable shell beds to be stripped of shell.

Unlicensed fishing is also an issue and was identified as the current priority compliance risk for the TSPSF in 2013 (HCWG/7). PZJA annual reports from 1988 through to 2001-02 generally report a good level of compliance with management arrangements. However, fishermen have suggested that compliance with regulations has been questionable. The attempted sale of oversized shell is becoming more common.

Research additionally suggests that conventional management strategies (i.e. size limits, quotas, closed seasons and gear restrictions) are inappropriate for patchily distributed, sessile, broadcast-spawning species (Gascoigne & Lipcius 2004). Chronic depletion of wildstock could thus potentially be attributed to their use in the TSPSF. However, these strategies are the most practical for the TSPSF in the context of resource availability and the preferred Commonwealth approach to small fishery management (see *Box 4*).

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<sup>9</sup> The depleted state of the TSPSF is noted in newspapers (*The Queensland pearl shell industry* 1904; *The pearl shell industry* 1905), historical accounts (Bach 1955), fishery assessments (Colgan & Reichelt 1991; O'Brien & Colgan 1995; Williams & Coles 2000) and at management meetings (e.g. from the HCWG, TSFMC, TSFMAC, PZJA and TSSIIFIC).



## 6.5 Evaluation of size limits

In contrast to Gascoigne and Lipcius (2004), AFMA's TSPSF Discussion Paper (2006) describes size limits to protect juveniles and broodstock as a sound management tool. There is limited documented evidence as to the reasoning behind the minimum size limit of 130mm, but it assumedly allows males to reach reproductive maturity (at approximately 120mm) and spawn at least once before harvesting. Minimum size limits are often found to be effective for protecting juvenile populations even when not originally scientifically based (Hancock 1990).

The maximum size limit of 230mm is not effective in protecting larger adult broodstock (AFMA 2006; HCWG/7, 8). 230mm was defined as the maximum size limit after complaints from the pearl industry that the initial maximum of 200mm was too restrictive; industry also advised that a maximum of 230mm would protect broodstock (TSFIICC/7). Former QAIF representative for the Queensland pearl industry Ms Serena Sanders (2014, pers. comm., 01 October) expressed surprise that the maximum size limit for the Torres Strait was 230mm, as it corresponds with the maximum size of pearl shell usually found in wildstock.

## 7 Issues for management

### 7.1 Uncertain status of pearl stocks

The current status of stocks in the TSPSF is uncertain. The fishery has not been formally assessed since 1989 (Colgan & Reichelt 1991), has not undergone strategic assessment (initially planned for 2005), and is barely mentioned in the most recent five-year strategic research plan for the Torres Strait due to insignificant harvesting activity in the fishery and its low economic value.

Conflicting reports regarding the recovery or depletion of stocks could be because of:

- The patchy/clumped distribution patterns and fluctuating recruitment of oysters in general making the accurate estimation of existing stocks difficult
- Major changes in the location of shell beds (O'Brien & Colgan 1995)
- Localised stock recovery.

Additional factors include the belief that:

- Natural reserves of inaccessible unfished shell beds exist in deeper waters and ensure continued recruitment into accessible stocks (Gervis & Sims 1992). The existence of such reserves is unconfirmed
- Low levels of supply to farms are due to low catch effort rather than stock depletion.

Lack of formal stock assessment precludes the rational management of the TSPSF (O'Brien & Colgan 1995; Williams & Coles 2000). The TSPSF Fisheries Assessment Report (1995) defines adequate stock assessment information as one of the performance criteria for the TSPSF. Stock assessment of the TSPSF would be in line with its original management objectives, as well as with suggestions from PNG at the 2012 Bilateral Torres Strait Treaty Meetings.



A comprehensive stock survey is required if the use of the TSPSF is to be maximized in accordance with the *Torres Strait Fisheries Act 1984*. Certainty regarding the current status of stocks would ensure the effective management of the fishery.

An indicative cost for a benchmark pearl shell survey can be described based on the 2002 CSIRO tropical rock lobster (TRL) survey. The TRL survey cost AFMA \$273 000, with an additional contribution from CSIRO of \$175 000 (AFMA 2006) (for a total of \$448 000).

### Box 3: History of TSPSF stock assessments

- Data from surveys conducted by the Japanese (in 1938 and 1957), by CSIRO (1952–1960) and the Commonwealth Fisheries Department (1956–1962) are of low quality and in many cases missing (O'Brien & Colgan 1995)
- *P. maxima* stocks in the Old Grounds have previously been estimated at approximately 33 000 shell per 1000km<sup>2</sup> (Colgan & Reichelt 1991). This was half the overall density of a survey in the central Torres Strait (Pitcher et al 1992) where population estimates were 72 000 shell per 1000km<sup>2</sup>. The reports describe shell stocks as 'generally low' and 'not abundant'
- Data from a private survey and harvesting operation in 2001 provided limited information on the state of stocks (TSFMAC/1)
- A five-day private survey by a licence holder in parts of the Mainland Ground (Figure 3) in late 2014 reported only 32 shell within the legal size limits and a predominance of 180–200mm shell across 46 hours of diving by two divers; low levels of shell were attributed to lack of familiarity with survey techniques and uncertainty regarding the current location of pearl beds
- Stocks reported by industry as prolific on the PNG side of the fishery (P King 2014, pers. comm., 19 November)
- A visual survey in November 2014 simultaneous to annual TRL surveys sighted 11 shell at eight sites (of 130 sites surveyed). It is possible some shell was missed due to the focus on TRL (D Dennis [CSIRO] 2014, pers. comm., 04 December)

## 7.2 Possible failure of stock recruitment

History indicates that the TSPSF has experienced repeated cycles of overexploitation and recovery, with a steady decline in overall stocks. AFMA's TSPSF Discussion Paper (2006) notes that the fishery appears to remain overexploited with reduced numbers of broodstock to enable recruitment.

However much of the pearl industry and indigenous community believe that pearl oyster stocks recover quickly from overexploitation and can support ongoing harvesting activity. This belief is reflected in management arrangements, which have remained virtually unchanged for over 100 years (see *Attachment A*).



The assumption of guaranteed stock recovery has been challenged in Hawaii (Schultz et al 2011) and the Solomon Islands (Hawes et al 2011), where overexploited pearl oyster populations have failed to recover despite harvest bans being enforced in 1930 and 1993 respectively. Failure to recover has been attributed to the patchy distribution patterns of *P. maxima*, which make it prone to Allee effects and population collapse (Gascoigne & Lipcius 2004).<sup>10</sup> Stock recovery could also be affected by the collection of undersized and oversized shell in the course of the allowances for community and traditional fishing in current management arrangements.

Recent scientific papers also suggest that larval dispersal in oceanic systems is shorter than previously expected and recruitment more localised than expected. Recruitment to pearl grounds in Torres Strait may therefore be more reliant on localised shell stocks than those in other areas (e.g. Queensland's East Coast or PNG waters) (QDPI 1994; AFMA 2006).

