TORRES STRAIT TROPICAL ROCK LOBSTER

RESOURCE ASSESSMENT GROUP (TRLRAG) MEETING #22

TUESDAY 27 March 2018 1:00PM-5:30PM

WEDNESDAY 28 March 2018 8:30AM-12:00PM

THURSDAY ISLAND, TSRA CONFERENCE ROOM

AGENDA

1. Preliminaries (Chair)
   - 1.1. Apologies
   - 1.2. Adoption of agenda
   - 1.3. Declaration of interests
   - 1.4. Action items from previous meetings (AFMA)

2. Updates from Members
   - 2.1. Industry and scientific
   - 2.2. Government
     - 2.2.1. Torres Strait Fisher Receiver System
     - 2.2.2. TRL Fishery Strategic Assessment
     - 2.2.3. Torres Strait legislative amendments
   - 2.3. PNG-NFA
   - 2.4. Native Title

3. 2017/18 TRL catch and effort information (AFMA, CSIRO)

4. Finalising the stock assessment update and recommended biological catch (CSIRO)

5. Data rules for using catch data reported in the Torres Strait Buyers and Processors Docket Book (CSIRO)

6. TRL harvest strategy (AFMA)

7. Justification for a January season start date for the QLD East Coast TRL Fishery (QDAF and CSIRO)

8. Setting of hookah closures (TSRA)

9. Other Business

10. Date and venue for next meeting

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
PRELIMINARIES **Opening prayer, acknowledgement of Traditional Owners, welcome and apologies**	**Agenda Item 1.1** **For Noting**

RECOMMENDATIONS

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

BACKGROUND

Apologies have been received from:

1. Aaron Tom;
2.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
PRELIMINARIES **Adoption of agenda**	**Agenda Item 1.2** **For DECISION**

RECOMMENDATIONS

1. That the Working Group consider and **ADOPT** the agenda.

BACKGROUND

2. A draft agenda was circulated to members and other participants on 28 February 2018. No comments were received.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	Meeting 22 27-28 March 2018
PRELIMINARIES Declarations of interests	Agenda Item No. 1.3 For ACTION

RECOMMENDATIONS

1. That RAG members:
   a. **DECLARE** all real or potential conflicts of interest in the Torres Strait Rock Lobster Fishery at the commencement of the meeting;
   b. **DETERMINE** whether the member may or may not be present during discussion of or decisions made on the matter which is the subject of the conflict;
   c. **ABIDE** by decisions of the RAG regarding the management of conflicts of interest; and
   d. **NOTE** that the record of the meeting must record the fact of any disclosure, and the determination of the RAG as to whether the member may or may not be present during discussion of, or decisions made, on the matter which is the subject of the conflict.

BACKGROUND

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. RAG members are asked to provide the Executive Officer with a list of declared interests.
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.
7. TRLRAG declarations of interest as at meeting 21 held on 12-13 December 2017 are enclosed.

TRLRAG Declarations of Interest as at meeting 20 held on 4-5 April 2017

Name	Position	Declaration of interest
Members		
Ian Knuckey	Chair	Nil. Member of other RAG's and conducts various AFMA research projects. No research projects in the Torres Strait.
Dean Pease	TRLRAG Executive Officer	Nil
Selina Stoute	AFMA Member	Nil
John Ramsay	TSRA Member	Nil. TSRA holds multiple TVH TRL fishing licences on behalf of Torres Strait Communities but does not benefit from them.
Samantha Miller, (replaces Tom Roberts)	QDAF member	Nil
Eva Plaganyi	Scientific Member	Project staff for PZJA funded TRL research projects.
Andrew Penney	Independent Scientific Member	Member of other RAG's and research consultant. No research projects in the Torres Strait.
Aaron Tom	Industry Member	Industry representative, does not hold a TIB licence.
Mark David	Industry Member	TIB licence holder and industry representative.
Terrence Whap	Industry Member	Industry representative, does not hold a TIB licence.
Les Pitt	Industry Member	TIB licence holder and industry representative.
Phillip Ketchell	Industry Member	TIB licence holder and industry representative.
Daniel Takai	Industry Member	Pearl Island Seafood, Tanala Seafood and TIB licence holder
Ray Moore	Industry Member	Industry representative.
Brett Arlidge	Industry Member	General Manager MG Kailis Pty Ltd, MG Kailis is a holder of TVH licences.

Observers		
Jerry Stephen	Invited Participant (TSRA Fisheries Portfolio Member)	TIB licence holder
Maluwap Nona	Chairperson Malu Lamar	TIB licence holder
Allison Runck	TSRA	Nil. TSRA holds multiple TVH TRL fishing licences on behalf of Torres Strait Communities but does not benefit from them.
Mark Tonks	CSIRO	Project staff for PZJA funded TRL research projects
Sandy Morison	TRLWG Chair	Nil. Member of other RAG's and conducts various AFMA research projects. No research projects in the Torres Strait.

Australian Government
Australian Fisheries Management Authority

TRLRAG #22 – TUESDAY & WEDNESDAY 27-28 MARCH 2018

Name	Declaration of Interests	Signature

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 28 and 29 March 2018
PRELIMINARIES **Action items from previous TRLRAG and relevant TRLWG meetings**	**Agenda Item 1.4** **FOR NOTING**

RECOMMENDATIONS

1. That the RAG:
   a. **NOTE** the final TRLRAG meeting record no. 21 is at **Attachment A**.
   b. **NOTE** the progress against actions arising from previous meetings, including the 21st meeting of the Tropical Rock Lobster Resource Assessment Group held on 12-13 December 2017 **(enclosed Table 1)**.

BACKGROUND

Meeting record

2. The TRLRAG meeting record no. 21 was ratified out of session, the final meeting record was sent to RAG member and observers on 12 February 2018 for comment.

3. TSRA provided comments on the RAG draft record, a copy of TSRA comments in track changes are provided in **Attachment B**. The TSRA suggested changes on page three about declaration of interests were accepted and the suggested changes on page 10 about TVH sector licence lease back were not accepted.

Actions arising

4. Updates are provided on the status of actions arising from previous TRLRAG meetings in **Table 1** and relevant TRLWG meetings in **Table 2** of the enclosure.

Enclosure

Table 1 TRLRAG Action Items

No.	Action Item	Agenda	Agency	Due Date	Status
1.	AFMA to review the effectiveness of certain TIB licensing arrangements (in its 2016 licencing review) including: • TIB licenses should share a common expiry date • licences to last for longer than the current 12 month period.	TRLRAG14 1.3	AFMA	2017	Ongoing AFMA has begun undertaking a review of licensing of Torres Strait Fisheries, this issue will be considered as part of this review. At present however, AFMA resources are focused on progressing the proposed legislative amendments as a matter of priority.
2.	AFMA and CSIRO prepare a timeline of key events that have occurred in the Torres Strait Tropical Rock Lobster Fishery (e.g. licence buy backs, weather events and regulation changes) and provide a paper to TRLRAG.	TRLRAG14 3	AFMA CSIRO	TRLRAG17 2016	Ongoing AFMA to complete further work. This has been difficult to action ahead of other priorities for the Fishery.
3.	AFMA to prepare a summary of evidence that PNG trawl-caught TRL are a shared stock between Australia and PNG, including details such as the TRL biological characteristics, larvae dispersal, tag recapture data and catch and effort information. AFMA will circulate the paper to the RAG out-of-session for comment before sending to PNG NFA.	TRLRAG19	AFMA		Ongoing AFMA sent a letter to PNG NFA outlining concerns of trawlers retaining TRL on 8 March 2017. AFMA presented the key findings of the CSIRO larval advection model at the Fisheries Bilateral meeting held in Port Moresby on 5 February. The bilateral meeting noted that the findings show the Australian and PNG TRL fisheries are based on a single stock **(Attachment C)**. AFMA and CSIRO (Dr Plaganyi) met with PNG NFA officials, including the NFA Managing Director, John Kasu on 7 February 2018 at NFA offices in Port Moresby. Dr Plaganyi presented the updated stock assessment results and larval advection modelling. There was agreement that the updated larval modelling together with past research provides strong evidence that TRL is a shared stock between Australia and PNG.
4.	Malu Lamar RNTBC to provide AFMA with the map of traditional boundaries and regional area and reef names for each of the Torres Strait Island nations and for CSIRO to examine possible revised naming conventions for survey sites	TRLRAG20	Malu Lamar RNTBC		Ongoing Reminder sent 20/12/2017 to Maluwap Nona, Chairperson Malu Lamar. Reminder sent 08/03/2018 to Chairperson Malu Lamar.
5.	AFMA to investigate the potential cause of the TVH sector misreporting of fishing hours.	TRLRAG21		RAG 22	Complete The missing data was tracked to logbooks returns from two vessel operators. The licence holder was notified.
6.	Lamp fishing data should be used for future TIB CPUE analyses	TRLRAG21			Complete TIB sector CPUE analysis will be updated to include lamp fishing.

7.	Torres Strait Docket Book (TDB01) data rules to be presented at the next RAG meeting scheduled for March 2018 The scientific observer recommended that RAG members and observers read the meeting paper prior to discussing this agenda item at the next meeting.	TRLRAG21	CSIRO and AFMA	Deferred to RAG 22	Complete Data rules to be considered at TRLRAG 22.

Table 2 TRL Working Group Action Items relevant to the TRLRAG

No.	Action Item	Agenda	Agency	Due Date	Status
1	TRLRAG to provide advice on any findings relating to the impacts of changing the season start date to provide industry with a longer TAC notice period.	TRLWG #5 held on 5-6 April 2016	AFMA to draft RAG paper	TRLRAG22	Ongoing Due to be completed at TRLRAG22
	TRLRAG review the advice and justification for opening the east coast TRL season on 1 January. AFMA present that advice as an update at the next TRLWG meeting.	TRLWG #5 held on 5 6 April 2016	QDAF and CSIRO	At the next TRLRAG meeting.	Complete Due to be discussed at Agenda Item 7 by QDAF. CSIRO provided a report titled Biology, larval transport modelling and commercial logbook data analysis to support management of the NE Queensland rock lobster fishery. The report was sent to members and observers prior to the TRLWG meeting no. 6 The report provides information to support management arrangements for the East Coast Fishery. The RAG has not yet considered this action item.

*TRLWG actions not relevant to RAG have been removed from this paper.

Torres Strait Tropical Rock Lobster Resource Assessment Group

Meeting Record 21

12 & 13 December 2017

Northern Fisheries Centre, Cairns

In-session meeting

Note all meeting papers and record available on the PZJA webpage:

www.pzja.gov.au

Australian Government

Australian Fisheries Management Authority

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Contents

Meeting participants

Members

Name	Position	Declaration of interest
Ian Knuckey	Chair	Nil Member of other RAG's and conducts various AFMA research projects. No research projects in the Torres Strait.
Dean Pease	TRLRAG Executive Officer	Nil
Selina Stoute	AFMA Member	Nil
Mariana Nahas	TSRA Member	Nil – public servant employed by TSRA, a government authority. TSRA holds multiple TVH TRL fishing licences on behalf of Torres Strait Communities but does not benefit from them. Partner holds a Fish Receiver Licence.
Eva Plaganyi	CSIRO Scientific Member	Project staff for AFMA funded TRL research projects.
Andrew Penney	Independent Scientific Member	Member of other RAG's and research consultant. None research projects in the Torres Strait.
Mark David	Industry Member	TIB licence holder and industry representative
Terrence Whap	Industry Member	Industry representative, does not hold a TIB licence.
Les Pitt	Industry Member	TIB licence holder and industry representative
Phil Ketchell	Industry member	TIB licence holder and industry representative
Brett Arlidge	Industry Member	General Manager MG Kailis Pty Ltd, holder of TVH licences

Name	Position	Declaration of interest
Daniel Takai	Industry Member	Pearl Island Seafood, Tanala Seafood, TIB licence holder and TVH lease applicant

Observers

Name	Position	Declaration of interest
Jerry Stephen	TSRA Deputy Chair TSRA Fisheries Portfolio	TIB licence holder
Robert Campbell	Scientific Observer	Project staff for AFMA funded TRL research projects
Mark Tonks	Scientific Observer	Project staff for AFMA funded TRL research projects
Suzannah Salam	Industry Observer	Fish Receiver licence holder and buyers of Torres Strait seafood
Tony Salam	Industry Observer	TIB licence holder
Ken McKenzie	Industry Observer	TVH licence holder
David Sabatino	Industry Observer	TIB licence holder
Trent Butcher[1]	Industry Observer	TVH licence holder
Mark Dean[2]	Industry Observer	TVH fisher
Ian Liviko[2]	PNG NFA	NIL

[1] Attended the meeting on the morning of day one only.

[2] Attended the meeting on day two only.

Action items and recommendations

Action Items

Number	Action
1.	Tropical Rock Lobster Fishery catch and effort data should be provided by 31 October each year to allow sufficient time for the stock assessment model to be updated.
2.	AFMA to investigate the potential cause of the TVH sector misreporting of fishing hours.
3.	Lamp fishing data should be used for future TIB CPUE analyses
4.	The RAG **AGREED** to defer the decision on the Torres Strait Docket Book (TDB01) data rules to the next RAG meeting scheduled for March 2018, this was due to a lack of time to present and discuss the results of the paper. The RAG **AGREED** that members and observers review the meeting paper out of session and provide any comments on the paper at the next meeting.
5.	The RAG **AGREED** to defer discussion on the harvest strategy agenda item to the next RAG meeting scheduled for March 2018 due to a lack of time to adequately present and discuss the agenda item.

Recommendations

Recommendations
The RAG **RECOMMENDED** a preliminary recommended biological catch (RBC) of 299 tonnes for Australia and PNG inclusive, based on the following: • the current stock biomass is estimated at 76 per cent of B_{1973} which is above the target biomass of 65 per cent; • the RBC was calculated by applying the interim harvest strategy to the preliminary results of the integrated fishery stock assessment; • the reduction in the RBC is primarily due to the stock assessment responding to the low indices for 1+ lobster; and • the 0+ index of lobster is the lowest ever recorded by a pre-season survey, however the 0+ indices is uncertain due to the small size and cryptic nature of 0+ lobster; and, • although poorly estimated, the stock biomass is predicted to drop to 59 per cent of B_{1973} in 2019.
The RAG **STRONGLY RECOMMENDED** that under the current low levels of abundance, all management actions should be considered to ensure the 2018 RBC of 299 tonnes is not breached.

Agenda Item 1 - preliminaries

1.1 Apologies

Apologies were received from Tom Roberts (QDAF member); Samantha Miller (QDAF member); Ray Moore (industry member); Aaron Tom (industry member); Meremi Maina (PNG industry observer) and Maluwap Nona (Chairperson Malu Lamar RNTBC).

1.2 Adoption of agenda

The RAG adopted the agenda without any changes. The TSRA observer requested that a discussion on moon-tide hookah closures be included in other business at Agenda Item 10.

1.3 Declaration of interest

The RAG generally noted that there could be potential conflicts of interest for members and observers when providing information and advice on some agenda items and these conflicts should be tabled by members. The Chair requested members and observers to leave the meeting room in groups so RAG members could consider the potential conflicts of interest and agree on how those potential conflicts should be managed.

Scientific Member and Observers

The remaining RAG members noted that CSIRO is the major research provider for the Fishery and have interests in fishery research projects. The RAG noted that no new research projects were being discussed at this meeting and that advice from CSIRO members and observers was important for the RAG agenda items. No conflict of interest issues were identified.

Industry Members and Observers

The remaining RAG members noted that industry members and observers have pecuniary interests in the Fishery, however industry is needed at the meeting for their advice and expertise. The RAG considered that there was a diverse representation of industry across the various sectors and it was unlikely the discussion may be biased by a single sector or individual. The RAG agreed it did not need to remove industry members or observers for any of the agenda items. The remaining RAG members noted that in the event that one person's views biased the discussions the RAG Chair may ask them to leave for the discussion or recommendations.

1.4 Action items from previous meetings

The RAG noted progress against action items from previous meetings. The up-to-date list of action items and progress is provided in **Attachment A**.

The independent scientific member noted that for action item 4 'AFMA preparing a summary of evidence of a single stock'; the information paper should include the historical information and the results of the larval modelling research (agenda item 6) that reconfirms the tropical rock lobster fishery is a single stock.

The RAG noted that for agenda item 5 'naming of reefs and significant areas', that Malu Lamar RNTBC is best placed to provide the names of reefs and significant areas. The

scientific observer noted that CSIRO have included the traditional names of some reefs in their meeting papers and presentations.

The RAG noted that the RAG 21 meeting record was ratified out-of-session. Some comments were received from members and these were provided in the RAG meeting papers with track changes (pages 29-45). No further comments were received on the draft meeting record and the RAG agreed the record was a true and accurate representation of the meeting.

Agenda Item 2 - updates

Industry

The RAG noted the updates provide by industry members.

- One industry observer asked whether any further research had been undertaken to provide more information on the spawning of tropical rock lobster, noting that this information is important for managing the stock sustainably. The scientific member noted that research is expensive and there is a limited amount of funding for Torres Strait research projects. The larval advection modelling project (agenda item 6) was cost effective research that aimed to improve the understanding of lobster larval dispersal into the Torres Strait from Yule Island, PNG and Princess Charlotte Bay, QLD.

- One industry member noted that there was a low abundance of lobsters throughout 2017 that corresponded to the low recommended biological catch (RBC) and total allowable catch (TAC) figure of 495 tonnes. The member noted that he was not aware of any exemptions being issued to PNG trawlers in 2017 and to his knowledge there was not any large volumes of PNG trawl caught lobster tails on the market.

- Some industry observers were concerned that the low abundance of lobsters in 2017 and 2018 was a result of PNG trawlers taking spawning lobsters on their migration to Yule Island.

- One industry member noted that fishing on Darnley Island has been slow since the season start on 1 December. The member noted that he has observed large numbers of berried lobsters from Don Cay to Dowar Island. One industry member stated it was too early to comment on the fishing conditions around Mabuiag Island.

- One industry member noted the start of the 2017/18 fishing season is similar to 2016/17 season. The member noted that lobsters had already moulted and this was unusual for the start of the season and it was believed to be due to high water temperature.

- One industry member noted that the tides had not been favourable for the start of the fishing season, however the catches around Yam Island have been good with free dive fisher's landing between 50-80 kilograms of tails for one days fishing, however there has been high number of double skin (moulting lobsters). The member noted

that most of the catch was coming from the shallow water and there was low numbers of lobsters in the deeper water.

- The scientific observer asked industry members what the level of discard in the fishery is. Industry member noted discarding is unlikely for the TIB dinghies because any mortality is processed to a tailed lobster. The AFMA EO noted that the TVH sector complete a daily fishing log and that any post capture mortality and discarding should be captured by the daily fishing log (TRL04).

- One industry member asked other members and observers for any information about PNG fisheries and if they have changed their fishing methods or practices over time and whether this may be having an impact on the stock. One industry member stated he did not believe that PNG had a large increase in fishing efficiency and they are fishing with the same equipment as previous, the member noted that the Australia industry has become more efficient over time with GPS, sounders and faster vessels.

- The scientific member noted that the catch history for the fishery starts in 1973 and there was approximately 573 tonnes of reported trawl catch from PNG. The scientific member noted that the stock assessment includes all sources of fishing mortality and historically the Fishery was trending well and that it seems like in recent years the Fishery has experienced anomalous conditions.

- One industry member noted that there could be some link between the environmental conditions in the Fly River and impacts on the lobster stock, the member noted that recently the Gulf of Papua barramundi fishery had collapsed and black jewfish was in decline. The scientific member noted there are reported increasing levels of toxins in the Fly River, however the impact was further to the north east and unlikely to impact the lobster stock, however further analysis could be undertaken.

Government

The RAG noted the update provided by the AFMA member:

- The introduction of a mandatory fish receiver system (also known as catch disposal record) for Torres Strait fisheries was implemented on 1 December 2017. Since the introduction of the system there has been an increase in licensing and reporting from the TIB sector. The timely reporting of catch landing will help to monitor total catch for the Fishery.

- At its last meeting the TRL Working Group considered outcomes of the consultation process undertaken for the TRL management Plan. The TIB sector representatives noted they want to take into account findings of a New Zealand study tour on Maori fishing entitlements. The TSRA observer noted that a fisheries summit will be held in 2018 for the TIB sector to discuss and agree on the preferred management of the Fishery.

The RAG noted the updated provided by the TSRA Member that:

- In the past year TSRA has purchased 3 TVH licences and noted that there may be some changes to catch and effort for the fishery. The TSRA noted they are intending to lease the three licences out to traditional inhabitants. The Chair asked if leasing the TVH licences was to be ongoing or a once off. The TSRA member stated the objective was to work towards 100 per cent ownership of Torres Strait fisheries by traditional inhabitants and that leasing revenue as well as other sources of funding may be used.

PNG NFA

The RAG noted the update provided by the PNG National Fisheries Authority observer:

- There have been no exemptions issued to PNG prawn trawlers for 2017 or 2018 allowing them to retain tropical rock lobster;
- Observer coverage on the PNG prawn trawler fleet is ongoing, observer coverage is high during the months of September and October when there is a high risk of incidental catch of lobster. PNG NFA officials also monitor the unloads of prawn trawlers;
- Data reporting by the PNG prawn fleet is slow and the NFA are aiming to improve data reporting by implementing a logbook system that is consistent with the PNG tuna fishery.
- The NFA are introducing mandatory bycatch reduction devices (BRDs) for the prawn fleet including turtle excluder device (TED) to reduce turtle bycatch; square mesh panel and fish eye reduction device to reduce the bycatch of finfish.

Native title

The Chairperson for Malu Lamar RNTBC was an apology for the meeting, no update was provided.

Agenda Item 3 – catch summary

The RAG noted an update on the fishery catch and effort information based on the paper titled '*Torres Strait Tropical Rock Lobster Catch Data Summary'* and '*Estimation of Total Annual Effort in the Torres Strait Rock Lobster Fishery – 2017 Update*.'

The RAG noted advice from the scientific observer that:

- The 2016/17 notional TAC was set at 495 tonne for Australia and PNG inclusive. The Australian catch was 255.4 tonnes (TIB caught 104.6 tonnes and TVH sector caught 149.0 tonnes);
- The PNG catch was 113.0 tonnes;
- There was zero reported trawl catch from PNG in 2016/17; and
- There are some uncertainties in the PNG data. When comparing figures from PNG processors and the PNG export data there are large discrepancies in reported PNG

catch in some years. A precautionary approach was taken and the higher catch figures from each year for PNG were used for stock assessment purposes.

The scientific observer noted that AFMA provided the last four years of catch and effort data for the 2017 update. A large number of late returns of the TDB01 docket book were received and this has resulted in an increase in the total reported catch. The scientific member noted that a standard procedure should be developed for receiving fishery data because there is a tight deadline to meet.

The RAG **AGREED** that the Tropical Rock Lobster Fishery catch and effort data should be provided by 31 October each year to allow sufficient time for the stock assessment model to be updated.

The AFMA member noted that there should be an improvement with the provision of accurate and timely data with the introduction of the Torres Strait Fish Receiver System and the Catch Disposal Record.

The AFMA EO questioned whether the increase in unreported fishing hours by the TVH sector from ~2 per cent to ~12 per cent from 2016 to 2017 was accurate. The scientific observer noted that this was an accurate representation.

The RAG **AGREED** for AFMA to investigate the potential cause of the TVH sector under-reporting of fishing hours.

The scientific observer noted that the 2016-17 TIB sector data had a significant change in the reported fishing location. The number of docket book returns with no fishing location recorded significantly decreased and the number of returns with Thursday Island listed as the fishing location significantly increased. One industry member noted that the Thursday Island fishing location (area 9) is likely to be incorrect and over reported for 2016-17.

The independent scientific member recommended that the area effect (whether the reported fishing location impacts on catch and catch rates) be removed from the CPUE standardisation to examine if it is influencing the results in any significant way. The scientific observer undertook an analysis of area effect and reported to the RAG that it is not having a strong influence of the CPUE standardisation.

The RAG Chair questioned if there was any trends of increasing fishing efficiency captured in the time series of data. The scientific member noted that the absence of fine scale spatial information precludes the ability to identify if there has been a trend to accessing deeper water, however it can be captured by looking at when hookah equipment was introduced or the amount of fishing effort at Kirkaldie.

Agenda Item 4 – catch per unit effort indices

The RAG noted an update by Scientific Observer Dr Robert Campbell on the fishery catch per unit effort (CPUE) standardisation for the TIB and TVH sectors as per the papers titled '*An Abundance Index for Torres Strait Rock Lobster using TIB data'* and '*An Abundance Index for Torres Strait Rock Lobster using TVH data*.'**4A – TVH sector standardisation**

Robert noted the stock assessment relies on an index of abundance that is provided by the pre-season survey and the standardised CPUE for the TIB and TVH sectors. The CPUE is standardised to account for changes that influence catch and catch rates. The standardisation process also looks at whether a combination of factors influence catch or catch rates. The relative fishing power across the fleet has the largest effect in the model for the TVH data and it varies from 36 per cent to 192 per cent.

Robert noted that for the TVH CPUE the area effect and fishing method effect did not appear to have a large influence on the model.

4B – TIB sector standardisation

Robert noted that in 2013 there was a reduction in the reporting of fishing effort for the TIB sector and more recently in 2015 and 2016 there was a reduction in the reporting of effort information because some processors reported aggregate catch. This had made the CPUE analysis more difficult for the TIB sector.

Robert noted that in previous years the TIB sector docket book records for lamp fishing (n=4,435 records) were not used in the analysis. The RAG **AGREED** that lamp fishing data should be used for future TIB CPUE analyses.

Robert noted that as per previous discussions, there was a reduction in catch by unknown area and increase in reported catch for Thursday Island (area 9). The RAG noted the increase in reported catch for the Thursday Island was likely to be incorrect and over represented. The RAG noted that when the area effect (the impact of the reported fishing area on model results) was tested it had limited influence on the stock assessment results.

The RAG noted that the Main-Effects model (the base-case used for the fishery assessment) increased by 20 per cent for 2017 when compared to the long-term average. The scientific observer noted that further checks were undertaken and the increase was due to a recent shift from predominately tailed lobster to live lobster for the TIB sector (it was not due to the over representation of catch for Thursday Island, area 9).

Agenda item 5 – pre-season survey results

The RAG noted an update on the fishery independent pre-season survey that was held from 1 to 12 November 2017 presented by the scientific observer Mark Tonks.

Mark noted that:

- There was good visibility and mostly favourable weather conditions throughout the duration of the dive survey;
- A total of 77 reef sites were surveys, each site is surveyed by diving and observing lobsters over a 400 metre long by 4 metre wide belt transect;
- The 2017 1+ index is the lowest ever recorded for the pre-season survey, there was an average of 1.78 lobsters per transect. This is down 75 per cent from 2015 and 15 per cent from 2016;

- The pre-season survey does not provide an index for 2+ lobsters because these lobsters have already migrated from the Torres Strait, instead the Fishery uses the standardised CPUE indices for the 2+ indices;
- Across the 77 sites surveyed only 18 0+ lobsters were observed, this was a substantial decrease from 2016 pre-season survey of 90 0+ lobsters;
- There was no observations of extraordinary changes to benthic habitat at survey sites.

The Chair questioned whether inter-diver comparisons are made to check if one diver or a dive team may be biasing the results. The scientific observer noted that the survey procedures minimise the effect of individual divers on the lobster count. However, there may be up to 15 per cent undercount of 0+ lobster from 2016, due to Darren Dennis retiring (Darren conducted CSIRO lobster dive surveys from 1989 to 2016).

Mark noted that the 77 dive sites do not include deeper dive sites on the eastern edge of Warrior Reef that have previously been included in the dive surveys. The scientific member Eva Plaganyi noted that the survey was at a reduced scale with 77 sites, however before reducing the scale of the survey the RAG made considered the data and agreed that 77 sites would be representative. Eva noted that the survey number of 0+ lobster are so low that the model cannot fit the data well (the model over estimates the number of 0+).

Eva noted the potential factors that may have led to the low 2017 pre-season survey results were:

- overfishing may be a potential factor, the stock has been observed to decline in the past due trawling of migrating and spawning lobster. The high reported trawl catch in 2014 may have reduced the abundance of 1+ lobster in 2016;
- natural fluctuations based on environmental conditions and density dependence of the lobster stock;
- environmental anomaly relating to the strong El Nino event in 2015 and 2016 that led to highest ever recorded sea surface temperatures. High sea surface temperatures are known to influence growth and survival of lobsters and changes to oceanic currents may have impacted on larval advection;
- there was reported loss of habitat recently with sand incursions and coral bleaching that may have reduced the productivity of the ecosystem and had a negative impact on lobster abundance;
- the survey method and procedures were consistent with previous years and undertaken by an experienced dive team. The survey method was not considered to be a factor for the low survey count.

Agenda item 6 – larval movement

The RAG noted the preliminary results of the research project titled '*Environmental update for the Torres Strait tropical lobster Panulirus ornatus*' presented by the scientific member Dr Eva Plaganyi. The aim of the research was to gather better understanding about the

connectivity of the tropical rock lobster population between Papua New Guinea, Torres Strait and Queensland East Coast and to improve the reliability of the fishery stock assessment.

The RAG noted the following information and results from research project presented by the scientific member:

- The project modelled larvae dispersal from two location, Yule Island in Papua New Guinea and Princess Charlotte Bay in Queensland;
- Once larvae are released they spend five months travelling in oceanic currents before they settle as a 0+ lobster, and only a very small percentage of larvae survive and settle as a 0+ lobster;
- There is clear evidence that the Torres Strait Tropical Rock Lobster Fishery, the PNG Tropical Rock Lobster Fishery and the Queensland East Coast Lobster Fishery are based on a single stock of tropical rock lobster;
- The plots show that some larvae released at Yule Island and Princess Charlotte Bay settle in the Torres Strait, however there was no clear relationship between larvae modelling, the pre-season survey and stock assessment results and the level of catch;
- There is a lack of tidal flow information for the Torres Strait and as a result the model does not accurately predict the dispersal of larvae once it reaches the Torres Strait.

The independent scientific member noted that the modelling confirmed that the fisheries are based on a single stock and the model is not able to predict how the stock may be influenced by various fishing or environmental conditions. The independent scientific member noted that the model does not predict how the stock may be influenced by anomalous environmental conditions because it did not explore these event in detail.

The independent scientific member noted the modelling results show that the Fishery recruitment is variable from year to year and is reliant on a healthy spawning biomass throughout the range of the lobster population. This is because across multiple years there is likely to be changing conditions that favour the settlement of larvae in the Torres Strait from different locations.

One industry observer noted that Cape Grenville is an important spawning area for tropical rock lobster on the east coast of Queensland and that lobsters spawning in this area may be important for the recruitment of tropical rock lobster into the Torres Strait.

Agenda item 7 – stock assessment update

The RAG noted the preliminary results of the stock assessment update and the recommended biological catch (RBC) based on the presentation titled '*Draft Updated 2017 Integrated Stock Assessment to provide management advice on the Torres Strait rock lobster fishery*' by Dr Eva Paganyi.

Eva noted the stock assessment model is not fitting to the pre-season season survey 0+ lobster indices. The poor model fit relates to the difficulty of accurately sampling 0+ lobsters and the model is unable to predict the trend in abundance of 0+ lobsters.

The independent scientific member noted the model is predicting that there are more 0+ lobster that what were observed in the pre-season survey. As a result, the stock assessment is providing a slightly more optimistic RBC.

Eva noted that the predicted biomass for the Fishery in 2018 is 0.76 (90% CI 0.54 to 0.98) and dropping to 0.59 in 2019.The target biomass reference point for the Fishery is 0.65. The Chair noted that the model is responding (by reducing the recommended biological catch) to what the potential catch will be for 2018, the model does this by placing a large weighting on the 1+ survey index of abundance, rather than the stock biomass.

Eva advised that in line with the stock assessment outcomes and the interim Harvest Strategy the recommended biological catch (RBC) for 2017/18 fishing season is 299 tonnes. The large reduction from 495 tonne in 2016/17 to 299 tonnes is primarily due to the reduction in the 1+ lobster indices.

Eva noted that the draft empirical harvest control rule (eHCR) can only be implemented once the PZJA agreed to the fishery Harvest Strategy. If the RBC was set based on the eHCR the RBC would have been higher, this is due to the eHCR averaging the indices over the previous 5 years to reduce the variability. The independent scientific member noted that if the eHCR uses data from the past four years it would set an RBC of 280 tonnes, this is consistent with the stock assessment result.

The RAG **RECOMMENDED** a preliminary recommended biological catch (RBC) of 299 tonnes for Australia and PNG inclusive, based on the following:

- the current stock biomass is estimated at 76 per cent of B_{1973} which is above the target biomass of 65 per cent;
- the RBC was calculated by applying the interim harvest strategy to the preliminary results of the integrated fishery stock assessment;
- the reduction in the RBC is primarily due to the stock assessment responding to the low indices for 1+ lobster; and
- the 0+ index of lobster is the lowest ever recorded by a pre-season survey, however the 0+ indices is uncertain due to the small size and cryptic nature of 0+ lobster; and,
- although poorly estimated, the stock biomass is predicted to drop to 59 per cent of B_{1973} in 2019.

The RAG noted the stock assessment results will be finalised in March 2018 and presented to the RAG at its next meeting, however it is unlikely that the results will change significantly.

The RAG **STRONGLY RECOMMENDED** that under the current low levels of abundance, all management actions should be considered to ensure the 2018 RBC of 299 tonnes is not breached.

The following members and observers left the meeting: Eva Plaganyi (scientific member); Mariana Nahas (TSRA member); Brett Arlidge (industry member) and Phil Ketchell (industry member).

Agenda item 8 – stock assessment data rules

The RAG **AGREED** to defer the decision on the Torres Strait Docket Book (TDB01) data rules to the next RAG meeting scheduled for March 2018, this was due to a lack of time to present and discuss the results of the paper. The scientific observer recommended that RAG members and observers read the meeting paper prior to discussing this agenda item at the next meeting.

The RAG **AGREED** that members and observers review the meeting paper out of session and provide any comments on the paper at the next meeting.

Agenda item 9 – harvest strategy

The RAG **AGREED** to defer discussion on the harvest strategy agenda item to the next RAG meeting scheduled for March 2018 due to a lack of time to present and discuss the agenda item.

Agenda item 10 – other business

The RAG Chair noted that the TSRA observer requested to discuss the setting of moon-tide hookah closures for the fishery and wanted the RAG to consider if a second moon-tide closure should be implemented during the months February to September.

The RAG Chair recommended the TSRA observer provide a paper to the RAG prior to the next meeting to support an informed discussion.

Agenda item 11 – next meeting

The Chair noted the next meeting was scheduled for March 2018. The meeting was closed.

Torres Strait Tropical Rock Lobster Resource Assessment Group

Meeting Record 21

12 & 13 December 2017

Northern Fisheries Centre, Cairns

In-session meeting

Note all meeting papers and record available on the PZJA webpage:

www.pzja.gov.au

Australian Government

Australian Fisheries Management Authority

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Contents

Meeting participants

Members

Name	Position	Declaration of interest
Ian Knuckey	Chair	Nil Member of other RAG's and conducts various AFMA research projects. No research projects in the Torres Strait.
Dean Pease	TRLRAG Executive Officer	Nil
Selina Stoute	AFMA Member	Nil
Mariana Nahas	TSRA Member	Nil – public servant employed by TSRA, a government authority. TSRA holds multiple TVH TRL fishing licences on behalf of Torres Strait Communities but does not benefit from them. Partner holds a Fish Receiver Licence.
Eva Plaganyi	CSIRO Scientific Member	Project staff for AFMA funded TRL research projects.
Andrew Penney	Independent Scientific Member	Member of other RAG's and research consultant. None research projects in the Torres Strait.
Mark David	Industry Member	TIB licence holder and industry representative
Terrence Whap	Industry Member	Industry representative, does not hold a TIB licence.
Les Pitt	Industry Member	TIB licence holder and industry representative
Phil Ketchell	Industry member	TIB licence holder and industry representative
Brett Arlidge	Industry Member	General Manager MG Kailis Pty Ltd, holder of TVH licences

Name	Position	Declaration of interest
Daniel Takai	Industry Member	Pearl Island Seafood, Tanala Seafood, TIB licence holder and TVH lease applicant

Observers

Name	Position	Declaration of interest
Jerry Stephen	TSRA Deputy Chair TSRA Fisheries Portfolio	TIB licence holder
Robert Campbell	Scientific Observer	Project staff for AFMA funded TRL research projects
Mark Tonks	Scientific Observer	Project staff for AFMA funded TRL research projects
Suzannah Salam	Industry Observer	Fish Receiver licence holder and buyers of Torres Strait seafood
Tony Salam	Industry Observer	TIB licence holder
Ken McKenzie	Industry Observer	TVH licence holder
David Sabatino	Industry Observer	TIB licence holder
Trent Butcher[1]	Industry Observer	TVH licence holder
Mark Dean[2]	Industry Observer	TVH fisher
Ian Liviko[2]	PNG NFA	NIL

[1] Attended the meeting on the morning of day one only.

[2] Attended the meeting on day two only.

Action items and recommendations

Action Items

Number	Action
1.	Tropical Rock Lobster Fishery catch and effort data should be provided by 31 October each year to allow sufficient time for the stock assessment model to be updated.
2.	AFMA to investigate the potential cause of the TVH sector misreporting of fishing hours.
3.	Lamp fishing data should be used for future TIB CPUE analyses
4.	The RAG **AGREED** to defer the decision on the Torres Strait Docket Book (TDB01) data rules to the next RAG meeting scheduled for March 2018, this was due to a lack of time to present and discuss the results of the paper. The RAG **AGREED** that members and observers review the meeting paper out of session and provide any comments on the paper at the next meeting.
5.	The RAG **AGREED** to defer discussion on the harvest strategy agenda item to the next RAG meeting scheduled for March 2018 due to a lack of time to adequately present and discuss the agenda item.