There are some indications that pearl oyster stocks in the Torres Strait could be close to collapse. Mr James Prescott, formerly involved in the management of the fishery, stated that from previous experience he had observed very few young shell (2014, pers. comm., 30 December). Private exploratory surveys by a licence holder in late 2014 found the majority of shell was 180-200mm, with only 37 per cent catch <200mm. There is also a predominance of large shell in what is presented to pearl farmers for purchase. These reports suggest low levels of recruitment into the TSPSF.

### **7.3 Commonwealth vs Torres Strait fisheries priorities**

The Commonwealth's *Fisheries Management Act 1991* emphasises that the exploitation of fisheries resources should be conducted in a manner consistent with the principles of ecologically sustainable development and include the exercise of the precautionary principle where applicable. Management activities are to have regard to achieving the optimum utilization of living resources and preventing overexploitation. The current uncertainty regarding the status of the TSPSF and its history of depletion would suggest that under the *Fisheries Management Act 1991* the fishery should be closed until stocks have recovered.

The objectives of the *Torres Strait Fisheries Act 1984* similarly seek to protect and preserve marine resources, but prioritise maximizing indigenous opportunities and the rights associated with the traditional way of life. Where possible, measures for ecological sustainability are to minimize any restrictive effect on traditional fishing. The TSPSF thus remains open, with those engaged in traditional fishing being exempt from licencing requirements and traditional and community fishing being exempt from size restrictions.

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<sup>10</sup> The Allee effect occurs when some component of species fitness (e.g. success of fertilisation) deteriorates as population density decreases towards zero.





There is therefore conflict between the management priorities of Commonwealth fisheries legislation and those of the Torres Strait. The allowances for traditional and community activities under the *Torres Strait Fisheries Act 1984* have led to concerns that the collection of under- and over-sized shell as a food source<sup>11</sup>, as well as the legally sized shell for sale to pearl farms, could lead to overexploitation and stock collapse.

**Box 4: Commonwealth approach to management in small fisheries**

The TSPSF falls under the definition of a ‘small’ Commonwealth fishery (i.e. a fishery with a gross annual production of <\$1.5m). The fishery is estimated to have a value of approximately \$8000. The estimated cost of managing the fishery ranges at \$20 000–40 000, approximately three to five times the value of the fishery (HCWG/2). The Australian Government has a preference that unless net returns are positive a fishery should be closed to fishing. If it is not possible to close the fishery, management regimes must seek to ensure stock sustainability at minimal cost (Galeano et al 2005).

Complete closure of the TSPSF does not appear to be an option. Size limits and licencing are regarded as the most economically efficient way to regulate the fishery due to the expense of setting and enforcing quotas.

#### **7.4 Assumption that pearl farms are breeding pools**

Pearl farms relocate oysters from wildstock into a small area. Increased proximity of shell enhances the spawning success of broadcasting species such as oysters. Pearl oyster farms are consequently often regarded as breeding pools that feed back into wild populations. This is a common belief among pearl farmers in the Torres Strait.

The belief that pearl farms function as breeding pools may be incorrect. Research has identified that sex ratios in cultured *P. maxima* are overwhelmingly biased towards maleness. The ratio of female to male can be up to 0.01:1 (i.e., one female to every 100 males) (Lee 2010). Lack of females and female gametes in the culture environment would decrease rates of successful fertilization and negate recruitment contributions back into wildstock.

**Box 5: Potential cause of male gender bias in the pearl farm environment**

Predominance of males in a culture environment is possibly an indication of ambient stress and/or unsuitable conditions (e.g. overcrowding) (Lee 2010). While unaware if there was a gender bias in their own operations, Torres Pearls suggested that the male bias in a culture environment could be caused by the process involved in cleaning the shell (R Tully 2014, pers. comm., 05 November). Pearl oysters in culture are removed from the water every few months to be cleaned of algae and other marine organisms that have settled on the shell. Cleaning is usually completed with high-pressure hoses and could cause enough stress to encourage maleness.

<sup>11</sup> More recent reports conflict with older accounts that taking of shell outside legal size limits ‘was not an issue as the local fishermen reported it as a very uncommon practice’ (TSFMC/13).



### 7.5 Detrimental effects of x-ray

X-ray is used by the pearl culture industry to unobtrusively monitor the growth of the pearl within the oyster shell. Oysters are x-rayed once per seeding cycle to determine that the pearl nuclei has successfully established<sup>12</sup>. Use of x-ray in the pearl culture industry was initiated by Solomon (1910) as a way to preserve wildstock and increase the value of pearl yields<sup>13</sup>.

The x-ray process may affect the viability of gametes. Low-dose chronic irradiation has been reported to cause developmental defects in embryos and embryo death in various fish species, as well as chromosomal aberrations, decreased fertilization, and developmental defects in marine molluscs (Rugh 1953; Anderson & Harrison 1986; Li et al 2000; Seaver et al 2009). The outcome of irradiation is thought to be strongly influenced by the frequency and intensity of irradiation, and may vary depending on the stage of the reproductive cycle at which the organism is irradiated (Anderson & Harrison 1986).

While not specific to *P. maxima*, previous research on irradiation and the reproductive biology of marine invertebrates presents the question of whether pearl oysters are exposed to x-ray at an intensity and frequency that affects gamete viability.

*If gamete viability is unaffected:* Farmed populations can be regarded as breeding pools that can feed back into the wild population (dependent on gender ratios in the pearl farm environment; see Section 7.4).

*If gamete viability is affected:* Collection from wildstock would need to be recognised as being equivalent to permanent removal from the breeding population.

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<sup>12</sup> X-ray is also used to differentiate cultured and natural pearls on the commercial market (Karampelas et al 2010; Sun & Mei 2010; Agatonovic-Kustrin & Morton 2010). X-ray fluorescence analysis can identify the ‘mother species’ of fresh and seawater pearls based on distinct absorption signatures (Miyoshi et al 1987). High- and low- energy radiation exposure has also been used to artificially alter the colour of cultured pearls (Tsuiji 1962; Matsuda & Miyoshi 1988; Miyoshi 1992).

<sup>13</sup> Pearl harvest in the early pearl industry involved killing the oyster. The practice was widely regarded as wasteful, as pearls were generally found in approximately 10 per cent of catch (Solomon 1910).





**Box 6: Clarification on whether x-ray negatively affects shell growth**

The minutes from the Torres Strait HCWG/7 (October 2013) note that Ms Vanessa Drotini referred to a report produced by a previous AFMA graduate as including information about how x-ray can affect the growth of pearl shell. The previous graduate was eventually identified as Mr Matthew Stadler (now of DFWA). The report was tentatively identified as the basis of AFMA's TSPSF Discussion Paper (2006) but did not contain the aforementioned information. Mr Stadler confirmed that he completed work on the feasibility of wild pearl shell collection for a graduate project in 2005 but did not explore the effects of x-ray.