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Recommendations

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The RAG **RECOMMENDED** a preliminary recommended biological catch (RBC) of 299 tonnes for Australia and PNG inclusive, based on the following: • the current stock biomass is estimated at 76 per cent of B_{1973} which is above the target biomass of 65 per cent; • the RBC was calculated by applying the interim harvest strategy to the preliminary results of the integrated fishery stock assessment; • the reduction in the RBC is primarily due to the stock assessment responding to the low indices for 1+ lobster; and • the 0+ index of lobster is the lowest ever recorded by a pre-season survey, however the 0+ indices is uncertain due to the small size and cryptic nature of 0+ lobster; and, • although poorly estimated, the stock biomass is predicted to drop to 59 per cent of B_{1973} in 2019.
The RAG **STRONGLY RECOMMENDED** that under the current low levels of abundance, all management actions should be considered to ensure the 2018 RBC of 299 tonnes is not breached.

Agenda Item 1 - preliminaries

1.1 Apologies

Apologies were received from Tom Roberts (QDAF member); Samantha Miller (QDAF member); Ray Moore (industry member); Aaron Tom (industry member); Meremi Maina (PNG industry observer) and Maluwap Nona (Chairperson Malu Lamar RNTBC).

1.2 Adoption of agenda

The RAG adopted the agenda without any changes. The TSRA observer requested that a discussion on moon-tide hookah closures be included in other business at Agenda Item 10.

1.3 Declaration of interest

The RAG generally noted that there could be potential conflicts of interest for members and observers when providing information and advice on some agenda items and these conflicts should be tabled by members. The Chair requested members and observers to leave the meeting room in groups so RAG members could consider the potential conflicts of interest and agree on how those potential conflicts should be managed.

Scientific Member and Observers

The remaining RAG members noted that CSIRO is the major research provider for the Fishery and have interests in fishery research projects. The RAG noted that no new research projects were being discussed at this meeting and that advice from CSIRO members and observers was important for the RAG agenda items. No conflict of interest issues were identified.

Industry Members and Observers

The remaining RAG members noted that industry members and observers have pecuniary interests in the Fishery, however industry is needed at the meeting for their advice and expertise. The RAG considered that there was a diverse representation of industry across the various sectors and it was unlikely the discussion may be biased by a single sector or individual. The RAG agreed it did not need to remove industry members or observers for any of the agenda items. The remaining RAG members noted that in the event that one person's views biased the discussions the RAG Chair may ask them to leave for the discussion or recommendations.

1.4 Action items from previous meetings

The RAG noted progress against action items from previous meetings. The up-to-date list of action items and progress is provided in **Attachment A**.

The independent scientific member noted that for action item 4 'AFMA preparing a summary of evidence of a single stock'; the information paper should include the historical information and the results of the larval modelling research (agenda item 6) that reconfirms the tropical rock lobster fishery is a single stock.

The RAG noted that for agenda item 5 'naming of reefs and significant areas', that Malu Lamar RNTBC is best placed to provide the names of reefs and significant areas. The

scientific observer noted that CSIRO have included the traditional names of some reefs in their meeting papers and presentations.

The RAG noted that the RAG 21 meeting record was ratified out-of-session. Some comments were received from members and these were provided in the RAG meeting papers with track changes (pages 29-45). No further comments were received on the draft meeting record and the RAG agreed the record was a true and accurate representation of the meeting.

Agenda Item 2 - updates

Industry

The RAG noted the updates provide by industry members.

- One industry observer asked whether any further research had been undertaken to provide more information on the spawning of tropical rock lobster, noting that this information is important for managing the stock sustainably. The scientific member noted that research is expensive and there is a limited amount of funding for Torres Strait research projects. The larval advection modelling project (agenda item 6) was cost effective research that aimed to improve the understanding of lobster larval dispersal into the Torres Strait from Yule Island, PNG and Princess Charlotte Bay, QLD.
- One industry member noted that there was a low abundance of lobsters throughout 2017 that corresponded to the low recommended biological catch (RBC) and total allowable catch (TAC) figure of 495 tonnes. The member noted that he was not aware of any exemptions being issued to PNG trawlers in 2017 and to his knowledge there was not any large volumes of PNG trawl caught lobster tails on the market.
- Some industry observers were concerned that the low abundance of lobsters in 2017 and 2018 was a result of PNG trawlers taking spawning lobsters on their migration to Yule Island.
- One industry member noted that fishing on Darnley Island has been slow since the season start on 1 December. The member noted that he has observed large numbers of berried lobsters from Don Cay to Dowar Island. One industry member stated it was too early to comment on the fishing conditions around Mabuiag Island.
- One industry member noted the start of the 2017/18 fishing season is similar to 2016/17 season. The member noted that lobsters had already moulted and this was unusual for the start of the season and it was believed to be due to high water temperature.
- One industry member noted that the tides had not been favourable for the start of the fishing season, however the catches around Yam Island have been good with free dive fisher's landing between 50-80 kilograms of tails for one days fishing, however there has been high number of double skin (moulting lobsters). The member noted

that most of the catch was coming from the shallow water and there was low numbers of lobsters in the deeper water.

- The scientific observer asked industry members what the level of discard in the fishery is. Industry member noted discarding is unlikely for the TIB dinghies because any mortality is processed to a tailed lobster. The AFMA EO noted that the TVH sector complete a daily fishing log and that any post capture mortality and discarding should be captured by the daily fishing log (TRL04).
- One industry member asked other members and observers for any information about PNG fisheries and if they have changed their fishing methods or practices over time and whether this may be having an impact on the stock. One industry member stated he did not believe that PNG had a large increase in fishing efficiency and they are fishing with the same equipment as previous, the member noted that the Australia industry has become more efficient over time with GPS, sounders and faster vessels.
- The scientific member noted that the catch history for the fishery starts in 1973 and there was approximately 573 tonnes of reported trawl catch from PNG. The scientific member noted that the stock assessment includes all sources of fishing mortality and historically the Fishery was trending well and that it seems like in recent years the Fishery has experienced anomalous conditions.
- One industry member noted that there could be some link between the environmental conditions in the Fly River and impacts on the lobster stock, the member noted that recently the Gulf of Papua barramundi fishery had collapsed and black jewfish was in decline. The scientific member noted there are reported increasing levels of toxins in the Fly River, however the impact was further to the north east and unlikely to impact the lobster stock, however further analysis could be undertaken.

Government

The RAG noted the update provided by the AFMA member:

- The introduction of a mandatory fish receiver system (also known as catch disposal record) for Torres Strait fisheries was implemented on 1 December 2017. Since the introduction of the system there has been an increase in licensing and reporting from the TIB sector. The timely reporting of catch landing will help to monitor total catch for the Fishery.
- At its last meeting the TRL Working Group considered outcomes of the consultation process undertaken for the TRL management Plan. The TIB sector representatives noted they want to take into account findings of a New Zealand study tour on Maori fishing entitlements. The TSRA observer noted that a fisheries summit will be held in 2018 for the TIB sector to discuss and agree on the preferred management of the Fishery.

The RAG noted the updated provided by the TSRA Member that:

- In the past year TSRA has purchased 3 TVH licences and noted that there may be some changes to catch and effort for the fishery. The TSRA noted they are intending to lease the three licences out to traditional inhabitants. The Chair asked if ~~leasing the~~buying TVH licences was to be ongoing or a once off. The TSRA member stated the objective was to work towards 100 per cent ownership of Torres Strait fisheries by traditional inhabitants and that leasing revenue as well as other sources of funding may be used.

PNG NFA

The RAG noted the update provided by the PNG National Fisheries Authority observer:

- There have been no exemptions issued to PNG prawn trawlers for 2017 or 2018 allowing them to retain tropical rock lobster;
- Observer coverage on the PNG prawn trawler fleet is ongoing, observer coverage is high during the months of September and October when there is a high risk of incidental catch of lobster. PNG NFA officials also monitor the unloads of prawn trawlers;
- Data reporting by the PNG prawn fleet is slow and the NFA are aiming to improve data reporting by implementing a logbook system that is consistent with the PNG tuna fishery.
- The NFA are introducing mandatory bycatch reduction devices (BRDs) for the prawn fleet including turtle excluder device (TED) to reduce turtle bycatch; square mesh panel and fish eye reduction device to reduce the bycatch of finfish.

Native title

The Chairperson for Malu Lamar RNTBC was an apology for the meeting, no update was provided.

Agenda Item 3 – catch summary

The RAG noted an update on the fishery catch and effort information based on the paper titled '*Torres Strait Tropical Rock Lobster Catch Data Summary'* and '*Estimation of Total Annual Effort in the Torres Strait Rock Lobster Fishery – 2017 Update*.'

The RAG noted advice from the scientific observer that:

- The 2016/17 notional TAC was set at 495 tonne for Australia and PNG inclusive. The Australian catch was 255.4 tonnes (TIB caught 104.6 tonnes and TVH sector caught 149.0 tonnes);
- The PNG catch was 113.0 tonnes;
- There was zero reported trawl catch from PNG in 2016/17; and
- There are some uncertainties in the PNG data. When comparing figures from PNG processors and the PNG export data there are large discrepancies in reported PNG

catch in some years. A precautionary approach was taken and the higher catch figures from each year for PNG were used for stock assessment purposes.

The scientific observer noted that AFMA provided the last four years of catch and effort data for the 2017 update. A large number of late returns of the TDB01 docket book were received and this has resulted in an increase in the total reported catch. The scientific member noted that a standard procedure should be developed for receiving fishery data because there is a tight deadline to meet.

The RAG **AGREED** that the Tropical Rock Lobster Fishery catch and effort data should be provided by 31 October each year to allow sufficient time for the stock assessment model to be updated.

The AFMA member noted that there should be an improvement with the provision of accurate and timely data with the introduction of the Torres Strait Fish Receiver System and the Catch Disposal Record.

The AFMA EO questioned whether the increase in unreported fishing hours by the TVH sector from ~2 per cent to ~12 per cent from 2016 to 2017 was accurate. The scientific observer noted that this was an accurate representation.

The RAG **AGREED** for AFMA to investigate the potential cause of the TVH sector under-reporting of fishing hours.

The scientific observer noted that the 2016-17 TIB sector data had a significant change in the reported fishing location. The number of docket book returns with no fishing location recorded significantly decreased and the number of returns with Thursday Island listed as the fishing location significantly increased. One industry member noted that the Thursday Island fishing location (area 9) is likely to be incorrect and over reported for 2016-17.

The independent scientific member recommended that the area effect (whether the reported fishing location impacts on catch and catch rates) be removed from the CPUE standardisation to examine if it is influencing the results in any significant way. The scientific observer undertook an analysis of area effect and reported to the RAG that it is not having a strong influence of the CPUE standardisation.

The RAG Chair questioned if there was any trends of increasing fishing efficiency captured in the time series of data. The scientific member noted that the absence of fine scale spatial information precludes the ability to identify if there has been a trend to accessing deeper water, however it can be captured by looking at when hookah equipment was introduced or the amount of fishing effort at Kirkaldie.

Agenda Item 4 – catch per unit effort indices

The RAG noted an update by Scientific Observer Dr Robert Campbell on the fishery catch per unit effort (CPUE) standardisation for the TIB and TVH sectors as per the papers titled '*An Abundance Index for Torres Strait Rock Lobster using TIB data'* and '*An Abundance Index for Torres Strait Rock Lobster using TVH data*.'**4A – TVH sector standardisation**

Robert noted the stock assessment relies on an index of abundance that is provided by the pre-season survey and the standardised CPUE for the TIB and TVH sectors. The CPUE is standardised to account for changes that influence catch and catch rates. The standardisation process also looks at whether a combination of factors influence catch or catch rates. The relative fishing power across the fleet has the largest effect in the model for the TVH data and it varies from 36 per cent to 192 per cent.

Robert noted that for the TVH CPUE the area effect and fishing method effect did not appear to have a large influence on the model.

4B – TIB sector standardisation

Robert noted that in 2013 there was a reduction in the reporting of fishing effort for the TIB sector and more recently in 2015 and 2016 there was a reduction in the reporting of effort information because some processors reported aggregate catch. This had made the CPUE analysis more difficult for the TIB sector.

Robert noted that in previous years the TIB sector docket book records for lamp fishing (n=4,435 records) were not used in the analysis. The RAG **AGREED** that lamp fishing data should be used for future TIB CPUE analyses.

Robert noted that as per previous discussions, there was a reduction in catch by unknown area and increase in reported catch for Thursday Island (area 9). The RAG noted the increase in reported catch for the Thursday Island was likely to be incorrect and over represented. The RAG noted that when the area effect (the impact of the reported fishing area on model results) was tested it had limited influence on the stock assessment results.

The RAG noted that the Main-Effects model (the base-case used for the fishery assessment) increased by 20 per cent for 2017 when compared to the long-term average. The scientific observer noted that further checks were undertaken and the increase was due to a recent shift from predominately tailed lobster to live lobster for the TIB sector (it was not due to the over representation of catch for Thursday Island, area 9).

Agenda item 5 – pre-season survey results

The RAG noted an update on the fishery independent pre-season survey that was held from 1 to 12 November 2017 presented by the scientific observer Mark Tonks.

Mark noted that:

- There was good visibility and mostly favourable weather conditions throughout the duration of the dive survey;
- A total of 77 reef sites were surveys, each site is surveyed by diving and observing lobsters over a 400 metre long by 4 metre wide belt transect;
- The 2017 1+ index is the lowest ever recorded for the pre-season survey, there was an average of 1.78 lobsters per transect. This is down 75 per cent from 2015 and 15 per cent from 2016;

- The pre-season survey does not provide an index for 2+ lobsters because these lobsters have already migrated from the Torres Strait, instead the Fishery uses the standardised CPUE indices for the 2+ indices;
- Across the 77 sites surveyed only 18 0+ lobsters were observed, this was a substantial decrease from 2016 pre-season survey of 90 0+ lobsters;
- There was no observations of extraordinary changes to benthic habitat at survey sites.

The Chair questioned whether inter-diver comparisons are made to check if one diver or a dive team may be biasing the results. The scientific observer noted that the survey procedures minimise the effect of individual divers on the lobster count. However, there may be up to 15 per cent undercount of 0+ lobster from 2016, due to Darren Dennis retiring (Darren conducted CSIRO lobster dive surveys from 1989 to 2016).

Mark noted that the 77 dive sites do not include deeper dive sites on the eastern edge of Warrior Reef that have previously been included in the dive surveys. The scientific member Eva Plaganyi noted that the survey was at a reduced scale with 77 sites, however before reducing the scale of the survey the RAG made considered the data and agreed that 77 sites would be representative. Eva noted that the survey number of 0+ lobster are so low that the model cannot fit the data well (the model over estimates the number of 0+).

Agenda item 6 – larval movement

The RAG noted the preliminary results of the research project titled '*Environmental update for the Torres Strait tropical lobster Panulirus ornatus*' presented by the scientific member Dr Eva Plaganyi. The aim of the research was to gather better understanding about the connectivity of the tropical rock lobster population between Papua New Guinea, Torres Strait and Queensland East Coast and to improve the reliability of the fishery stock assessment.

Eva noted the potential factors that may have led to the low 2017 pre-season survey results were:

- overfishing may be a potential factor, the stock has been observed to decline in the past due trawling of migrating and spawning lobster. The high reported trawl catch in 2014 may have reduced the abundance of 1+ lobster in 2016;
- natural fluctuations based on environmental conditions and density dependence of the lobster stock;
- environmental anomaly relating to the strong El Nino event in 2015 and 2016 that led to highest ever recorded sea surface temperatures. High sea surface temperatures are known to influence growth and survival of lobsters and changes to oceanic currents may have impacted on larval advection;
- there was reported loss of habitat recently with sand incursions and coral bleaching that may have reduced the productivity of the ecosystem and had a negative impact on lobster abundance;

- the survey method and procedures were consistent with previous years and undertaken by an experienced dive team. The survey method was not considered to be a factor for the low survey count.

The RAG noted the following information and results from research project presented by the scientific member:

- The project modelled larvae dispersal from two location, Yule Island in Papua New Guinea and Princess Charlotte Bay in Queensland;
- Once larvae are released they spend five months travelling in oceanic currents before they settle as a 0+ lobster, and only a very small percentage of larvae survive and settle as a 0+ lobster;
- There is clear evidence that the Torres Strait Tropical Rock Lobster Fishery, the PNG Tropical Rock Lobster Fishery and the Queensland East Coast Lobster Fishery are based on a single stock of tropical rock lobster;
- The plots show that some larvae released at Yule Island and Princess Charlotte Bay settle in the Torres Strait, however there was no clear relationship between larvae modelling, the pre-season survey and stock assessment results and the level of catch;
- There is a lack of tidal flow information for the Torres Strait and as a result the model does not accurately predict the dispersal of larvae once it reaches the Torres Strait.

The independent scientific member noted that the modelling confirmed that the fisheries are based on a single stock and the model is not able to predict how the stock may be influenced by various fishing or environmental conditions. The independent scientific member noted that the model does not predict how the stock may be influenced by anomalous environmental conditions because it did not explore these event in detail.

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One industry observer noted that Cape Grenville is an important spawning area for tropical rock lobster on the east coast of Queensland and that lobsters spawning in this area may be important for the recruitment of tropical rock lobster into the Torres Strait.

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Eva noted that the draft empirical harvest control rule (eHCR) can only be implemented once the PZJA agreed to the fishery Harvest Strategy. If the RBC was set based on the eHCR the RBC would have been higher, this is due to the eHCR averaging the indices over the previous 5 years to reduce the variability. The independent scientific member noted that if the eHCR uses data from the past four years it would set an RBC of 280 tonnes, this is consistent with the stock assessment result.

The RAG **RECOMMENDED** a preliminary recommended biological catch (RBC) of 299 tonnes for Australia and PNG inclusive, based on the following:

- the current stock biomass is estimated at 76 per cent of B_{1973} which is above the target biomass of 65 per cent;
- the RBC was calculated by applying the interim harvest strategy to the preliminary results of the integrated fishery stock assessment;
- the reduction in the RBC is primarily due to the stock assessment responding to the low indices for 1+ lobster; and
- the 0+ index of lobster is the lowest ever recorded by a pre-season survey, however the 0+ indices is uncertain due to the small size and cryptic nature of 0+ lobster; and,
- although poorly estimated, the stock biomass is predicted to drop to 59 per cent of B_{1973} in 2019.

The RAG noted the stock assessment results will be finalised in March 2018 and presented to the RAG at its next meeting, however it is unlikely that the results will change significantly.

The RAG **STRONGLY RECOMMENDED** that under the current low levels of abundance, all management actions should be considered to ensure the 2018 RBC of 299 tonnes is not breached.

The following members and observers left the meeting: Eva Plaganyi (scientific member); Mariana Nahas (TSRA member); Brett Arlidge (industry member) and Phil Ketchell (industry member).

Agenda item 8 – stock assessment data rules

The RAG **AGREED** to defer the decision on the Torres Strait Docket Book (TDB01) data rules to the next RAG meeting scheduled for March 2018, this was due to a lack of time to present and discuss the results of the paper. The scientific observer recommended that RAG members and observers read the meeting paper prior to discussing this agenda item at the next meeting.

The RAG **AGREED** that members and observers review the meeting paper out of session and provide any comments on the paper at the next meeting.

Agenda item 9 – harvest strategy

The RAG **AGREED** to defer discussion on the harvest strategy agenda item to the next RAG meeting scheduled for March 2018 due to a lack of time to present and discuss the agenda item.

Agenda item 10 – other business

The RAG Chair noted that the TSRA observer requested to discuss the setting of moon-tide hookah closures for the fishery and wanted the RAG to consider if a second moon-tide closure should be implemented during the months February to September.

The RAG Chair recommended the TSRA observer provide a paper to the RAG prior to the next meeting to support an informed discussion.

Agenda item 11 – next meeting

The Chair noted the next meeting was scheduled for March 2018. The meeting was closed.

Report of the Fisheries Committee Bilateral Meeting

5 February 2018

Sir Manasupe Haus

Port Moresby, Papua New Guinea

1. Welcome

1.1. The Fisheries Committee Bilateral Meeting was held on 5 February 2018, at Sir Manasupe Haus, Port Moresby, Papua New Guinea to discuss items under Articles 20-28 of the Torres Strait Treaty (the Treaty).

1.2. The meeting was opened at 1400 hrs and co-chaired by Mr Ian Liviko, Prawn and Lobster Fisheries Manager, Papua New Guinea National Fisheries Authority (PNG-NFA) and Dr Nicholas Rayns, Executive Manager, Fisheries Management Branch, Australian Fisheries Management Authority (AFMA). A delegation list is provided at **Attachment A.**

1.3. The meeting **NOTED** the importance of Fisheries Bilateral meetings as valuable fora to discuss fisheries matters in relation to shared common resources of great importance to both countries for cultural, community and commercial purposes.

1.4. The meeting **NOTED** that several key issues discussed at the Traditional Inhabitant's Meeting (TIM meeting) were directly relevant to the Fisheries Committee Meeting. The Co-Chair thanked the TIM Co-Chairs for the opportunity to observe the TIM meeting held prior to the Fisheries Committee Meeting.

1.5. The meeting **NOTED** AFMA advice on improvements made to management arrangements across Australian managed Torres Strait fisheries in 2017 to improve monitoring and data gathering. These reforms included the implementation of mandatory vessel monitoring systems (satellite tracking) on all primary and processor-carrier boats in the Torres Strait. Also implemented was the fish receiver system which makes it mandatory for all commercial catches to be weighed at point of landing and catch disposal records filled out and returned to AFMA.

2. Review of actions items: Fisheries Bilateral Meeting 2016

2.1. The meeting **NOTED** the progress on actions arising items from the 2016 Fisheries Bilateral Meeting.

3. Compliance and Licensing

3.1. The meeting **NOTED** the co-operation between Australian and Papuan New Guinean compliance teams to deliver compliance services under the Treaty. The meeting further **NOTED** that the joint approach in conducting patrols, intelligence sharing and investigations has led to successful prosecutions in both jurisdictions. The meeting strongly **SUPPORTED** the continuation of this approach to address compliance risks in the region.

3.2. The meeting **NOTED** that cross-decking of compliance officers would remain a priority.

3.3. The meeting **NOTED** advice that PNG-NFA's capacity to respond in a timely manner to compliance reports relies on assets being available. The meeting further **NOTED** PNG-NFA advice that compliance patrols were problematic within the 'dogleg' area as it is an uncharted area of waters making navigation hazardous.

Amendment of the Torres Strait Fisheries Act 1984

3.4. The meeting **NOTED** advice from AFMA that it is working to progress a limited number of amendments to the *Torres Strait Fisheries Act 1984* (the Act). The amendments have a narrow focus, intended to deliver immediate improvement to the administration of the Act. The amendments include the introduction of infringements notices, streamlining delegations and removing impediments to implementing mandatory reporting across all licences.

3.5. The meeting **RECOGNISED** the importance of involving Traditional Inhabitant members in any legislative amendments noting the Act was created to implement the Australian government's responsibilities under the Treaty. The meeting **WELCOMED** the Australian Government's Commitment to consult with communities, native title holders and the Protected Zone Joint Authority (PZJA) advisory committees.

4. Prawn Fishery

4.1. The meeting **NOTED** prawn fishing activity in the Australian zone remains low with effort dropping to 1004 nights fished in 2007. This is down from 2472 nights fished in 2016. Total catch reported in 2017 was 111 tonnes and 25 tonnes for tiger prawn and endeavour prawns respectively. The meeting **NOTED** that effort was largely driven by economic factors rather than stock availability.

4.2. The meeting **NOTED** that amendments had been made to the Australian prawn fishery and AFMA plans to update the stock assessment and undertake an Ecological Risk Assessment of the fishery over the next two years.

4.3. PNG-NFA **ADVISED** that there is little interest in prawn fishing in PNG waters of the TSPZ and declined the offer of catch sharing arrangements in the Australian Torres Strait Prawn Fishery. Australia did not seek to take up its entitlement in PNG waters for 2017.

PNG Treaty Traditional Inhabitants benefiting from the Treaty

4.4. The meeting **NOTED** advice from PNG Traditional Inhabitants that they have not been able to realise any of the benefits envisaged under the Treaty as it relates to commercial fishing. The PNG Traditional Inhabitants advised that have not been able to utilise the catch sharing arrangements provided under the Treaty and do not have expansive territorial seas in which to commercially fish.

4.5. The meeting **NOTED** support from the Australian Traditional Inhabitants for opportunities to ensure PNG Traditional Inhabitants are able to derive benefits from fisheries resources in the TSPZ in line with the Treaty.

4.6. The meeting **NOTED** advice from PNG-NFA that the authority confirms its commitment to support Treaty villages and has secured a budget to fund consultation and awareness raising visits to Treaty villages and fisheries intervention activities & projects. PNG-NFA further advised that they have the ability to deliver practical assistance, several administrative matters need to be resolved and stakeholders need to agree on their needs.

4.7. PNG-NFA **REQUESTED** to work collaboratively with AFMA to develop options on how PNG can effectively take up catch sharing options. AFMA welcomed the opportunity to assist PNG-NFA.

4.8. The meeting **NOTED** AFMA and PNG-NFA's strong commitment to ensure catch sharing arrangements are administered in line with the Treaty and in a manner that that does not unnecessarily impede traditional inhabitants from utilising those entitlements.

5. Tropical Rock Lobster Fishery

5.1. The meeting **NOTED** outcomes of the pre-season survey conducted in Australian waters in November 2017 and preliminary outcomes of the updated stock assessment. Based on the updated stock assessment the total recommended catch for 2018 is 299 tonnes.

5.2. The meeting **NOTED** AFMA advice that the pre-season survey index abundance for Tropical Rock Lobsters (TRL) was very low. While TRL is characterised as having highly variable recruitment, consideration of other contributing factors to the low pre-season abundance is ongoing. Factors likely include, environmental anomalies experienced over the last three years including, strong El Nino events, record high sea temperatures, habitat changes (industry reported significant sand incursions over certain fishing grounds) and coral bleaching events.

5.3. The meeting **AGREED** that 2018 catch sharing arrangements are to be finalised out of session in April once the final consideration of the stock assessment has been finalised and considered by the PZJA advisory committee. AFMA reiterated the standing invitation for PNG-NFA to attend the PZJA advisory committee meetings.

5.4. AFMA and PNG-NFA **REAFFIRMED** their commitment to providing timely and accurate catch reporting to ensure the integrity of future stock assessments. This includes the reporting of catch from all sectors.

PNG trawlers retaining Tropical Rock Lobster

5.5. The meeting **NOTED** PNG-NFA advice that the PNG prawn trawl industry are interested in retaining Tropical Rock Lobster that are incidentally caught and dead when brought on-board.

5.6. The meeting **NOTED** PNG-NFAs **REQUEST** to work with AFMA to further evaluate the impacts of various levels of trawl catch on the TRL stock and identify possible management options (seasonal or spatial closures) that could be developed to benefit all sectors. AFMA welcomed the opportunity to assist PNG-NFA and reiterated the importance of a taking a precautionary approach when considering any amendments to the current trawl ban.

5.7. The meeting **NOTED** advice from traditional inhabitants that the longstanding trawl bans in both jurisdictions where implemented after much negotiation to protect the sustainability of TRL and there would need to be strong case put forward to depart from this arrangement.

5.8. The meeting **REITERATED** the need to manage the take of tropical rock lobsters to the agreed global Total Allowable Catch irrespective of fishing method.

Stock structure

5.9. The meeting **NOTED** draft modelling outcomes of likely larval movements of tropical rock lobsters within the region. The meeting **NOTED** the research was undertaken by CSIRO and was an update of previous work using an updated model and data from additional years.

5.10. The meeting **NOTED** the following key findings:

- Australian and Papua New Guinea tropical rock lobster fisheries are based on single stock;
- recruitment success to Torres Strait is highly variable with recruits coming from Yule Island and northern Queensland placing further importance on having a healthy spawning biomass across its range; and
- the model did not find a clear relationship between larval dispersal and pre-season survey results (abundance and distribution of tropical rock lobster). This means the current model cannot assist in predicting how the stock may be influenced by catches or changing environmental conditions. Further work may be considered to improve the model, such as including fine scale tidal information for the Torres Strait.

6. Traditional Fisheries

6.1. The meeting **NOTED** the update on turtle and dugong management in Australian waters.

6.2. The meeting **NOTED** advice from PNG traditional inhabitants that the *Moro Momoro Gamo* management plan has been completed but has not yet been implemented. Noting that the plan covers a large number of communities (14 maritime boundaries), work is in progress to develop individual management plans to suit each community.

6.3. The meeting **NOTED** previous committee advice that the issue of illegal netting of dugong and turtle needs to be considered within the broader issues of livelihoods in PNG Treaty Villages.

6.4. PNG traditional inhabitants **ADVISE** that while illegal fishing was not supported, the incentive for Treaty villagers to fish illegally is likely linked to their immediate needs to provide food for themselves and their families. It was further **RECOGNISED** that this incentive is only likely to increase with population growth together with a lack of alternative livelihoods and persistent poverty in the PNG Treaty Villages. Advice from PNG traditional inhabitants was **NOTED** that the Treaty, in their view, has removed access to historical fishing grounds and provided little benefit to the PNG Treaty villagers.

6.5. Australian Traditional Inhabitant representatives **SUGGESTED** that gear restrictions in Torres Strait, limiting take of turtle and dugong to traditional methods only, could also be reflected in PNG community management plans under development. PNG Traditional Inhabitant representatives advised that they will encourage their members to discuss this suggestion with communities.

7. Spanish Mackerel

7.1. The meeting **NOTED** the update on Spanish mackerel as detailed in the agenda paper.

7.2. The meeting **NOTED** that a harvest strategy was under development for Torres Strait Finfish Fishery (which will apply to Spanish mackerel and coral trout) which would guide future management decisions for fishery.

7.3. The meeting **NOTED** advice from PNG-NFA that the PNG industry remains very small scale and did not yet have the capacity to utilise catch sharing arrangements under the Treaty.

7.4. Australia and Papua New Guinea both graciously **DECLINED** to enter into catch sharing arrangements for the 2017-18 fishing season.

8. Pearl Shell

8.1. The meeting **NOTED** the update on pearl shell as detailed in the agenda paper.

8.2. The meeting **NOTED** advice from AFMA and PNG-NFA that fishing activity for pearl shell remains negligible in both jurisdictions.

8.3. The meeting **NOTED** further advice from PNG-NFA that there are many skilled pearl shell divers within Treaty communities and **REQUESTED** to work with AFMA to explore opportunities under the Treaty to develop the pearl shell fishery. AFMA welcomed the opportunity to assist with PNG-NFA.

8.4. Australia and Papua New Guinea both graciously **DECLINED** to enter into catch sharing arrangements for 2018.

9. Other Fisheries

Beche-de-mer

9.1. The meeting **NOTED** the update on the Australian Beche-de-mer Fishery as detailed in the agenda paper.

9.2. The meeting **NOTED** AFMA advice that interest was increasing in the Australian beche-de-mer fishery with fishers focussing on providing the market with alternative species such as curryfish.

9.3. The meeting **NOTED** AFMA advice that it was working with scientists and traditional inhabitants in developing a harvest strategy for beche-de-mer which would guide future management decisions and support the sustainable development of the fishery.

9.4. The meeting **NOTED** PNG-NFA advice that the PNG moratorium on the take and possession of beche-de-mer was lifted in April 2017. The total allowable catches were taken quickly resulting in all provinces closed again to beche-de-mer fishing by July 2017. The Fishery remains closed.

9.5. The meeting **NOTED** the PNG-NFA is currently reviewing management arrangements for the Fishery in consultation with stakeholders and monitoring stocks with monitors regularly visiting fishing communities. A further opening of the fishery will be informed by the review. PNG-NFA **AGREED** to provide the Fisheries Committee with an update on any changes to management arrangements for the Fishery.

9.6. The meeting **NOTED** PNG-NFA advice that illegal fishing for beche-de-mer is prevalent and that Indonesian buyers were very active in PNG during the beche-de-mer season creating strong demand for product.

Barramundi

9.7. The meeting **NOTED** advice from PNG-NFA that fishers had raised concerns that catches of Barramundi appear to be declining.

9.8. The meeting **NOTED** that a stock assessment scheduled for barramundi had not occurred due to funding limitations. PNG-NFA now plans to undertake a desk-top study this year using information from previous studies on harvest rates (for example research by Dr Sara Bussliachi).

9.9. The meeting **WELCOMED** further advice and acknowledgement from PNG-NFA that the South Fly Government has supported the reopening of the barramundi hatchery on Daru and continues to support efforts to re-establish the restocking exercise in to the wild.

Finfish fishery – reef-line sector - update on activity in the Australian jurisdiction

9.10. The meeting **NOTED** the update on finfish activity in Australian waters was detailed in the agenda paper.

9.11. The meeting **NOTED** that a harvest strategy was under development for the Torres Strait Finfish Fishery (Spanish mackerel and coral trout) which would guide future management decisions for the Fishery.

9.12. The meeting **NOTED** that an initial stock assessment for coral trout would be conducted as part of the harvest strategy development.

10. Other Business

Research in the Torres Strait

10.1. The meeting **NOTED** the update on research projects in progress, or proposals under consideration relevant to the Torres Strait as detailed in the agenda paper.

10.2. The meeting co-chair **ADVISED** the meeting of broader research projects of relevance to the Torres Strait including CSIRO work to support Australia wide decadal monitoring for the effects of climate change which is due for completion in mid-2018. Also **NOTED** was another CSIRO project looking to examine optimising the yield that could be gained from Australian commercial seafood species which includes Torres Strait.

10.3. The meeting **REQUESTED** to revisit the outcomes of prior CSIRO research presented by James Butler 'Developing legal value chains and alternative markets for South Fly District fisheries'.

Presentation "Value-chains in Western Province Fisheries" by Dr Sara Busillachi.

10.4. The meeting **NOTED** the presentation from Dr Sara Busillachi, CSIRO which outlined recent findings from the collection of economic data from sales of PNG marine-derived commodities through the market chain into the Asian market. These commodities include beche-de-mer, shark fin and fish maw (swim bladder) from jewfish and barramundi.

10.5. The meeting **NOTED** that the research indicates that fishers in the Western Province are paid only a small proportion of the final market price of these commodities and face many risks in harvesting the products.

10.6. The meeting **NOTED** that the collection of supply chain data was the initial phase of the project with data still being analysed until July 2018. Funding for a second stage will likely be sought.

Next meeting

10.7. The meeting **NOTED** that the 2018 bilateral meeting is to be held in Australia and delegates will be advised by the Australian government on the arrangements for the meeting.

11. Closing Prayer

11.1. The meeting closed at 1700hrs with a closing prayer from TSRA Chairperson Pedro Stephen.

Table of actions arising from the 2017 Fisheries Bilateral Meeting (5 Feb 2018)

Item Number	Agenda #	Action	Responsible Agency
2017-1	4	AFMA and PNG-NFA to work collaboratively to investigate how treaty villages may effectively engage in commercial fisheries under the Treaty.	AFMA and PNG-NFA
2017-1	5.1	AFMA and PNG-NFA to work to collaboratively to further evaluate the impact of PNG prawn trawl catches impacting the Tropical Rock Lobster stock.	AFMA and PNG-NFA
2017-2	10.1	The outcomes of the CSIRO research project “Developing legal value chains and alternative markets for South Fly District fisheries” are to be made available to the meeting attendees.	AFMA

Attachment A
Fisheries Committee Bilateral Meeting 2016
Delegation List

Australian Delegation

Australian Traditional Inhabitant Representatives
Cr Getano Lui (Jr), Iama (Yam) Island (Traditional Inhabitant Meeting Co-chair)
Cr Fraser Nai, Masig (Yorke) Island
Cr Patrick Thaiaday, Erub (Darnley) Island
Mr Erik Peter, Torres Strait Regional Authority, Member for Boigu

Australian Government Representatives
Dr Nick Rayns, Australian Fisheries Management Authority – Australian Co-Chair
Ms Leilani Bin-Juda, Treaty Liaison Officer, Department of Foreign Affairs and Trade
Mr Pedro Stephen, Chairperson, Torres Strait Regional Authority
Mr Charlie Caddy, A/g Chief Executive Officer, Torres Strait Regional Authority
Mr Stan Lui, A/g Environment Program Manager, Torres Strait Regional Authority
Ms Fiona Pemberton, Department of Immigration and Border Protection
Mr Lyndon Peddell, A/g Manager Foreign Compliance, Australian Fisheries Management Authority
Ms Selina Stoute, Manager Torres Strait Fisheries, Australian Fisheries Management Authority
Mr Andrew Trappett, Senior Fisheries Management Officer, Australian Fisheries Management Authority, Fisheries Committee Meeting Secretariat

Papua New Guinea Delegation

Papua New Guinea Traditional Inhabitant Representatives
Cr Kebei Salee, Councillor for Sigabaduru, Traditional Inhabitant Meeting co-chair
Cr Frank Warapa, Councillor for Buji/Ber
Cr Tibau Kaware, Councillor for Katatai
Cr Murray Dimia, Councillor for Sui
Cr Peter Papua, Councillor for Mabudauan

Papua New Guinea Government Representatives
Mr Ian Liviko, Manager, Prawn and Lobster Fisheries, Papua New Guinea National Fisheries Authority
Mr Joseph Posu, Management Officer, Prawn and Lobster Fisheries, Papua New Guinea National Fisheries Authority
Mr Rei Vagi, Conservation and Environment Officer, CEPA

Mr Ian Liviko
Papua New Guinean Co-Chairperson
Manager, Prawn and Lobster Fisheries, Papua New Guinea National Fisheries Authority

Dr Nick Rayns
Australian Co-Chairperson
Executive Manager, Fisheries Management Branch, Australian Fisheries Management Authority

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
FISHERY UPDATES **Industry and scientific update**	**Agenda Item 2.1** **For DISCUSSION**

RECOMMENDATIONS

1. That the RAG:
   a. **NOTE** updates provided by industry and scientific members;
   b. **DISCUSS** strategic issues, including economic, fishing and research trends relevant to the management the TRL Fishery.

BACKGROUND

2. Verbal reports are sought from industry and scientific members under this item.
3. It is important that the RAG develops a common understanding of any strategic issues, including economic, fishing and research trends relevant to the management the TRL Fishery. This includes within adjacent jurisdictions. This ensures that where relevant, the RAG is able to have regard for these strategic issues and trends.
4. RAG members are asked to provide any updates on trends and opportunities in markets, processing and value adding. Industry is also asked to contribute advice on economic and market trends where possible.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 21 12-13 December 2017
FISHERY UPDATES **Government agencies update**	**Agenda Item 2.2** **For NOTING**

RECOMMENDATIONS

1. That the Working Group:
   a. **NOTE** the update provided by AFMA below;
   b. **NOTE** the update provided by AFMA for Agenda Items: 2.2.1 Torres Strait Fish Receiver System; 2.2.2 TRL Fishery Strategic Assessment and 2.2.3 Torres Strait legislative amendments; and
   c. **NOTE** a verbal update will be provided by the QDAF and TSRA.

AFMA UPDATES

TRL Fishery Industry Meeting – 27 February 2018

2. AFMA facilitated an industry meeting with the TRL Fishery on 27 February 2018 at the Thursday Island Bowls Club. AFMA provided industry members information about the preliminary recommended biological catch (RBC) and catch rates, explained the stock assessment process, explained the purpose of this RAG and the following Working Group Meeting, to notify industry members that additional measures may be needed to regulate catch in the 2017/18 fishing season and to gather industry views.

3. A copy of the draft meeting record is provided at **Attachment A**.

4. A copy of the meeting presentation is provided at **Attachment B.**

5. AFMA also wrote to all fishing boat and fish receiver licence holders on 22 February 2018 to advise them of the preliminary RBC of 299 t for the 2017-18 fishing season **(Attachment C)**.

TRL draft quota management plan

6. The TRLWG met on 25-26 July to consider the outcomes of the public consultation process on the draft quota management plan for TRL Fishery. The TRLWG Industry Members, including those with Transferable Vessel Holder (TVH) interest, supported setting aside further development of the draft plan until the Traditional Inhabitant sector has developed preferred options for managing their quota allocation.

7. In light of what was learnt from the TSRA Maori study tour New Zealand, in July and concerns raised about the draft plan through the public consultation, the TSRA Fisheries Portfolio Member and the Malu Lamar (Torres Strait Islander) Corporation RNTBC (Malu Lamar) Chairperson did not support any further discussion on the draft plan until the Traditional Inhabitant Boat (TIB) sector and native holders more broadly, first meet to consider how their quota entitlements might be managed in order to meet their aspirations from the Fishery.

8. The TSRA are undertaking further consultation with the TIB sector about how their quota entitlements would be managed under a quota management system. Outcomes of the public consultation on the TRL Plan and the consultation on TIB sector allocation held by TSRA will be tabled with the PZJA together with advice from the TRLWG on the TRL Plan.

Australia and PNG bilateral meeting

9. The Joint Advisory Council (JAC) met on 8 February 2018 in Port Moresby, Papua New Guinea, in accordance with Article 19 of the Torres Strait Treaty.

10. A Fisheries Committee Meeting met prior to this meeting on 5 February 2018 **(Attachment D)** and provided advice to the JAC (summarised below).

11. In addition to the formal Bilateral Treaty meetings, AFMA and CSIRO staff attended the PNG National Fisheries Authority office to provide an update on Tropical Rock Lobster science related to our shared stock and to emphasise the importance of timely and accurate data sharing between our countries fisheries management agencies.

Fisheries Committee report to the JAC

12. The JAC noted ongoing interest by the PNG prawn trawl fishing industry to retain tropical rock lobster and agreed that any departures from the current ban must be assessed in line with the Treaty. The JAC recognised the importance of the resource to Traditional inhabitants noting that it is a shared stock and the potential for trawling to impact spawning migration pathways and biomass in the Torres Strait. The JAC welcomed AFMA and PNG-NFAs commitment to work together in evaluating the impacts of trawl fishing.

13. The JAC noted advice of the likely reduction in the tropical rock lobster catch in the 2018 season and the need for both AFMA and PNG-NFA to work with their industries to ensure that catches are kept at or below the catch limit.

Australian National Audit Office (ANAO) performance audit

14. The ANAO has commenced a Performance Audit of Australian Government Coordination Arrangements in the Torres Strait.

15. Currently prescribed audited entities are the:
    a. Australian Fisheries Management Authority
    b. Department of Agriculture and Water Resources
    c. Department of Foreign Affairs and Trade
    d. Department of Home Affairs
    e. Torres Strait Regional Authority

16. Officer from the ANAO will be visiting the Torres Strait in April as part of the performance audit.

17. The objective of the Audit is to assess the effectiveness of the coordination arrangements of Australian Government entities operating in the Torres Strait.

18. The Audit will apply two criteria:

    Criteria 1: Do Australian Government entities operating in the Torres Strait have appropriate governance arrangements to support the coordination of their activities?

    Criteria 2: Are the coordination arrangements effective in supporting Australian Government activities in the Torres Strait?

19. Further information on the Performance Audit is at **Attachment E** and can be found at the ANAO website**:** **https://www.anao.gov.au/work/performance-audit/coordination-arrangements-australian-government-entities-operating-torres-strait#0-0-auditcriteria**

Australian Government

Australian Fisheries Management Authority

Industry Meeting
27 February 2018

Meeting Record

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Contents

Figures

Tables

1 Purpose

AFMA convened a public meeting on 27 February 2018 at Thursday Island with industry members and stakeholders from the Torres Strait Tropical Rock Lobster Fishery (the Fishery) to provide information about:

- the preliminary recommended biological catch (RBC) and catches for the 2017-18 fishing season;
- the stock assessment process;
- the RAG and Working Group meetings scheduled for 27-29 March 2018;
- the low preliminary RBC and to notify that additional management measures may be needed to regulate catches; and
- to gather general views from industry about the Fishery.

1.1 Information overview

Information provided to meeting participants was:

- letter to stakeholders dated 22 February 2018 about the preliminary stock assessment and preliminary recommended biological catch (RBC) for the Torres Strait Tropical Rock Lobster Fishery **(Attachment A)**;
- historical catches and total allowable catch (TAC) for the Torres Strait Tropical Rock Lobster Fishery **(Attachment B)**;
- landed catch (kilograms whole weight) of tropical rock lobster by sector for the Torres Strait Tropical Rock Lobster Fishery from the period 1 December 2017 to 22 February 2018 **(Attachment C);**
- table of historical cumulative catch by month for the Torres Strait Tropical Rock Lobster Fishery from 2004 to 2018 **(Attachment D)**;
- TRL Fishery industry information meeting for Tuesday 27 February 2018 at Thursday Island **(Attachment E)**.

2 Summary of presentation

2.1 Recommended biological catch

The recommended biological catch (RBC) is the estimated total annual catch that can be taken by fishing, while achieving the management objectives for the Fishery. The RBC is used to:

- agree to catch sharing arrangements with Papua New Guinea (PNG) under the Torres Strait Treaty;
- to monitor the sustainability of fishing activities on the stock;
- to support the implementation of a total allowable catch (TAC) under a quota management system.

The TAC is the overall catch limit set as an output control on catches. The term 'global TAC' is applied to TACs that cover fishing mortality from all fleets, for the TRL Fishery that is Australia and PNG inclusive.

The preliminary RBC for the Torres Strait Protected Zone (TSPZ) is 299 tonnes. The RBC figure is low compared to the long-term average, this is due to low numbers of one year old lobsters counted in the fishery independent pre-season survey that was conducted in November 2017. Based on the preliminary RBC of 299 tonnes, the global TAC would be set at 299 t, the catch shares would be split approximately 200 tonnes for Australia and 99 tonnes for PNG.

The RBC is calculated using the fishery integrated stock assessment model and by applying the interim harvest strategy for the Fishery. The integrated assessment incorporates information including the catch and effort data for the traditional inhabitant boat (TIB) and transferrable vessel holder (TVH) sectors, results of the fishery independent dive surveys, environmental conditions and biological information of the stock such as sex-ration and length frequency data.

The interim harvest strategy applies a target biomass (B_{TARG}) of 65 per cent of the unfished biomass (B_0). That is the desired biomass of the stock, chosen to be the management target within the interim harvest strategy. The interim harvest strategy applies a biomass limit reference point (B_{LIM}) of 40 per cent of the unfished biomass. At B_{LIM} the stock biomass is below a level which the risk to the stock is regarded as unacceptably high.

2.2 Why is the preliminary RBC low?

There are a range of potential factors that have resulted in a low preliminary RBC for the Fishery including:

- natural fluctuations of the TRL population based on environmental conditions and density dependence of the lobster stock;
- environmental anomaly relating to the strong El Nino event in 2015 and 2016 that led to highest ever recorded sea surface temperatures. High sea surface temperatures are known to influence growth and survival of lobsters and changes to oceanic currents may have impacted the dispersal of larvae;
- the reported loss of habitat recently with sand incursions and coral bleaching that may have reduced the productivity of the ecosystem and had a negative impact on lobster abundance; and
- The high reported PNG trawl catch of 110 tonnes in 2014 may have reduced the abundance of 1+ lobster in 2016.

2.3 Finalising RBC and TAC advice

The preliminary advice on the RBC was provided at the Torres Strait Tropical Rock Lobster Fishery Resource Assessment Group (TRLRAG) meeting number 21 held in Cairns on 12-13 December 2017.

The final RBC advice will be provided by the resource assessment group (RAG) at its 22nd meeting on 27-28 March 2018 at Thursday Island. The TRL Working Group (TRLWG) will then consider the RBC advice provided by the RAG and recommend a TAC at its 7th meeting on 28-29 March at Thursday Island (immediately after the TRLRAG meeting). The Working Group will also consider whether the current controls are adequate or whether additional management arrangements may be needed to regulate catch to a low TAC.

Prior to presenting the final RBC advice at the RAG meeting the Commonwealth Scientific and Industrial Research Organisation (CSIRO) will be examining all available information for the current season, including:

- The reported catch landings and effort data from the Torres Strait Catch Disposal Record (TDB02);
- The reported catch and effort data for the TVH sector from the Torres Strait Tropical Rock Lobster Fishery Daily Fishing Log (TRL04); and
- tropical rock lobster sex-ratio and length frequency information.

2.4 Current and historical fishery catches

The records for landed catch for the 2017-18 fishing season **(Table 1)** were presented to meeting participants.

Table 1. Landed catch (kilograms whole weight) of tropical rock lobster by sector for the Fishery from the period 1 December 2017 to 22 February 2018. Catch records from the Torres Strait Tropical Rock Lobster Catch Disposal Record (TDB02).

Dates	TIB (kgs)	TVH (kgs)	Combined catch (kgs)	Number of records
01/12/2017 to 31/12/2017	11333.7	33.2	11366.9	322
01/01/2018 to 31/01/2018	9874.5	0.0	9874.5	354
01/02/2018 to 22/02/2018	10906.3	18866.4	29772.7	258
Total	**32114.5**	**18899.6**	**51014.1**	**934**

*Note that there may be some outstanding catch disposal records (TDB02) for the month of February. Therefore the landed catch reported for February may be under-reported.

The Fishery historical catch and TACs **(Figure 1)** were presented to meeting participants. It was noted that the preliminary RBC of 299 tonnes is low, however it is within the historical range of catch for the Fishery.

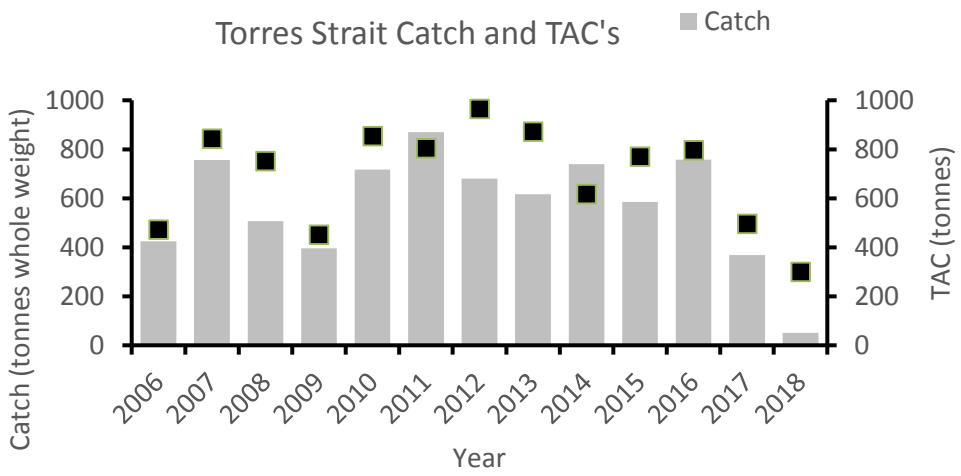


Figure 1. Torres Strait Tropical Rock Lobster Fishery global catch and global TAC from 2004 to 2018.

2.5 Upcoming meetings

The upcoming meeting schedule was presented to meeting participants **(Table 2)**.

Table 2. AFMA meeting schedule for the TRLRAG and TRLWG.

Meeting	Date	Time	Venue
TRLRAG	27/03/18	1300 to 1700	TSRA Board Room
TRLRAG	28/03/18	0830 to 1200	TSRA Board Room
TRLWG	28/03/18	1300 to 1700	TSRA Board Room
TRLWG	29/03/18	0830 to 1200	TSRA Board Room

3 Summary of industry comments

Following the presentation meeting participants provided comments on a range of topics including quota management system, sectoral allocations, input controls to manage catch to the TAC, data collection and compliance.

Quota management system

Some industry members stated that:

1. The TIB sector does not support a quota management system until the sector owns 100 per cent of the quota units in the Fishery. Under this arrangement the existing TVH sector operators would be permitted to lease TIB quota units to access the Fishery.

Sectoral allocation

Some industry members stated that:

2. The TVH sector needs to be capped to its provisional allocation. If the sectors were capped to their provisional allocation shares, the 200 tonnes of catch available to Australian operators would be split approximately 132 tonnes to the TIB sector and 68 tonnes to the TVH sector. The catch allocation figures refer to a sectoral catch spilt of 66.18 per cent TIB sector and 33.82 per cent TVH sector.
3. The TVH sector should stop fishing when the TAC for a fishing season is low or below an agreed tonnage amount.
4. Industry members from both sectors could come together and agree on limiting the total catch from each sector to the provisional allocation figures.
5. The Government is not currently in a position to implement a quota management system and catch shares for the current fishing season, however industry members can get together and agree to voluntarily implement the provisional allocations.

Input controls

Some industry members recommended the following management measures:

6. Another hookah closure should be implemented for the Fishery (in addition to the current seven day closure during the months of February to September) to slow down catch rates and allow operators to fish throughout the entire season.
7. A 10 nautical mile closure for the TVH sector around inhabited islands.
8. 30 per cent tender boat reduction for primary licences, which is consistent with the 2007 interim tender boat reduction.
9. Primary vessels should not be permitted to leave Thursday Island harbour limits prior to the opening of hookah fishing (generally this occurs on 1 February).

Data collection

Some industry members stated that:

10. Fishing effort has been increasing over the years and there is concern that the Fishery is overfished because it is becoming harder to maintain catch rates. The increase in effort is not captured in the daily fishing log (TRL04), the docket book (TDB01) or the catch disposal record (TDB02).

Compliance

Some meeting participants stated that:

11. They are concerned that there is not enough of a compliance presence on the water in the region.
12. The fines for breaching management arrangements are not high enough and they may not deter some people from illegally fishing.
13. There should be training offered to indigenous people from the region to enable them to work as fishery compliance officers. The revenue raised by the TSRA from leasing of finfish catch shares could be used to provide this training.

Other

14. A meeting participant questioned how the Queensland East Coast Tropical Rock Lobster Fishery managed. The AFMA member noted that East Coast Fishery is managed sustainably by a number of controls including a total allowable catch that is

set at a precautionary limit of 195 tonnes each season, quota management system and mandatory daily fishing logs.

15. A meeting participant stated that the Australian Fisheries Management Authority (AFMA) is unable to manage the fishery adequately.

16. Some meeting participants stated that the TVH sector licences purchased by the TSRA should not have been leased to traditional inhabitants. Some participants stated that the TSRA did not adequately consult with industry members prior to leasing the TVH licences.

WHY ARE WE MEETING?

- To provide information about the current Recommended Biological Catch (RBC) and catches
- To explain the stock assessment process
- To explain the purpose of the upcoming RAG and WG meetings
- To flag that depending on the RBC, additional measures may be needed to regulate catches.
- Get industry views

RBC: What is it?

- Total recommended catch for the stock.
- The RBC is used to:
  - agree catch sharing with PNG;
  - monitor the sustainability of catches; and
  - support implementation of a TAC under quota management.
- The **PRELIMINARY** RBC for the Protected Zone is **299 tonnes**. (very low numberers of 1+ lobsters seen in November survey)
- The shares would be ~200t for Australia and ~99t for PNG.

RBC: How was is calculated?

STOCK ASSESSEMENT

- uses catch and fishing effort information, dive survey information, environmental and biological information.
- Estimates size of the stock.

INTERIM HARVEST STRATEGY

- ***target*** $B_{0.65}$. Keep the stock at 65 per cent of the unfished biomass (B_0).
- ***limit*** $B_{0.4}$. Don't let the stock get smaller than 40 per cent of the unfished biomass (B_0).

RBC: When will it be finalised?

- December RAG meeting:
  - Preliminary RBC advice
- 27-28 March RAG Meeting:
  - Final RBC advice
- 28-29 March WG Meeting:
  - Consider RBC advice and recommend any additional management measures to regulate catch.

RBC: Why is it low?

There are a range of potential factors

- Natural fluctuations
- Environment - strong El nino event in 2015 and 2016.
- Loss of habitant - sand incursions, coral bleaching. Change productivity of ecosystem.
- High reported prawn trawl catch in 2014 (110t)

MANAGEMENT PROCESS

INFORMATION and ANALYSIS

- CSIRO are checking all available information.
- Catch landings and logbook data being processed and sent to CSIRO.

ARE CURRENT FISHING RULES GOOD ENOUGH?

- Subject to final RBC and catch rates, evaluate whether or not current controls will protect the sustainability of the fishery.

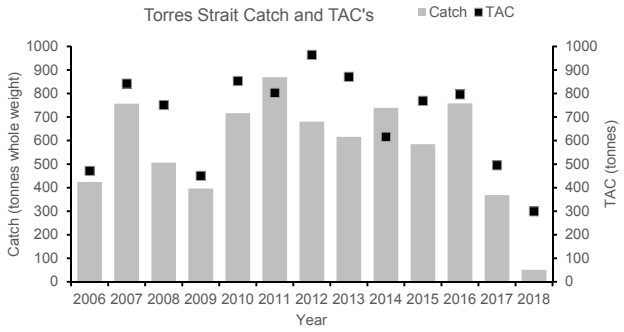
TRL Fishery Catches

- Landed catch (kilograms whole weight) of tropical rock lobster by sector for the Torres Strait Tropical Rock Lobster Fishery from the period 1 December 2017 to 22 February 2018. Catch data from the Torres Strait Tropical Rock Lobster Catch Disposal Record (TDB02).

Dates	TIB (kgs)	TVH (kgs)	Combined catch (kgs)	Number of records
01/12/2017 to 31/12/2017	11,333.7	33.2	11,366.9	322
01/01/2018 to 31/01/2018	9,874.5	0.0	9,874.5	354
01/02/2018 to 22/02/2018	10,906.3	18,866.4	29,772.7	258
Total	32,114.5	18,899.6	51,014.1	934

HISTORICAL CATCHES

- The 299 tonne RBC is low however it is within the historical range of catches for the Fishery.
- Refer to hand-out for historical catches and TAC's



*Please note that there may be some outstanding catch disposal records (TDB02) for the month of February. Therefore the landed catch reported for February may be under-reported.

Your views?

- AFMA is available to explain information and get your views anytime
- RAG and WG members are here
- Industry solutions
- Good data – provide catch and effort data

UPCOMING MEETINGS

Meeting	Date	Time	Venue
TRLRAG	27/03/18	1300 to 1700	TSRA Board Room
TRLRAG	28/03/18	0830 to 1200	TSRA Board Room
TRLWG	28/03/18	1300 to 1700	TSRA Board Room
TRLWG	29/03/18	0830 to 1200	TSRA Board Room

QUESTIONS?

Australian Government
Australian Fisheries Management Authority

22 February 2018

Dear Licence Holder

I am writing to update you with information about the preliminary stock assessment and preliminary recommended biological catch (RBC) for the Torres Strait Tropical Rock Lobster Fishery (the Fishery) for 2018.

The Torres Strait Tropical Rock Lobster Resource Assessment Group (TRLRAG) met on 12 and 13 December 2017 to provide a preliminary recommended biological catch (RBC) for the Fishery which is based on an updated fishery stock assessment.

The preliminary RBC for Australia and Papua New Guinea inclusive was recommended to be set at 299 tonnes. The fishery stock assessment will be finalised at a TRLRAG meeting scheduled for late March 2018 on Thursday Island. The preliminary RBC of 299 tonnes is low, however it is within the historical range of catches for the Fishery **(Attachment A)**. The RBC is shared between Australia and Papua New Guinea under Treaty arrangements resulting in the Australian share being around 200 tonnes. The reported catch landings of Australian operators for this fishing season, which started on 1 December 2017, are provided in **Attachment B**.

To ensure that the Fishery is managed sustainably a Tropical Rock Lobster Working Group (TRLWG) meeting will be held immediately after the TRLRAG meeting to discuss measures to keep catches in line with the RBC. AFMA will consider the advice of the TRLWG prior to deciding whether additional measures need to be taken to control fishing effort and/or catch.

If you have any questions please contact Dean Pease (dean.pease@afma.gov.au) or Selina Stoute (selina.stoute@afma.gov.au) at the AFMA Thursday Island office by email or by phoning (07) 4069 1990.

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Yours sincerely

Selina Stoute

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YEAR	TIB	TVH	AUS DIVERS TOTAL	AUS TRAWL	AUS TOTAL	PNG DIVERS	YULE DIVERS	PNG DIVERS TOTAL	PNG_TRAWL	PNG TOTAL	TORRES STRAIT TOTAL	TORRES STRAIT TAC	AUS SHARE	PNG SHARE
1973			0	0	0	54.0	19	73	562	635	635	-		
1974			0	0	0	75.0	83	158	107	265	265	-		
1975			0	0	0	62.0	13	75	214	289	289	-		
1976			0	0	0	48.0	0	48	262	310	310	-		
1977			0	0	0	72.0	35	107	131	238	238	-		
1978			296.1	0	296	43.0	3	46	187	233	530	-		
1979			308.5	0	309	56.0	13	69	0	69	378	-		
1980			328.4	21	349	94.0	3	97	589	686	1035	-		
1981			495.1	131	626	96.0	3	99	262	361	987	-		
1982			669.2	201	870	102.0	3	105	399	504	1374	-		
1983			432.9	139	572	86.0	0	86	112	198	770	-		
1984			330.9	8	339	86.0	0	86	29	115	454	-		
1985			537.4	24	561	187.0	16	203	0	203	764	-		
1986			890.6	21	912	198.0	62	260	0	260	1172	-		
1987			622.0	0	622	128.0	54	182	0	182	804	-		
1988			537.4	0	537	150.0	5	155	0	155	692	-		
1989			651.0	0	651	211.0	24	235	0	235	886	-		
1990			490.1	0	490	158.0	0	158	0	158	648	-		
1991			444.1	0	444	168.0	0	168	0	168	612	-		
1992			423.2	0	423	134.0	0	134	0	134	557	-		
1993			505.7	0	506	166.0	0	166	0	166	672	-		
1994		123.0	577.8	0	578	247.0	0	247	0	247	825	-		
1995		101.0	556.9	0	557	257.0	0	257	0	257	814	-		
1996		226.9	584.1	0	584	228.0	0	228	0	228	812	-		
1997		275.0	653.1	0	653	241.0	0	241	0	241	894	-		
1998		329.6	661.4	0	661	201.0	0	201	0	201	862	-		
1999		95.1	409.6	0	410	163.0	0	163	0	163	573	-		
2000		128.9	418.0	0	418	235.0	0	235	0	235	653	-		
2001	52.0	69.1	121.1	0	121	173.0	0	173	5	178	299	-		
2002	68.0	147.7	215.7	0	216	327.0	0	327	43	370	585	-		
2003	123.0	361.4	484.4	0	484	211.0	0	211	5	216	701	-		
2004	232.0	481.1	713.1	0	713	182.0	0	182	0	182	895	-		
2005	358.5	545.0	903.5	0	903	228.0	0	228	0	228	1131	-		
2006	146.9	135.4	282.4	0	282	142.0	0	142	0	142	424	471	317.9	153.1
2007	260.1	268.6	528.7	0	529	228.0	0	228	0	228	757	842	568.4	273.7
2008	184.9	100.4	285.4	0	285	221.0	0	221	0	221	506	751	506.9	244.1
2009	143.9	91.1	234.9	0	235	161.4	0	161.4	0	161	396	450	303.8	146.3
2010	141.2	282.6	423.8	0	424	292.8	0	292.8	0	293	717	853	575.8	277.2
2011	201.2	503.5	704.7	0	705	165.0	0	165.0	0	165	870	803	542.0	261.0
2012	136.4	370.5	506.9	0	507	173.7	0	173.7	0	174	681	964	650.7	313.3
2013	146.1	361.7	507.8	0	508	108.3	0	108.3	0	108	616	871	587.9	283.1
2014	204.6	273.2	477.8	0	478	151.4	0	151.4	110	261	739	616	415.8	200.2
2015	196.2	152.7	348.9	0	349	235.7	0	235.7	0	236	585	769	519.1	249.9
2016	266.1	243.7	509.8	0	510	248.0	0	248.0	0	248	758	796	537.3	258.7
2017	106.4	149.0	255.4	0	255	113	0	113.0	0	113	368	495	334.1	160.9
2018	-	-	70.4	0	-	-	-	-	-	-	-	299	201.8	97.2

*2018 reported AUS DIVERS catch based on CDR returns from 1 December 2017 to 8 March 2018.

*299 tonne provisional RBC for 2018 fishing season

*2017 PNG catch data needs to be verified

ATTACHMENT B

Table 2. Landed catch (kilograms whole weight) of tropical rock lobster by sector for the Torres Strait Tropical Rock Lobster Fishery from the period 1 December 2017 to 8 March 2018. Source: catch records from the Torres Strait Tropical Rock Lobster Catch Disposal Record (TDB02).

Dates	TIB (kg's)	TVH (kg's)	Combined catch (kg's)	Number of records
01/12/2017 to 31/12/2017	8,302.8	31.3	8,334.1	402
01/01/2018 to 31/01/2018	9,732.7	0.0	9,732.7	487
01/02/2018 to 28/02/2018	21,454.6	27,307.8	48,762.4	747
1/03/2018 to 08/03/2018	961.8	2,638.6	3,600.4	58
Total	**40,451.9**	**29,977.8**	**70,429.6**	**1,694**

*Please note that there may be some outstanding catch disposal records (TDB02) for the period 1 to 8 March. Therefore the landed catch reported for the March period may be under-reported.

Report of the Fisheries Committee Bilateral Meeting

5 February 2018

Sir Manasupe Haus

Port Moresby, Papua New Guinea

1. Welcome

1.1. The Fisheries Committee Bilateral Meeting was held on 5 February 2018, at Sir Manasupe Haus, Port Moresby, Papua New Guinea to discuss items under Articles 20-28 of the Torres Strait Treaty (the Treaty).

1.2. The meeting was opened at 1400 hrs and co-chaired by Mr Ian Liviko, Prawn and Lobster Fisheries Manager, Papua New Guinea National Fisheries Authority (PNG-NFA) and Dr Nicholas Rayns, Executive Manager, Fisheries Management Branch, Australian Fisheries Management Authority (AFMA). A delegation list is provided at **Attachment A.**

1.3. The meeting **NOTED** the importance of Fisheries Bilateral meetings as valuable fora to discuss fisheries matters in relation to shared common resources of great importance to both countries for cultural, community and commercial purposes.

1.4. The meeting **NOTED** that several key issues discussed at the Traditional Inhabitant's Meeting (TIM meeting) were directly relevant to the Fisheries Committee Meeting. The Co-Chair thanked the TIM Co-Chairs for the opportunity to observe the TIM meeting held prior to the Fisheries Committee Meeting.

1.5. The meeting **NOTED** AFMA advice on improvements made to management arrangements across Australian managed Torres Strait fisheries in 2017 to improve monitoring and data gathering. These reforms included the implementation of mandatory vessel monitoring systems (satellite tracking) on all primary and processor-carrier boats in the Torres Strait. Also implemented was the fish receiver system which makes it mandatory for all commercial catches to be weighed at point of landing and catch disposal records filled out and returned to AFMA.

2. Review of actions items: Fisheries Bilateral Meeting 2016

2.1. The meeting **NOTED** the progress on actions arising items from the 2016 Fisheries Bilateral Meeting.

3. Compliance and Licensing

3.1. The meeting **NOTED** the co-operation between Australian and Papuan New Guinean compliance teams to deliver compliance services under the Treaty. The meeting further **NOTED** that the joint approach in conducting patrols, intelligence sharing and investigations has led to successful prosecutions in both jurisdictions. The meeting strongly **SUPPORTED** the continuation of this approach to address compliance risks in the region.

3.2. The meeting **NOTED** that cross-decking of compliance officers would remain a priority.

3.3. The meeting **NOTED** advice that PNG-NFA's capacity to respond in a timely manner to compliance reports relies on assets being available. The meeting further **NOTED** PNG-NFA advice that compliance patrols were problematic within the 'dogleg' area as it is an uncharted area of waters making navigation hazardous.

Amendment of the Torres Strait Fisheries Act 1984

3.4. The meeting **NOTED** advice from AFMA that it is working to progress a limited number of amendments to the *Torres Strait Fisheries Act 1984* (the Act). The amendments have a narrow focus, intended to deliver immediate improvement to the administration of the Act. The amendments include the introduction of infringements notices, streamlining delegations and removing impediments to implementing mandatory reporting across all licences.

3.5. The meeting **RECOGNISED** the importance of involving Traditional Inhabitant members in any legislative amendments noting the Act was created to implement the Australian government's responsibilities under the Treaty. The meeting **WELCOMED** the Australian Government's Commitment to consult with communities, native title holders and the Protected Zone Joint Authority (PZJA) advisory committees.

4. Prawn Fishery

4.1. The meeting **NOTED** prawn fishing activity in the Australian zone remains low with effort dropping to 1004 nights fished in 2007. This is down from 2472 nights fished in 2016. Total catch reported in 2017 was 111 tonnes and 25 tonnes for tiger prawn and endeavour prawns respectively. The meeting **NOTED** that effort was largely driven by economic factors rather than stock availability.

4.2. The meeting **NOTED** that amendments had been made to the Australian prawn fishery and AFMA plans to update the stock assessment and undertake an Ecological Risk Assessment of the fishery over the next two years.

4.3. PNG-NFA **ADVISED** that there is little interest in prawn fishing in PNG waters of the TSPZ and declined the offer of catch sharing arrangements in the Australian Torres Strait Prawn Fishery. Australia did not seek to take up its entitlement in PNG waters for 2017.

PNG Treaty Traditional Inhabitants benefiting from the Treaty

4.4. The meeting **NOTED** advice from PNG Traditional Inhabitants that they have not been able to realise any of the benefits envisaged under the Treaty as it relates to commercial fishing. The PNG Traditional Inhabitants advised that have not been able to utilise the catch sharing arrangements provided under the Treaty and do not have expansive territorial seas in which to commercially fish.

4.5. The meeting **NOTED** support from the Australian Traditional Inhabitants for opportunities to ensure PNG Traditional Inhabitants are able to derive benefits from fisheries resources in the TSPZ in line with the Treaty.

4.6. The meeting **NOTED** advice from PNG-NFA that the authority confirms its commitment to support Treaty villages and has secured a budget to fund consultation and awareness raising visits to Treaty villages and fisheries intervention activities & projects. PNG-NFA further advised that they have the ability to deliver practical assistance, several administrative matters need to be resolved and stakeholders need to agree on their needs.

4.7. PNG-NFA **REQUESTED** to work collaboratively with AFMA to develop options on how PNG can effectively take up catch sharing options. AFMA welcomed the opportunity to assist PNG-NFA.

4.8. The meeting **NOTED** AFMA and PNG-NFA's strong commitment to ensure catch sharing arrangements are administered in line with the Treaty and in a manner that that does not unnecessarily impede traditional inhabitants from utilising those entitlements.

5. Tropical Rock Lobster Fishery

5.1. The meeting **NOTED** outcomes of the pre-season survey conducted in Australian waters in November 2017 and preliminary outcomes of the updated stock assessment. Based on the updated stock assessment the total recommended catch for 2018 is 299 tonnes.

5.2. The meeting **NOTED** AFMA advice that the pre-season survey index abundance for Tropical Rock Lobsters (TRL) was very low. While TRL is characterised as having highly variable recruitment, consideration of other contributing factors to the low pre-season abundance is ongoing. Factors likely include, environmental anomalies experienced over the last three years including, strong El Nino events, record high sea temperatures, habitat changes (industry reported significant sand incursions over certain fishing grounds) and coral bleaching events.

5.3. The meeting **AGREED** that 2018 catch sharing arrangements are to be finalised out of session in April once the final consideration of the stock assessment has been finalised and considered by the PZJA advisory committee. AFMA reiterated the standing invitation for PNG-NFA to attend the PZJA advisory committee meetings.

5.4. AFMA and PNG-NFA **REAFFIRMED** their commitment to providing timely and accurate catch reporting to ensure the integrity of future stock assessments. This includes the reporting of catch from all sectors.

PNG trawlers retaining Tropical Rock Lobster

5.5. The meeting **NOTED** PNG-NFA advice that the PNG prawn trawl industry are interested in retaining Tropical Rock Lobster that are incidentally caught and dead when brought on-board.

5.6. The meeting **NOTED** PNG-NFAs **REQUEST** to work with AFMA to further evaluate the impacts of various levels of trawl catch on the TRL stock and identify possible management options (seasonal or spatial closures) that could be developed to benefit all sectors. AFMA welcomed the opportunity to assist PNG-NFA and reiterated the importance of a taking a precautionary approach when considering any amendments to the current trawl ban.

5.7. The meeting **NOTED** advice from traditional inhabitants that the longstanding trawl bans in both jurisdictions where implemented after much negotiation to protect the sustainability of TRL and there would need to be strong case put forward to depart from this arrangement.

5.8. The meeting **REITERATED** the need to manage the take of tropical rock lobsters to the agreed global Total Allowable Catch irrespective of fishing method.

Stock structure

5.9. The meeting **NOTED** draft modelling outcomes of likely larval movements of tropical rock lobsters within the region. The meeting **NOTED** the research was undertaken by CSIRO and was an update of previous work using an updated model and data from additional years.

5.10. The meeting **NOTED** the following key findings:

- Australian and Papua New Guinea tropical rock lobster fisheries are based on single stock;
- recruitment success to Torres Strait is highly variable with recruits coming from Yule Island and northern Queensland placing further importance on having a healthy spawning biomass across its range; and
- the model did not find a clear relationship between larval dispersal and pre-season survey results (abundance and distribution of tropical rock lobster). This means the current model cannot assist in predicting how the stock may be influenced by catches or changing environmental conditions. Further work may be considered to improve the model, such as including fine scale tidal information for the Torres Strait.

6. Traditional Fisheries

6.1. The meeting **NOTED** the update on turtle and dugong management in Australian waters.

6.2. The meeting **NOTED** advice from PNG traditional inhabitants that the *Moro Momoro Gamo* management plan has been completed but has not yet been implemented. Noting that the plan covers a large number of communities (14 maritime boundaries), work is in progress to develop individual management plans to suit each community.

6.3. The meeting **NOTED** previous committee advice that the issue of illegal netting of dugong and turtle needs to be considered within the broader issues of livelihoods in PNG Treaty Villages.

6.4. PNG traditional inhabitants **ADVISE** that while illegal fishing was not supported, the incentive for Treaty villagers to fish illegally is likely linked to their immediate needs to provide food for themselves and their families. It was further **RECOGNISED** that this incentive is only likely to increase with population growth together with a lack of alternative livelihoods and persistent poverty in the PNG Treaty Villages. Advice from PNG traditional inhabitants was **NOTED** that the Treaty, in their view, has removed access to historical fishing grounds and provided little benefit to the PNG Treaty villagers.

6.5. Australian Traditional Inhabitant representatives **SUGGESTED** that gear restrictions in Torres Strait, limiting take of turtle and dugong to traditional methods only, could also be reflected in PNG community management plans under development. PNG Traditional Inhabitant representatives advised that they will encourage their members to discuss this suggestion with communities.

7. Spanish Mackerel

7.1. The meeting **NOTED** the update on Spanish mackerel as detailed in the agenda paper.

7.2. The meeting **NOTED** that a harvest strategy was under development for Torres Strait Finfish Fishery (which will apply to Spanish mackerel and coral trout) which would guide future management decisions for fishery.

7.3. The meeting **NOTED** advice from PNG-NFA that the PNG industry remains very small scale and did not yet have the capacity to utilise catch sharing arrangements under the Treaty.

7.4. Australia and Papua New Guinea both graciously **DECLINED** to enter into catch sharing arrangements for the 2017-18 fishing season.