According to the literature, the x-ray process itself is accepted as having no noticeable effect on the physical growth of pearl shell. Solomon (1910) discussed the topic in detail in a report for the Proceedings of the Fourth International Fishery Congress in Washington (USA) in 1908. Having consulted with experts on the effects of x-ray on animal tissues, Solomon believed that 'the slight exposure' necessary for the x-ray process could have no effect on growth. He also noted that continuous exposure of live oysters to x-ray for extended time periods under experimental conditions did not produce any physical ill-effects.

There is no further mention of x-ray having harmful effects on the growth of pearl shell in recent scientific research. Enquiries regarding the topic were often met with puzzlement by industry and management representatives, as well as by James Cook University pearl oyster biologist Paul Southgate. Considering that x-ray technology has been considerably refined since 1908, it is unlikely that harmful effects on the physical growth of pearl shell have remained unnoticed.



## 8 Addendum: Alternative measure of size

Shell size is the conventional standard measure used in the management of mollusc resources. The accuracy of shell size as an indicator of the age of shell was questioned by Mr Rusty Tully at the Torres Strait HCWG/7 in 2013. Shell age is important in the pearl industry as older shell is less suitable for culture. Based on personal experience, Mr Tully proposed hinge width as a more reliable measure of age (R Tully 2014, pers. comm., 22 September). 15mm was suggested as a potential maximum hinge width for shell of an age most suitable for use in pearl culture.

A similar suggestion was made in 1997 but was discarded after Dr John Norton, a Senior Veterinary Pathologist with QDPI at the time, recommended against it without more information (TSFMAC/14). The suggestion was subsequently investigated for this report to clarify the issue.

### 8.1 Patterns of shell growth in marine molluscs

Normal growth in molluscs is characterised by fast initial increases in shell size 'to near maximum size', with a subsequent increase in the thickness of the shell (Herdman 1903; Mohammad 1976). The faster growth of younger oysters (i.e. smaller size groups) in comparison to older larger size groups is well documented (Herdman 1903; Gervis & Sims 1992; Chellam 1978; Lee 2010). Increases in shell size are generally considered to be small after two years (Herdman 1903; Gervis & Sims 1992).

### 8.2 Why shell size is an inaccurate measure of age

Variation in the growth rate of shell is a common characteristic of bivalve molluscs. Shell growth is a function of interactions among several environmental variables (Lee 2010). Fast growth is indicative of good health and healthy environmental conditions (Herdman 1903). Growth is particularly influenced by temperature (Gervis & Sims 1992), with faster growth in the warmer summer months, and at shallower depths (Yukihira et al 2007; Lee 2010). The growth of *P. maxima* has also been linked to variations in pH, salinity, water temperature, biofouling, and particulate matter (Lee 2010).

Differences in the shell size of similarly aged oysters in different locations was first documented by Herdman (1903) (Figure 4), as well as in more recent studies (Hart et al 1999; Kvingedal et al 2010). Shell size is therefore an unreliable measure of age, due to its sensitivity to local environmental conditions.



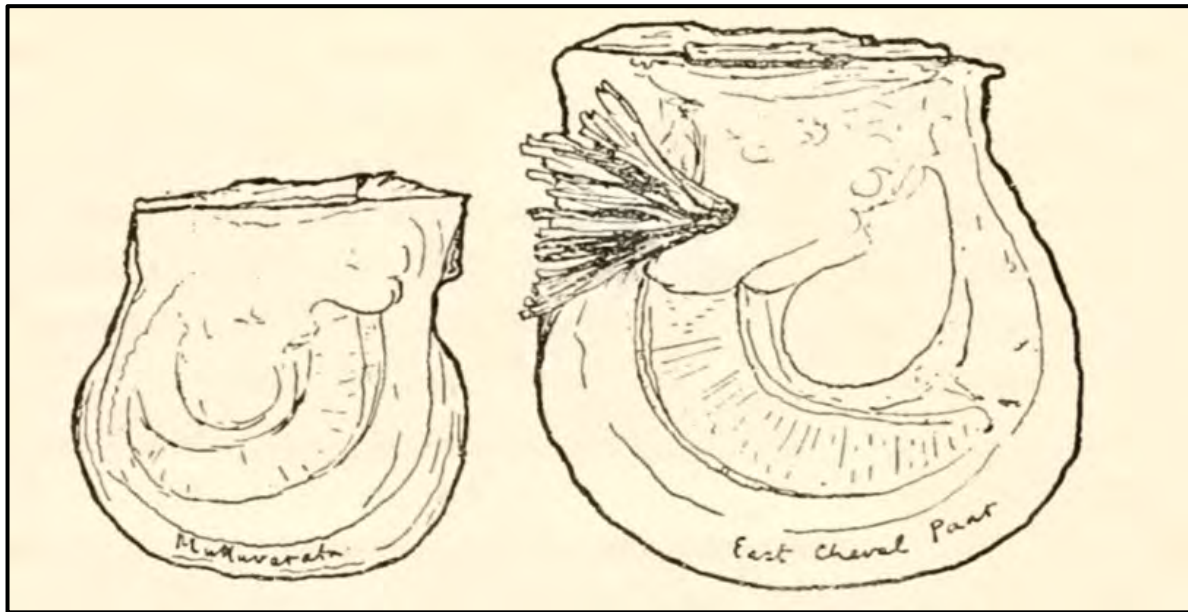


Figure 4: Effect of location (i.e. different environmental conditions) on the growth of pearl shell of the same age (Herdman 1903). Good conditions increase shell growth rates.

The actual definition of shell size is also unclear. There are at least four definitions for shell size in the scientific literature (e.g. Tranter 1958a vs Sims 1990 vs Chellam 1978 vs Mohammad 1976), and these may differ from legislative definitions (e.g. in the *Pearling (Pearl Oyster Shell Size) Notice 1997*) and from its common interpretation by industry.