8. Pearl Shell

8.1. The meeting **NOTED** the update on pearl shell as detailed in the agenda paper.

8.2. The meeting **NOTED** advice from AFMA and PNG-NFA that fishing activity for pearl shell remains negligible in both jurisdictions.

8.3. The meeting **NOTED** further advice from PNG-NFA that there are many skilled pearl shell divers within Treaty communities and **REQUESTED** to work with AFMA to explore opportunities under the Treaty to develop the pearl shell fishery. AFMA welcomed the opportunity to assist with PNG-NFA.

8.4. Australia and Papua New Guinea both graciously **DECLINED** to enter into catch sharing arrangements for 2018.

9. Other Fisheries

Beche-de-mer

9.1. The meeting **NOTED** the update on the Australian Beche-de-mer Fishery as detailed in the agenda paper.

9.2. The meeting **NOTED** AFMA advice that interest was increasing in the Australian beche-de-mer fishery with fishers focussing on providing the market with alternative species such as curryfish.

9.3. The meeting **NOTED** AFMA advice that it was working with scientists and traditional inhabitants in developing a harvest strategy for beche-de-mer which would guide future management decisions and support the sustainable development of the fishery.

9.4. The meeting **NOTED** PNG-NFA advice that the PNG moratorium on the take and possession of beche-de-mer was lifted in April 2017. The total allowable catches were taken quickly resulting in all provinces closed again to beche-de-mer fishing by July 2017. The Fishery remains closed.

9.5. The meeting **NOTED** the PNG-NFA is currently reviewing management arrangements for the Fishery in consultation with stakeholders and monitoring stocks with monitors regularly visiting fishing communities. A further opening of the fishery will be informed by the review. PNG-NFA **AGREED** to provide the Fisheries Committee with an update on any changes to management arrangements for the Fishery.

9.6. The meeting **NOTED** PNG-NFA advice that illegal fishing for beche-de-mer is prevalent and that Indonesian buyers were very active in PNG during the beche-de-mer season creating strong demand for product.

Barramundi

9.7. The meeting **NOTED** advice from PNG-NFA that fishers had raised concerns that catches of Barramundi appear to be declining.

9.8. The meeting **NOTED** that a stock assessment scheduled for barramundi had not occurred due to funding limitations. PNG-NFA now plans to undertake a desk-top study this year using information from previous studies on harvest rates (for example research by Dr Sara Bussliachi).

9.9. The meeting **WELCOMED** further advice and acknowledgement from PNG-NFA that the South Fly Government has supported the reopening of the barramundi hatchery on Daru and continues to support efforts to re-establish the restocking exercise in to the wild.

Finfish fishery – reef-line sector - update on activity in the Australian jurisdiction

9.10. The meeting **NOTED** the update on finfish activity in Australian waters was detailed in the agenda paper.

9.11. The meeting **NOTED** that a harvest strategy was under development for the Torres Strait Finfish Fishery (Spanish mackerel and coral trout) which would guide future management decisions for the Fishery.

9.12. The meeting **NOTED** that an initial stock assessment for coral trout would be conducted as part of the harvest strategy development.

10. Other Business

Research in the Torres Strait

10.1. The meeting **NOTED** the update on research projects in progress, or proposals under consideration relevant to the Torres Strait as detailed in the agenda paper.

10.2. The meeting co-chair **ADVISED** the meeting of broader research projects of relevance to the Torres Strait including CSIRO work to support Australia wide decadal monitoring for the effects of climate change which is due for completion in mid-2018. Also **NOTED** was another CSIRO project looking to examine optimising the yield that could be gained from Australian commercial seafood species which includes Torres Strait.

10.3. The meeting **REQUESTED** to revisit the outcomes of prior CSIRO research presented by James Butler 'Developing legal value chains and alternative markets for South Fly District fisheries'.

Presentation "Value-chains in Western Province Fisheries" by Dr Sara Busillachi.

10.4. The meeting **NOTED** the presentation from Dr Sara Busillachi, CSIRO which outlined recent findings from the collection of economic data from sales of PNG marine-derived commodities through the market chain into the Asian market. These commodities include beche-de-mer, shark fin and fish maw (swim bladder) from jewfish and barramundi.

10.5. The meeting **NOTED** that the research indicates that fishers in the Western Province are paid only a small proportion of the final market price of these commodities and face many risks in harvesting the products.

10.6. The meeting **NOTED** that the collection of supply chain data was the initial phase of the project with data still being analysed until July 2018. Funding for a second stage will likely be sought.

Next meeting

10.7. The meeting **NOTED** that the 2018 bilateral meeting is to be held in Australia and delegates will be advised by the Australian government on the arrangements for the meeting.

11. Closing Prayer

11.1. The meeting closed at 1700hrs with a closing prayer from TSRA Chairperson Pedro Stephen.

Table of actions arising from the 2017 Fisheries Bilateral Meeting (5 Feb 2018)

Item Number	Agenda #	Action	Responsible Agency
2017-1	4	AFMA and PNG-NFA to work collaboratively to investigate how treaty villages may effectively engage in commercial fisheries under the Treaty.	AFMA and PNG-NFA
2017-1	5.1	AFMA and PNG-NFA to work to collaboratively to further evaluate the impact of PNG prawn trawl catches impacting the Tropical Rock Lobster stock.	AFMA and PNG-NFA
2017-2	10.1	The outcomes of the CSIRO research project “Developing legal value chains and alternative markets for South Fly District fisheries” are to be made available to the meeting attendees.	AFMA

Attachment A
Fisheries Committee Bilateral Meeting 2016
Delegation List

Australian Delegation

Australian Traditional Inhabitant Representatives
Cr Getano Lui (Jr), Iama (Yam) Island (Traditional Inhabitant Meeting Co-chair)
Cr Fraser Nai, Masig (Yorke) Island
Cr Patrick Thaiaday, Erub (Darnley) Island
Mr Erik Peter, Torres Strait Regional Authority, Member for Boigu

Australian Government Representatives
Dr Nick Rayns, Australian Fisheries Management Authority – Australian Co-Chair
Ms Leilani Bin-Juda, Treaty Liaison Officer, Department of Foreign Affairs and Trade
Mr Pedro Stephen, Chairperson, Torres Strait Regional Authority
Mr Charlie Caddy, A/g Chief Executive Officer, Torres Strait Regional Authority
Mr Stan Lui, A/g Environment Program Manager, Torres Strait Regional Authority
Ms Fiona Pemberton, Department of Immigration and Border Protection
Mr Lyndon Peddell, A/g Manager Foreign Compliance, Australian Fisheries Management Authority
Ms Selina Stoute, Manager Torres Strait Fisheries, Australian Fisheries Management Authority
Mr Andrew Trappett, Senior Fisheries Management Officer, Australian Fisheries Management Authority, Fisheries Committee Meeting Secretariat

Papua New Guinea Delegation

Papua New Guinea Traditional Inhabitant Representatives
Cr Kebei Salee, Councillor for Sigabaduru, Traditional Inhabitant Meeting co-chair
Cr Frank Warapa, Councillor for Buji/Ber
Cr Tibau Kaware, Councillor for Katatai
Cr Murray Dimia, Councillor for Sui
Cr Peter Papua, Councillor for Mabudauan

Papua New Guinea Government Representatives
Mr Ian Liviko, Manager, Prawn and Lobster Fisheries, Papua New Guinea National Fisheries Authority
Mr Joseph Posu, Management Officer, Prawn and Lobster Fisheries, Papua New Guinea National Fisheries Authority
Mr Rei Vagi, Conservation and Environment Officer, CEPA

Mr Ian Liviko
Papua New Guinean Co-Chairperson
Manager, Prawn and Lobster Fisheries, Papua New Guinea National Fisheries Authority

Dr Nick Rayns
Australian Co-Chairperson
Executive Manager, Fisheries Management Branch, Australian Fisheries Management Authority

ANAO Performance Audit: Australian Government Coordination Arrangements in the Torres Strait

Australian National Audit Office

Objective

To assess the effectiveness of the coordination arrangements of Australian Government entities operating in the Torres Strait.

Criteria

1. Do Australian Government entities operating in the Torres Strait have appropriate governance arrangements to support the coordination of their activities?

2. Are the coordination arrangements effective in supporting Australian Government activities in the Torres Strait?

Sub-criteria

1.1 Entities assess the risks and benefits associated with the conduct of coordinated activities, and prioritise coordinated activities accordingly.

1.2 As part of their risk assessment, entities consider the impact of their operations on Torres Strait communities and community engagement is prioritised accordingly.

1.3 Entities have agreements in place to support the coordination of their activities with other government and non-government entities.

1.4 Roles and responsibilities are clearly defined and agreed between entities.

1.5 Governance structures (such as committees and communication mechanisms) are effective in supporting the coordination of activities.

1.6 Entities have developed mechanisms to support coordinated activities (including data sharing and IT systems integration).

2.1 The coordination arrangements are effective in supporting the Torres Strait Treaty and Border Control operations, including through:

- the management of the biosecurity risk (people, animal and plant health);
- the control of people movements (including under the Treaty's traditional visits provisions); and
- the monitoring of fishing activities (to control illegal and over fishing).

2.2 The coordination arrangements are effective in facilitating better integration of services in the Torres Strait, including through:

- the mapping of services and the identification of gaps and duplications;
- the alignment of services to agreed regional and Australian Government objectives; and
- the alignment of performance measures to support effective service performance monitoring and assessment.

2.3 The coordination arrangements are effective in optimising the use of facilities and resources, including sharing and pooling of transport, accommodation, corporate services and skills of government officials.

Audit details

Audit team

Dr Isabelle Favre	Senior Director (Audit Manager)	02 6203 7513	isabelle.favre@anao.gov.au
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Deborah Jackson	Executive Director	02 6203 7584	deborah.jackson@anao.gov.au

Contribute to the audit

via email on the ANAO website:
www.anao.gov.au

Audit timeframe

Fieldwork	Mar-Sept 2018
Report Preparation Papers to auditee	Sept 2018
Proposed (s.19) report to auditee	Nov 2018
Report tabled	Jan 2019

PZJA Torres Strait Tropical Rock Lobster Fishery Resource Assessment Group	27-28 March 2018
Fish receiver system update	**Agenda Item 2.2.1** **FOR NOTING**

RECOMMENDATIONS

1. That the RAG **NOTE** the update provided regarding the implementation of a Torres Strait fish receiver system (FRS), in particular:
    a. the FRS became mandatory for all Torres Strait Fisheries, excluding the Torres Strait Prawn Fishery, on 1 December 2017;
    b. AFMA have received good catch and effort information through the FRS to date. This data is more comprehensive and timely than that received under the previous voluntary arrangements and will be used to support better decision making about how fisheries are managed, including setting and monitoring total allowable catches;
    c. over the coming 12 months, further community visits will be conducted with Torres Strait Island and Northern Peninsula Area (NPA) communities, to provide ongoing support and education and receive feedback on how the FRS is functioning.

KEY ISSUES

2. The following table provides a summary of licences and activities undertaken to date (8 March 2018).

Number of fish receiver licences granted	66
Number of fish receivers that have received fish and submitted CDRs	18
Kilograms of Finfish reported through FRS	7,150 kg (all species combined)
Kilograms of Tropical Rock Lobster reported through FRS	70,429.6 kg
Kilograms of Beche-de-mer reported through FRS	7,508 kg (all species combined)

3. In general the response to the FRS has been very positive with fish receivers providing accurate data in a timely manner. A significant proportion of this data is coming from the TIB licence sector, a sector which has historically had poor data returns.
4. The FRS is still in the early stages of implementation. AFMA is providing ongoing education and support to fishers and fish receivers as well as targeting compliance activities to ensure all parties understand and are meeting their responsibilities under the FRS:
    a. fish receivers are completing and submitting catch disposal records correctly;
    b. fish receivers are only receiving from licensed fishers;
    c. fishers have a valid licence;
    d. fishers are having their catch weighed by a fish receiver at the first point of landing.
5. AFMA will also be conducting further community visits over the coming 12 months, to continue this education and support and receive feedback on how the FRS is functioning.

6. AFMA is also working to develop reports on the catch taken in each Torres Strait fishery that can be made publically available on a regular basis (e.g. monthly). The reports will provide industry and other stakeholders with an indication as to how a season is performing and where catch may be approaching TACs. AFMA will ensure that any disclosure of catch or effort data is only done so in accordance with AFMA's Information Disclosure policy. This includes not releasing catch or effort data prior to the end of a fishing season where the data represents less than five vessels. The policy can be accessed on AFMA's website at http://www.afma.gov.au/about/fisheries-management-policies/

Fisher and fish receiver responsibilities

7. Fishers and fish receivers have a number of responsibilities under the FRS – the table below provides a summary of these.

Fish Receivers	Fishers
Fish receivers are only permitted to receive fish from licenced fishers	Fishers must have their commercial catch weighed by a licenced fish receiver when it is first landed. Catch is landed when it is brought ashore or unloaded to a Carrier Class B or C boat. This does not include the catch you keep in cages or traps at sea (e.g. live Kaiar in sea cages)
Fish receivers must weigh (and if required, count) the fish and complete a Catch Disposal Record as soon as they receive the fish. The Catch Disposal Record must be completed as per the instructions	Fishers must provide their name, fishing licence number and boat symbol to the fish receiver and sign the section of the Catch Disposal Record which shows this information
Fisher receivers may request information about the fishers fishing area and method. This is voluntary, but is very important information for managing Torres Strait Fisheries sustainably	Fishers may provide information about their fishing area and method. This is voluntary, but is very important information for managing Torres Strait Fisheries sustainably
Fish receivers can only receive fish at the premises (or boats if you are receiving on a Carrier Class B or C licenced boat) nominated on their licence	
Fish receivers must give the pink copy of the Catch Disposal Record to the fisher	
Fish receivers must place the white copy of the Catch Disposal Record in the mail to AFMA (using the prepaid envelopes provided) within 3 business days of receiving the fish	
Fish receivers must retain the green copy of the Catch Disposal Record for five years	
Fish receivers must nominate an agent using the RA form if they wish to have a person other than themselves complete the Catch Disposal Record on their behalf	

Fish receivers must display a copy of their licence in public view at each of the premises identified on the licence	
Fish receivers should contact AFMA for a replacement Catch Disposal Record book prior to the completion of the existing book	

BACKGROUND

8. In March 2017, the PZJA agreed to replace the current voluntary Torres Strait Seafood Buyers and Processors Docket Book system with a mandatory FRS for all Torres Strait Fisheries, excluding Torres Strait Prawn Fishery, by 1 December 2017.
9. Accurate reporting and catch monitoring against TACs and individual catch allocations is not only important to ensure the sustainability of fisheries but also to maintain general compliance and integrity of management arrangements. The latter is very important for maintaining the value and security of fishing entitlements.
10. In relation to Torres Strait fisheries, effective catch monitoring through the FRS will support:
    a. the effectiveness of a quota management system in the Tropical Rock Lobster Fishery;
    b. guiding expansion in the Bêche-de-mer and Finfish Fisheries;
    c. rebuilding Black Teatfish stocks. Competition for the resource is increasing however the TAC is likely to remain small (15 tonnes) in the short to medium term or until such time new information is gathered to justify an increase in harvest levels; and
    d. ensuring the integrity of the finfish leasing arrangements which are based on individual catch allocations.
11. Consultation on the introduction of the FRS was conducted through the PZJA RAGS, MACs and Working Groups, native title representative bodies, letters to all stakeholders and visits to all Torres Strait Island and Northern Peninsula Area (NPA) communities.

Torres Strait Tropical Rock Lobster Working Group	Meeting 2018 27-28 March 2018
MANAGEMENT **TRL Fishery export approval under the EPBC Act.**	**Agenda Item 2.2.2** **FOR NOTING**

RECOMMENDATION

1. That the Working Group **NOTE** that the Torres Strait Tropical Rock Lobster Fishery has, subject to conditions, received export approval under the *Environment Protection and Biodiversity Conservation Act 1999* until 2020.

KEY ISSUES

2. The Torres Strait Tropical Rock Lobster Fishery has been declared an approved Wildlife Trade Operation (WTO) under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for a further three years, valid under 18 December 2020 (**Attachment A**).

3. This approval is:
    a. necessary in order to legally export commercially wild caught seafood from Australia; and
    b. subject to conditions which require ongoing work by the PZJA (**Table 1**).

4. The Working Group will need to have regard for the conditions currently in place when developing management advice for the Fishery.

5. One new condition has been added to the WTO that states:
    a. The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion in the fishery

    b. This may include data collection and analysis protocols to manage risks, triggers and/or limits for managing harvest, and should also account for all sources of stock mortality, including commercial, recreational, Traditional and illegal harvest.

6. Conditions carried over from the previous certification are:
    a. The need for the fishery to operate in accordance with the management arrangements in for under the Torres Strait Fisheries Act 1984.
    b. PZJA to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Tropical Rock Lobster Fishery management arrangements against which EPBC Act decisions are made.
    c. PZJA to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition
    d.

Table 1 WTO conditions for the Torres Strait Tropical Rock Lobster Fishery, a comparison with previous consideration and status of any relevant management actions.

Number	Condition	Comparison to previous WTO	Status of any relevant management actions
1.	Operation of the Torres Strait Tropical Rock Lobster Fishery will be carried out in accordance with management arrangements in force under the Torres Strait Fisheries Act 1984.	Carry over	Condition adhered to.
2.	The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Tropical Rock Lobster Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.	Carry over – standard condition on all WTOs.	Amendments to management arrangements (if any performed) are reported to DoEE through scheduled Strategic Assessment Reports.
3.	The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition.	Carry over -standard condition on all WTOs.	Reports are submitted to DoEE in support of renewing WTO export accreditation.
4.	The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion in the fishery. This may include data collection and analysis protocols to manage risks, triggers and/or limits for managing harvest, and should also account for all sources of stock mortality, including commercial, recreational, Traditional and illegal harvest.	New condition	The PZJA is working to implement a quota management system (QMS) including an enforceable TAC for the fishery. The PZJA is working to implement a final harvest strategy for the Fishery that includes decision rules that promote sustainable management of the stock. AFMA continues to promote catch reporting with industry across all sectors and collects data from daily fishing log books (mandatory TVH sector) and as of 1 December 2017, catch disposal records from TIB and TVH sectors.

BACKGROUND

7. The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the Australian Government to assess the environmental performance of fisheries and promote ecologically sustainable fisheries management.

8. The Minister for the Department of the Environment and Energy is responsible for the assessment of fisheries managed under Commonwealth legislation and state export fisheries in accordance with the EPBC Act.

9. Several separate assessments are undertaken under the EPBC Act:
    - the strategic assessment of fisheries under Part 10 of the EPBC Act;
    - assessments relating to impacts on protected marine species under Part 13; and,
    - assessments for the purpose of export approval under Part 13A.

10. In assessing a management plan under Part 10 of the EPBC Act the Minister for the Environment is assessing the framework for managing the fishery and declaring that actions approved in accordance with the accredited plan do not require approval under Part 9 for impact on the environment (approval of actions relating to matters of national environmental significance).

11. In assessing a management plan under Part 13 of the EPBC Act the Minister for the Environment is determining that all reasonable steps are being taken to avoid killing or injuring protected species and that the fishery to which the plan relates does not, or is not likely to, adversely affect the survival or recovery in nature of any listed threatened species or the conservation status of a listed migratory species, cetacean, or listed marine species or a population of that species.

12. In assessing a management plan under Part 13A of the EPBC Act the Minister for the Environment is determining whether species taken in the fishery should be included on the list of exempt native specimens (LENS) and therefore allowed to be exported. For each specimen on the list there is to be a notation that states whether the inclusion of the specimen in the list is subject to restrictions or conditions and, if so, the nature of those restrictions or conditions.

13. The Torres Strait Tropical Rock Lobster Fishery was first assessed 2004 under Parts 10, 13 and 13 A of the EPBC Act. Export approval was granted through amending the LENS and declaring the TRL Fishery a Wildlife Trade Operation (WTO) for a period of three years, valid until 24 November 2007. A further three WTO approvals were granted with the last valid until 4 May 2016.

14. On 12 April 2017, AFMA submitted an application on behalf of the PZJA, for reassessment of the Torres Strait Tropical Rock Lobster Fishery under the EPBC Act as a wildlife trade operation **(Attachment B)**.

15. The Department of the Environment and Energy assessed this application against the Australian Government 'Guidelines for the Ecologically Sustainable Management of Fisheries – 2nd Edition'. Public consultation was undertaken on the application between 26 April and 31 May 2017. No comments were received.

16. The Department of the Environment and Energy assessment is at **Attachment C**.

17. The Delegate of the Minister for the Environment and Energy wrote to AFMA and Senator the Hon Anne Ruston, Assistant Minister for Agriculture and Water Resources on 20 December 2017 advising of her decision in relation to the reassessment of seven Commonwealth-managed fisheries including the Torres Strait Tropical Rock Lobster Fishery (**Attachment D**).

LIST OF ATTACHMENTS

Attachment A – Declaration of an approved Wildlife Trade Operation – Torres Strait Tropical Rock Lobster Fishery, December 2017.

Attachment B – Report submitted by AFMA to DoEE on behalf of PZJA for the Torres Strait Tropical Rock Lobster Fishery.

Attachment C – DoEE Assessment of the Torres Strait Tropical Rock Lobster Fishery**.** December 2017.

Attachment D – Letter from delegate on decision to declare WTO, 20 December 2017

COMMONWEALTH OF AUSTRALIA

Environment Protection and Biodiversity Conservation Act 1999

DECLARATION OF AN APPROVED WILDLIFE TRADE OPERATION – TORRES STRAIT TROPICAL ROCK LOBSTER FISHERY, DECEMBER 2017

I, ILSE KIESSLING, Acting Assistant Secretary, Wildlife Trade and Biosecurity Branch, as Delegate of the Minister for the Environment and Energy, have considered in accordance with section 303FN of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) the application from the Australian Fisheries Management Authority and advice on the ecological sustainability of the operation. I am satisfied on those matters specified in section 303FN of the EPBC Act. I hereby declare the operations for the harvesting of specimens that are or are derived from fish or invertebrates, other than specimens that belong to species listed under Part 13 of the EPBC Act (other than a species listed in the conservation dependent category), and specimens that belong to taxa listed under section 303CA of the EPBC Act (Australia's CITES list), taken in the Torres Strait Tropical Rock Lobster Fishery as defined in the management regime in force under the *Torres Strait Fisheries Act 1984* (Cth) and the Torres Strait Fisheries Regulations 1985 (Cth), to be an approved wildlife trade operation, in accordance with subsection 303FN(2) and paragraph 303FN(10)(d), for the purposes of the EPBC Act.

Unless amended or revoked, this declaration:

a) is valid until 18 December 2020 and;

b) is subject to the conditions applied under section 303FT specified in the Schedule.

Dated this 20 day of December 2017

……

Delegate of the Minister for the Environment and Energy

A person whose interests are affected by this declaration may, within 28 days, make an application in writing to the Department of the Environment and Energy for the reasons for the decision.
An application for independent review of the decision (under section 303GJ(1) of the *Environment Protection and Biodiversity Conservation Act 1999*) may be made to the Administrative Appeals Tribunal (AAT), on payment of the relevant fee by the applicant, either within 28 days of receipt of the reasons for the decision, or within 28 days of this declaration if reasons for the decision are not sought. Applications should be made to the Deputy Registrar, AAT in your Capital City. Please visit the AAT's website at http://www.aat.gov.au/ for further information.
You may make an application under the *Freedom of Information Act 1982* (Cth) to access documents relevant to this decision. For further information, please visit http://www.environment.gov.au/foi/index.html.
Further enquiries should be directed to the Director, Wildlife Trade Assessments Section, Department of the Environment and Energy, Telephone: (02) 6274 1917 Email: sustainablefisheries@environment.gov.au.

SCHEDULE

Declaration of the Harvest Operations of the Torres Strait Tropical Rock Lobster Fishery as an approved wildlife trade operation, December 2017

ADDITIONAL PROVISIONS (section 303FT)

Relating to the harvesting of specimens that are or are derived from fish or invertebrates, other than specimens that belong to species listed under Part 13 of the EPBC Act (other than a species listed in the conservation dependent category), and specimens that belong to taxa listed under section 303CA of the EPBC Act (Australia's CITES list), taken in the Torres Strait Tropical Rock Lobster Fishery:

1. Operation of the Torres Strait Tropical Rock Lobster Fishery will be carried out in accordance with management arrangements in force under the *Torres Strait Fisheries Act 1984*.

2. The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Tropical Rock Lobster Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.

3. The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

4. The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion in the fishery.

   This may include data collection and analysis protocols to manage risks, triggers and/or limits for managing harvest, and should also account for all sources of stock mortality, including commercial, recreational, Traditional and illegal harvest.

Strategic Assessment Report

Torres Strait Tropical Rock Lobster Fishery

February 2017

Prepared by the Australian Fisheries Management Authority on behalf of the Torres Strait Protected Zone Joint Authority

Australian Government

Australian Fisheries Management Authority

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Contents

Tables

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Executive summary

The Torres Strait Tropical Rock Lobster Fishery (the Fishery) was strategically assessed in May 2014 under Parts 10, 13 and 13A of the EPBC Act. Export approval was granted through declaring the Fishery a Wildlife Trade Operation (WTO) for a period of three years, valid until 4 May 2017.

This submission has been produced to allow the Department of the Environment to assess the current management arrangements under the EPBC Act prior to the expiry of the current WTO approval. A formal management plan for the Fishery is being developed by the Australian Fisheries Management Authority (AFMA) on behalf of the PZJA, the Plan is due to be implemented in 2018.

This report describes the current status and nature of the Fishery; the current management arrangements, the research and monitoring regime of the Fishery and trends of catch and effort, including spatial and temporal information.

This document has been developed in accordance with AFMAs obligations under the EPBC Act to declare the Fishery an approved WTO.

Torres Strait Tropical Rock Lobster Fishery Strategic Assessment Report – February 2017

Introduction

This draft assessment report for the Torres Strait Tropical Rock Lobster Fishery (the Fishery) The report provides the basis for the strategic assessment of the Fishery consistent with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Consultation

The Protected Zone Joint Authority (PZJA) is responsible for making management decisions for PZJA fisheries, including the TRL Fishery. The PZJA membership is comprised of the Commonwealth Assistant Minister for Agriculture, The Queensland Government Minister for Agriculture, Fisheries and Forestry and the Chair of the Torres Strait Regional Authority. Further information regarding the PZJA is provided in **Section 2.2**.

1. Description of the fishery

At a glance	
Principle species	Tropical rock lobster (*Panulirus ornatus*)
Fishery sectors	Transferrable Vessel Holder (TVH) Traditional Inhabitant Boat (TIB) Papua New Guinea (PNG) cross-endorsed
No. concessions 2016	TVH: 12 licences, 33 tenders, limited entry TIB: 291 PNG: 0 (cross-endorsed) (ABARES Fishery Status Report 2016)
Fishing methods	Hookah – diving assisted by surface supply breathing apparatus Free diving – diving with breath hold only Lamp fishing – fishing at night with a light and collecting lobster by a handheld spear or net from a boat
Estimated catch and value or 2014/15	Australia TRL catch 303 t (~$A12.2 million) PNG TRL catch 192 t (value uncertain) (ABARES Fishery Status Report 2016)
Primary markets	Live lobsters and frozen tails – domestic Frozen tails – United States Live lobsters – Hong Kong and China (ABARES fishery status report 2016)
Stock status	2014/15 not overfished 2014/15 not subject to overfishing (ABARES fishery status report 2016)
Management plan	None In preparation to move from the current predominantly effort based management system to one based on quota a management plan is being developed for the Fishery.
Management method	Under the current management system input controls are the primary management tool with restrictions on fishing gear and seasonal closures. These controls are complemented with a minimum size limit (115 mm tail length or 90 mm carapace length) and traditional landing and recreational bag limits.
Consultative mechanism	The PZJA is responsible for making management decisions for the Fishery. The PZJA has established two consultative forums for the Fishery: the Tropical Rock Lobster Resource Assessment Group (TRLRAG) and the Tropical Rock Lobster Working Group (TRLWG) who provide recommendations to the PZJA.

1.1 Target/permitted/prohibited species

The Tropical Rock Lobster Fishery is based on a single species, the tropical rock lobster (*Panulirus ornatus*). Other species of rock lobster (*P. versicolour, P. penicillatus and P. femoristriga* and *P. polyphagus*) have been recorded in the Torres Straits; however catches of these species are negligible.

Bycatch or by-product species are not encountered/taken due to the selective nature of the fishery. Other species may be targeted opportunistically by TRL fishers who hold other fishery endorsements.

1.2 Fishing method employed

The TRL Fishery is primarily a dive-based, hand-collection fishery using hookah or by free-diving, a small quantity of lobster is also taken by lamp fishing. The hookah dive method typically has one diver working from each fishing vessel (called tenders); tenders are generally four to six metres in length. Hookah divers work to about 20 metres in depth during daylight hours. Lamp fishing involves collecting lobsters at night by drifting over shallow reefs using handheld spears or scoops.

The TVH sector generally uses primary boats in conjunction with smaller fishing tenders and fish for lobster using hookah. The TVH sector normally undertakes trips to fishing grounds that last from a few days to several weeks.

The TIB sector typically uses smaller fishing tenders only with trips lasting for one or two days. However, recently an increasing number of TIB sector operators have started using larger primary boats in conjunction with fishing tenders and hookah dive equipment. Some TIB operators' lamp fish the shallow reefs at night.

1.3 Fishery area

See the map detailing the area of the fishery **(Attachment A)**, available from: http://pzja.gov.au/wp-content/uploads/2011/05/lobster_map.gif.

Majority of the Tropical Rock Lobster is taken from the western and central zones of the fishery **(Section 3.9)**.

1.4 Allocation between sectors

Catch sharing arrangements between Australia and PNG are defined under the under the *Treaty between Australia and the Independent State of Papua New Guinea concerning Sovereignty and Maritime Boundaries in the area between the two Countries, including the area known as the Torres Strait, and Related Matters* (the Treaty), for further information on the Torres Strait Treaty see **Section 2.1**.

Under the Treaty PNG cross-endorsed vessels are entitled to take 25 per cent of the TAC within the Australian area of jurisdiction and Australia is entitled to take 75 per cent of the TAC. The Australian TAC is notional and not used to control harvest of the TIB and TVH sectors, currently the level of catch is controlled by input controls. The proposed management plan will allocate quota units to TIB and TVH sectors and will be used to control harvest.

1.5 Status of export approval /accreditation under Environment Protection and Biodiversity Conservation Act 1999

The Fishery was granted export approval/accreditation under the EPBC Act on 7 May 2014 for a period of three years and is valid until 4 May 2017. The declaration of the harvest operations of the Torres Strait Tropical Rock Lobster Fishery as an approved wildlife trade operation (WTO) stipulates three additional provisions **(Attachment B)**.

2. Management arrangements

2.1 Governing legislation

The Torres Strait Treaty establishes the Torres Strait Protected Zone (TSPZ) and aims to protect the traditional way of life and livelihood of the traditional inhabitants of the Torres Strait and adjacent coastal areas of the two countries. Australia and Papua New Guinea are obligated to cooperate in the conservation, management and utilisation of the Protected Zone fisheries and both countries have sovereign rights within the Protected Zone.

Management of Protected Zone fisheries in the Australian area of jurisdiction is subject to the *Torres Strait Fisheries Act 1984*. The purpose of the Act is to give effect, in Australian law, to the fisheries elements of the Torres Strait Treaty.

The Act also establishes the PZJA **(Section 2.2)** and a PZJA policy decision outlines which agencies are able to administer the day to day functions of the PZJA **(Section 2.3)**.

In addition to the above Act, Protected Zone fisheries are subject to assessment under three parts of the EPBC Act for fisheries where:

- a formal management plan or regime is to be determined (part 10);
- there are interactions with listed threatened species and ecological communities (part 13); and
- fisheries product is to be exported (part 13A).

2.2 Protected Zone Joint Authority (PZJA)

The PZJA members comprise the Commonwealth and Queensland Ministers responsible for fisheries, and the Chair of the Torres Strait Regional Authority. The Australian Government Minister is the Chair of the PZJA.

To assist in the management of the PZJA fisheries, the PZJA has established advisory bodies comprising a wide range of stakeholders and fishery experts, including:

- industry (traditional inhabitant and non-traditional inhabitant);
- Australian and Queensland government officials; and
- other technical experts.

The PZJA is advised by several forums on issues associated with the Fishery; these are the PZJA Standing Committee **(Section 2.3)**, the Torres Strait Scientific Advisory Committee (TSSAC), Tropical Rock Lobster Fishery Working Group (TRLWG), and the Tropical Rock Lobster Fishery Resource Assessment Group (TRLRAG).

The PZJA Standing Committee
The PZJA Standing Committee consists of senior representatives from the PZJA member agencies. Its function is to provide strategic and operational recommendations to the PZJA on the management of the fisheries in accordance with the PZJA's statutory obligations and to oversee the implementation of the PZJA's agreed policy commitments.

The Torres Strait Scientific Advisory Committee
The TSSACs main role is to advise on the strategic direction, priorities and funding for research undertaken by AFMA across all PZJA fisheries in the Protected Zone. This advice gives consideration to meeting research gaps in line with the objectives of the *Torres Strait Fisheries Act 1984*.

Tropical Rock Lobster Working Group
The TRLWG provides recommendations to PZJA forums on fishery specific issues, including input to research gaps, operational issues and compliance issues. The TRLWG is comprised of members and observers from industry, AFMA, QDAF, TSRA, fishery scientists. Observers to the TRLWG are Malu Lamar registered native title body corporate (RNTBC), PNG National Fisheries Authority (NFA) and industry members (TIB, TVH and PNG). The TRLWG enables greater participation from industry members (traditional inhabitant and non-traditional inhabitant) in the consultative process.

The Tropical Rock Lobster Resource Assessment Group
The TRLRAG provides advice on stock assessment related matters that address biological, economic and social/cultural factors affecting the Fishery. These matters include; the status of fish stocks, sub-stocks, species (target and non-target species) and the impact of fishing on the marine environment. Members of the TRLRAG include research members, industry members, AFMA, QDAF and TSRA. Observers to the TRLRAG are Malu Lamar RNTBC, industry members, PNG NFA and industry members (TIB, TVH and PNG).

2.3 Agencies roles and responsibilities

The PZJA Standing Committee is comprised of AFMA, QDAF, TSRA and the Australian Government Department of Agriculture and Water Resources.

Australian Fisheries Management Authority
AFMA undertakes fisheries management and licencing functions in consultation with the other agencies and maintains an office on Thursday Island. AFMA is responsible for developing fisheries management arrangements such as management plans and provides support and secretariat services for the PZJA, TSSAC, the TRLRAG and the TRLWG. AFMA is also responsible for foreign compliance in Commonwealth waters.

Queensland Department of Agriculture and Fisheries
Fisheries Queensland is the delegate for Torres Strait domestic compliance. They also provide fisheries management and licencing advice on day-to-day operational issues at an officer level and through the Standing Committee.

The Torres Strait Regional Authority
The TSRA provide input to fisheries management decisions and represent the interests of Traditional Inhabitants in fisheries management.

The TSRA have also taken the lead on the development of community management plans for Turtle and Dugong. Additionally, Turtle and Dugong are detailed as a fishery under the *Torres Strait Fisheries Act 1984* meaning that current legislation regarding sustainability is administered by AFMA.

The Commonwealth Department of Agriculture and Water Resources

The Commonwealth Department of Agriculture continues to work closely with AFMA in assisting with legislative reform and policy advice.

2.4 Proposed management arrangements for the fishery

Current arrangements

The Fishery is managed by a range of input controls such as size limits and gear restrictions and output controls such as minimum size limits. These management measures exist in the form of management notices and licence conditions **(Table 1)**.

A recommended biological catch (the maximum amount of TRL that should be taken in a season) and a notional total allowable catch are set each year. The notional TAC is used to measure the stock status and for catch sharing arrangements with PNG, it is not used to control harvest in the Fishery.

Vessel monitoring system will be mandatory on all commercially licenced primary and carrier vessels operating under the *Torres Strait Fisheries Act 1984* by 1 July 2017. The introduction of VMS will improve monitoring, control and surveillance of licenced fishing vessels in the Torres Strait.

Proposed arrangements

AFMA is working with the PZJA to develop a mandatory fish receiver system for all Torres Strait Fisheries to replace the voluntary Torres Strait Seafood Buyers and Processors Docket Book (TDB01). Currently the TDB01 provides the principle source of catch and effort information for the TIB sector, however because it is voluntary some TIB catch is unaccounted each year.

Under the proposed fish receiver system licenced fish receivers will be required to report the catch and fishing effort information for both TIB and TVH fishers. The system will improve reporting of catch and effort data for the TIB sector and further reduce uncertainty in the stock assessment. The fish receiver system will be used to reconcile catch against quota and improve monitoring, control and surveillance supporting the proposed quota management system.

A plan of management is being developed for the Fishery to transition the management arrangements to output controls through the allocation of TRL quota units to the TIB and TVH sectors. Output controls regulate the fishing activity by restricting the amount of fish that can be landed. The Plan pursuant to section 15A of the *Torres Strait Fisheries Act 1984* will:

- determine a total allowable catch (TAC) (a measure of fishing capacity (s15A(4)) each fishing season for tropical rock lobster (*Panulirus spp*.);

- allocate units (division and allocation of fishing capacity (s15A(6)) to eligible persons and/or entities. Each unit (known as quota units) will entitle the holder to an equal share of the TAC; and
- allow for the trading (selling and leasing) of quota units (s15A(6)).

The total allowable catch (TAC) will be determined by the PZJA in line with requirements of the TRL Harvest Strategy and following advice from the TRLRAG and TRLWG.

Table 1. Torres Strait Tropical Rock Lobster Fishery management measures.