### 8.3 Alternative measures of age

Hinge width, shell thickness and heel depth (Figure 5) have been identified by a small number of studies as reliable measures of age in molluscs. In order of usefulness, these are:

- Hinge width:* increases steadily with age irrespective of environmental conditions and provides a reliable and accessible measure of age (Mohammad 1976)
- Shell thickness:* increases steadily with age irrespective of environmental conditions but can stagnate in larger shell sizes (Mohammad 1976; Chellam 1978)
- Heel depth:* increases steadily with age irrespective of environmental conditions (Tranter 1957, 1958a, 1958b) but can be degraded by environmental conditions



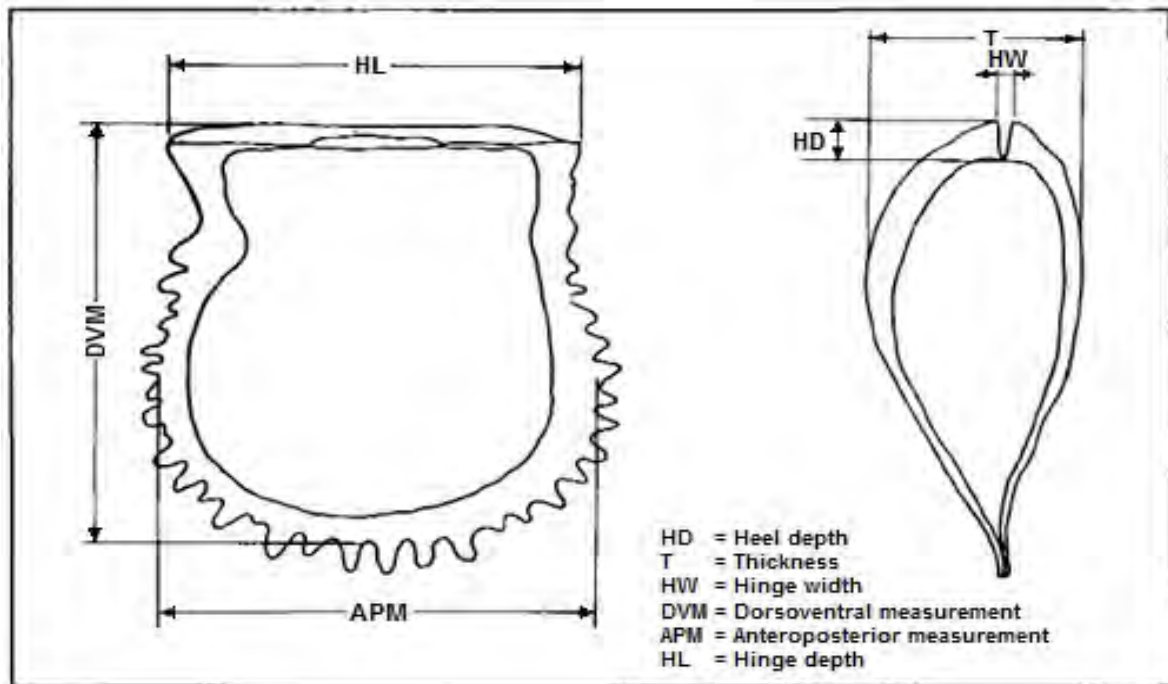


Figure 5: Shell dimensions of pearl oysters. DVM is most commonly used in scientific studies.

#### 8.4 Recommendations

Research regarding the growth of pearl oysters confirms Mr Tully's suggestion that hinge width is more accurate than shell size as a measure of age. However, the use of hinge width would be difficult to implement as part of management arrangements (T Skewes [CSIRO] 2014, pers. comm., 14 October). While both size and age may be significant variables in determining sex in *P. maxima*, shell size may be the more important factor (Lee 2010); it is consequently the more appropriate measure for managing pearl oyster stocks as a long-term sustainable resource. Shell size is also likely to be more practical during the physical process of collecting shell. Hinge width may be regarded as alternative measure that may be useful in the pearl culture industry for identifying and purchasing shell suitable for culture.



## 9 Acknowledgements

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## Attachment A: Management history of the TSPSF from 1868-2014

Year	Events
1868	Pearl shell first collected in the Torres Strait (at Warrior Island, and Wapa and Orman reefs in the Endeavour Strait, and in various passages of the Prince of Wales group)
1881	Old Grounds discovered west of Badu. Other deep water grounds reported off Darnley and Mount Adolphus Islands. <i>Pearl Shell and Beche-de-Mer Fishery Act 1881</i> enacted to regulate the Queensland fishery with annual boat licences
1886	Pearl grounds reported as seriously depleted (Bach 1955). <i>Pearl Shell and Beche-de-Mer Fishery Act Amendment Act 1886</i> amends licencing arrangements for vessels and prescribes licenses for persons employed in the fishery
1888	<i>Queensland Pearl Shell and Beche-de-Mer Fisheries (Extra-territorial) Act 1888</i> enforces the provisions of the <i>Pearl Shell and Beche-de-Mer Fishery Acts</i> in 'Australasian waters adjacent to Queensland'
1891	<i>Pearl Shell and Beche-de-Mer Fishery Act Amendment Act 1891</i> prohibits the take of shell <152mm
1893	Darnley Island grounds declared closed under the <i>Pearl Shell and Beche-de-Mer Fishery Act Amendment Act 1891</i> (Bach 1955)
1897	Minimum legal size reduced to <b>127mm</b> for economic reasons (Bach 1955)
1901	Restrictions on the number of pearling licences introduced and a portion of the Old Ground including the Endeavour Strait closed for two years. Later assessment describes the methods of closure as ineffective (Bach 1955)
1904	Article on the Queensland pearl shell industry in the <i>Marlborough Express</i> notes that the fishery is becoming exhausted. A report commissioned due to concerns about the severe depletion of the fishery recommends the restoration of the 152mm minimum size limit and sparks interest in a system of fishery closures (Bach 1955)
1908	Mackay Royal Commission enquiry (1908) into the state and problems of the Queensland pearl fishery recommends immediate action if the industry is to be permanent and profitable
1914-18	Fishing activity halts due to WWI
1932	Resurgence in the fishery follows the end of the Great Depression
1938	Japanese survey pearl grounds; results not published (O'Brien & Colgan 1995)
1941-45	Fishing activity halts due to WWII