Management measures	Traditional Inhabitant Sector (TIB)	Non-Indigenous Sector (TVH)	What instrument is used to impose the measure	Will the arrangement continue immediately after the Management Plan (MP)*	Will the arrangement be in the MP[1].
Requirement to hold a licence	Yes	Yes	*Torres Strait Fisheries Act 1984* and *Community Fishing Notice 1*.	Yes	MP
Tender/dinghy number restrictions	No[2]	Yes (maximum 7)	TVH sector: result of limited entry policy.	Yes	No, other instrument.
Catch reporting	No	Yes	Licence conditions	Yes	No, other instrument.
Moon-tide hookah closures	Yes	Yes	Licence conditions	Yes	No, other instrument.
Fishery closure (1 Oct – 30 Nov)	Yes	Yes	Torres Strait Fisheries Management Instrument No.9	Yes, to be reviewed.	No, other instrument.
Hookah closure (1 Dec – 31 Jan)	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes, to be reviewed.	No, other instrument.
Size restrictions, minimum tail size of 115 mm or minimum carapace length of 90 mm.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	No, other instrument.
Prohibition on using SCUBA or any kind of equipment used for breathing underwater other than hookah gear.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	No, other instrument.

*Note: All management arrangements are subject to periodic review.

[1] Details will be set out in other instruments or licence conditions.
[2] Policy removed in 2014. Tender numbers are now constrained by vessel survey standards

Management measures	Traditional Inhabitant Sector (TIB)	Non-Indigenous Sector (TVH)	What instrument is used to impose the measure	Will the arrangement continue immediately after the Management Plan (MP)*	Will the arrangement be in the MP or operational detail be in the actual MP
Collection by hand, spear, scoop net only.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	No, other instrument.
Prohibition on carrying meat removed from lobster.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	No, other instrument.
Prohibition on carrying diving equipment at night.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	No, other instrument.
A Master Fisherman's licence must be held by person in charge of the boat.	Yes	Yes	Policy	Yes	MP
A processor/carrier licence is required to carry or process TRL at sea.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	MP
A bag limit of three lobsters per person or six lobsters per boat applies to traditional fishing (Islander or visiting PNG Traditional Inhabitants) and recreational fishing.	Yes	Yes	*Torres Strait Fisheries Management Instrument No.9*	Yes	No, other instrument
Boat length restrictions and boat replacement policy[3]	Yes (maximum 20m)	Yes (maximum 18m)	Licence conditions and *Fisheries Management Notice No.47* (maximum 20m)	Yes	No, other instrument

[3]
- boats up to six metres may be replaced by another boat up to six metres;
- boats greater than six metres and less than or equal to ten metres may be replaced by a boat up to and including 10 metres;
- boats greater than ten metres and less than or equal to 14 metres may be replaced by a boat up to and including 14 metres; and
- boats greater than 14 metres may be replaced by another boat of equal length. The maximum size for fishing boats is 20 metres.

2.5 Statement of the performance of the fishery against objectives, performance indicators and performance measures

A statement of the performance of the TRL Fishery against its objectives, performance indicators and performance measures is made annually in PZJA's annual report. A copy of the current statement can be found on the PZJA website.

2.6 Compliance risks present in the fishery and actions taken to reduce these risks

Queensland Boating and Fisheries Patrol (QBFP) carries out the domestic compliance programs for the Torres Strait under an agreement between the Commonwealth of Australia and the State of Queensland relating to the cost of management of fisheries in the Australian area of jurisdiction.

AFMA is responsible for the foreign compliance program for the Torres Strait and it liaises closely with PNG National Fisheries Authority (NFA) and Australian Border Force - Maritime Border Command.

QBFP compliance regime

During 2014/15 Queensland Boating and Fisheries Patrol (QBFP) had four matters involving the Torres Strait Tropical Rock Lobster Fishery referred to the Commonwealth Director of Public Prosecutions. Decisions on these matters are still pending; they involve offences including: unlicensed fishing, breaches of licence conditions and commercial sale of no take species.

AFMA compliance regime

AFMA and (QBFP) undertake an annual compliance risk assessment process for the Torres Strait. The 2015 compliance risk assessment process identified six moderate to high level risks within the area of the Torres Strait. Three identified risks are of direct relevance to the Torres Strait Tropical Rock Lobster Fishery.

The breaching of trip, gear, size and jurisdictional limits:

- breach of gear restrictions, in particular the use of surface supply breathing apparatus (hookah) and seasonal closures.
- breach of possession limits, size limits and fishing during seasonal closures.

The occurrence unauthorized fishing:

- unlicensed domestic (non-traditional and traditional) operators and unlicensed PNG nationals.

The occurrence of logbook misreporting:

- failure to accurately complete logbooks (TVH sector only).
- failure to submit logbooks within the required timeframe (TVH sector only).

At the 2014 and 2015 bilateral meetings between AFMA and PNG, officials discussed the options currently in place for enhancing the foreign compliance regime in the Torres Strait, including:

PNG Treaty Awareness Program and Treaty Village Identification Scheme
Australian and PNG government agencies conduct visits to the 13 PNG Torres Strait Treaty Villages, situated along the Southern Coastline of Western Province, PNG, as a part of the Department of Foreign Affairs (DFAT) led Treaty Awareness Program.

The Treaty Awareness Program is designed to educate and advise members of the Treaty villages on their rights and responsibilities under the Torres Strait Treaty between Australia and Papua New Guinea. The visits involve agencies responsible for fisheries, immigration, biosecurity, maritime safety and health. AFMA officers discuss traditional fishing rights under the Torres Strait Treaty, Australian fisheries law and the ramifications of not adhering to fisheries legislation. AFMA has also implemented the Traditional Vessel Identification Scheme as part of these treaty awareness visits. Identified treaty village vessels are marked with unique identification labels which assist the Australian Border Force and AFMA in monitoring the movements of fishing vessels under the Treaty arrangements. Approximately 90 per cent of all vessels (152 boats) in the area have Treaty Village Identification labels. Only one labelled treaty village boat has been apprehended for illegal fishing since implementation of this scheme in 2012.

Joint Patrols and activities
During the 2014/2015 year AFMA and PNG National Fisheries Authority (NFA) coordinated respective patrol boat movements on both sides of the TSPZ during two operations. Suspected illegal fishing activity decreased noticeably during these periods. One PNG NFA officer also joined AFMA and Royal Australian Navy (RAN) officers for a targeted operation against illegal TRL fishing on Warrior Reef.

PNG NFA and police officers based in Daru have conducted a series of at sea transfers of apprehended PNG nationals from Australian patrol boats this year. These transfers provide for repatriation and subsequent processing and prosecution of the offenders under PNG legislation and in keeping with the spirit of the Torres Strait Treaty.

Monitoring, Control and Surveillance
The foreign compliance regime in the Torres Strait is conducted by Australian Border Force - Maritime Border Command working closely with the AFMA Foreign Compliance Operations sector and fishery stakeholders to detect, intercept and disrupt illegal maritime activity.

From October 2013 – January 2016 a total of 27 foreign fishing vessels with PNG origin have been apprehended or otherwise subject to enforcement action within the TSPZ. Of these apprehended vessels 15 resulted in forfeiture of vessels and related fishing gear, including a total number of 247kgs of whole TRL and 50kgs of tailed TRL.

Maritime Border Command has a dedicated Operations Centre which coordinates the civil maritime surveillance program, identifying incursions into Australia's Exclusive Economic Zone (EEZ) and the TSPZ. The intelligence-led, risk-based intervention approach is drawn upon to plan, prioritise and coordinate operations to counter maritime security threats.

AFMA carries out a role as an ongoing patrol presence in response to compliance risks associated with the region. Periods of identified heightened risk through ongoing methods of surveillance may lead to the request of additional assets and patrols for certain areas.

Border Force assets include Bay Class and Cape Class patrol vessels, contracted fixed wing and rotary aircraft including; Dash-8 and Rheims surveillance aircraft, AS350 Squirrel and Bell 412 rotary aircraft. Defence-assigned assets include Royal Australian Air Force AP-3 Orion maritime patrol aircraft and Royal Australian Navy patrol boats. Maritime Border Command also utilises commercial satellite imagery to conduct surveillance of remote areas of our ocean.

The goal is to maintain a secure and safe maritime operating environment for industry participants to be able to conduct their business. The AFMA Foreign Compliance Operations Section in the Torres Strait engages with industry to improve on water awareness, prevention, preparedness and response to potential incidents.

2.7 Description of cross-jurisdictional management arrangements

Australia and PNG entered into the Treaty on 15 February 1985. The Treaty requires Australia and PNG to cooperate in the conservation, management and optimum utilisation of all Article 23 commercial fisheries in the TSPZ. It also allows for catch sharing arrangements between the two countries which are negotiated annually at the fisheries bilateral meeting **(Section 1.4)**.

2.8 Demonstration of compliance with Threat Abatement Plan's, recovery plans etc

As the fishery is a highly selective single species fishery **(Section 1.1)** and no bycatch is taken, there are no threat abatement plans, recovery plans or bycatch reduction strategies applicable to the fishery.

3. Research and monitoring

3.1 Research priorities and funding

Research proposals are considered by a number of consultative forums; these forums evaluate the research proposals and advise AFMA on research priorities and funding. The consultative process for research proposals is described below:

AFMA sends a call for pre-proposals for fisheries research in the Torres Strait region. The call for research details priority projects (identified by the TSSAC). Applicants may also submit pre-proposals for projects not identified as priority work.

All pre-proposals are considered by the TRLRAG and the TRLWG, these forums will advise on the preferred research projects based the fishery priorities. The TRLRAG and TRLWG meeting records, including any recommendations, will be provided to the TSSAC for consideration.

The TSSAC will evaluate pre-proposals based on the specific criteria detailed in the annual operational plan. A strong emphasis is placed on the ability of research proposals and principal investigators to engage Torres Strait Islanders in the research process in

meaningful and culturally appropriate ways. The TSSAC will also consider recommendations from the TRLRAG and TRLWG.

Researchers are notified of the TSSACs evaluation of proposals. Individual applicants are then invited to prepare a full (detailed) proposal based on evaluation of the pre-proposals. Full proposals are considered and if accepted endorsed by the TRLRAG, TRLWG and TSSAC.

3.2 Fishery independent surveys

Annual fishery-independent monitoring of the Torres Strait TRL population has been carried out since 1989. Dive surveys are conducted mid-year (June) and additionally pre-season (November) for the years 2005-2008 and 2015, provide information on the relative abundance of recruiting and fished lobsters. The most recent information on the monitoring program and the Fishery stock assessment is provided annually in the 'Torres Strait Tropical Rock Lobster Fishery Survey and Stock Assessment, Research Project RR2013/803, Final Report - Draft' produced by CSIRO **Attachment C**.

There have been several changes to the sampling method since 1989, however abundance data has been standardised for the duration of the monitoring program. A total of 140 (full-scale) or 74 (reduced-scale) sites are allocated to the established sampling strata. Measured belt transects (500 m by 4 m) comprise the primary sampling unit. At the completion of each transect a diver records; the number of lobsters caught (and measured), the number and age-class of those observed but not caught, depth, visibility, distance swum, numbers of pearl shell (*Pinctada maxima*) and holothurian species observed, percent covers of standard substratum and biota (including seagrass and algae species) categories.

Pre-season population surveys inform the abundance recruiting lobster; these surveys were identified by the TRLRAG as critical to support the move of the TRL Fishery to quota management, first proposed by the PZJA in 2005. As a result pre-season surveys were conducted in 2005-2008 and 2015, in addition to mid-year surveys, to provide managers with information on the abundance and biomass of recruiting TRL and the likely stock biomass available to be fished each season. This information underpins the outputs of the stock assessment model which has been developed to assess the fishery status and to forecast the recommended biological catch of TRL for each fishing season. The reduced scale (77 sites) pre-season surveys are considered to be representative for the Fishery. There is a strong correlation (R=0.97) between the index of abundance for 1+ TRL from the mid-season and pre-season survey.

A stock assessment is completed for the Fishery annually to provide a recommended biological catch (RBC) for the shared fishery (Australia and PNG). The stock assessment model is informed by historic catch per unit effort (CPUE) information for the TIB sector (years 2004-2015) and for the TVH sector (years 1994-2015), catch information from PNG and results of the fishery independent survey. The CPUE information provides data on the abundance of fished lobsters and informs model predictions of the spawning biomass; this is a fundamental parameter to forecast the RBC. The model also incorporates the southern oscillation index (strength of El Nino or La Nina events) into the RBC calculation.

3.3 Catch and effort reporting

Mandatory catch and effort reporting requirements are in place for the TVH sector. Catch and effort data for the TVH sector is recorded in the Tropical Rock Lobster Logbook (TRL04), an example of the TRL04 logbook page is provided at **Attachment D**. For each vessel day there can be multiple shots (up to four) with each shot consisting of up to eight tenders. Each tender has a catch record by dive method (hookah, freedive or unknown) and by processed form (whole, tailed or unknown). Currently reporting of catch and effort data is not compulsory for the TIB sector due to legislative limitations.

In January 2004, AFMA introduced the Torres Strait Seafood Buyers and Processors docket-book (TDB01) to commercial and community freezer operators to collect data on Torres Strait Islander catch. Unlike the TRL04 logbook, which requires catch and effort data to be recorded for individual fishing operations related to each vessel tender, the docket-book requires only aggregate catch and effort data to be recorded at the end of each trip. The use of the TDB01 docket-book is voluntary. An example of the TDB01 docket book page is available at **Attachment E**. Currently there is no observer program for the Torres Strait Tropical Rock Lobster Fishery. Traditional and recreational catch is considered to be negligible (a bag limit of 3 per person and 6 per boat applies to traditional and recreational fishing east of Cape York Peninsula) and constant over time, it is not incorporated into the fishery stock assessment.

A mandatory fish receiver system is being developed for all Torres Strait Fisheries to replace the TDB01 docket-book. The fish receiver system will improve the reporting of catch information for the TIB sector. Licenced fish receivers will be required to report the landed catch of TRL and fishing effort information for both TIB and TVH fishers. The fish receiver system will be used to reconcile catch against quota and improve monitoring, control and surveillance supporting the proposed quota management system.

3.4 Total catch of target species

The total reported global catches (Australia and PNG) of TRL and the global total allowable catch for the years 2012 to 2015 is provided in **Table 2**.

Table 2. Global reported catch and total allowable catch of TRL (tonnes in live weight) from 2012-2016.

Year	Australia Catch (tonnes)	PNG Catch (tonnes)	Total Allowable Catch (tonnes)
2012	521	174	964
2013	489	108	871
2014	405	261	616
2015	326.6	235.7	869
2016	444.7	127.1	796

3.5 Total catch of target species taken by other fisheries

The Torres Strait Prawn Fishery (TSPF) has historically interacted with TRL. Licensing conditions limit TSPF operators to retain 20 kg of TRL per trip if caught in trawl nets and all

TRL catches must be reported. PNG have reported catches of TRL in demersal trawl fisheries targeting prawns. The combined quantity of TRL reported taken in PNG fisheries (dive and trawl caught) is provided in **Table 2**.

An AFMA independent fishery observer was on-board two TSPF vessel trips during 2015, observing a total of 54 fishing days and a total of 203 shots. The number of Tropical Rock Lobster observed during this period is provided in **Table 3**.

Table 3. Number of TRL caught and discarded on TSPF observer voyage OB15/043.

Species	Common name	Number caught	Discarded alive	Discarded dead	Per cent discarded dead
Panulirus ornatus	Tropical Rock Lobster	628	613	15	2.5

3.6 Bycatch and byproduct species

The fishery is a highly selective single species fishery as a result of the hand collection fishing method **(Section 1.2)**. There is no bycatch or byproduct species reported in the fishery. However, operators with other fishery endorsements may harvest those species opportunistically while targeting TRL.

3.7 Harvest by each sector

The total catch of Tropical Rock Lobster (tonnes in live weight) for the Australian sectors (TIB and TVH) and PNG for the years 2004-2015 is provided at **Table 4**. The number of TIB sector docket-book records decreased significantly after 2012. This is due to the fact that 43% of the catch in 2013 was not recorded in the docket-book but instead was attributed to two aggregate catch records added to the TIB database to account for 40,029 kgs of whole lobsters and 5,746 kgs of tails received by processors. This occurred again in 2014 and 2015 when two aggregate catch records (representing around 50% of the total catch for both years) were added to the TIB database to account for catch received by processors but not recorded in the docket-book. These amounts were an additional 45,312 kgs of whole lobsters and 7,975 kgs of tails for 2014 and an additional 56,133 kgs of whole lobsters and 7,759 kgs of tails for 2015.

Table 4. Australia (TIB and TVH) and PNG annual catch (tonnes live weight) of Tropical Rock Lobster and Total Allowable Catch for the years 2004 to 2015.

Year	TIB	TVH	PNG	Total Catch	Total Allowable Catch	Catch as % of TAC
2004	211	481	192	874	*	*
2005	345	545	228	1118	*	*
2006	143	135	142	420	471	89
2007	267	269	228	764	842	91
2008	207	100	221	528	751	70

2009	135	91	161	387	450	86
2010	182	279	293	754	853	88
2011	201	503	165	869	803	108
2012	151	370	174	695	964	72
2013	127	362	108	597	871	69
2014	132	173	261	666	616	108
2015	173.9	152.7	235.7	562.3	769	73
2016	207.1	237.6	127.1	571.8	796	72

*Information not available

3.8 Effort data including information on trends

Between 2004 and 2016 there are a total of 35,869 TRL04 records for the TVH sector. The distribution of these records by year and month are given in **Table 5**. It is apparent that there has been little if any effort during October and November before 2006 and since 2006 there has been zero effort in the months October-to-January.

Effort is recorded as 'Hours-Fished' which records the duration of the fishing trip for each tender-set. The number of hours fished recorded for only 31,171 (93.8%) of the 33,235 records. A total of 30,831 records (92.8% of all tender-sets) recorded effort between 0.5 and 12 hours. There were 20 records where the recorded hours fished was greater than 12 hours, two records where effort was less than 0.5 hours and 315 records where effort was recorded as 24 hours (1.2% of records). Effort in the TVH sector declined between 2006 and 2009 as a result of the removal of licences in the fishery through the voluntary buyback process. Effort increased in 2010, and has been relatively constant from 2010-2015.

Table 5. Number of TVH catch records by year and month.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004	24	607	712	571	662	761	729	633	395			106
2005	13	662	615	543	519	538	552	533	323			4
2006		409	436	361	286	206	349	289	92			
2007		288	427	446	542	489	402	184	91			
2008		133	222	113	161	96	159	175	152			
2009		148	227	174	201	200	125	163	70			
2010		255	333	302	324	292	309	294	253		6	
2011		286	384	371	322	380	356	310	261			
2012		166	344	371	311	366	318	264	201			
2013		461	383	414	424	324	374	385	243			
2014		357	395	297	433	408	445	274	291		1	
2015		419	408	441	355	313	250	346	127			

2016	12	500	444	315	379	334	313	183	124			
TOTAL	49	4691	5330	4719	4919	4707	4681	4033	2623	0	7	110

Between 2004 and 2016 there are a total of 72,930 TDB01 docket-book records for the TIB sector. The structure of the docket-book indicates that there should be a unique record for each vessel, date and seller-name. However, there are often multiple records where for the same vessel, date and seller name there are multiple unique records where the number of days fished is different. The annual listing of the number of TIB docket-book seller records and number of days fished is provided in **Table 6**.

Table 6. Annual listing of the number of TIB seller records against the number of days fished.

Days-Fish	04	05	06	07	08	09	10	11	12	13	14	15
0	688	407	336	345	165	89	110	217	240	411	223	118
1	3000	4752	2926	4652	3859	2716	2184	2303	650	39	1170	868
2	354	398	257	376	311	260	67	82	195	99	124	142
3	129	183	138	123	116	131	77	60	110	77	56	88
4	87	89	60	45	35	64	19	44	41	2	17	43
5	55	97	50	61	37	52	3	32	25	1	6	34
6	12	38	3	5	8	13	2	22	36	0	1	8
7	12	24	15	5	9	17	2	11	16	0	4	4
8	10	10	6	8	4	5	4	5	10	0	2	7
9	11	5	1	2	0	0	0	3	5	0	1	5
10	2	5	2	2	1	7	0	8	2	0	0	0
11	3	0	0	0	3	5	0	1	7	0	0	0
12	0	5	0	1	0	2	0	0	0	0	0	0
13	4	1	1	2	0	0	0	0	0	0	0	0
14	2	1	1	1	0	0	0	1	0	0	0	0
15	0	0	0	1	0	1	0	0	0	0	0	0
16	0	0	3	0	0	0	0	0	0	0	0	0
TOT	4369	6015	3799	5629	4548	3362	2468	2789	1337	629	1604	1317

The nominal catch per unit effort (CPUE) (total catch/total effort) for the TVH and TIB sectors is provided in **Table 7**. The nominal CPUE for TIB and TVH sectors is variable; this is consistent with the high natural variability of the Torres Strait Tropical Rock Lobster and may also be attributed to changes to management arrangements and changes to the fishing fleet through time.

Table 7. Nominal catch per unit effort for TIB and TVH sectors for the years 2004-2015.

Year	Nominal CPUE TIB sector	Nominal CPUE TVH sector
2004	0.98	1.08
2005	1.17	1.47
2006	0.80	0.67
2007	0.96	1.07
2008	0.95	0.86
2009	0.83	0.61
2010	1.02	1.22
2011	1.40	2.08
2012	1.38	1.62
2013	*	1.26
2014	0.76	1.02
2015	0.73	0.61
2016	1.04	1.10

*Data not available

3.9 Spatial and temporal issues/trends

The spatial distribution of TRL is reported by the TIB sector using the 21 zones identified in the TDB01 docket-book. Since 2004, the western zones of the TSPZ (Thursday Island Bridge, Mabuiag and Badu strata) have accounted for approximately 65 per cent of the TIB sectors catch. The eastern zones (Warrior and Warraber strata) have accounted for approximately nine and eight per cent of the TIB sectors catch respectively.

The spatial distribution of TRL is reported by the TVH sector using modified docket book zones. Since 1994, the central zones (Kircaldie and Warraber strata) have accounted for approximately 65 per cent of the TVH sectors catch. The northern zones (Buru and Numar strata) have accounted for approximately 20 per cent of the TVH sectors catch.

Stock assessment surveys conducted by CSIRO reported that there were no significant trends or correlation between spatial information and lobster density. Lobster density was reported to be ‘loosely’ correlated with seagrass habitat. However, seagrass coverage is highest in the Thursday Island Bridge and Mabuiag strata and the correlations between seagrass coverage and lobster density were poor.

Tagging studies of Torres Strait Tropical Rock Lobster has shown that during the months of August to October each year most 2+ lobsters (at least two years old) emigrate from the western and central Torres Strait and move north-east into the Gulf of Papua, undergoing reproductive development at the same time. Lobsters arriving in Papuan waters are in very poor condition and almost all lobsters die after breeding. Annual variability observed in Tropical Rock Lobster distribution is influenced by environmental conditions such as strong

trade winds, food availability and high turbidity. These factors may also result in spatial and temporal changes to fishing operations.

3.10 Benthic communities

The benthic habitat of the Torres Strait was surveyed in May-June 1989, using almost 600 transects randomly dispersed over an area of approximately 25 000 km^2 (Pitcher et al. 1992). The distribution and relative abundance of seagrasses tended to increase from almost zero abundance in the southern and eastern areas of the survey to moderately dense in north-western Torres Strait. The substratum type also varied greatly, with the greatest diversity and abundance of biota associated with the harder substrata. The ongoing TRL monitoring program **(Section 3.1)** has shown that seagrass coverage may change overtime, while substrate (sand, rubble, hard cover) has been consistent through the monitoring period (CSIRO unpublished data).

Australian Government

Department of the Environment and Energy

Assessment of the

Torres Strait Tropical Rock Lobster Fishery

December 2017

CONTENTS

{ TOC \O "1-3" \H \Z \U }

EXECUTIVE SUMMARY OF THE ASSESSMENT OF THE TORRES STRAIT TROPICAL ROCK LOBSTER FISHERY

On 12 April 2017, the Australian Fisheries Management Authority (AFMA) submitted an application on behalf of the Torres Strait Protected Zone Joint Authority (PZJA), for assessment of the Torres Strait Tropical Rock Lobster Fishery under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as a Wildlife Trade Operation (WTO).

The Department of the Environment and Energy assessed this application against the Australian Government 'Guidelines for the Ecologically Sustainable Management of Fisheries – 2nd Edition'. Public consutlation on the application was undertaken 26 April to 31 May 2017. No comments were received.

The Torres Strait Tropical Rock Lobster Fishery targets a single species, *Panulirus ornatus*, using hand-collection methods in the Torres Strait Protected Zone. The target stock is not considered overfished and bycatch is negligible. While log books do not facilitate reporting of interactions with EPBC Act-listed species, the risk of interactions is considered to be low based on hand collection of the target stock.

The fishery is unlikely to have an unsustainable ecological impact during the period of the proposed approval (three years). The Department has proposed conditions, specified in Section 4 of this assessment, to ensure risks are managed.

The proposed conditions include the development and implementation of a harvest strategy and improvements to data collection and analysis protocols. A number of measures are already underway. Most notably, AFMA's capacity to monitor and manage catches has significantly improved since 1 December 2017 with the introduction of its fisher receiver system.

The Department recommends that, subject to the conditions specified in Section 4 of this report, the Torres Strait Tropical Rock Lobster Fishery be declared an approved Wildlife Trade Operation for a period of three years until 18 December 2020. Product derived from the fishery should be included on the List of Exempt Native Specimens while a declaration for an approved wildlife trade operation is in place.

Unless a specific time frame is provided, each condition must be addressed within the period of the approved wildlife trade operation declaration for the fishery.

SECTION 1: ASSESSMENT SUMMARY OF THE TORRES STRAIT TROPICAL ROCK LOBSTER FISHERY AGAINST THE GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES (2ND EDITION), CONSISTENT WITH THE EPBC ACT.

	Meets	Partially meets	Does not meet	Details
Guidelines				
Management regime	5 of 9 & 1 N/A	3 of 9	0 of 9	Improvements in management are occurring with actions being implemented. Capacity to monitor and manage catches has significantly improved since the last assessment. Further reforms are expected within the life of the recommended WTO.
Principle 1 (target stocks)	1 of 11 & 2 N/A	8 of 11	0 of 11	The species is not considered overfished or subject to overfishing. The fishery is seeking to manage uncertainty in a precautionary way. Accounting for all sources of mortality is expected to within the life of the recommended WTO.
Principle 2 (bycatch and TEPS)	5 of 12 & 5 N/A	1 of 12	1 of 12	Logbooks do not require reporting of TEP interactions. Collection methods used in this fishery are considered to be low risk.
Principle 2 (ecosystem impacts)	0 of 5	5 of 5	0 of 5	An ecological risk assessment of the fishery found no species, habitats or communities at high risk. The assessment is intended to be revised at least every four years, including during the life of the recommended WTO. Collection methods used in this fishery are considered to be low risk.
EPBC requirements				
Part 12				No marine bioregional plans apply to the area of the Torres Strait.
Part 13	Meets			Impact on EPBC listed species likely to be low. No interactions reported to date.
Part 13A	Meets			This assessment report recommends declaring the fishery a Wildlife Trade Operation for three years until 18 December 2020.
Part 16	Meets			The management regime and collection methods are sufficiently precautionary to prevent serious or irreversible environmental damage.

Assessment history:
1st assessment finalised November 2004 – WTO with 3 conditions; 10 recommendations
2nd assessment finalised November 2007 – WTO with 3 conditions; 5 recommendations
3rd assessment finalised November 2010 – WTO with 3 conditions; 5 recommendations
4th assessment finalised May 2014 – WTO with 3 conditions; 3 recommendations

Fishery reporting:
- Annual report – no reports have been provided.
- { HYPERLINK "http://www.afma.gov.au/sustainability-environment/protected-species-management/protected-species-interaction-reports/" }
- { HYPERLINK "http://pzja.gov.au/resources/publications/annual-reports/pzja-annual-report-2011-2014/" \l ".WWbP-f7QCUk" }

Enforcing legislation:
- { HYPERLINK "https://www.legislation.gov.au/Details/C2016C00677" }
- { HYPERLINK "http://www.comlaw.gov.au/comlaw/management.nsf/lookupindexpagesbyid/IP200400637?OpenDocument" \t "_blank" \o "Torres Strait Fisheries Regulations 1985 " }
- { HYPERLINK "https://www.legislation.gov.au/Details/C2004A02886/Download" }
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/09/Fisheries-Management-Instrument-9.pdf" }{ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/09/Logbook-Instrument-No-1.pdf" } (pdf copy marked as 'current' on PZJA website but repealed 26 August 2014. Replaced by { HYPERLINK "https://www.legislation.gov.au/Details/F2015L01256" } (Registered 12 August 2015 and valid to 1 June 2018).
- { HYPERLINK "https://www.legislation.gov.au/Details/F2008B00509" } (not listed on PZJA website)
- { HYPERLINK "https://www.legislation.gov.au/Details/F2008B00528" }
- Fisheries Management Notice No. 42 (Incomplete pdf copy on PZJA website. Full copy on { HYPERLINK "https://www.legislation.gov.au/Details/F2008B00528" }).
- { HYPERLINK "https://www.legislation.gov.au/Details/F2008B00753" }
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/cfn01.pdf" } (pdf on PZJA website not legislation.gov.au)
- { HYPERLINK "http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/TREATIES/AUS-PNG1978TS.PDF" }

Risk assessment and mitigation:
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/4.pdf" } (April 2007)
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }

Stock assessment:
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/Refined-Stock-Assessment-and-TAC-Estimation-for-the-Torres-Strait-Rock-Lobster-TRL-Fishery.pdf" }
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/Revised-2010-Assessment-of-the-Tropical-Rock-Lobster-Panulirus-ornatus-Fishery-in-the-Torres-Straits.pdf" }

Other:
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/torres-rock-lobster.pdf" }
- { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/6.pdf" }

SECTION 2: DETAILED ANALYSIS OF THE TORRES STRAIT TROPICAL ROCK LOBSTER FISHERY AGAINST THE GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES (2ND EDITION)

	Comment
THE MANAGEMENT REGIME	
The management regime does not have to be a formal statutory fishery management plan as such, and may include non-statutory management arrangements or management policies and programs. The regime should:	
Be documented, publicly available and transparent	**Partially meets** While information is available on the PZJA website, some information is unavailable, inaccurate, inconsistent or difficult to locate. This makes it difficult to determine what arrangements apply to the fishery and could affect fisher's capacity to understand and comply with the arrangements. The Queensland Boating and Fisheries Patrol reported fisher's "lack of knowledge of relevant licensing conditions" as a compliance issue for this fishery ({ HYPERLINK "http://pzja.gov.au/resources/publications/annual-reports/pzja-annual-report-2011-2014/" \l ".WWbP-f7QCUk" }). AFMA has committed to review the PZJA website by July 2018.
Be developed through a consultative process providing opportunity to all interested and affected parties, including the general public	**Meets** The management regime is developed through a consultative process. The PZJA established advisory bodies in 2003 and records of various meetings are published on the { HYPERLINK "http://pzja.gov.au/pzja-and-committees/" \l ".WYKur_7QAy9" }. Traditional Inhabitant representatives are chosen by their communities, and together with industry and government representatives (Commonwealth and state), participate in the development of management arrangements. The PZJA is also advised by the Torres Strait Protected Zone Joint Authority Standing Committee, management advisory committees, the Torres Strait Scientific Advisory Committee, working groups, and resource assessment groups. The PZJA consults Australian traditional inhabitant fishers (commercial and traditional fishing), non-traditional inhabitant commercial fishers, Australian and Queensland government officials, and other technical experts, and conducts Native Title notification in accordance with the *Native Title Act 1993*.
Ensure that a range of expertise and community interests are involved in individual fishery management committees and during the stock assessment process	**Meets** Consultative groups include relevant expertise and community interest. Details are prescribed in the terms of reference for groups such as the { HYPERLINK "http://pzja.gov.au/pzja-and-committees/torres-strait-scientific-advisory-committee-tssac/torres-strait-scientific-advisory-committee-tssac-terms-of-reference/" \l ".WV3u2f7QCUk" }. The policy guiding membership, operation, administration and key decision making processes of the advisory bodies (other than the Torres Strait Protected Zone Joint Authority Standing Committee) is documented in { HYPERLINK "http://www.pzja.gov.au/wp-content/uploads/2011/06/fisheries-management-paper-no1.pdf" } on the PZJA website.
Be strategic, containing objectives and performance criteria by which the effectiveness of the management arrangements are measured	**Meets** The fishery is managed in accordance with the "Interim Torres Strait Tropical Rock Lobster Fishery Harvest Strategy, 2008". This includes objectives and performance criteria to measure fishery performance. A revised harvest strategy, informed by a management strategy evaluation will also be implemented from December 2019.

Be capable of controlling the level of harvest in the fishery using input and/or output controls	**Partially meets** A mix of input and output controls are used. There are a limited number of non-traditional (TVH) commercial licenses, but the number of traditional inhabitant (TIB) licenses is unlimited. Licensed vessels operate up to 14 tenders which are usually around five meters long and typically carry two divers ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/Refined-Stock-Assessment-and-TAC-Estimation-for-the-Torres-Strait-Rock-Lobster-TRL-Fishery.pdf" }). Each year notional catch limits are set for the fishery based on pre-season surveys and recommendations from the fishery's resource assessment group. Catch is then allocated between Australian and Papua New Guineas fishers in accordance with catch sharing arrangements under the Torres Strait Treaty. There are no individual quota allocations; the notional catch limit applies to the fishery and is fished competitively. From 1 December 2017 all commercial fishers are required to unload their catches to licenced fish receivers, who must then report the catch to AFMA within three days. This measure provides AFMA with much greater capacity to monitor and manage fishing effort than was previously the case. The ecological risk management strategy for the fishery ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }) anticipated introduction of a quota management system before 2011. AFMA is still pursuing these reforms but they have not yet occurred. AFMA also expects to implement a revised harvest strategy, which will be subject to a management strategy evaluation, from December 2019. When implemented these measures should improve AFMA's capacity to control the level of harvest in the fishery. The Minister responsible for the fishery can control fishing via legislative instrument (s16 *Torres Strait Fisheries Act 1984*), but this mechanism is likely to be reserved for emergency situations.
Contain the means of enforcing critical aspects of the management arrangements	**Meets** The *Torres Strait Fisheries Act 1984* outlines penalties for non-compliance with fisheries management arrangements and the Queensland Boating and Fisheries Patrol currently provide enforcement for Australian fishers in the Torres Strait. AFMA is responsible for foreign compliance in the Torres Strait and liaises closely with the Papua New Guinean National Fisheries Authority and Australian Border Force - Maritime Border Command in this process. AFMA and the Queensland Boating and Fisheries Patrol undertake an annual compliance risk assessment for the Torres Strait and in 2015 identified six moderate to high level risks, of which three are directly relevant to the Torres Strait Tropical Rock Lobster Fishery. During 2014–2015 fishing season the Queensland Boating and Fisheries Patrol referred four matters involving the Torres Strait Tropical Rock Lobster Fishery to the Commonwealth Director of Public Prosecutions. These included unlicensed fishing, breaches of licence conditions and commercial sale of no take species.
Provide for the periodic review of the performance of the fishery management arrangements and the management strategies, objectives and criteria	**Meets** The fishery is managed in accordance with the "Interim Torres Strait Tropical Rock Lobster Fishery Harvest Strategy, 2008". This includes objectives and performance criteria which are considered each year by the fishery's resource assessment group. A revised harvest strategy, informed by a Management Strategy Evaluation, is also expected to be implemented from December 2019. The Australian Government Bureau of Agricultural and Resource Economics and Sciences undertake annual assessments of the fishery based on available information.