1946	Commonwealth Government Enquiry into the fishery recommends surveys of the grounds and studies on the biology of the oyster (Colgan & Reichelt 1991)
1952	<i>Pearl Fisheries Act 1952</i> repeals the <i>Queensland Pearl Shell and Beche-de-Mer Fisheries (Extra-territorial) Act 1888</i> . It defines the powers of the Minister in relation to the fishery, divides the fishery into subareas, and prohibits engagement in pearling without a license
1952-60	CSIRO conducts biology and ecology studies from a field station on Thursday Island and surveys pearl grounds on the <i>Gahleru</i> . The results are never published (Colgan & Reichelt 1991)
1953	<i>Pearl Fisheries Act 1953</i> is enacted as an amendment to the <i>Pearl Fisheries Act 1952</i> , refining the definition of the boundaries the TSPSF
1956-62	Commonwealth Fisheries Department conducts 'non-scientific' surveys of the grounds on the <i>Paxie</i> (Colgan & Reichelt 1991)
1957	Japanese survey pearl grounds; results not published (O'Brien & Colgan 1995)
1968	<i>Continental Shelf (Living Natural Resources) Act 1968</i> repeals the <i>Pearl Fisheries Act 1952 and 1953</i> and replaces pearl-specific legislation with more general provisions for 'sedentary organisms'
1970	<i>Oceanic Grandeur</i> maritime accident and oil spill allegedly causes shell mass mortality and failed recruitment on the Old Grounds (Hynd 1970)
1976	<i>Fisheries Act 1976</i> consolidates and amends laws for pearling, oystering and fisheries, with provisions for licenses and a minimum size limit of <b>160mm</b>
1984	<i>Torres Strait Fisheries Act 1984</i> enacted to regulate the fisheries of the PZJA and give effect to the fisheries elements of the Torres Strait Treaty
1985	<i>Torres Strait Fisheries Act 1984 – Proclamation (1985)</i> and the <i>Torres Strait Fisheries Regulations 1985</i> define the extent and regulations of the TSPSF. <i>FMN No. 6</i> prohibits the taking of shell within the TSPSF of a size less than <b>160mm</b> and prohibits collection by any method other than diving or hand. <i>FMN No. 7</i> prohibits the removal of live pearl shell from the Torres Strait Protected Zone without a license.
1986	A Torres Strait Consultative Meeting suggests a minimum size limit of 115mm and recommends an economic study of the fishery
1987	<i>FMN No. 6</i> revoked by <i>FMN No. 16</i> , allowing for the inclusion of the black-lipped pearl oyster <i>P. margaritifera</i> in regulations. Existing licence controls regarding as relatively loose (having been previously adopted to attract effort to the fishery) and the fishery as exploited, with a need to assess whether the arrangements are appropriate. Industry requests that the minimum size limit is reduced to 120–125mm (TSFIICC/5). A working party is established to assess size limits and provide management recommendations (TSFMC/5)



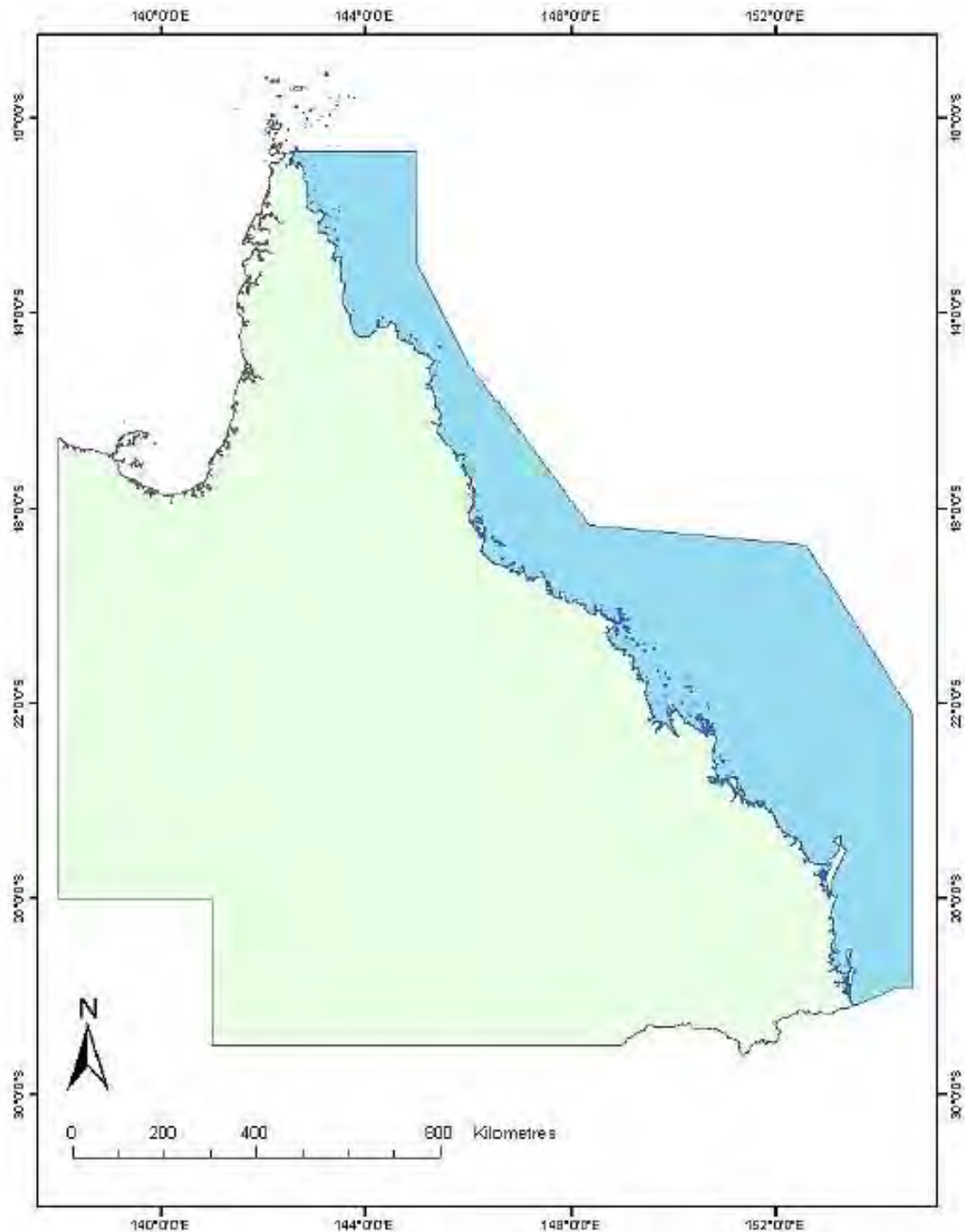
1988	<i>FMN No. 21</i> enacts a prawn trawling ban in areas of the TSPZ. PNG agrees to mirror the ban to protect pearl beds (TSFMC/6). <i>FMN No. 25</i> replaces <i>FMN No. 16</i> and enacts a seasonal closure of the TSPSF from 01 June–31 August. A size limit of <b>130-200mm</b> and licensing restrictions to increase indigenous activity are enforced. Stock status is unable to be assessed due to lack of data; declines mainly attributed to substantial latent effort
1989	Results of Bureau of Rural Science field surveys (Colgan & Reichelt 1991) are described as inconclusive without further work; but abundance estimated as low. <i>FMN No. 30</i> replaces <i>FMN No. 25</i> and increases the maximum size limit to <b>230mm</b> , with 200mm being regarded as too restrictive for farms purchasing shell (TSFIICC/7). Seasonal closure is continued. Licences for boats >6m in community fishing mandatory
1990	Abundance of pearl shell in the Torres Strait remains low (TSFSAC/15) despite anecdotal reports of recovery. <i>FMN No. 36</i> replaces <i>FMN No. 30</i> and removes seasonal closures for the fishery
1991	PZJA decides to establish a Pearl Shell Working Group
1992	Abundance of shell low with some indications of stock recovery
1994	Pearl shell logbooks replaced with annual catch surveys. Abundance of shell low with some indications of recovery
1995	Abundance of shell thought to be low with some indications of stock recovery
1996	Concern expressed regarding lack of stock recovery in the old grounds (TSFMC/12). Industry describes size limits as ineffective and without enforcement. Pearl Shell Working Group recommendations for area closures and an education program to protect broodstock opposed by local community and industry. Quotas regarded as too difficult due to the unlimited number of fishers
1997	<i>FMN No. 46</i> replaces <i>FMN No. 36</i> and allows for any person holding a prawn licence to carry up to four pearl shells; persons engaged in community fishing with a boat <6m and traditional fishing are exempt from the ban on collecting shell. Persons engaged in traditional fishing are exempt from size limits. Issue of shell size being an inadequate measurement for collection raised (TSFMC/14)
1998	Abundance of shell thought to be low, although some indications of stock recovery
1999	Enactment of the <i>Torres Strait Community Fishing Notice No. 1</i> prohibits the taking, processing or carrying of fish by persons engaged in community fishing unless under licence.
2000	Agreement allowing for five Australian pearl shell vessels to fish for pearl in PNG waters cease. Annual Reports indicate the agreement was in place from 1990-91
2003	Recommendation that management arrangements may require revision due to the fishery being in a severely depleted state, as well as a longstanding lack of data on stocks (TSFMAC/1; PZJA/15). Pearl Shell Working Group merged into TSFMAC (PZJA/15)