Be capable of assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates	**Partially meets** An ecological risk assessment of the fishery found no species, habitats or communities at high risk, and states that it will be revised at least every four years ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/4.pdf" }). However, the ecological risk assessment has not been amended since 2007 (10 years) though it is scheduled to be reviewed in 2019–2020. At the end of each year, the fishery's management advisory committee considers changes in spatial distribution of effort, total fishing effort, and any expansion of new gear type or configuration, and if these changes occur, review the risk assessment. Although annual stock surveys (proposed to be triennial under a new harvest strategy) collect some information on habitats (e.g. sea grass beds and sand incursions), these observations do not appear to be driven by the ecological risk assessment and mitigation strategies. Notwithstanding, hand collection (including use of spears and scoop nets) is likely to have a minimal impact on the physical environment. The ecological risk management strategy ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }) anticipated introduction of a quota management system before 2011, but this has still not occurred. Risk mitigation strategies are expected to be reviewed when the risk assessment is revised.
Requires compliance with relevant threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under the policy	**Not applicable** There are no threat abatement plans, recovery plans, national bycatch policies or action strategies applicable to this fishery.
PRINCIPLE 1 - A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover**.**	
Objective 1 - The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability.	
Information requirements	
1.1.1 There is a reliable information collection system in place appropriate to the scale of the fishery. The level of data collection should be based upon an appropriate mix of fishery independent and dependent research and monitoring.	**Partially meets** From 1 December 2017, all commercial fishers are required to unload their catch to a licenced fish receiver, who then must report this information to AFMA within three days. Reporting information, other than what the fish receivers report on their behalf, is entirely voluntary (ie. location, effort, discards). This applies to more than 96 per cent of licenses. AFMA is pursuing legislative changes to enable it to mandate reporting of fishery data by all fishers (including commercial Traditional Inhabitant fishers). AFMA considers Traditional (non-commercial) and recreational catch to be negligible, constant over time and does not consider them in fishery stock assessments. Fishery-independent monitoring of the Torres Strait tropical rock lobster population has been carried out since 1989. This program currently involves a pre-season dive survey to provide information on the relative abundance of recruiting lobsters and the likely stock biomass available to be fished each season. These surveys are expected to occur triennially under a new harvest strategy (in development).
Assessment	

1.1.2 There is a robust assessment of the dynamics and status of the species/fishery and periodic review of the process and the data collected. Assessment should include a process to identify any reduction in biological diversity and /or reproductive capacity. Review should take place at regular intervals but at least every three years.	**Partially meets** Stock assessments are undertaken each year but do not attempt to identify any change in biological diversity or reproductive capacity. The 2015 stock assessment used catch and effort data as well as annual fishery-independent survey data. The fishery is characterised by highly variable annual recruitment and a small number of age classes. Estimates of maximum sustainable yield can be uncertain and annual yields tend to fluctuate widely around deterministically predicted estimates. On this basis, conservative, but non-binding total allowable catch limits are calculated each year, with the aim of keeping the biomass at roughly current levels. At the end of each year, the fishery's management advisory committee considers changes in spatial distribution of effort, total fishing effort, and any expansion of new gear type or configuration, and if these changes occur, review the risk assessment.
1.1.3 The distribution and spatial structure of the stock(s) has been established and factored into management responses.	**Partially meets** Tropical rock lobster populations in Torres Strait (managed under the PZJA), the Coral Sea (managed by the Commonwealth) and Queensland (managed by Queensland) are thought to comprise a single biological stock due to the mixing of larvae in the Coral Sea ({ HYPERLINK "http://frdc.com.au/research/Final_Reports/2002-008-DLD.pdf" }). However, unlike Coral Sea and Queensland stocks, Torres Strait lobsters are thought to migrate to Papua New Guinea to spawn, after which time they die. Stock assessments for the Torres Strait Tropical Rock Lobster Fishery therefore do not consider catch data from outside the Torres Strait. The pre-season stock surveys in the Torres Strait focus on areas of the Torres Strait Tropical Rock Lobster Fishery which are considered to be representative of the Torres Strait Tropical Rock Lobster Fishery as a whole. The surveys are undertaken as close to the start of the new season as possible, to give the best indication of fishable biomass. At the end of each year, the fishery's management advisory committee considers changes in spatial distribution of effort, total fishing effort, and if these changes occur, review the risk assessment.
1.1.4 There are reliable estimates of all removals, including commercial (landings and discards), recreational and indigenous, from the fished stock. These estimates have been factored into stock assessments and target species catch levels.	**Partially meets** Reporting fishery data is not mandatory for the Traditional Inhabitant Boat (TIB) sector, or for any operator with a boat seven metres or less in length. However as of 1 December 2017, all commercial fishers are required to unload their catch to a licenced fish receiver, who then must report this information to AFMA within three days. Information other than landed catch volumes are reported on an almost entirely voluntary basis (more than 96 per cent of licenses), but generally at a coarse scale. AFMA is pursuing legislative changes to enable it to mandate reporting of fishery data by all fishers (including commercial Traditional Inhabitant fishers). Tropical rock lobsters are also caught as bycatch in the Torres Strait Prawn Fishery but, based on observer records from 2015, the majority are discarded alive ({ HYPERLINK "http://www.environment.gov.au/system/files/pages/89160a83-68a6-4f07-81d3-e7df1a02bdbd/files/torres-strait-tropical-rock-lobster-application-2017.pdf" }). The extent of any traditional (non-commercial) or other catch in the area of the fishery is unknown.

1.1.5 There is a sound estimate of the potential productivity of the fished stock/s and the proportion that could be harvested.	**Partially meets** Estimates of potential productivity are uncertain due to highly variable annual recruitment and the limited number of age classes in the stock. However, annual yields can be expected to fluctuate widely around deterministically predicted estimates ({ HYPERLINK "http://data.daff.gov.au/data/warehouse/9aam/fsrXXd9abm_/fsr16d9abm_20160930/17_FishStatus2016TorresStraitTropicalRockLobster_1.0.0.pdf" }). AFMA attempt to account for this uncertainty by undertaking pre-season stock surveys as close to the start of the new season as possible, to give the best indication of fishable biomass. The survey results are then used in conjunction with the interim harvest strategy (which includes biological reference points) to set the notional total allowable catch limits for the fishery. The catch limits are non-binding and not used to control harvest ({ HYPERLINK "http://www.environment.gov.au/system/files/pages/89160a83-68a6-4f07-81d3-e7df1a02bdbd/files/torres-strait-tropical-rock-lobster-application-2017.pdf" }), but fishing can be controlled at any time by a Ministerial direction under section 16 of the *Torres Strait Fisheries Act 1984*.
Management responses	
1.1.6 There are reference points (target and/or limit), that trigger management actions including a biological bottom line and/or a catch or effort upper limit beyond which the stock should not be taken.	**Partially meets** An interim harvest strategy is in place for the fishery and includes a number of reference points based on unfished biomass, but no decision rules. The interim harvest strategy is used to determine the nominal (non-binding) total allowable catch limit for the fishery, but this catch limit is not used to control harvest ({ HYPERLINK "http://data.daff.gov.au/data/warehouse/9aam/fsrXXd9abm_/fsr16d9abm_20160930/17_FishStatus2016TorresStraitTropicalRockLobster_1.0.0.pdf" }). A revised harvest strategy is in development and expected to include fishery-specific target and limit reference points which will support the fishery's transition from effort-based to quota-based controls, and also contain a harvest control rule that reduces exploitation rate linearly to zero as the spawning biomass declines from trigger to limit reference points ({ HYPERLINK "http://data.daff.gov.au/data/warehouse/9aam/fsrXXd9abm_/fsr16d9abm_20160930/17_FishStatus2016TorresStraitTropicalRockLobster_1.0.0.pdf" }). It is unclear when the transition to quota-based management will occur. This was initially forecast for 2007, then by 2011, and continues to receive opposition from some stakeholders. Fishing can however, be controlled at any time via a Ministerial direction under section 16 of the *Torres Strait Fisheries Act 1984*.

1.1.7 There are management strategies in place capable of controlling the level of take.	**Partially meets** An interim harvest strategy is in place for the fishery but this does not include decision rules. A new harvest strategy, informed by a management strategy evaluation is currently being developed and is expected to be implemented from December 2019. AFMA is also seeking to introduce quota management reforms which, if successful, will significantly improve the capacity to manage the level of take in the fishery. In lieu of these changes, fishing can be controlled via a Ministerial direction under section 16 of the *Torres Strait Fisheries Act 1984*, but this is unlikely to be used as a routine management tool. Other issues which affect capacity to control take in the fishery include the complex set of input and output controls, which differ for the Traditional Inhabitant Boat and non-traditional Transferable Vessel Holder sectors and contain various exceptions. For example persons are prohibited from taking, processing or carrying tropical rock lobsters unless they hold a licence; do so in the course of traditional fishing; or do so for private purposes with the use of an Australian boat. Not all of the arrangements are well communicated and only some are documented on the { HYPERLINK "http://pzja.gov.au/resources/publications/fisheries-management-and-logbook-notices/" \l ".WV35fP7QCUm" }. Information presented via the site is often incomplete, inconsistent or out of date. The PZJA website is expected to be updated by July 2018.
1.1.8 Fishing is conducted in a manner that does not threaten stocks of byproduct species.	**Meets** Hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising the risk of catching byproduct.
(Guidelines 1.1.1 to 1.1.7 should be applied to byproduct species to an appropriate level)	
1.1.9 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.	**Partially meets** The issues identified in items 1.1.1 to 1.1.7 above are likely to affect fisher's ability to understand and comply with the management requirements, and the various management and compliance agencies capacity to enforce the arrangements.
If overfished, go to Objective 2: **If not overfished, go to PRINCIPLE 2:**	
Objective 2 - Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes.	
Management responses	
1.2.1 A precautionary recovery strategy is in place specifying management actions, or staged management responses, which are linked to reference points. The recovery strategy should apply until the stock recovers, and should aim for recovery within a specific time period appropriate to the biology of the stock.	**Not applicable** Species in the Torres Strait Tropical Rock Lobster Fishery are not currently considered overfished or subject to overfishing ({ HYPERLINK "http://data.daff.gov.au/data/warehouse/9aam/fsrXXd9abm_/fsr17d9abm_20170929/17_FishStatus2017TorresStraitTropicalRockLobster_1.0.0.pdf" }).
1.2.2 If the stock is estimated as being at or below the biological and / or effort bottom line, management responses such as a zero targeted catch, temporary fishery closure or a 'whole of fishery' effort or quota reduction are implemented.	**Not applicable** Species in the Torres Strait Tropical Rock Lobster Fishery are not currently considered overfished or subject to overfishing ({ HYPERLINK "http://data.daff.gov.au/data/warehouse/9aam/fsrXXd9abm_/fsr17d9abm_20170929/17_FishStatus2017TorresStraitTropicalRockLobster_1.0.0.pdf" }).
PRINCIPLE 2 - Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.	
Objective 1 - The fishery is conducted in a manner that does not threaten bycatch species.	
Information requirements	

2.1.1 Reliable information, appropriate to the scale of the fishery, is collected on the composition and abundance of bycatch.	**Not applicable** Hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising potential for interactions with bycatch.
Assessments	
2.1.2 There is a risk analysis of the bycatch with respect to its vulnerability to fishing.	**Partially meets** An ecological risk assessment of the fishery found no species, habitats or communities at high risk but committed to revise the assessment at least every four years. However, is has not been amended since 2007 (10 years) though it is scheduled to be reviewed in 2019–2020. While not a full ecological risk assessment, at the end of each year the fishery's management advisory committee considers changes in spatial distribution of effort, total fishing effort and gear. If changes are considered necessary, the committee reviews the fishery's risk assessment.
Management responses	
2.1.3 Measures are in place to avoid capture and mortality of bycatch species unless it is determined that the level of catch is sustainable (except in relation to endangered, threatened or protected species). Steps must be taken to develop suitable technology if none is available.	**Meets** Hand collection methods (hand-held snares, spears and scoop nets) are highly selective, allowing bycatch to be avoided. In addition, AFMA's ecological risk management strategy for the fishery took this into account and concluded the risk to be negligible ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }).
2.1.4 An indicator group of bycatch species is monitored.	**Not applicable** Hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising potential for interactions with bycatch.
2.1.5 There are decision rules that trigger additional management measures when there are significant perturbations in the indicator species numbers.	**Not applicable** Hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising potential for interactions with bycatch.
2.1.6 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.	**Meets** Hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising potential for interactions with bycatch.
Objective 2 - The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities.	
Information requirements	

2.2.1 Reliable information is collected on the interaction with endangered, threatened or protected species and threatened ecological communities.	**Does not meet** While there have been no reported interactions with endangered, threatened or protected species and threatened communities in this fishery, and the risks are low, there is no means to verify this. Existing reporting tools ({ HYPERLINK "http://www.environment.gov.au/system/files/pages/89160a83-68a6-4f07-81d3-e7df1a02bdbd/files/attachment-d-torres-strait-tropical-rock-lobster-daily-fishing-log.pdf" \o "Attachment D - Torres Strait Tropical Rock Lobster Daily Fishing Log" } and { HYPERLINK "http://www.environment.gov.au/system/files/pages/89160a83-68a6-4f07-81d3-e7df1a02bdbd/files/attachment-e-torres-strait-seafood-buyers-processors-docket-book.pdf" \o "Attachment E - Torres Strait Seafood Buyers and Processors Docket Book" } make no mention of protected species reporting obligations and do not facilitate reporting and it is unlikely that fishers are aware of their obligations under the EPBC Act. The Department has a memorandum of understanding with AFMA to allow fishers to report interactions via AFMA, but AFMA does not have the legislative capacity to mandate reporting by Traditional Inhabitant fishers (96% of licences in the fishery). AFMA is pursuing legislative changes in order to mandate reporting by all fishers (including commercial Traditional Inhabitant fishers), but this is unlikely to occur in the short term.
Assessments	
2.2.2 There is an assessment of the impact of the fishery on endangered, threatened or protected species.	**Meets** An ecological risk assessment considered 90 protected species, including 27 marine reptile, six seabird, six marine mammal and 51 teleost (bony fish) species ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/4.pdf" }; { HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }). None of these species were assessed to be above negligible or minor risk in the ecological risk assessment. This risk assessment is expected to be reviewed in 2019–2020.
2.2.3 There is an assessment of the impact of the fishery on threatened ecological communities.	**Not applicable** There are no threatened ecological communities in the area of the fishery.
Management responses	
2.2.4 There are measures in place to avoid capture and/or mortality of endangered, threatened or protected species.	**Meets** An ecological risk mitigation strategy has been developed for the fishery but risk of interaction with or impacts on threatened species was considered negligible and therefore did not specify mitigation measures ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }). The mitigation strategy defers to international plans of action (e.g. Recovery Plan for Marine Turtles in Australia) and commits to take all reasonable steps to minimise interactions with protected species. In addition, hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising potential for interactions with bycatch.
2.2.5 There are measures in place to avoid impact on threatened ecological communities.	**Not applicable** There are no threatened ecological communities in the area of the fishery.
2.2.6 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.	**Meets** While reporting information is not being facilitated through log books, various ecological risk assessments have concluded that the fishery is managed in a way to minimise impacts. This is further supported by the annual review of effort, area and gear undertaken by the fishery's advisory committee. In addition, hand collection methods (hand-held snares, spears and scoop nets) are highly selective, minimising potential for interactions with non-target species.
Objective 3 - The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.	
Information requirements	

2.3.1 Information appropriate for the analysis in 2.3.2 is collated and/or collected covering the fisheries impact on the ecosystem and environment generally.	**Partially meets** While an ecological risk assessment of the fishery found no species, habitats or communities at high risk this has not been amended since 2007. This is scheduled to be reviewed in 2019–2020.
Assessment	
2.3.2 Information is collected and a risk analysis, appropriate to the scale of the fishery and its potential impacts, is conducted into the susceptibility of each of the following ecosystem components to the fishery. 1. Impacts on ecological communities • Benthic communities • Ecologically related, associated or dependent species • Water column communities 2. Impacts on food chains • Structure • Productivity/flows 3. Impacts on the physical environment • Physical habitat • Water quality	**Partially meets** The ecological risk mitigation strategy for the fishery determined that there was little risk posed to ecosystem components from fishing ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }). However, there is no established system to collect information on ecosystem components in the fishery. The ecological risk assessment for this fishery is scheduled to be reviewed in 2019–2020.
Management responses	
2.3.3 Management actions are in place to ensure significant damage to ecosystems does not arise from the impacts described in 2.3.1.	**Partially meets** There is no means to monitor ecosystem impacts, however these impacts are likely to be minimal based on the results of the ecological risk mitigation strategy ({ HYPERLINK "http://pzja.gov.au/wp-content/uploads/2011/06/5.pdf" }).
2.3.4 There are decision rules that trigger further management responses when monitoring detects impacts on selected ecosystem indicators beyond a predetermined level, or where action is indicated by application of the precautionary approach.	**Partially meets** Although the ecological risk assessment found little risk directly associated with the fishery, some risk was associated with external factors (e.g. coastal development, oil spills, line-fishing and Traditional Inhabitant catches of turtles and dugongs that may affect the same fish communities). The PZJA and AFMA do not have management responsibility for these external factors, but do have some capacity to respond via legislative instrument (s16 *Torres Strait Fisheries Act 1984*). This mechanism is likely to be reserved for emergency situations.
2.3.5 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.	**Partially meets** The risk posed by the fishery is relatively low. There is no apparent system to account for the impacts of external factors which were identified in the ecological risk assessment for the fishery.

SECTION 3: ASSESSMENT OF THE TORRES STRAIT TROPICAL ROCK LOBSTER FISHERY AGAINST THE REQUIREMENTS OF PARTS 12, 13 (13A) AND 16 OF THE EPBC ACT

The table below is not a complete or exact representation of the EPBC Act. It is intended to show that the relevant sections and components of the EPBC Act have been taken into account in the formulation of advice on the fishery in relation to decisions under Part 13 and Part 13A.

Part 12

Section 176 Bioregional Plans	**Comment**
(5) Minister must have regard to relevant bioregional plans	**Not applicable** There is no marine bioregional plan in place for the Torres Strait.

Part 13

Accreditable plan, regime or policy (Division 1, Division 2, Division 3, Division 4)	**Comment**
s. 208A (1) (a-e) , s.222A (1) (a-e), s.245A (1) (a-e), s.265 (1) (a-e) Does the fishery have an accreditable plan of management, regime or policy?	**Yes** The "Torres Strait Tropical Rock Lobster Fishery management policy" was { HYPERLINK "http://www.environment.gov.au/system/files/pages/e137c539-ec79-44c0-9b4d-43ebb552c0d4/files/accreditation-may-2014.pdf" }. The management regime for the fishery is described in this assessment report and forms the basis for ongoing accreditation.
Division 1 Listed threatened species, Section 208A Minister may accredit plans or regimes	
(f) Will the plan, regime or policy require fishers to take all reasonable steps to ensure that members of listed threatened species (other than conservation dependent species) are not killed or injured as a result of the fishing?	**Yes** The ecological risk mitigation strategy acknowledges protected species and considers the risks posed by the fishery to be negligible. It commits the fishery to taking all reasonable steps to avoid interactions.
(g) And, is the fishery likely to adversely affect the survival or recovery in nature of the species.	**No** AFMA records show no reported interactions with listed protected species in the fishery during the period 1 January 2012 to 30 June 2017.
Division 2 Migratory species, Section 222A Minister may accredit plans or regimes	
(f) Will the plan, regime or policy require fishers to take all reasonable steps to ensure that members of listed migratory species are not killed or injured as a result of the fishing?	**Yes** The ecological risk mitigation strategy acknowledges protected species and considers the risks posed by the fishery to be negligible. It commits the fishery to taking all reasonable steps to avoid interactions.
(g) And, is the fishery likely to adversely affect the conservation status of a listed migratory species or a population of that species?	**No** AFMA records show no reported interactions with listed migratory species in the fishery during the period 1 January 2012 to 30 June 2017.
Division 3 Whales and other cetaceans, Section 245 Minister may accredit plans or regimes	

(f) Will the plan, regime or policy require fishers to take all reasonable steps to ensure that cetaceans are not killed or injured as a result of the fishing?	**Yes** The ecological risk mitigation strategy acknowledges protected species and considers the risks posed by the fishery to be negligible. It commits the fishery to taking all reasonable steps to avoid interactions.
(g) And is the fishery likely to adversely affect the conservation status of a species of cetacean or a population of that species?	**No** AFMA records show no reported interactions with cetaceans in the fishery during the period 1 January 2012 to 30 June 2017.
Division 4 Listed marine species, Section 265 Minister may accredit plans or regimes	
(f) Will the plan, regime or policy require fishers to take all reasonable steps to ensure that members of listed marine species are not killed or injured as a result of the fishing?	**Yes** The ecological risk mitigation strategy acknowledges listed species and considers the risks posed by the fishery to be negligible. It commits the fishery to taking all reasonable steps to avoid interactions.
(g) And is the fishery likely to adversely affect the conservation status of a listed marine species or a population of that species?	**No** AFMA records show no reported interactions with listed marine species in the fishery during the period 1 January 2012 to 30 June 2017.
Section 303AA Conditions relating to accreditation of plans, regimes and policies	
(1) This section applies to an accreditation of a plan, regime or policy under section 208A, 222A, 245 or 265.	**Accreditation is recommended** No interactions with protected species have been reported and the risk of interactions occurring is considered negligible under existing arrangements.
(2) The Minister may accredit a plan, regime or policy under that section even though he or she considers that the plan, regime or policy should be accredited only: (a) during a particular period; or (b) while certain circumstances exist; or (c) while a certain condition is complied with. In such a case, the instrument of accreditation is to specify the period, circumstances or condition.	**No conditions required**
(7) The Minister must, in writing, revoke an accreditation if he or she is satisfied that a condition of the accreditation has been contravened.	**Not applicable**

Part 13A

Section 303BA Objects of Part 13A	
(1) The objects of this Part are as follows: (a) to ensure that Australia complies with its obligations under CITES and the Biodiversity Convention; (b) to protect wildlife that may be adversely affected by trade; (c) to promote the conservation of biodiversity in Australia and other countries; (d) to ensure that any commercial utilisation of Australian native wildlife for the purposes of export is managed in an ecologically sustainable way; (e) to promote the humane treatment of wildlife; (f) to ensure ethical conduct during any research associated with the utilisation of wildlife; and (h) to ensure the precautionary principle is taken into account in making decisions relating to the utilisation of wildlife.	
Section 303 CG Minister may issue permits (CITES species)	**Comment**
(3) The Minister must not issue a permit unless the Minister is satisfied that: (a) the action or actions specified in the permit will not be detrimental to, or contribute to trade which is detrimental to: i the survival of any taxon to which the specimen belongs; or ii. the recovery in nature of any taxon to which the specimen belongs; or iii any relevant ecosystem (for example, detriment to habitat or biodiversity).	**Not applicable**
Section 303DC Minister may amend list (non CITES species)	
(1) The Minister may, by legislative instrument, amend the list referred to in section 303DB [list of exempt native specimens] by: (a) doing any of the following: (i) including items in the list; (ii) deleting items from the list; (iii) imposing a condition or restriction to which the inclusion of a specimen in the list is subject; (iv) varying or revoking a condition or restriction to which the inclusion of a specimen in the list is subject; or (b) correcting an inaccuracy or updating the name of a species.	The Department **recommends** that specimens derived from species harvested in the Torres Strait Tropical Rock Lobster Fishery, other than specimens that belong to species listed under Part 13 of the EPBC Act, be included in the list of exempt native specimens while the Torres Strait Tropical Rock Lobster Fishery is subject to a declaration as an approved wildlife trade operation.

(1A) In deciding to amend the LENS, the Minister must rely primarily on outcomes of Part 10, Div 1 or 2 assessment	**Meets** The Torres Strait Tropical Rock Lobster Fishery was assessed under Part 10 of the EPBC Act in November 2004 and the management regime was accredited pursuant to section 33 of the EPBC Act on 10 May 2005. There have been no significant changes to the management regime since that time. The Department recommends that you amend the LENS under section 303DC(1)(a) to include product derived from the Torres Strait Tropical Rock Lobster Fishery while the specimens are covered by an approved wildlife trade operation declaration under section 303FN.
(1C) The above does not limit matters that may be considered when deciding to amend LENS.	**Meets** The Torres Strait Tropical Rock Lobster Fishery is consistent with Objects of Part 13A.
(3) Before amending the LENS, the Minister must consult: (a) other Minister or Ministers as appropriate; and (b) other Minister or Ministers of each State and self-governing Territory as appropriate; and (c) other persons and organisations as appropriate.	**Meets** The Department considers that the consultation requirements have been met. The application for the Torres Strait Tropical Rock Lobster Fishery was released for public comment from 26 April 2017 to 31 May 2017. No comments were received.
Section 303FN Approved wildlife trade operation	
(2) The Minister may, by instrument published in the *Gazette*, declare that a specified wildlife trade operation is an ***approved wildlife trade operation*** for the purposes of this section.	
(3) The Minister must not declare an operation as an approved wildlife trade operation unless the Minister is **satisfied** that: (a) the operation is consistent with the objects of Part 13A of the Act; and	**Meets** Fishery is consistent with Objects of 13A – see above assessment.
(b) the operation will not be detrimental to: i. the survival of a taxon to which the operation relates; or ii. the conservation status of a taxon to which the operation relates; and (ba) the operation will not be likely to threaten any relevant ecosystem including (but not limited to) any habitat or biodiversity; and	**Meets** The fishery will not be detrimental to the survival or conservation status of a taxon to which it relates, nor will it threaten any relevant ecosystem, within the life of the WTO, given the management measures currently in place.

(c) if the operation relates to the taking of live specimens that belong to a taxon specified in the regulations – the conditions that, under the regulations, are applicable to the welfare of the specimens are likely to be complied with; and	**Not applicable.** The Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations) do not specify crustacea or fish as a class of animal in relation to the welfare of live specimens.
(d) such other conditions (if any) as are specified in the regulations have been, or are likely to be, satisfied.	**Not applicable** No other conditions are specified in relation to commercial fisheries in the EPBC Regulations.
(4) In deciding whether to declare an operation as an approved wildlife trade operation the Minister must have **regard** to: (a) the significance of the impact of the operation on an ecosystem (for example, an impact on habitat or biodiversity); and	**Meets** The Torres Strait Tropical Rock Lobster Fishery will not have a significant impact on any relevant ecosystem within the next three years, given the current management measures currently in place.
(b) the effectiveness of the management arrangements for the operation (including monitoring procedures).	**Meets** The management arrangements that will be employed for the Torres Strait Tropical Rock Lobster Fishery as outlined in this assessment are likely to be effective.
(5) In deciding whether to declare an operation as an approved wildlife trade operation the Minister must have **regard** to: (a) whether legislation relating to the protection, conservation or management of the specimens to which the operation relates is in force in the State or Territory concerned; and (b) whether the legislation applies throughout the State or Territory concerned; and (c) whether, in the opinion of the Minister, the legislation is effective.	**Meets** The Torres Strait Tropical Rock Lobster Fishery is managed in accordance with the *Torres Strait Fisheries Act 1984* and Torres Strait Fisheries Regulations 1985. The Torres Strait Fisheries Act applies throughout the Torres Strait Protected Zone. This legislation is likely to be effective.
(10) For the purposes of section 303FN, an operation is a wildlife trade operation if, an only if, the operation is an operation for the taking of specimens and: (a) the operation is a commercial fishery.	**Meets** The Torres Strait Tropical Rock Lobster Fishery is a commercial fishery.
(10A) In deciding whether to declare that a commercial fishery is an approved wildlife trade operation for the purposes of this section, the Minister must rely primarily on the outcomes of any assessment in relation to the fishery carried out for the purposes of Division 1 or 2 of Part 10.	**Meets** The Torres Strait Tropical Rock Lobster Fishery was assessed under Part 10 of the EPBC Act in November 2004 and the management regime was accredited pursuant to section 33 of the EPBC Act on 10 May 2005. Actions taken under the management regime were considered unlikely to have an unacceptable or unsustainable impact on the environment in a Commonwealth marine area.
(10B) Subsection (10A) does not limit the matters that may be taken into account in deciding whether to declare that a fishery is an approved wildlife trade operation for the purposes of this section.	

Section 303FR Public consultation	
(1) Before making a declaration under section 303FN, the Minister must cause to be published on the Internet a notice: (a) setting out the proposal to make the declaration; and (b) setting out sufficient information to enable persons and organisations to consider adequately the merits of the proposal; and (c) inviting persons and organisations to give the Minister, within the period specified in the notice, written comments about the proposal. (2) A period specified in the notice must not be shorter than 20 business days after the date on which the notice was published on the Internet.	**Meets** A public notice, which set out the proposal to declare the Torres Strait Torres Strait Tropical Rock Lobster Fishery an approved wildlife trade operation and included the application from AFMA, was released for public comment on 26 April 2017 to 31 May 2017, a total of 26 business days.
(3) In making a decision about whether to make a declaration under section 303FN, the Minister must consider any comments about the proposal to make the declaration that were given in response to the invitation in the notice.	**Not applicable** No public comments about the proposal were received.
Section 303FT Additional provisions relating to declarations	
(1) This section applies to a declaration made under section 303FN, 303FO or 303FP.	A declaration for the Torres Strait Tropical Rock Lobster Fishery will be made under section 303FN.
(4) The Minister may make a declaration about a plan or operation even though he or she considers that the plan or operation should be the subject of the declaration only: (a) during a particular period; or (b) while certain circumstances exist; or (c) while a certain condition is complied with. In such a case, the instrument of declaration is to specify the period, circumstances or condition.	The standard conditions applied to commercial fishery wildlife trade operations include: • operation in accordance with the management regime • notifying the Department of changes to the management regime, and • annual reporting in accordance with the requirements of the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries – 2nd Edition.* The Wildlife Trade Operation instrument for this fishery specifies these standard conditions and others in Section 4 of this report.
(8) A condition may relate to reporting or monitoring.	Conditions specified in Section 4 of this report include reporting requirements..
(9) The Minister must, by instrument published in the *Gazette*, revoke a declaration if he or she is satisfied that a condition of the declaration has been contravened.	
(11) A copy of an instrument under section 303FN,or this section is to be made available for inspection on the internet.	The instrument for the Torres Strait Tropical Rock Lobster Fishery made under sections 303FN and the conditions under section 303FT will be registered as a notifiable instrument and made available through the Department's website.

Part 16

Section 391 Minister must consider precautionary principle in making decisions	**Comment**
(1) Minister must take account of precautionary principle. (2) The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.	**Meets** The management regime is sufficiently precautionary to prevent serious or irreversible environmental damage being caused by this fishery.

SECTION 4: TORRES STRAIT TROPICAL ROCK LOBSTER FISHERY – SUMMARY OF ISSUES REQUIRING CONDITIONS, DECEMBER 2017

Issue	Condition
General Management Export decisions relate to the arrangements in force at the time of the decision. To ensure that these decisions remain valid and export approval continues uninterrupted, the Department of the Environment and Energy needs to be advised of any changes that are made to the management regime and make an assessment that the new arrangements are equivalent or better, in terms of ecological sustainability, than those in place at the time of the original decision. This includes operational and legislated amendments that may affect sustainability of the target species or negatively impact on byproduct, bycatch, EPBC Act protected species or the ecosystem.	**Condition 1**: Operation of the Torres Strait Tropical Rock Lobster Fishery will be carried out in accordance with management arrangements in force under the *Torres Strait Fisheries Act 1984.* **Condition 2**: The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Tropical Rock Lobster Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.
Annual Reporting It is important that reports be produced and presented to the Department annually in order for the performance of the fishery and progress in implementing the conditions in this report and other managerial commitments to be monitored and assessed throughout the life of the declaration. Annual reports should follow Appendix B to the 'Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition' and include a description of the fishery, management arrangements in place, research and monitoring outcomes, recent catch data for all sectors of the fishery, status of target stock, interactions with EPBC Act protected species, impacts of the fishery on the ecosystem in which it operates and progress in implementing the Department's conditions. Electronic copies of the guidelines are available from the Department's website at http://www.environment.gov.au/resource/guidelines-ecologically-sustainable-management-fisheries	**Condition 3**: The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition.*

Issue	Condition
Harvest controls Effective harvest controls are necessary to manage the ecological effects of fishing. The Torres Strait Tropical Rock Lobster Fishery includes various controls, and an interim harvest strategy. However the strategy is not publicly available and does not include decision rules. There are also a number of issues that affect the fishery's capacity to manage risk. These include: • unconstrained effort. • problems with catch reporting and limited ability to respond quickly to catches. • complexity and exceptions to management controls. The PZJA has committed to address these issues over the next two years.	**Condition 4:** The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion in the fishery. This may include data collection and analysis protocols to manage risks, triggers and/or limits for managing harvest, and should also account for all sources of stock mortality, including commercial, recreational, Traditional and illegal harvest.

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Australian Government
Department of the Environment and Energy

Ref: 002068366

Senator the Hon Anne Ruston
Assistant Minister for Agriculture and Water Resources
Parliament House
CANBERRA ACT 2600

Dear Senator

I am writing to you as Delegate of the Minister for the Environment and Energy in relation to the reassessment of seven Commonwealth-managed fisheries under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In early 2017, the Australian Fisheries Management Authority (AFMA) applied for export approvals for the Commonwealth Coral Sea, Commonwealth North West Slope and Western Deepwater Trawl, Torres Strait Bêche-de-mer, Torres Strait Finfish, Torres Strait Prawn, Torres Strait Trochus, and Torres Strait Tropical Rock Lobster fisheries under the EPBC Act.

These applications have now been assessed and I have agreed to declare five fisheries (Commonwealth Coral Sea, Commonwealth North West Slope and Western Deepwater Trawl, Torres Strait Bêche-de-mer, Torres Strait Finfish and Torres Strait Tropical Rock Lobster fisheries) as approved wildlife trade operations under section 303FN (Part 13A) of the EPBC Act for three years, until 18 December 2020. These approvals are subject to conditions agreed by officials from both departments as areas requiring ongoing attention (Attachment 1).

Based on current management arrangements, I have also agreed to exempt the Torres Strait Prawn and Torres Strait Trochus Fisheries from requiring EPBC Act export permits for nine years, until 9 October 2026. Should fishing effort reach any of the trigger limits in the Torres Straight Prawn Fishery Harvest Strategy 2011, or recommence in the Torres Strait Trochus Fishery, the Department will consider reassessing these fisheries.

The list of exempt native specimens has been amended to allow export of product from these seven fisheries for the duration that the respective approvals are in place. Please note that any person whose interests are affected by this decision may make an application to the Department for the reasons for the decision, and may apply to the Administrative Appeals Tribunal to have this decision reviewed. I have enclosed further information on these processes at Attachment 2.

The Department of the Environment and Energy requires AFMA to report annually on each of the seven fisheries, as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

I wish to acknowledge the strong engagement and collaboration of AFMA officials in completing these assessments.

Yours sincerely

Dr Ilse Kiessling
Delegate of the Minister for the Environment and Energy
20 December 2017

Attachment 1

Conditions on the approved wildlife trade operation declaration for the Commonwealth Coral Sea, North West Slope and Western Deepwater Trawl fisheries, and the Torres Strait Bêche-de-mer, Finfish, and Tropical Rock Lobster fisheries – December 2017

Commonwealth Coral Sea Fishery

1. Operation of the Coral Sea Fishery will be carried out in accordance with management arrangements in force under the Commonwealth *Fisheries Management Act 1991*, Fisheries Management Regulations 1992 and relevant Commonwealth fisheries policies.

2. The Australian Fisheries Management Authority to inform the Department of the Environment and Energy of any intended material changes to the Coral Sea Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.

3. The Australian Fisheries Management Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

4. AFMA to limit the take of species listed under the Convention on the International Trade of Endangered Species (CITES), from the area of the Coral Sea Fishery to no more than:
    a. 40 tonnes of any mixture of species belonging to the family Acroporidae per year (1 July – 30 June).
    b. 50 individual humphead Maori wrasse (*Cheilinus undulates*) per year (1 July – 30 June).

5. AFMA to:
    a. review the species composition and spatial extent of all coral harvest when 20 tonnes of coral has been harvested.
    b. ensure that a disproportionate amount of coral species are not taken from a single reef.

6. AFMA to evaluate, document and seek to mitigate any risks posed by the Coral Sea Fishery to CITES-listed species. For coral species this will be undertaken at the reef-level, while for humphead Maori wrasse this will be undertaken at the sub-reef level.

7. AFMA to report the following to the CITES Scientific Authority of Australia, as part of the annual reporting referred to in Condition 3:
    a. the harvested weight and locations of harvest for each coral species
    b. the number of individual humphead Maori wrasse, their sex, lengths and locations of harvest
    c. any assessments, management changes or findings relevant to the management of CITES listed species in the Coral Sea Fishery.

8. AFMA to complete the following for all sectors of the Coral Sea Fishery:
    a. review and revise the ecological risk assessments
    b. develop and implement ecological risk management strategies
    c. review and revise the Bycatch and Discarding Workplan.

Commonwealth North West Slope Trawl and Western Deepwater Trawl Fisheries

1. Operation of the Western Deepwater Trawl and North West Slope Trawl fisheries will be carried out in accordance with management arrangements in force under the Commonwealth *Fisheries Management Act 1991, F*isheries Management Regulations 1992 and relevant Commonwealth fisheries policies.

2. The Australian Fisheries Management Authority to inform the Department of the Environment and Energy of any intended material changes to the Western Deepwater Trawl and North West Slope Trawl fisheries management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.

3. The Australian Fisheries Management Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

4. AFMA to ensure ecological risk assessments and associated management strategies are reviewed, updated and implemented.

5. AFMA to ensure:
   a. that the harvest strategy for the North West Slope and Western Deepwater Trawl fisheries contains triggers and/or limits which are specific, measurable, time bound, and capable of managing the ecological effects of fishing.
   b. that the fisheries' performance under harvest strategy triggers and limits is monitored; and triggered management actions are undertaken within specified timeframes.

   Harvest strategy performance should be reported as part of the requirements specified in Condition 3 above.

Torres Strait Bêche-de-mer Fishery

1. Operation of the Torres Strait Bêche-de-mer Fishery will be carried out in accordance with the management regime in force under the *Torres Strait Fisheries Act 1984*.

2. The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Bêche-de-mer Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.

3. The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

4. The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion for all species harvested in the fishery. This may include data collection and analysis protocols to manage risks, triggers and/or limits for managing harvest, and should also account for all sources of stock mortality, including commercial, recreational, Traditional and illegal harvest.

5. Torres Strait Protected Zone Joint Authority to complete an ecological risk assessment and implement an ecological risk mitigation strategy to ensure all environmental and ecological risks are appropriately managed.

6. Torres Strait Protected Zone Joint Authority to continue to pursue the changes necessary to facilitate reporting of interactions with species listed in Part 13 of the *Environment Protection and Biodiversity Act* 1999.

Torres Strait Finfish Fishery

1. Operation of the Torres Strait Finfish Fishery will be carried out in accordance with management arrangements in force under the *Torres Strait Fisheries Act 1984*.

2. The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Finfish Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.

3. The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

4. The Torres Strait Protected Zone Joint Authority to implement strategies to improve data collection, and monitoring and management of catch in all sectors of the Torres Strait Finfish Fishery by 2019.

5. The Torres Strait Protected Zone Joint Authority to complete an ecological risk assessment for the Torres Strait Finfish Fishery.

6. The Torres Strait Protected Zone Joint Authority to improve estimates of stock abundance and harvest potential for all target species in the Torres Strait Finfish Fishery.

7. The Torres Strait Protected Zone Joint Authority to develop and implement reference points and relevant management triggers, including timeframes for management responses, for the Torres Strait Finfish Fishery.

Torres Strait Tropical Rock Lobster Fishery

1. Operation of the Torres Strait Tropical Rock Lobster Fishery will be carried out in accordance with management arrangements in force under the *Torres Strait Fisheries Act 1984*.