2004	<p><i>FMN No. 69</i> replaces <i>FMN No. 46</i> and prohibits the taking of pearl shell by persons engaged in the prawn fishery. Size limits for persons with the appropriate licence or those engaged in community fishing using a boat &lt;6m continue at <b>130-230mm</b>. Traditional fishing continues to be exempt from size limits. Collection continues to be by diving or hand</p>
2007	<p>HCWG established to monitor trochus, beche-de-mer, pearl, crab and sponge fisheries</p>
2007-08	<p>Demand for pearls declines following the Global Financial Crisis (DFWA 2013)</p>
2008	<p>Potential management options, including a long-term closure, discussed regarding the future of the fishery but it was decided that there was not enough information for decisions to be made (HCWG/2)</p>
2011	<p><i>FMI No.7</i> replaces <i>FMN No.69</i>, allowing for inclusion of the genus <i>Pteria</i> in regulations. <i>Torres Strait Fisheries Logbook Instrument No.1</i> makes use of logbooks for 'hand collectables' such as pearl shell compulsory for TVH sector operators.</p>
2013	<p>Resurgence in industry interest to decrease the minimum size limits (HCWG/7)</p>



## Attachment B: The Queensland East Coast Pearl Fishery

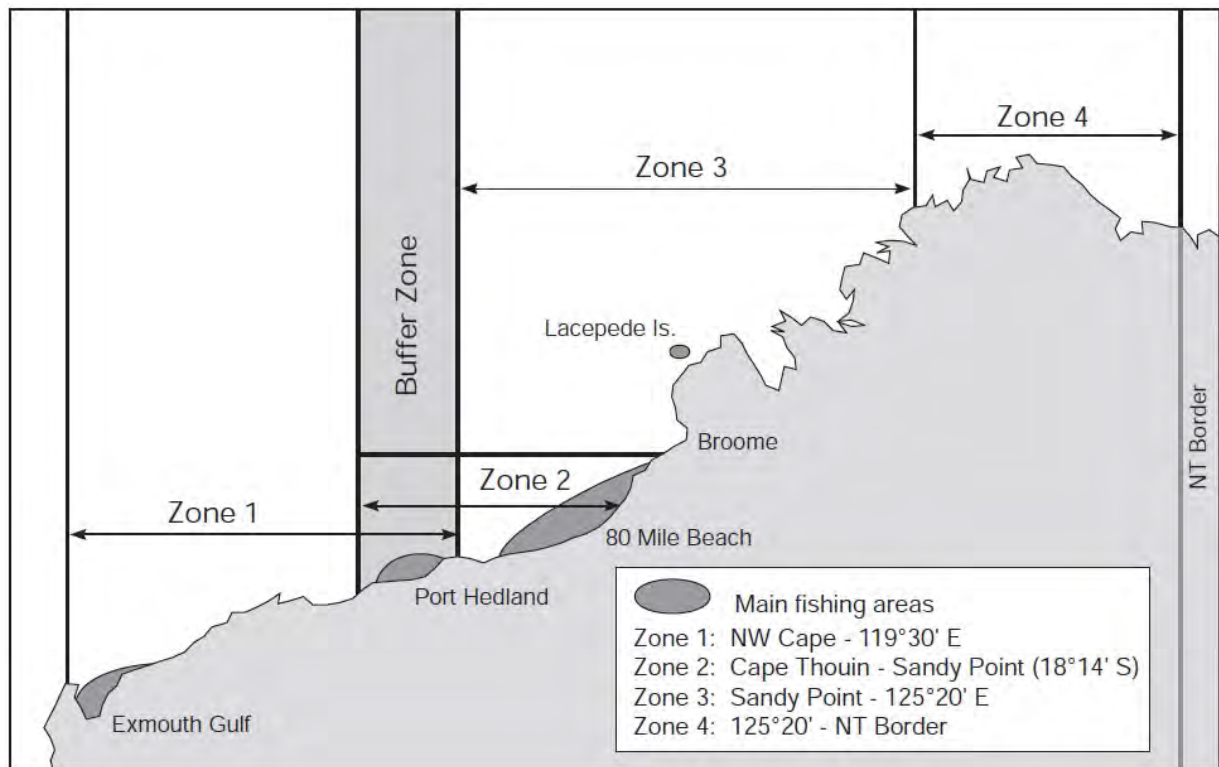


*The East Coast Pearl Fishery (Fletcher et al 2006)*

Queensland's East Coast Pearl Fishery (ECPF) consists of tidal waters south of latitude 10°41'S and east of longitude 142°31'49"E (Young 2004).



## Attachment C: The Western Australia Pearl Oyster Fishery



*The Western Australia Pearl Oyster Fishery Zones (Hart et al 2013)*

The Western Australia Pearl Oyster fishery is separated into four zones. These consist of:

*Pearl Oyster Zone 1:* NW Cape (including the Exmouth Gulf) to longitude 119°30' E.

*Pearl Oyster Zone 2:* East of Cape Thouin (118°20' E) and south of latitude 18°14' S.

*Pearl Oyster Zone 3:* West of longitude 125°20' E and north of latitude 18°14' S.

*Pearl Oyster Zone 4:* East of longitude 125°20' E to the Western Australia-Northern Territory border.

There is a buffer zone between Zones 1 and 2.



<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>UPDATES ON OTHER HAND COLLECTABLE FISHERIES</b> <b>Crab</b>	<b>Agenda Item 12.2</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** discussions and recommendations from at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting concerning the Torres Strait Crab Fishery (the Crab Fishery), if any;
  - b. **NOTE** updates concerning the Crab Fishery and **RAISE** any management issues for discussion.