2. The Torres Strait Protected Zone Joint Authority to inform the Department of the Environment and Energy of any intended material changes to the Torres Strait Tropical Rock Lobster Fishery management arrangements that may affect the assessment against which *Environment Protection and Biodiversity Conservation Act 1999* decisions are made.

3. The Torres Strait Protected Zone Joint Authority to produce and present reports to the Department of the Environment and Energy annually as per Appendix B of the *Guidelines for the Ecologically Sustainable Management of Fisheries - 2nd Edition*.

4. The Torres Strait Protected Zone Joint Authority to implement a strategy to manage the risks of overfishing and localised depletion in the fishery.

   This may include data collection and analysis protocols to manage risks, triggers and/or limits for managing harvest, and should also account for all sources of stock mortality, including commercial, recreational, Traditional and illegal harvest.

Australian Government
Department of the Environment and Energy

Attachment 2

Notification of Reviewable Decisions and Rights of Review[1]

There is a right of review to the Administrative Appeals Tribunal in relation to certain decisions made by the Minister or the Minister's delegate under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Section 303GJ of the EPBC Act provides that applications may be made to the Administrative Appeals Tribunal for the review of the following decisions of the Minister:

(1) Subject to subsection (2), an application may be made to the Administrative Appeals Tribunal for review of a decision:

(a) to issue or refuse a permit; or

(b) to specify, vary or revoke a condition of a permit; or

(c) to impose a further condition of a permit; or

(d) to transfer or refuse to transfer a permit; or

(e) to suspend or cancel a permit; or

(f) to issue or refuse a certificate under subsection 303CC(5); or

(g) of the Secretary under a determination in force under section 303EU; or

(h) to make or refuse a declaration under section 303FN, 303FO or 303FP; or

(i) to vary or revoke a declaration under section 303FN, 303FO or 303FP.

(2) Subsection (1) does not apply to a decision made personally by the Minister (but the subsection does apply to a decision made by a delegate of the Minister).

If you are dissatisfied with a decision of a type listed above you may:

- by notice, provided in writing, request that the Minister or the Minister's delegate give you a statement in writing setting out the reasons for the decision; and
- apply to the Administrative Appeals Tribunal (AAT) for independent merits review of the decision. Application for review of a decision must be made to the AAT within 28 days after the day on which you have received the reviewable decision. However an extension of time for lodging an application may be granted by the AAT under certain circumstances. Please visit the AAT's website at http://www.aat.gov.au/ or telephone 1300 366 700 for further information. The role of the AAT is to provide a review mechanism that is fair, just, economical, informal and quick.

Applications & Costs

Applications to the AAT are made by lodging an Application Form (Form 1). This can be found on the AAT's website http://www.aat.gov.au/.

There are no strict timelines in which the AAT must review the decision, however the first Conference between the parties will usually be held within 6-10 weeks of the Application

[1] In accordance with the *Administrative Appeals Tribunal Act 1975* Code of Practice for Notification of Reviewable Decisions and Rights of Review

being lodged. The time frame for review of certain decisions can be expedited in some circumstances.

The cost of lodging an application for review is $884 (GST inclusive) (current as of 1 July 2016).

You may be eligible to pay a reduced fee of $100.00 if:

- you are receiving legal aid for your application;
- you hold a health care card, a Commonwealth seniors health card or any other card issued by the Department of Social Services or the Department of Veteran's Affairs that entitles the holder to Commonwealth health concessions;
- you are in prison or lawfully detained in a public institution;
- you are under 18 years of age; or
- you are receiving youth allowance, Austudy or ABSTUDY.

You may also be eligible for a reduced fee if you can demonstrate to the AAT that paying the full fee would cause you financial hardship. Further information can be found on the AAT's website.

Contact Details

Further information or enquiries relating to the decision should be directed to:

The Director
Wildlife Trade Assessments Section
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601
Telephone: +61 (0) 2 6274 1917
Email: sustainablefisheries@environment.gov.au

Alternatively you may contact the AAT at their Principal Registry or the Deputy Registrar, Administrative Appeals Tribunal in your Capital City or Territory.

Administrative Appeals Tribunal
Street address: Level 6, 83 Clarence Street, Sydney
Mailing address: GPO Box 9955, Sydney, NSW 2001
T: 1800 228 333 and (02) 9276 5000
F: (02) 9276 5599
E: generalreviews@aat.gov.au
W: http://www.aat.gov.au

Freedom of Information Request

You may make an application under the *Freedom of Information Act 1982* (FOI Act) to access documents. Further information can be found at http://www.environment.gov.au/foi/index.html. Please contact the Freedom of Information Contact Officer at foi@environment.gov.au for more information.

PZJA Torres Strait Tropical Rock Lobster Fishery Resource Assessment Group	Meeting 2018 27-28 March 2018
Legislative amendments update	**Agenda Item 2.2.3** **FOR NOTING**

RECOMMENDATION

1. The RAG **NOTE** the status of proposed amendments to the *Torres Strait Fisheries Act 1984* (the Act) and *Torres Strait Fisheries Regulations 1985* (the Regulations), which govern how fisheries are managed in the Torres Strait.

BACKGROUND

What are the proposed amendments?

2. Following PZJA approval, AFMA is progressing amendments to the Act and Regulations. The proposed amendments are administrative in nature and will provide improvements to the efficiency and effectiveness of fisheries administration in the Torres Strait.

3. The proposed amendments will provide:
    a. the ability to require catch reporting across all licence holders;
    b. the ability to provide electronic licensing and monitoring to licence holders;
    c. the ability to delegate the powers to grant and vary scientific and development permits;
    d. the ability to simplify the renewal of fishing licences;
    e. the ability to delegate powers to contracted service providers;
    f. for the simplification of the disclosure of fisheries information; and
    g. the ability to issue Fisheries Infringement Notices.

4. A number of additional amendments are also being considered for inclusion and will go to the PZJA shortly for approval before being progressed any further. These include:
    a. the ability for a single licence to be issued for primary and tender packages;
    b. the ability for all licences to be granted for up to five years; and
    c. the ability for a licence to be issued without a nominated boat.

    Further details on the proposed amendments will be provided as this project progresses.

5. Of particular relevance to the Working Group is for the amendment to provide for catch reporting across all licence holders will allow for the implementation of mandatory daily logbook reporting by TIB licence holders. This will provide for improved data on which to base management advice and decisions.

When will stakeholders be consulted?

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

How long will the amendments take?

7. AFMA now has dedicated resources to be able to progress this important piece of work. However, the amendment process is a lengthy and complex one, and is expected to take a number of years (please refer to the below table).

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

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

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
FISHERY UPDATES **PNG National Fisheries Authority update**	**Agenda Item 2.3** **For NOTING**

RECOMMENDATIONS

1. That the RAG **NOTE** the update to be provided by the PNG National Fisheries Authority.

BACKGROUND

2. A verbal report will be provided under this item subject to the availability of NFA officers.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
FISHERY UPDATES **Native Title update**	**Agenda Item 2.4** **For Noting**

RECOMMENDATIONS

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

BACKGROUND

2. On 7 August 2013 the High Court of Australia confirmed co-existing Native Title rights, including commercial fishing, in the claimed area (covering most of the Torres Strait Protected Zone). This decision gives judicial authority for Traditional Owners to access and take the resources of the sea for all purposes. Native Title rights in relation to commercial fishing must be exercisable in accordance with the *Torres Strait Fisheries Act 1984*.
3. Traditional Owners and Native Title representative bodies have an important role in the management of Torres Strait fisheries.
4. AFMA has extended an invitation to Malu Lamar RNTBC to attend all PZJA consultative forums as an observer and is investigating longer term arrangements for representation in consultation with PZJA agencies.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
2017/18 Catch and Effort Update	**Agenda Item 3** **For Noting**

RECOMMENDATIONS

1. That the RAG **NOTE:**
    a. the reported catch for the Fishery (TIB and TVH sectors only) is 70,430 kilograms from 1 December 2017 to 8 March 2018;
    b. if available, total landed catch reported to date for the PNG TRL Fishery; and
    c. an update on catch and effort to date for the fishing season to be provided by CSIRO.

KEY ISSUES

2. As reported through the new mandatory fish receiver system (implemented on 1 December 2017) the total landed catch reported for the Australian TRL Fishery from 1 December 2017 to 8 March 2018 is 70,430 kgs **(Table 1)**.
3. AFMA is awaiting an update from the PNG National Fisheries Authority on catches to date for the PNG TRL Fishery.
4. CSIRO will provide a further summary of catch and effort data to date at the meeting.

Table 2. Landed catch (kilograms whole weight) of tropical rock lobster by sector for the Torres Strait Tropical Rock Lobster Fishery from the period 1 December 2017 to 8 March 2018. Source: catch records from the Torres Strait Tropical Rock Lobster Catch Disposal Record (TDB02).

Dates	TIB (kg's)	TVH (kg's)	Combined catch (kg's)	Number of records
01/12/2017 to 31/12/2017	8,302.8	31.3	8,334.1	402
01/01/2018 to 31/01/2018	9,732.7	0.0	9,732.7	487
01/02/2018 to 28/02/2018	21,454.6	27,307.8	48,762.4	747
1/03/2018 to 08/03/2018	961.8	2,638.6	3,600.4	58
Total	**40,451.9**	**29,977.8**	**70,429.6**	**1,694**

*Please note that there may be some outstanding catch disposal records (TDB02) for the period 1 to 8 March. Therefore the landed catch reported for the March period may be under-reported.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-18 March 2018
Stock Assessment update and Final Recommended Biological Catch (RBC) Advice	Agenda Item 4 For discussion and advice

RECOMMENDATION

1. The RAG **consider** the final stock assessment update for the Torres Strait Tropical Rock Lobster Fishery to be presented by the CSIRO Scientific Member;

2. The RAG **discuss** and **provide advice** on the final recommended biological catch (RBC) advice for the 2017/18 fishing season; and

3. The RAG **note** the preliminary stock assessment was presented at RAG meeting no. 21 on 12-13 December 2017. The preliminary RBC was recommended to be 299 tonnes (Australia and PNG inclusive).

KEY ISSUES

4. At RAG meeting no. 21 on 12-13 December 2017 the RAG **RECOMMENDED** a preliminary recommended biological catch (RBC) of 299 tonnes for Australia and PNG inclusive, based on the following:
   - the current stock biomass is estimated at 76 per cent of B_{1973} which is above the target biomass of 65 per cent;
   - the RBC was calculated by applying the interim harvest strategy to the preliminary results of the integrated fishery stock assessment;
   - the reduction in the RBC is primarily due to the stock assessment responding to the low indices for 1+ lobster; and
   - the 0+ index of lobster is the lowest ever recorded by a pre-season survey, however the 0+ indices is uncertain due to the small size and cryptic nature of 0+ lobster; and,
   - although poorly estimated, the stock biomass is predicted to drop to 59 per cent of B_{1973} in 2019.

5. The RAG noted the stock assessment results will be finalised in March 2018 and presented to the RAG at its next meeting, however it is unlikely that the results will change significantly.

6. The RAG **STRONGLY RECOMMENDED** that under the current low levels of abundance, all management actions should be considered to ensure the 2018 RBC of 299 tonnes is not breached.

7. The RBC has been calculated using the integrated fishery stock assessment model and interim harvest strategy (see below). Note: the revised TRL Harvest Strategy based on the revised empirical harvest control rule (eHCR) has not yet been agreed by the PZJA.

8. A final stock assessment update will be presented to the RAG by the Scientific Member. The stock assessment update incorporates catch and effort data for the 2016/17 fishing season, historic catch and effort information, environmental and

biological information and the results of the pre-season survey conducted in November 2017.

Interim TRL Harvest Strategy

- B_0 = varied between 0.65 and 0.80 of unfished biomass
- B_{TARG} = 0.65 B_0
- B_{THRES} is the RAG-agreed threshold biomass level below which more stringent rules for calculating the TAC apply, B_{THRES} = 0.48.
- B_{LIM} = 0.4 B_0
- F_{TARG} = 0.15 year-1
- F_{LIM} = F_{TARG}

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-18 March 2018
Data rules for using TRL catch data reported in the Torres Strait Buyers and Processors Docket Book (TDB01)	**Agenda Item 5** **FOR ADVICE**

RECOMMENDATION

The RAG **discuss** and **provide advice** on recommended data rules for the Torres Strait Tropical Rock Lobster Fishery at **Attachment A**.

KEY ISSUES

1. The Torres Strait Buyers and Processors Docket Book (TDB01) was the principle source of catch and effort information for the traditional inhabitant boat (TIB) sector between 2004 and 2017. There are a number of issues relating to Docket Book catch records. Note the Docket Book was replaced by the Torres Strait Catch Disposal Record (CDR) under the new mandatory fish receiver system implemented on 1 December 2017.
2. The catches reported in the docket book can also be reported in the Torres Strait Tropical Rock Lobster Daily Fishing log (TRL04) and catches sold between processors may be recorded in the docket book. Recording of TVH catch and on-sold product between processors results in duplicate catch records and uncertainty in the catch taken in the Fishery.
3. A number of mechanisms have been introduced in an attempt to reduce duplicate catch records, however a number of uncertainties still remain (see **Attachment B** for more information):
    a) The docket book related-logs field to record if the catch has been reported elsewhere. The fisher or processor may accidently not complete this field and therefore duplicate catches are not identified.
    b) The docket book seller-type field to identify the fisher by name/entity which can be used to identify between TIB and TVH fishers. Seller names are often not included, misspelt or a nickname is used reducing the utility of this field.
    c) The docket-book vessel-type field to identify vessels with a symbol listed in the TVH logbook data.
4. For a large number of records the information within the field's seller-type and related-log is missing or unknown. Given the uncertainty a number of data rules for classifying the data as TIB, TVH or processor-to-processor is needed. Once the rules are established they can be used consistently each year to assign any unknown data to a data type.
5. The recommended data rules are proposed to assign catch records with unknown or missing information to either the TIB catch, TVH catch or processor-to-processor trading.

6. The RAG was presented the data rules at TRLRAG meeting no. 21 on 12-13 December 2017. There was insufficient time to finalise the agenda item and the RAG agreed to postpone to TRLRAG meeting no. 22.

7. The RAG agreed that members would consider the data rules agenda item out-of-session and provide comments to the AFMA Executive Officer in preparation for completing the agenda item at TRLRAG 22.

8. The recommended data rules are below.

Attachment A

The recommended data rules for using TRL catch data reported in the Torres Strait Buyers and Processors Docket Book (TDB01)

1. Where Seller-Type is identified as a processor then the corresponding catch record should be interpreted as a duplicate associated with a Processor-to-Processor trade and as such should not be included in the catch for the TIB sector. The DATA_TYPE associated with these records is therefore set to 'PROCESSOR'.
    a. An exception is made for the records associated with Joseph Dai where DATA_TYPE='TIB'.

2. Where Seller-Type is identified as processor but the Seller-Name is a business name then the corresponding catch record should be identified with the fishery sector (TIB or TVH). The DATA-TYPE is listed as 'TVH-TradeName' or 'TIB-TradeName' respectively.

3. Where Vessel-Type is identified as a TVH-vessel then the corresponding catch record should be interpreted as a duplicate associated with the TVH sector and as such should not be included in the catch for the TIB sector. The DATA-TYPE is listed as TVH.
    a. Note, whether or not the corresponding catch is contained in the TVH database needs to be checked.

4. Where Vessel-Type identifies the distinguishing symbol as an 'F-symbol' then the corresponding catch record should be included in the catch for the TIB sector and the DATA-TYPE is listed as 'TIB'.
    a. An exception is made for the two vessels with the symbol FXYC or FWED which are TVH vessels and for these records the DATA-TYPE is listed as 'TVH'.

5. Where Related-Log is blank then the corresponding catch record should be identified as a catch for the TIB sector and the DATA-TYPE is listed as 'TIB'

6. All other records should be attributed to the TIB sector and the DATA-TYPE listed as 'TIB'.
    a. After fitting the five rules above, only 1055 records (of the 77,358 in total) remained un-assigned. Note: all but 3 of the 1055 (22 of the 25 vessels-symbols) occur in the Docket-Book database where the DATA-TYPE has already been assigned to the TIB sector

Separating TIB, TVH and Processor catch records from Docket-Book Data – 2017 Update

Robert Campbell[1] and Dean Pease[2]

1. *CSIRO Oceans and Atmosphere Flagship, Melbourne*
2. *Australian Fisheries Management Authority, Thursday Island*

December 2017

1. Introduction

The Torres Strait Seafood Buyers and Processors Docket Book (TDB01) was used in the Torres Strait Tropical Rock Lobster Fishery (the fishery) principally to record the catch and effort for fishers operating in the TIB sector of the fishery. The Docket Book (TDB01) was replaced on 1 December 2017 by the mandatory Torres Strait Catch Disposal Record (TDB02). This report recommends data rules that should be applied to the historical Docket Book (TDB01) data to accurately determine the traditional inhabitant boat (TIB) sector catch.

In principle, the completed Docket Book form was a receipt given to the fisher landing the catch by the processor to which the lobsters are sold. Due to the receipt-like nature of the Docket-Book the reported catches can also be reported in other formats, including the Torres Strait Tropical Rock Lobster Fishery Daily Fishing Log (TRL04). Catches sold between processors can also sometimes be recorded in the Docket-Book. Reporting of TVH catches and catch sold between processors means that duplicate catch records are created resulting in some degree of uncertainty and difficulty in ascertaining the true total catch taken by the TIB sector of the fishery.

Several mechanisms have been introduced to help identify duplicate catch records included in the Docket-Book data. First, there is a specific field on the Docket-Book which asks whether the fisher (identified by the data label SELLER-NAME) has recorded their catch elsewhere. Where this has occurred, the seller is requested to identify where the catch has been recorded (the data label is called the RELATED-LOG). For example, TVH sellers would report that the catch has been recorded in the TRL04 logbook, while sellers identified as processors may indicate that the catch has been recorded in the TDB01 docket-book. In such instances these duplicate catch records can be separated from the TIB sector catch data. Where the RELATED-LOG field is null it is interpreted that the catch data has not been recorded elsewhere and the catch data is related to the TIB sector. However, there are a range of other entries in this field, for example the Torres Strait Hand Collectable Daily Fishing Log (HC01), the Torres Strait Hand Collectable Catch Disposal Record (HC02), Torres Strait Finfish Daily Fishing Log (TSF01), NSS BESI, etc..

Second, around 2006 an additional field (SELLER-TYPE) was added to the Docket-Book data to indicate whether the seller is a TIB or TVH sector licence holder or a processor. This field is used to identify and remove duplicate TVH catch records and duplicate records of catch sold between processors. It was based on linking the SELLER-NAME on the Docket-Book to the SELLER-TYPE (TIB, TVH or processor) in a Microsoft Excel look-up table. However, the list of SELLER-NAMES and SELLER-TYPES is now out of date, and together with the fact that the SELLER-NAMES are often misspelt or a nick-name is used, the SELLER-TYPE most often remains unknown. This reduces the utility of this data field to identify the SELLER-TYPE.

Using both the SELLER-TYPE and RELATED-LOG fields defined above, together with the vessel symbol (e.g. the symbol for most TVH vessels start with an ‘F’), it should be possible to identify and remove non-TIB catch records and duplicate catch records from the Docket-Book data. Together with the two data fields identified above, the following fields are also used in this analysis:

1. LOG-TYPE: identifies where the data was originally recorded (for example; TDB01, TRL04, HC01, HC02, TSF01).

2. SELLER-TYPE (S-TYPE): identifies seller-type (TIB, TVH or processor).
3. RELATED-LOG: identifies the other logbook where the catch has been recorded
4. VESSEL-TYPE: identifies the type of vessel. This is a data field added by CSIRO to identify vessels with a symbol also listed in the TVH logbook data (denoted TVH-Vessel) and vessels with a symbol beginning in 'F' but not in the TVH logbook data (denoted F-Symbol).
5. CLIENT-NAME: identifies the business purchasing the catch being sold by the fisher.
6. RECORD-NUMBER: identifies the unique record number of the Docket-Book form relating to the landed catch sold by a fisher on a given day.

This document outlines the data analysis undertaken and the Data-Rules identified to assign a DATA-TYPE (TIB, TVH or Processor) to each Docket-Book record. In particular, the analysis proceeds by investigating the data utilizing the information in each of the data fields listed and defined above. A summary of all Docket-Book data currently held by CSIRO classified according to the combination of several of the data fields listed above is shown in Table 2.

2. Log-Type

The LOG-TYPE field identifies the source of the data and the five log-types listed in Table 1 relate to the data sources:

DocketBook : based on catch recorded in the TDB01 Docket-Book and provided annually by AFMA as separate Operations and Catch data-sets.

Combined : based on catch recorded in the TDB01 Docket-Book and provided by AFMA as a single combined Operations and Catch table prior to 2012.

LogBook : based catch recorded in the TRL04 Log-Book but subsequently identified as TIB catch.

PEARL : aggregate annual catch only data provided by Pearl Islands Seafood Pty Ltd for the years 2013 to 2016.

TORRES : aggregate annual catch only data provided by Torres Straits Seafood Pty Ltd for 2016.

TIB vessels using TVH-logbook

The data listed in Table 1 includes 713 records which are related to large TIB vessels which recorded their catch in the TRL04 logbook. This occurred for a period of time because some TIB operators believed the TRL04 logbook was mandatory, though they later became aware reporting for TIB is currently voluntary, until the *Torres Strait Fisheries Act 1984* is amended to require the TIB sector to report. A listing of these vessels is provided in Table 1. These records are assigned the DATA-TYPE='TIB' under Data-Rule #1.

Table 1. Listing of TIB vessels where catch has been recorded in the TRL04 logbook.

LOG-TYPE	VESSEL	N-RECORDS	MIN-YR	MAX-YR
LogBook	BI173	83	2011	2013
LogBook	FXAY	305	2000	2010
LogBook	TRAWQ348	57	2014	2015
LogBook	TRAWQ456	21	2012	2012
LogBook	TRAWQ458	179	2012	2013
LogBook	TRAWQ460	68	2012	2013
Total		713		

Data Not Recorded in Docket-Book

Between 2013 and 2016 two processors reported aggregate annual catch data by a Microsoft Excel spreadsheet, as these catches were not being recorded in the TDB01 Docket-Book. Each client reported the catch for tailed and whole lobsters separately, so that for each year that this data was provided two data records were added to the Docket-Book data. These records are assigned the DATA-TYPE='TIB' under Data-Rule #2.

Table 2. Classification of Docket-Book data held by CSIRO classified according to several related data fields defined in the text. Note: N-RECORDS is the number of unique RECORD-NUMBERS associated with each set of data.

LOG-TYPE	SELLER-TYPE	RELATED-LOG	VESSEL-TYPE	N-REC0RDS
Combined	PRC	TDB01		95
Combined	PRC	TRL04		3
Combined	PRC			39
Combined	TIB			115
Combined	TVH	TRL04	F_SYMBOL	13
Combined	TVH	TRL04	TVH VESSEL	204
Combined	TVH	TRL04		146
Combined	TVH		TVH VESSEL	6
Combined	TVH			166
Combined	U	OTHER	TVH VESSEL	1
Combined	U	OTHER		46
Combined	U	PEARL ISLAND		3
Combined	U	TDB01		44
Combined	U	TRL04	TVH VESSEL	1
Combined	U	TRL04		15
Combined	U		F_SYMBOL	360
Combined	U		TVH VESSEL	94
Combined	U			34,656
DocketBook	PRC	TDB01		61
DocketBook	PRC	TRL04	TVH VESSEL	25
DocketBook	PRC	TRL04		16
DocketBook	PRC		TVH VESSEL	1
DocketBook	PRC			11
DocketBook	TIB	TDB01		10
DocketBook	TIB	TRL04		6
DocketBook	TIB			3,886
DocketBook	TVH	TDB01 : TRL04	TVH VESSEL	1
DocketBook	TVH	TRL04	F_SYMBOL	10
DocketBook	TVH	TRL04	TVH VESSEL	90
DocketBook	TVH	TRL04		149
DocketBook	TVH		F_SYMBOL	1
DocketBook	TVH		TVH VESSEL	10
DocketBook	TVH			536
DocketBook	U	TDB01	TVH VESSEL	7
DocketBook	U	TDB01		233
DocketBook	U	TRL04	F_SYMBOL	15
DocketBook	U	TRL04	TVH VESSEL	505
DocketBook	U	TRL04		293
DocketBook	U		TVH VESSEL	41
DocketBook	U			8,483
DocketBook				1
LogBook	TIB	TRL04		713
PEARL	TIB			8
TORRES	TIB			2
TOTAL				51,121

3. Seller-Type

Of the data records not yet assigned a DATA-TYPE i.e. (Log-Type either Docket-Book or Combined in Table 1) there are four different SELLER-TYPES:

PRC : Seller/catch associated with Processor
TVH : Seller/catch associated with TVH sector
TIB : Seller/catch associated with TIB sector
U : Unknown (i.e. left blank)

Processor, PRC

Based on the information provided above, records where SELLER-TYPE is a processor (PRC) relate to catches sold between different processors and therefore should be considered to be duplicate catch records in the Docket-Book data. A summary of the 251 records where SELLER-TYPE ='PRC' is provided in Table 3. A majority of these records (200, or 80%) indicate that the catch has been recorded in another format, which is to be expected if these are catches being sold between processors (and therefore duplicate records). However, if this is the case then why a vessel-name is listed against several of these records remains unclear. Furthermore, it can be noted that of the nine SELLER-NAMES listed three correspond to personal names (Joseph Dai, Miroslav Vaculka and Richard Wilfred Bowie). A check indicates that Joseph Dai is a TIB fisher, Richard Bowie is a processor (Argun Seafood Pty Ltd) based on Badu Island, while Miroslav Vaculka works on TVH vessel. As such all records in Table 3 were considered to be duplicate catch records (assigned to the DATA-TYPE='PRC' under Data-Rule #3 except for: i) those associated with Joseph Dai (n=1) which were assigned to the DATA-TYPE='TIB' under Data-Rule #3A, and ii) those associated with Miroslav Vaculka (n=6) which were assigned to the DATA-TYPE='TVH' under Data-Rule #3B. For the 244 records listed in Table 3 and designated as processor records, a listing of the associated Clients (c.f. Table 4) indicates that in all cases the catches were sold to another processor.

Table 3. Summary of Docket-Book data where SELLER-TYPE='PRC'. (Note, S-TYPE=SELLER-TYPE, MIN-YR=first year in data, MAX-YR=last year in data)

SELLER-NAME	LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
ARGUN SEAFOODS PTY LTD	DocketBook	PRC	TDB01			27	2015	2017
	DocketBook	PRC				6	2014	2014
CAPE YORK ICE AND TACKLE	Combined	PRC	TDB01			2	2010	2010
JOSEPH DAI	DocketBook	PRC				1	2014	2014
LENREX PTY LTD	Combined	PRC				3	2010	2010
	DocketBook	PRC	TDB01			5	2012	2016
	DocketBook	PRC				1	2012	2012
M G KAILIS PTY LTD	DocketBook	PRC	TRL04	FVWJ	TVH VESSEL	25	2013	2015
	DocketBook	PRC	TRL04			10	2013	2015
	DocketBook	PRC		FVWJ	TVH VESSEL	1	2013	2013
MIROSLAV VACULKA	DocketBook	PRC	TRL04			5	2015	2015
	DocketBook	PRC				1	2015	2015
PEARL ISLAND SEAFOODS PTY LTD	DocketBook	PRC	TDB01			29	2016	2017
	DocketBook	PRC	TRL04			1	2017	2017
RICHARD WILFRED BOWIE	Combined	PRC	TDB01	BI115		2	2007	2007
	Combined	PRC	TDB01			85	2007	2010
	Combined	PRC	TRL04			3	2007	2010
	Combined	PRC		BI115		4	2007	2008
	Combined	PRC				23	2007	2010
	DocketBook	PRC				2	2012	2016
TRADEWINDS SEAFOODS	Combined	PRC	TDB01			6	2010	2010
	Combined	PRC				9	2010	2010
TOTAL						251		

Table 4. Listing of the Clients associated with SELLER-TYPE='PRC' records listed in Table 3 and designated as processor records.

SELLER-NAME	CLIENT-NAME	N-RECORDS
ARGUN SEAFOODS PTY LTD	KAILIS BROS PTY LTD	6
	M G KAILIS PTY. LTD.	27
CAPE YORK ICE AND TACKLE	PEARL ISLAND SEAFOOD	2
LENREX PTY LTD	KAILIS BROS PTY LTD	1
	M G KAILIS PTY. LTD.	7
	PEARL ISLAND SEAFOOD	1
M G KAILIS PTY LTD	M G KAILIS PTY. LTD.	36
PEARL ISLAND SEAFOODS PTY LTD	KAILIS BROS PTY LTD	15
	M G KAILIS PTY. LTD.	15
RICHARD WILFRED BOWIE	ARGUN SEAFOODS PTY LTD	2
	PEARL ISLAND SEAFOOD	111
	RICHARD WILFRED BOWIE	2
	TANALA SEAFOODS	4
TRADEWINDS SEAFOODS	PEARL ISLAND SEAFOOD	15
TOTAL		244

Business Names

A check of the list of all SELLER-NAMES in the Docket-Book data indicates the existence of nineteen other business-names which may be associated with a processor but where the SELLER-TYPE has not been recorded as a processor (i.e. has either been reported as TIB, TVH or left blank). A summary of the Docket-Book data related to the 823 records for these other businesses is provided in Table 5 (note, this is not a list of all businesses in the fishery). It is acknowledged that individual fishers may operate under a business name, in which case the data listed in Table 5 may relate to catches sold by fishers instead of catches on-sold by processors (as was the case with the data listed in Table 3). Indeed, if the former situation applies to these data then the SELLER-TYPE field should indicate which sector of the fishery each set of records belongs. However, unfortunately 95% of the records listed in Table 5 are associated with an unknown SELLER-TYPE, with the remaining 5% associated with a TVH SELLER-TYPE. On the other hand, the majority (61%) of related records (and 61% of the associated catch) summarized in Table 5 indicate that the catch has been recorded in the TRL04 logbook, while 38% of records (and 35% of the catch) is associated with a TVH vessel.

Some checks were first undertaken on the three businesses listed in Table 5 which were also listed in Table 3 (Argun Seafoods Pty Ltd, Pearl Islands Seafood Pty Ltd and Tradewinds Seafoods Pty Ltd). As the SELLER-TYPE associated with these three businesses in Table 5 is unknown, it remains uncertain as to whether the catch records are processor-to-processor trading and therefore should be treated as duplicate catch records.

First, for Argun Seafoods Pty Ltd, the associated SELLER-TYPE is listed as unknown (i.e. was left blank) for all records up until July 2014 while after this time the SELLER-TYPE is listed as PRC for all records. To be consistent with the data handling practices (as recorded in these latter years) all records associated with Argun Seafoods Pty Ltd data were considered duplicate records and were therefore assigned to the DATA-TYPE='PRC' under Data-Rule #3. This assumes that before June 2014 the SELLER-TYPE field was left blank instead of 'PRC' (c.f. Table 3). This assumption is supported by the fact that the client for all 26 records is MG Kailis Pty Ltd which indicates a processor-to-processor transaction (c.f. Table 6).

Second, for Pearl Islands Seafood Pty Ltd there is TDB01 data for the years 2012 to 2017. For the years 2012-15 the associated SELLER-TYPE was left blank while for the years 2016-17 the SELLER-TYPE is listed as PRC. Assuming that all records should have been labeled 'PRC' for all years (for consistency as above for the other processors), the 1,689 records associated with Pearl Islands Seafood Pty Ltd in Table 4 were assigned the DATA-TYPE='PRC' under Data-Rule #3. Again, this assumption is supported by the fact that the client for all 231 records is MG Kailis Pty Ltd which indicates a processor-to-processor transaction (c.f. Table 6).

Table 5. Summary of Docket-Book data where SELLER-NAME is identified as a business but SELLER-TYPE!='PRC'. (Note, S-TYPE=Seller-Type).

SELLER-NAME	LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
ARGUN SEAFOODS PTY LTD	DocketBook	U	TDB01			21	2012	2014
	DocketBook	U				5	2012	2014
BARRIER REEF LIVE CRAYS	DocketBook	TVH	TDB01 : TRL04	FVWJ	TVH VESSEL	1	2012	2012
	DocketBook	TVH	TRL04	FVWJ	TVH VESSEL	17	2012	2012
	DocketBook	TVH	TRL04			6	2012	2013
CIEJAM PTY LTD	DocketBook	U	TDB01			2	2016	2016
	DocketBook	U	TRL04	FRJP	TVH VESSEL	3	2015	2015
	DocketBook	U	TRL04	FVFD	TVH VESSEL	11	2014	2015
	DocketBook	U	TRL04			34	2014	2017
DIAKEN PTY LTD	DocketBook	TVH	TRL04	FQNQ	TVH VESSEL	3	2012	2012
	DocketBook	TVH	TRL04	FXHP	TVH VESSEL	7	2012	2012
	DocketBook	TVH		FQNQ	TVH VESSEL	1	2012	2012
	DocketBook	U	TDB01	FQNQ	TVH VESSEL	3	2012	2012
	DocketBook	U	TDB01	FXHP	TVH VESSEL	1	2014	2014
	DocketBook	U	TDB01			3	2016	2017
	DocketBook	U	TRL04	FQNQ	TVH VESSEL	71	2012	2015
	DocketBook	U	TRL04	FXHP	TVH VESSEL	66	2012	2017
	DocketBook	U	TRL04			54	2012	2017
	DocketBook	U		FQNQ	TVH VESSEL	1	2012	2012
	DocketBook	U		FXHP	TVH VESSEL	1	2013	2013
	DocketBook	U				1	2014	2014
E-FISHIENT PTY LTD	DocketBook	U	TDB01			1	2016	2016
	DocketBook	U	TRL04	FXYK	TVH VESSEL	30	2012	2017
	DocketBook	U	TRL04	FYGN	TVH VESSEL	2	2015	2017
	DocketBook	U	TRL04			32	2012	2017
	DocketBook	U		FXYK	TVH VESSEL	1	2012	2012
	DocketBook	U				1	2014	2014
EPAR INVESTMENTS PTY LTD	Combined	U				2	2010	2010
F N Q FISHERIES PTY LTD	DocketBook	U	TRL04	FVWJ	TVH VESSEL	1	2017	2017
	DocketBook	U	TRL04	FXYC	F_SYMBOL	13	2014	2015
	DocketBook	U	TRL04			26	2014	2017
HENJONVAL PTY LTD	Combined	U		BI173		2	2011	2011
	Combined	U		BI179		1	2011	2011
	Combined	U				1	2011	2011
	DocketBook	U	TRL04	BI173		2	2012	2012
	DocketBook	U	TRL04			2	2012	2012
	DocketBook	U				3	2012	2012
LUKEHURST LIVE LOBSTER PTY LTD	DocketBook	U	TRL04			2	2016	2016
N.U.C.H PTY LTD	Combined	TVH	TRL04			1	2004	2004
NATHAN STAN SEAFOODS	Combined	U				1	2006	2006
ORNATUS MARINE PRODUCTS PTY LTD	DocketBook	U	TRL04	FRJP	TVH VESSEL	10	2012	2012
	DocketBook	U	TRL04			2	2012	2012
PEARL ISLAND SEAFOODS PTY LTD	DocketBook	U	TDB01			144	2012	2015
	DocketBook	U	TRL04			8	2013	2015
	DocketBook	U				79	2012	2014
RUFF N TUFF FISHING PTY LTD	DocketBook	U	TRL04	FZAP	TVH VESSEL	12	2012	2013
	DocketBook	U	TRL04			1	2012	2012
TK FISHERIES	DocketBook	U	TRL04	TRAWQ460		3	2012	2012
	DocketBook	U	TRL04			7	2013	2016
	DocketBook	U		TRAWQ460		8	2012	2013
	DocketBook	U				18	2012	2015
TORRES CRAYS PTY LTD	DocketBook	U	TRL04	FVFD	TVH VESSEL	32	2012	2014
	DocketBook	U	TRL04			8	2012	2013
	DocketBook	U		FVFD	TVH VESSEL	3	2012	2013
TRADEWINDS SEAFOODS	Combined	U	TDB01			3	2010	2010
	Combined	U				3	2010	2010
VANIKO MARINE PRODUCTS	DocketBook	U	TDB01	FWDZ	TVH VESSEL	3	2014	2014
	DocketBook	U	TRL04	FRJP	TVH VESSEL	1	2012	2012
	DocketBook	U	TRL04	FWDZ	TVH VESSEL	22	2012	2014
	DocketBook	U	TRL04	FWED	F_SYMBOL	2	2012	2012
	DocketBook	U	TRL04	FZAT	TVH VESSEL	5	2013	2013
	DocketBook	U	TRL04			8	2012	2014
	DocketBook	U		FWDZ	TVH VESSEL	2	2012	2012
WAKAID CORAL SEAS CO PTY LTD	Combined	TVH				2	2010	2010
	Combined	U				1	2010	2010
TOTAL						823		

Table 6. Listing of the Clients associated with the Docket-Book records where SELLER-NAME is identified as a business but SELLER-TYPE!='PRC'. (c.f. Table 5).