## KEY ISSUES

### *Catch and effort summary*

2. AFMA understands the fishery to have little to no fishing activity in recent years (**Table 1**).

**Table 1. Reported annual catches of mud crab (*Scylla* spp.) in the Torres Strait Crab Fishery (source: TDB02 Catch Disposal Records).**

<b>Year</b>	<b>Reported catches (kg)</b>
2018	882
2019	-
2020	-
2021	-
2022	314
2023 (as at 5 October 2023)	110

3. The following number of fishing licences had crab (CB) fishery entries over the period 2021-2023 (**Table 2**). All licences are TIB or Carrier (class A) licences, there are no TVH licences in the Crab Fishery. The numbers below exclude Carrier (class B and C) licences.

**Table 2. Number of fishing licences with a crab (CB) fishery entry, as at 1 July each year.**

<b>Year</b>	<b>Number of fishing licences</b>
2021	68
2022	108
2023	93

**ABARES Fishery Status Reports**

4. The Crab Fishery has not been assessed by ABARES.

**BACKGROUND****Management arrangements**

5. The Crab Fishery primarily targets mud crab (*Scylla* spp.) although a small quantity of blue-swimmer crab (*Portunus pelagicus*) which are incidentally caught may also be retained.
6. The Crab Fishery is primarily managed under *Torres Strait Fisheries Management Notice No. 50*, which details:
  - a. a prohibition on the take or possession of female crabs;
  - b. a minimum carapace width of 150 mm;
  - c. prohibition on the take or possession of spanner crab (*Ranina ranina*);
  - d. restricting the number of prescribed crab apparatus to less than 50;
  - e. specific restrictions on crab apparatus markings, including size and colour of floats; and
  - f. no vessels greater than 14 metres in length;

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>UPDATES ON OTHER HAND COLLECTABLE FISHERIES</b> <b>Trochus</b>	<b>Agenda Item 12.3</b> <b>For RECOMMENDATION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** discussions and recommendations from at the preceding Hand Collectables Resource Assessment Group (HCRAAG) meeting concerning the Torres Strait Trochus Fishery (the Trochus Fishery), if any;
  - b. **NOTE** updates concerning the Trochus Fishery and **RAISE** any management issues for discussion.

## KEY ISSUES

### *Catch and effort summary*

2. AFMA understands the fishery to have no fishing activity in recent years, with no commercial catches reported since 2018 (**Table 1**).

**Table 1. Reported annual catches of trochus in the Torres Strait Trochus Fishery from 2018-2023 (source: TDB02 Catch Disposal Records).**

Year	Reported catches (kg)
2018	41.5
2019	-
2020	-
2021	-
2022	-
2023 (as at 5 October 2023)	-

3. The following number of licences had trochus (TR) fishery entries over the period 2018-2023 (**Table 2**). All licences are TIB licences, there are no TVH licences in the Trochus Fishery. The numbers below exclude Carrier (class B and C) licences.

**Table 2. Number of licences with a trochus (TR) fishery entry, as at 1 July each year.**

Year	Number of licences
2018	59
2019	78
2020	67
2021	80
2022	64
2023	54

**ABARES Fishery Status Reports**

4. The fishery was last assessed by ABARES in 2022. The Trochus Fishery was assessed as:
  - a. Fishing mortality – not subject to overfishing;
  - b. Biomass – uncertain. Given the long history of fishing for trochus in the Torres Strait, the unfished biomass is unknown. The survey in 2019/20 suggests a decrease in abundance since 2005; however, the surveys were focused on sea cucumber habitat, and results had low precision. On this basis, the biomass status for the stock is classified as uncertain.
5. ABARES Fishery Status Reports, including more information on the assessment of the Trochus Fishery can be accessed on the ABARES website at: <https://www.agriculture.gov.au/abares/research-topics/fisheries/fishery-status>

**BACKGROUND****Management arrangements**

6. The Trochus Fishery targets a single species, trochus (*Trochus niloticus*).
7. The Trochus Fishery is primarily managed under *Torres Strait Fisheries Management Instrument No. 13*. Key management arrangements in place for the Trochus Fishery include:
  - a. limiting the method of taking of trochus to hand collection;
  - b. the use of underwater breathing apparatus is not permitted;
  - c. a minimum size limit of 80 mm and maximum size limit of 125 mm (when measured in their original form as fished, at the widest part of the base of the shell) applies, except to traditional fishing; and
  - d. a competitive total allowable catch (measured in tonnes with animal in shell) of 150 tonnes.

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>OTHER BUSINESS</b>	<b>Agenda Item 13</b> <b>For DISCUSSION</b>

**RECOMMENDATIONS**

1. That the Hand Collectables Working Group (HCWG) **NOMINATE** any further business for discussion.

<b>TORRES STRAIT HAND COLLECTABLES WORKING GROUP</b>	<b>Meeting No. 20</b> <b>18-19 October 2023</b>
<b>HCWG PRIORITIES AND NEXT MEETING</b>	<b>Agenda Item 14</b> <b>For DISCUSSION</b>

## RECOMMENDATIONS

1. That the Hand Collectables Working Group (HCWG):
  - a. **NOTE** the summary of management priorities previously identified by the HCWG as outlined in **Table 1**, including the progress update against each priority;
  - b. **DISCUSS** and **PROVIDE ADVICE** on priorities for the HCWG, including a draft work plan; and
  - c. **NOMINATE** a date and a venue for the next meeting.

## KEY ISSUES

### *HCWG priorities*

2. The HCWG has a standing item at its meetings to discuss management priorities for Torres Strait hand collectables fisheries. These priorities are informed by the WG's meeting discussions, advice from individual members of the WG and/or advice from the Hand Collectable Resource Assessment Group (HCRAAG).
3. Where possible, the HCWG should aim to prioritise and set a timeline for any identified priorities, having regard for resourcing.
4. At its last meeting held on 10 November 2022, the HCWG noted that the agenda paper captured management priorities previously identified and endorsed by the HCWG, as well as a progress update against each item. A summary of the management priorities previously identified by the HCWG is outlined in **Table 1**, including the progress update against each priority. The HCWG is asked to consider these and provide advice on changes and updates as appropriate.

**Table 1. Management priorities previously identified by the HCWG. Management priorities are listed chronologically and not in order of importance.**

Management Priority			Progress to date and comments
1	HCWG9 June 2016	Development of a harvest strategy and recovery plans for overfished species	<b>Complete</b> CSIRO, together with AFMA, the HCWG and broader industry stakeholders have developed a Torres Strait Beche-de-mer Fishery (BDM Fishery) Harvest Strategy.  The BDM Fishery Harvest Strategy was endorsed by the Protected Zone Joint Authority (PZJA) in November 2019 and implemented on 1 January 2020.
2	HCWG9 June 2016	Future management arrangements for black teatfish and white teatfish	<b>Complete</b> Fishing for black teatfish is now open annually in accordance with the BDM Fishery Harvest Strategy.  <b>Ongoing</b>

Management Priority			Progress to date and comments
			The TSRA supported PZJA Traditional Inhabitant members to undertake cluster consultations in late 2019 which sought feedback from communities on the use of hookah to fish for white teatfish. Given the strongly divided community views on this matter, the HCWG recommended that it be further discussed at an industry workshop. The workshop was held in March 2023. The outcomes from the workshop will be discussed under <b>Agenda Item 10</b> . See also management priority #9.
3	HCWG9 June 2016	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	<b>Complete</b>  This work was progressed under the BDM Fishery Harvest Strategy project. Proposed changes were implemented under the <i>Torres Strait Fisheries (Beche-de-mer) Management Instrument 2022</i> .
4	HCWG9 June 2016	Review weight conversion ratios for gutted and dried beche-de-mer species	<b>Ongoing</b>  This work was progressed under the BDM Fishery Harvest Strategy project. Proposed changes were implemented under licence conditions for the BDM Fishery.  CSIRO is continuing to work with industry on understanding weight conversion ratios for curryfish species. An update on this work will be provided at the next HCWG meeting in 2024.
5	HCWG9 June 2016	Develop communication materials to assist industry members with the requirements of the new Fish Receiver System being implemented on 1 December 2017 and on current management arrangements and proposed future management priorities for the fishery.	<b>Complete</b>  As part of the 2019 Fish Receiver System (FRS) community visits, AFMA developed some educational material such as fact sheets and frequently asked questions (FAQs) on the FRS and harvest strategies for industry, as well as consulting on the draft BDM Fishery Harvest Strategy. A number of PZJA Traditional Inhabitant members also accompanied AFMA during the community visits and assisted in communicating the importance and benefits of the FRS.  During the TSRA cluster visits in late 2019 and January 2020, PZJA Traditional Inhabitant members presented on each fishery, including management priorities and the FRS.  AFMA and PZJA Traditional Inhabitant members undertook further community visits in late 2020 – early 2021 leading up to the black teatfish trial opening during which the FRS was also discussed and communication material provided.



Management Priority			Progress to date and comments
6	HCWG13 July 2018	Developing a Beche-de-mer management plan	<p><b>Not progressed</b></p> <p>The development and implementation of the BDM Fishery Harvest Strategy and mandatory FRS was progressed as the highest immediate priority.</p> <p>Further consideration by the HCWG is needed on the need and intended purpose of developing a statutory management plan for the BDM Fishery. A key purpose for implementing management plans is to implement quota (or effort unit) management.</p>
7	HCWG13 July 2018	Continuing education and awareness training with the Fish Receiver System	<p><b>Ongoing</b></p> <p>AFMA continues to liaise with industry on how to improve reporting through the FRS.</p> <p>See also management priority #5.</p>
8	HCWG13 July 2018	Improving communication and engagement with industry on current management arrangements and proposed future management priorities for the fishery	<p><b>Ongoing</b></p> <p>AFMA is continuing to work to improve communications on a range of fisheries topics, including segments on Radio 4MW, the PZJA website and a fisheries notice board outside the AFMA Torres Strait office.</p>
9	HCWG14 October 2018	Some industry members expressed support for Malu Lamar to develop their own proposal on the use of hookah to fish for white teatfish and fast track the issue to the PZJA for consideration, separate to the work that the TSRA is undertaking in this regard.	<p><b>Ongoing</b></p> <p>The TSRA supported PZJA Traditional Inhabitant members to undertake cluster consultations in late 2019 which sought feedback from communities on the use of hookah to fish for white teatfish. Given the strongly divided community views on this matter, the HCWG recommended that it be further discussed at an industry workshop. The workshop was held in March 2023. The outcomes from the workshop will be discussed under <b>Agenda Item 10</b>.</p> <p>See also management priority #2.</p>
10	HCWG15 August 2019	AFMA to arrange a half/full day future management priorities workshop in conjunction with the next Hand Collectables Working Group meeting. Participants to the meeting should include HCWG members, other industry stakeholders including factory processors and/or buyers, and should also include discussions on	<p><b>Ongoing</b></p> <p>AFMA will continue to work with the HCWG and industry to progress discussions on future management priorities for hand collectables fisheries. AFMA considers this a high priority.</p>

Management Priority		Progress to date and comments
		pearl shell and trochus fisheries.
11	HCWG18 October 2021	<p>The HCWG recommended:</p> <ul style="list-style-type: none"> <li>that the assessment and development of management options for the utilisation of white teatfish is a high short-medium term priority for the fishery requesting AFMA consider directing resources towards this management activity.</li> <li>an industry workshop be held to enable industry to develop its preferred management options for the utilisation of white teatfish, while acknowledging the need for AFMA's assessment of the administrative feasibility of the preferred management option(s).</li> </ul>
	HCWG19 November 2022	<p>The HCWG recommended the continuation of the 20t TAC (for black teatfish) and sought advice from the HCRAG on:</p> <ul style="list-style-type: none"> <li>the anticipated duration of an annual 20t catch limit, noting a few more years of data is required to increase certainty on what future annual TACs might be possible;</li> <li>the scientific basis for the development and application of under</li> </ul>
		<p><b>Ongoing</b></p> <p>The TSRA supported PZJA Traditional Inhabitant members to undertake cluster consultations in late 2019 which sought feedback from communities on the use of hookah to fish for white teatfish. Given the strongly divided community views on this matter, the HCWG recommended that it be further discussed at an industry workshop. The workshop was held in March 2023. The outcomes from the workshop will be discussed under <b>Agenda Item 10</b>.</p>
		<p><b>Pending</b></p> <p>This item will be considered at the preceding HCRAG meeting.</p>

Management Priority		Progress to date and comments
	catch carry-over provisions; and <ul style="list-style-type: none"> <li>options for the review of the BDM HS to include provisions to carry over undercatch and set provisional TACs.</li> </ul>	

5. **Table 2** provides a summary of key due dates for the BDM fishery that the HCWG may wish to consider in providing advice on a draft work plan. As far as practical AFMA proposes that a work plan be developed in-session.

**Table 3. Key dates for the TS BDM Fishery in 2024.**

Key date	Activity
1 January 2024	Start of the fishing season for the BDM Fishery.
April/May 2024 (dates TBA)	Black teatfish fishery opening - subject to industry advice on opening dates under <b>Agenda Item 10.3</b> .
September/October 2024 (dates TBA)	HCRAG and HCWG meetings to seek advice on TACs for the 2025 fishing season and annual and five-year research priorities, amongst other matters.
30 November 2024	Annual report to the Department of Climate Change, the Environment, Energy and Water relating to the Torres Strait Beche-de-mer Fishery.

***Next meeting***

6. AFMA proposes the next HCWG meeting be held in the second half of 2024.