SELLER-NAME	CLIENT-NAME	N-RECORDS	MIN-YR	MAX-YR
ARGUN SEAFOODS PTY LTD	M G KAILIS PTY. LTD.	26	2012	2014
BARRIER REEF LIVE CRAYS	M G KAILIS PTY. LTD.	24	2012	2013
CIEJAM PTY LTD	KAILIS BROS PTY LTD	10	2016	2017
	M G KAILIS PTY. LTD.	40	2014	2016
DIAKEN PTY LTD	KAILIS BROS PTY LTD	16	2016	2017
	M G KAILIS PTY. LTD.	196	2012	2016
E-FISHIENT PTY LTD	KAILIS BROS PTY LTD	11	2016	2017
	M G KAILIS PTY. LTD.	56	2012	2016
EPAR INVESTMENTS PTY LTD	PEARL ISLAND SEAFOOD	2	2010	2010
F N Q FISHERIES PTY LTD	KAILIS BROS PTY LTD	8	2016	2017
	M G KAILIS PTY. LTD.	32	2014	2016
HENJONVAL PTY LTD	TORRES STRAITS SEAFOOD	7	2012	2012
		4	2011	2011
LUKEHURST LIVE LOBSTER PTY LTD	TORRES STRAITS SEAFOOD	2	2016	2016
N.U.C.H PTY LTD	M G KAILIS PTY. LTD.	1	2004	2004
NATHAN STAN SEAFOODS	PEARL ISLAND SEAFOOD	1	2006	2006
ORNATUS MARINE PRODUCTS PTY LTD	M G KAILIS PTY. LTD.	12	2012	2012
PEARL ISLAND SEAFOODS PTY LTD	M G KAILIS PTY. LTD.	231	2012	2015
RUFF N TUFF FISHING PTY LTD	M G KAILIS PTY. LTD.	13	2012	2013
TK FISHERIES	TORRES STRAITS SEAFOOD	36	2012	2016
TORRES CRAYS PTY LTD	M G KAILIS PTY. LTD.	43	2012	2014
TRADEWINDS SEAFOODS	PEARL ISLAND SEAFOOD	6	2010	2010
VANIKO MARINE PRODUCTS	M G KAILIS PTY. LTD.	40	2012	2014
	TORRES STRAITS SEAFOOD	3	2012	2012
WAKAID CORAL SEAS CO PTY LTD	PEARL ISLAND SEAFOOD	3	2010	2010
TOTAL		823		

Third, for Tradewinds Seafoods Pty Ltd, there is data only for the year 2010. During this year, the associated SELLER-TYPE is listed as PRC for all records up until 8-July while after this time and until the end of October the SELLER-TYPE is listed as unknown (i.e. was left blank). The SELLER-TYPE is again listed as PRC for December. Again, for consistency throughout this year all records associated with Tradewinds Seafoods Pty Ltd data were seen as being duplicate processor records and were therefore assigned to the DATA-TYPE='PRC' under Data-Rule #3. Again, this assumes that Records with the SELLER-TYPE field that were left blank have been corrected to 'PRC' for several months in 2010 (c.f. Table 5). Again, this assumption is supported by the fact that the client for all 6 records is Pearl Islands Seafood Pty Ltd which indicates a processor-to-processor transaction (c.f. Table 6).

For the three processors listed above a total of 263 records (and 568,808 kg of associated catch) are attributed to processor trading (cf. Table 7).

For the other sixteen businesses listed in Table 5, a check of license information found that the records associated with the nine business names Barrier Reef Crays, Daiken, E-Fishient, EPAR Investments, FNQ Fisheries, Ornatus, Ruff-N-Tuff, Torres Crays and Vaniko Marine are associated with the TVH sector and as such the associated records for these businesses were assigned the DATA-TYPE='TVH' under Data-Rule #4A.

An additional check indicated that for the nine businesses listed above each had a least one set of records listed in Table 5 where either the SELLER-TYPE or VESSEL-TYPE was listed as TVH whilst for most records (98.9%) the CLIENT was either MG Kailis Pty Ltd or Kailis Bros Pty Ltd (c.f. Table 6). A check through the other seven business names listed in Table 5 indicated that such a co-association of SELLER_TYPE, VESSEL_TYPE or CLIENT was only associated with two other business names: CIEJAM Pty Ltd and N.U.C.H Pty Ltd. Accordingly, it was decided that all records associated with these two businesses should also be identified as TVH and accordingly were assigned the DATA-TYPE='TVH' under Data-Rule #4A.

Table 7. Allocation of Docket-Book data where Seller-Name is a Business but Seller-Type!='PRC'.

i) PROCESSOR

SELLER-NAME	LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
ARGUN SEAFOODS PTY LTD	DocketBook	U	TDB01			21	2012	2014
	DocketBook	U				5	2012	2014
PEARL ISLAND SEAFOODS PTY LTD	DocketBook	U	TDB01			144	2012	2015
	DocketBook	U	TRL04			8	2013	2015
	DocketBook	U				79	2012	2014
TRADEWINDS SEAFOODS	Combined	U	TDB01			3	2010	2010
	Combined	U				3	2010	2010
TOTAL						263		

ii) TVH Sector

SELLER-NAME	LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
BARRIER REEF LIVE CRAYS	DocketBook	TVH	TDB01 : TRL04	FVWJ	TVH VESSEL	1	2012	2012
	DocketBook	TVH	TRL04	FVWJ	TVH VESSEL	17	2012	2012
	DocketBook	TVH	TRL04			6	2012	2013
CIEJAM PTY LTD	DocketBook	U	TDB01			2	2016	2016
	DocketBook	U	TRL04	FRJP	TVH VESSEL	3	2015	2015
	DocketBook	U	TRL04	FVFD	TVH VESSEL	11	2014	2015
	DocketBook	U	TRL04			34	2014	2017
DIAKEN PTY LTD	DocketBook	TVH	TRL04	FQNQ	TVH VESSEL	3	2012	2012
	DocketBook	TVH	TRL04	FXHP	TVH VESSEL	7	2012	2012
	DocketBook	TVH		FQNQ	TVH VESSEL	1	2012	2012
	DocketBook	U	TDB01	FQNQ	TVH VESSEL	3	2012	2012
	DocketBook	U	TDB01	FXHP	TVH VESSEL	1	2014	2014
	DocketBook	U	TDB01			3	2016	2017
	DocketBook	U	TRL04	FQNQ	TVH VESSEL	71	2012	2015
	DocketBook	U	TRL04	FXHP	TVH VESSEL	66	2012	2017
	DocketBook	U	TRL04			54	2012	2017
	DocketBook	U		FQNQ	TVH VESSEL	1	2012	2012
	DocketBook	U		FXHP	TVH VESSEL	1	2013	2013
	DocketBook	U				1	2014	2014
E-FISHIENT PTY LTD	DocketBook	U	TDB01			1	2016	2016
	DocketBook	U	TRL04	FXYK	TVH VESSEL	30	2012	2017
	DocketBook	U	TRL04	FYGN	TVH VESSEL	2	2015	2017
	DocketBook	U	TRL04			32	2012	2017
	DocketBook	U		FXYK	TVH VESSEL	1	2012	2012
	DocketBook	U				1	2014	2014
EPAR INVESTMENTS PTY LTD	Combined	U				2	2010	2010
F N Q FISHERIES PTY LTD	DocketBook	U	TRL04	FVWJ	TVH VESSEL	1	2017	2017
	DocketBook	U	TRL04	FXYC	F_SYMBOL	13	2014	2015
	DocketBook	U	TRL04			26	2014	2017
N.U.C.H PTY LTD	Combined	TVH	TRL04			1	2004	2004
ORNATUS MARINE PRODUCTS PTY LTD	DocketBook	U	TRL04	FRJP	TVH VESSEL	10	2012	2012
	DocketBook	U	TRL04			2	2012	2012
RUFF N TUFF FISHING PTY LTD	DocketBook	U	TRL04	FZAP	TVH VESSEL	12	2012	2013
	DocketBook	U	TRL04			1	2012	2012
TORRES CRAYS PTY LTD	DocketBook	U	TRL04	FVFD	TVH VESSEL	32	2012	2014
	DocketBook	U	TRL04			8	2012	2013
	DocketBook	U		FVFD	TVH VESSEL	3	2012	2013
VANIKO MARINE PRODUCTS	DocketBook	U	TDB01	FWDZ	TVH VESSEL	3	2014	2014
	DocketBook	U	TRL04	FRJP	TVH VESSEL	1	2012	2012
	DocketBook	U	TRL04	FWDZ	TVH VESSEL	22	2012	2014
	DocketBook	U	TRL04	FWED	F_SYMBOL	2	2012	2012
	DocketBook	U	TRL04	FZAT	TVH VESSEL	5	2013	2013
	DocketBook	U	TRL04			8	2012	2014
	DocketBook	U		FWDZ	TVH VESSEL	2	2012	2012
TOTAL						507		

iii) TIB Sector

SELLER-NAME	LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
HENJONVAL PTY LTD	Combined	U		BI173		2	2011	2011
	Combined	U		BI179		1	2011	2011
	Combined	U				1	2011	2011
	DocketBook	U	TRL04	BI173		2	2012	2012
	DocketBook	U	TRL04			2	2012	2012
	DocketBook	U				3	2012	2012
LUKEHURST LIVE LOBSTER PTY LTD	DocketBook	U	TRL04			2	2016	2016
NATHAN STAN SEAFOODS	Combined	U				1	2006	2006
TK FISHERIES	DocketBook	U	TRL04	TRAWQ460		3	2012	2012
	DocketBook	U	TRL04			7	2013	2016
	DocketBook	U		TRAWQ460		8	2012	2013
	DocketBook	U				18	2012	2015
WAKAID CORAL SEAS CO PTY LTD	Combined	TVH				2	2010	2010
	Combined	U				1	2010	2010
TOTAL						53		

For the eleven businesses identified as TVH a total of 507 records (and 1,009,847 kg of associated catch) were attributed to the TVH catch (cf. Table 7).

Of the remaining five business-names listed in Table 5, the records for Henjonval Pty Ltd and TK Fisheries were selected as being associated with the TIB sector as the vessels associated with these records are TIB vessels (c.f. Table 2). Until further checking can be undertaken the records associated with the businesses Lukehurst Live Lobster Pty Ltd, Nathan Stan Seafoods and Wakaid Coral Sea Pty Ltd were also associated with the TIB sector. As such the associated records for these businesses were assigned the DATA-TYPE='TIB' under Data-Rule #4B. Note, unlike the records associated with businesses identified previously as being TVH, for the five businesses identified as being TIB no records had a VESSEL-TYPE listed as TVH (all are blank) nor was the CLIENT listed as either MG Kailis Pty Ltd or Kailis Bros Pty Ltd (the CLIENT associated with all records was either Pearl Islands Seafood Pty Ltd or Torres Straits Seafood Pty Ltd). Furthermore except for two records, the SELLER-TYPE was also not listed as TVH.

For the five businesses identified as TIB a total of 53 records (and 30,240 kg of associated catch) were attributed to the TIB catch (cf. Table 7).

Seller-Type=TVH

Where SELLER-TYPE='TVH' it is understood that the related catch is from the TVH sector of the fishery and therefore the catch reported in the Docket-Book should be considered as duplicates of TRL04 logbook reported catch. In such instances one would expect the RELATED-LOG field should indicate that the catch has been recorded in the TRL04 logbook.

A summary of the 1,294 records (associated with a catch of 211,606 kg) where SELLER-TYPE ='TVH' (and DATA-TYPE remains unassigned) is provided in Table 8. As there are a large number (99) of distinct SELLER-NAMEs associated with this data they are not shown. Several things can be noted. First, while the RELATED-LOG field indicates that the catch has also been recorded in the TRL04 logbook for 45% of these records (and 78% of the corresponding catch), this field has been left blank for 55% of the records (and 22% of the corresponding catch). Second, not all the vessels listed are TVH-vessels (i.e. correspond to a vessel listed in the TVH logbook database). The non-TVH vessels represent 78% of the records (and 53% of the corresponding catch) listed in Table 8. Docket-Book records where the SELLER-TYPE is listed as TVH and the RELATED-LOG are listed as TRL04, and the listed vessel is also a known TVH vessel should be interpreted as TVH catches (and therefore seen as duplicates to the catches recorded on the TRL04 logbook). However, it remains less certain as to which sector the other catches should be associated where these fields are either left blank or provide contradictory information (e.g. the SELLER-TYPE is listed as TVH or the RELATED-LOG is listed as TRL04 but the listed vessel is a TIB vessel). If it is reported as a TIB vessel, and this can be verified, then it should be TIB catch. Nevertheless, until this uncertainty can be clarified all records where the SELLER-TYPE is listed as TVH and the VESSEL-TYPE is identified as a TVH vessel were designated as TVH catches. As such the 282 associated records (and the 100,400 kg of associated catch) were assigned the DATA-TYPE='TVH' under Data-Rule #5A.

A further check was undertaken of all remaining records (i.e. where the DATA-TYPE remains unassigned) where the VESSEL-TYPE is designated as a TVH vessel. A summary of the 368 corresponding records is provided in Table 9. Apart from one record, the RELATED LOG is listed as TRL04 or is blank. As above, all records (and the 90,670 kg of associated catch) were also assigned the DATA-TYPE='TVH' under Data-Rule #5A.

Table 8. Summary of Docket-Book data where Seller-Type='TVH' and DATA-TYPE is null.

LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	TVH	TRL04	FSKR	TVH VESSEL	16	2005	2008
Combined	TVH	TRL04	FUPJ	TVH VESSEL	2	2005	2005
Combined	TVH	TRL04	FVFD	TVH VESSEL	1	2004	2004
Combined	TVH	TRL04	FVGU	TVH VESSEL	6	2005	2007
Combined	TVH	TRL04	FVGX	TVH VESSEL	102	2006	2008
Combined	TVH	TRL04	FVGZ	F_SYMBOL	1	2005	2005
Combined	TVH	TRL04	FWAV	TVH VESSEL	1	2004	2004
Combined	TVH	TRL04	FWCB	TVH VESSEL	15	2004	2008
Combined	TVH	TRL04	FWDZ	TVH VESSEL	3	2007	2007
Combined	TVH	TRL04	FXAY	F_SYMBOL	12	2004	2007
Combined	TVH	TRL04	FXEV	TVH VESSEL	6	2004	2005
Combined	TVH	TRL04	FXHP	TVH VESSEL	1	2005	2005
Combined	TVH	TRL04	FXTN	TVH VESSEL	26	2004	2008
Combined	TVH	TRL04	FYFL	TVH VESSEL	23	2004	2007
Combined	TVH	TRL04	FYGN	TVH VESSEL	1	2004	2004
Combined	TVH	TRL04	HPF	TVH VESSEL	1	2005	2005
Combined	TVH	TRL04	TRAWQ117		1	2008	2008
Combined	TVH	TRL04	TRAWQ166		1	2007	2007
Combined	TVH	TRL04	TRAWQ259		5	2008	2008
Combined	TVH	TRL04	TRAWQ373		2	2010	2010
Combined	TVH	TRL04	TRAWQ432		1	2010	2010
Combined	TVH	TRL04			135	2004	2010
Combined	TVH		BI181		1	2010	2010
Combined	TVH		FWAV	TVH VESSEL	6	2004	2005
Combined	TVH		MAB038		2	2010	2010
Combined	TVH		TDU063		1	2010	2010
Combined	TVH		TRAWQ166		19	2010	2010
Combined	TVH		TRAWQ168		1	2009	2009
Combined	TVH		TRAWQ178		1	2010	2010
Combined	TVH		TRAWQ232		1	2010	2010
Combined	TVH		TRAWQ258		1	2010	2010
Combined	TVH		TRAWQ267		4	2010	2010
Combined	TVH		TRAWQ273		1	2010	2010
Combined	TVH		TRAWQ282		7	2010	2010
Combined	TVH		TRAWQ329		2	2010	2010
Combined	TVH		TRAWQ373		15	2010	2010
Combined	TVH		TRAWQ381		2	2010	2010
Combined	TVH		TRAWQ398		2	2010	2010
Combined	TVH		TRAWQ429		1	2010	2010
Combined	TVH		TRAWQ430		1	2010	2010
Combined	TVH		TRAWQ432		10	2010	2010
Combined	TVH				92	2006	2010
DocketBook	TVH	TRL04	FRJP	TVH VESSEL	1	2012	2012
DocketBook	TVH	TRL04	FSML	TVH VESSEL	2	2013	2013
DocketBook	TVH	TRL04	FXYC	F_SYMBOL	10	2012	2012
DocketBook	TVH	TRL04	FXYK	TVH VESSEL	14	2013	2013
DocketBook	TVH	TRL04	FYGN	TVH VESSEL	25	2012	2013
DocketBook	TVH	TRL04	FZAL	TVH VESSEL	16	2012	2017
DocketBook	TVH	TRL04	FZAM	TVH VESSEL	1	2014	2014
DocketBook	TVH	TRL04	FZAP	TVH VESSEL	3	2013	2017
DocketBook	TVH	TRL04	FZAP-3	TVH VESSEL	1	2017	2017
DocketBook	TVH	TRL04	TRAWQ258		1	2012	2012
DocketBook	TVH	TRL04	TRAWQ348		10	2013	2014
DocketBook	TVH	TRL04	TRAWQ458		4	2012	2013
DocketBook	TVH	TRL04			128	2012	2017
DocketBook	TVH		40215		1	2015	2015
DocketBook	TVH		6772		1	2014	2014
DocketBook	TVH		FSML	TVH VESSEL	2	2013	2013
DocketBook	TVH		FWCB	TVH VESSEL	1	2012	2012
DocketBook	TVH		FWED	F_SYMBOL	1	2012	2012
DocketBook	TVH		FXYK	TVH VESSEL	1	2013	2013
DocketBook	TVH		FZAL	TVH VESSEL	3	2013	2014
DocketBook	TVH		FZAP	TVH VESSEL	1	2017	2017
DocketBook	TVH		FZAT	TVH VESSEL	1	2013	2013
DocketBook	TVH		MDW109		5	2012	2012
DocketBook	TVH		TRAWQ		1	2012	2012
DocketBook	TVH		TRAWQ003		3	2012	2012
DocketBook	TVH		TRAWQ117		4	2012	2012
DocketBook	TVH		TRAWQ129		1	2012	2012
DocketBook	TVH		TRAWQ259		7	2012	2014
DocketBook	TVH		TRAWQ320		2	2012	2012
DocketBook	TVH		TRAWQ329		7	2012	2015
DocketBook	TVH		TRAWQ348		3	2013	2013
DocketBook	TVH		TRAWQ429		1	2012	2012
DocketBook	TVH		TRAWQ458		1	2013	2013
DocketBook	TVH		TRAWQ468		1	2013	2013
DocketBook	TVH				498	2012	2017
TOTAL					1294		

Table 9. Summary of Docket-Book data where VESSEL-TYPE='TVH vessel' and DATA-TYPE is null.

LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	U	OTHER	FXTN	TVH VESSEL	1	2004	2004
Combined	U	TRL04	FWCB	TVH VESSEL	1	2004	2004
Combined	U		FRJP	TVH VESSEL	1	2010	2010
Combined	U		FSKR	TVH VESSEL	7	2007	2007
Combined	U		FUPJ	TVH VESSEL	13	2004	2006
Combined	U		FVGU	TVH VESSEL	6	2006	2006
Combined	U		FVGX	TVH VESSEL	34	2007	2008
Combined	U		FWAV	TVH VESSEL	8	2004	2004
Combined	U		FWCB	TVH VESSEL	7	2004	2008
Combined	U		FWDZ	TVH VESSEL	1	2007	2007
Combined	U		FXEV	TVH VESSEL	6	2005	2007
Combined	U		FXTN	TVH VESSEL	10	2006	2008
Combined	U		FYFL	TVH VESSEL	1	2004	2004
DocketBook	U	TRL04	FQNQ	TVH VESSEL	5	2013	2013
DocketBook	U	TRL04	FSML	TVH VESSEL	1	2013	2013
DocketBook	U	TRL04	FWCB	TVH VESSEL	3	2012	2012
DocketBook	U	TRL04	FXTN	TVH VESSEL	16	2012	2013
DocketBook	U	TRL04	FYFL	TVH VESSEL	80	2012	2014
DocketBook	U	TRL04	FZAL	TVH VESSEL	15	2012	2014
DocketBook	U	TRL04	FZAM	TVH VESSEL	87	2012	2014
DocketBook	U	TRL04	FZAP	TVH VESSEL	27	2012	2014
DocketBook	U	TRL04	FZAP-3	TVH VESSEL	5	2017	2017
DocketBook	U		FQNQ	TVH VESSEL	1	2013	2013
DocketBook	U		FSML	TVH VESSEL	2	2013	2013
DocketBook	U		FXTN	TVH VESSEL	7	2013	2014
DocketBook	U		FYFL	TVH VESSEL	6	2014	2014
DocketBook	U		FZAL	TVH VESSEL	2	2013	2013
DocketBook	U		FZAM	TVH VESSEL	12	2012	2014
DocketBook	U		FZAP	TVH VESSEL	3	2013	2014
TOTAL					368		

Seller-Type=TIB

A summary of the 4,017 records where SELLER-TYPE ='TIB' (and DATA-TYPE remains unassigned) is provided in Table 10. There are 140 distinct SELLER-NAMEs associated with this data. For 97% of the records (and 94% of the catch) there is no further information in the RELATED-LOG or other vessel fields. Where additional vessel information is available (101 records) all listed vessels are TIB vessels. However, there are 6 records where the RELATED-LOG is designated as TRL04 (though the vessel type remain unknown). As noted earlier, there are instances where TIB vessels have recorded catches in the TRL04 logbook (c.f. Table 2), and so it remains plausible that these 6 records may relate to the TIB sector. Given the available information, all 4,107 records (with an associated catch of 154,348 kg) listed in Table 9 were assigned the DATA-TYPE='TIB' under Data-Rule #5B.

Table 10. Summary of Docket-Book data where Seller-Type='TIB' and DATA-TYPE is null.

LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	TIB		TRAWQ127		1	2010	2010
Combined	TIB		TRAWQ166		71	2010	2010
Combined	TIB		TRAWQ258		24	2010	2010
Combined	TIB		TRAWQ259		3	2010	2010
Combined	TIB		TRAWQ358		1	2010	2010
Combined	TIB				15	2010	2010
DocketBook	TIB	TDB01			10	2016	2016
DocketBook	TIB	TRL04			6	2016	2017
DocketBook	TIB		TRAWQ488		1	2015	2015
DocketBook	TIB				3,885	2013	2017
TOTAL					4,017		

Seller-Type=U, Unknown

Finally, a summary of the 43,644 records (associated with a catch of 2,066,925 kg) where SELLER-TYPE ='U' for unknown (and DATA-TYPE remains unassigned) is provided in Table 11. Unlike the previous summaries the vessel symbol field is not included due to the large number of distinct vessel symbols (644) in this data. As the SELLER-TYPE field does not allow a designation of these records, additional analyses and checks were undertaken as described below.

Table 11. Summary of Docket-Book data where Seller-Type='U' and DATA-TYPE is null.

LOG-TYPE	S-TYPE	RELATED-LOG	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	U	OTHER		46	2004	2007
Combined	U	PEARL ISLAND		3	2004	2004
Combined	U	TDB01		41	2004	2010
Combined	U	TRL04		15	2010	2011
Combined	U		F_SYMBOL	360	2004	2007
Combined	U			34,645	2004	2011
DocketBook	U	TDB01		62	2014	2016
DocketBook	U	TRL04		104	2012	2017
DocketBook	U			8,368	2012	2017
TOTAL				43,644		

4. Related Log

As noted earlier, when the RELATED-LOG field has been completed this indicates that the catch recorded in the Docket-Book has been recorded in another format, for example the TRL04 logbook, or another TDB01 docket book. Again, where this occurs one needs to check that a double-counting of the corresponding catch does not occur.

TRL04

A summary of the 430 records where the RELATED-LOG ='TRL04' (and the DATA-TYPE remains unassigned) is provided in Table 12. Again, several things can be noted. First, 72% of all records

Table 12. Summary of Docket-Book data where Related-Log='TRL04' and DATA-TYPE is null. Vessels highlighted yellow are known TIB vessels which also recorded catch in the TRL04 Logbook..

LOG_TYPE	SELLER	RELATED_LOG	VESSEL	VES_TYPE	N-RECORDS	MIN_YR	MAX_YR
Combined	TVH	TRL04	FVGZ	F_SYMBOL	1	2005	2005
Combined	TVH	TRL04	FXAY	F_SYMBOL	12	2004	2007
Combined	TVH	TRL04	TRAWQ117		1	2008	2008
Combined	TVH	TRL04	TRAWQ166		1	2007	2007
Combined	TVH	TRL04	TRAWQ259		5	2008	2008
Combined	TVH	TRL04	TRAWQ373		2	2010	2010
Combined	TVH	TRL04	TRAWQ432		1	2010	2010
Combined	TVH	TRL04			135	2004	2010
Combined	U	TRL04	CN088		1	2011	2011
Combined	U	TRL04	CN123		1	2011	2011
Combined	U	TRL04	TRAWQ258		1	2010	2010
Combined	U	TRL04	TRAWQ326		1	2010	2010
Combined	U	TRL04	TRAWQ373		1	2010	2010
Combined	U	TRL04	TRAWQ432		1	2010	2010
Combined	U	TRL04	TRAWQ437		1	2010	2010
Combined	U	TRL04	WI068		1	2010	2010
Combined	U	TRL04	WI104		1	2011	2011
Combined	U	TRL04			6	2010	2011
DocketBook	TVH	TRL04	FXYC	F_SYMBOL	10	2012	2012
DocketBook	TVH	TRL04	TRAWQ258		1	2012	2012
DocketBook	TVH	TRL04	TRAWQ348		10	2013	2014
DocketBook	TVH	TRL04	TRAWQ458		4	2012	2013
DocketBook	TVH	TRL04			128	2012	2017
DocketBook	U	TRL04	130212		1	2012	2012
DocketBook	U	TRL04	BI173		3	2012	2013
DocketBook	U	TRL04	CN114		1	2012	2012
DocketBook	U	TRL04	TRAWQ258		4	2012	2012
DocketBook	U	TRL04	TRAWQ299		3	2012	2012
DocketBook	U	TRL04	TRAWQ348		1	2015	2015
DocketBook	U	TRL04	TRAWQ458		3	2013	2013
DocketBook	U	TRL04			88	2012	2017
TOTAL					430		

(and 71% of the corresponding catch) indicate that the SELLER-TYPE='TVH' (with the remainder being unknown). However, the vessel information associated with these records indicates that none of the records is associated with a known TVH vessel. Second, a number of vessels which are known to have active (or expired) TIB licenses are highlighted in yellow. As these vessels are also listed in Table 2 as being larger TIB vessels which recorded their catch in the TRL04 logbook, the associated data listed in Table 12 for these vessels was checked to endure that the data is not a duplicate of what is recorded in the TRL04 logbook. A check indicates that there are no common dates between the two sets of data and so the catches included in the Docket-Book data are assumed to be in addition to those recorded in the TRL04 logbook. Third, apart from the 21 records associated these three TIB vessels an additional 28 records are also associated with known TIB vessels (as the vessel symbol begins with the letters TRAWQ, CN, WI). Finally, a check of the SELLER_NAME associated with the vessel symbol '130212' indicates that this is a TIB catch record. As such the 50 records listed in Table 12 associated with known TIB vessels were assigned the DATA-TYPE='TIB' under Data-Rule #6A.

For the other 381 records listed in Table 12 while the RELATED-LOG field indicates that the catch was also reported in the TRL04 logbook (and for 75% of records that the Seller-Type was TVH), nevertheless there is little addition information on which to allocate these records. There is no information on the vessel for 357 of these records while the VESSEL-TYPE is listed as an F-vessel for 23 records. Further analysis is required.

Other Entries

A summary of the 152 records where Related-Log is either 'TDB01', 'Pearl Island' or some other non-null entry ('NSS BESI', 'TSF01', 'TSF01:TSSB' ,'Yam Island', 'T.I. ', '13', '9') is provided in Table 13. The following can be noted. First, the SELLER-TYPE for all records is Unknown. Second, 68% of all records (and 84% of the related catch) is associated with records where the RELATED-LOG='TDB01'. An examination of the SELLER-NAMES associated with these records indicates that they are associated with 34 individual personal names. Third, most records where the RELATED-LOG is shown as 'OTHER' occurred during 2004 (except for two records where RELATED-LOG= 'TSF01' in 2005 and 2007). In all instances these records are associated with a SELLER-NAME which is an individual personal name and the three listed vessels are TIB vessels. Finally, the vessels associated with the records where the RELATED-LOG is shown as 'Pearl Island' are also all TIB vessels. Given these findings, all 152 records listed in Table 13 were assigned the DATA-TYPE='TIB' under Data-Rule #6B.

Table 13. Summary of Docket-Book data where Related-Log='TDB01' or some other non-null entry. (Note S-TYPE=Seller-Type).

LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	U	OTHER	BI013		2	2004	2004
Combined	U	OTHER	CN050		1	2004	2004
Combined	U	OTHER	YKE106		1	2004	2004
Combined	U	OTHER			42	2004	2007
Combined	U	PEARL ISLAND	CN012		1	2004	2004
Combined	U	PEARL ISLAND	CN023		1	2004	2004
Combined	U	PEARL ISLAND	TRAWQ272		1	2004	2004
Combined	U	TDB01			41	2004	2010
DocketBook	U	TDB01	CN084		1	2014	2014
DocketBook	U	TDB01			61	2014	2016
TOTAL					152		

Related-Log=Null

Finally, a summary of the 44,074 records (with 2,046,320 kg of associated catch) where the RELATED-LOG is Null (and DATA-TYPE remains unassigned) is provided in Table 14. Again, as for Table 11 the vessel name field is not included due to the large number of distinct vessel symbols (648), though the vessel symbol remains unknown for 71% of these records. There is also a large number (1043) of distinct SELLER-NAMEs associated with these records. It is noted that 1.6% of the records are

Table 14. Summary of Docket-Book data where Related-Log is Null (and the DATA-TYPE is null).

LOG-TYPE	S-TYPE	RELATED-LOG	VES_TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	TVH			164	2006	2010
Combined	U		F_SYMBOL	360	2004	2007
Combined	U			34,645	2004	2011
DocketBook	TVH		F_SYMBOL	1	2012	2012
DocketBook	TVH			536	2012	2017
DocketBook	U			8,368	2012	2017
TOTAL				44,074		

associated with a SELLER-TYPE which is TVH, while the SELLER-TYPE is not assigned to the remainder of records. Where the SELLER_TYPE=TVH or the VESSEL-TYPE=F-Symbol the records were left unassigned. However, the 75,235 records (with 1,978,133 kg of related catch) where both the SELLER_TYPE and the VESSEL-TYPE are null (the latter indicating either an unknown vessel symbol or a TIB vessel) were assigned a DATA-TYPE='TIB' under Data-Rule #6C.

5. Vessel-Type

VESSEL-TYPE is a field that has been added to indicate whether the vessel-symbol listed on the Docket-Book corresponds to a vessel listed in the TVH database (known as a TVH Vessel), and if not whether the vessel-symbol begins with the letter 'F' (as this usually indicates a TVH vessel). If neither of these is the case the VESSEL-TYPE is left blank.

TVH Vessel

There are 986 records (associated with 24 distinct vessel symbols and a catch of 791,443 kg) in the Docket-Book data where VESSEL-TYPE='TVH Vessel'. A summary for these data is not displayed, as all these records have already been assigned the DATA-TYPE='TVH' under Data-Rules #3, #4A and #5A. While all vessels have a symbol beginning with the letter 'F' (as this corresponds to most vessels in the TVH database, though some TVH vessel symbols are different, e.g. HPF) only 32% of the records (and 19% of the corresponding catch) indicate that the SELLER-TYPE is 'TVH'. Nevertheless, 84% of all records (and 93% of the corresponding catch) indicate that the Docket-Book data is also associated with the RELATED-LOG TRL04. Such an association is to be expected if the catch data relates to the TVH sector of the fishery.

F-Symbol

A summary of the 384 records where VESSEL-TYPE='F-Symbol' (and DATA-TYPE remained unassigned) is provided in Table 15. Again, several things can be noted. First, 6% of all records (and 42% of the corresponding catch) indicate that the Docket-Book data is also associated with the RELATED-LOG TRL04, while the same records (except for 1) also indicate that the SELLER-TYPE

Table 15. Summary of Docket-Book data where VES-Type='F-Symbol' and DATA-TYPE is Null. Vessels highlighted yellow are TIB and vessels highlighted in green are TVH.

LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	TVH	TRL04	FVGZ	F_SYMBOL	1	2005	2005
Combined	TVH	TRL04	FXAY	F_SYMBOL	12	2004	2007
Combined	U		FSYE	F_SYMBOL	1	2004	2004
Combined	U		FVHA	F_SYMBOL	6	2004	2004
Combined	U		FXAY	F_SYMBOL	43	2004	2007
Combined	U		FXJG	F_SYMBOL	1	2004	2004
Combined	U		FXZS	F_SYMBOL	281	2004	2007
Combined	U		FYSE	F_SYMBOL	25	2004	2006
Combined	U		FYTQ	F_SYMBOL	3	2004	2005
DocketBook	TVH	TRL04	FXYC	F_SYMBOL	10	2012	2012
DocketBook	TVH		FWED	F_SYMBOL	1	2012	2012
TOTAL					384		

is 'TVH'. Second, vessels which are believed to be either TIB or TVH vessels are highlighted in yellow and green respectively. The two vessels FVGZ and FXAY are unknown TVH distinguishing symbols that reported a TVH SELLER-TYPE and TRL04 RELATED-LOG. It is possible that the data entry for these records was misspelt, or that the records were incorrectly coded to the TVH sector. However, a further check of the SELLER-NAMEs associated with these records indicate that they are TIB. It is possible that they were working on a TVH vessel for a period of time and also worked on a TIB dinghy in between trips on the TVH vessel. Note, the vessels FXYC and FWED were designated as TVH under Data-Rule #4A (c.f. Table 7-ii). Given these results, all records associated in Table 15 (except for vessels FWED and FXYC) were assigned the DATA-TYPE='TIB' under Data-Rule #7A and the records for vessels FWED and FXYC were assigned the DATA-TYPE='TVH' under Data-Rule #7B.

6. Unassigned Records

As described in the previous sections, a number of Data-Rules have been constructed to designate the status of the various data records currently held in the Docket-Book data. These data rules have been constructed based on information in the following data fields: LOG-TYPE, SELLER-TYPE, RELATED-LOG and VESSEL-TYPE. However, where specific information in these fields in missing, it remains difficult to ascertain the status of the corresponding data.

A summary of the 357 records (with 68,402 kg of related catch) which have yet to be assigned a Data-Type is displayed in Table 16. All records indicate that the catch has also been reported on the RELATED-LOG TRL04, though as the VESSEL-NAME remains unknown there is little additional information on which to assign the DATA-TYPE. An additional analysis was therefore undertaken by utilizing the SELLER-NAME associated with each record. The assumption was that where the SELLER-NAME had previously only been aligned with a single DATA-TYPE, then any unassigned records for the same SELLER-NAME would also assigned the same DATA-TYPE. Where the DATA-TYPE assigned previously for a given SELLER-NAME was not unique (i.e. 'PRC', 'TIB', or 'TVH) then further checks would need to be undertaken.

Table 16. Summary of Docket-Book data remaining unassigned to a DATA- STATUS after application of the data rules listed in the document. (Note S-TYPE=Seller-Type).

LOG-TYPE	S-TYPE	RELATED-LOG	VESSEL	VES-TYPE	N-RECORDS	MIN-YR	MAX-YR
Combined	TVH	TRL04			135	2,004	2010
Combined	U	TRL04			6	2,010	2011
DocketBook	TVH	TRL04			128	2,012	2017
DocketBook	U	TRL04			88	2,012	2017
TOTAL					357		

After undertaking the above analysis the following four groups of records were identified:

i) Sellers previously associated with only the Data-Type='TVH' (25 records),
ii) Sellers previously associated with only the Data-Type='TIB' (99 records),
iii) Sellers previously associated with both Data-Types (216 records),
iv) Sellers not previously listed (17 records).

A summary listing of these records is given in Table 17. Those records where the SELLER-NAME was associated with a unique previous DATA-TYPE (i.e. groups i and ii above) were assigned the corresponding DATA-TYPE under Data-Rule #8A and #8B respectively (124 records in total).

For those records where the SELLER-NAME was not associated with a unique previous Data-Type (i.e. groups iii and iv above) a further check was undertaken using the public register of Torres Strait licenses. This register was used to identify fishers holding a license associated with a vessel listed in the TVH database. As a result of this and other checks, and the determination under Data-Rule #3B, those records where the SELLER-NAME was included in the following list (Michael Kingdon, Tom Kingdon, Ty Kingdon, Sharn C Duff, Geoffrey D McKenzie, Luke S Dillon, Matthew S Bruce, Phillip J Hughes, Ryan Hughes and Miroslav Vaculka) were assigned the DATA-TYPE='TVH' under Data-Rule #8C and all remaining records were assigned the DATA-TYPE='TIB' under Data-Rule #8D.

Table 17. Division of remaining unassigned records after checking previous assigned SELLER-NAMES. (Note S-Type=Seller-Type).

i) TVH Data-Type

SELLER-NAME	S-TYPE	RELATED-LOG	N-RECORDS
DOMENIKO KARL DROTINI	TVH	TRL04	4
KARZY PHENGPRASEUTH	TVH	TRL04	2
LEVI KRIS	TVH	TRL04	1
LINDSAY DAVID PEARCE	U	TRL04	5
TRENT S BUTCHER	TVH	TRL04	9
WADE DUFF	TVH	TRL04	4
TOTAL			25

ii) TIB Data-Type

SELLER-NAME	S-TYPE	RELATED-LOG	N-RECORDS
AUGUSTINUS A TITASEY	TVH	TRL04	7
BENJAMIN CARLOS MOORE	TVH	TRL04	3
	U	TRL04	3
CAMERON PAUL BENJAMIN	TVH	TRL04	2
COREY WARD	TVH	TRL04	1
DARRYL FRANK	TVH	TRL04	5
DEN GAGAI	TVH	TRL04	1
DENNIS RICHARDS	U	TRL04	1
EDDIE MURDE	U	TRL04	1
FRANCIS ANTHONY HUGHES	TVH	TRL04	3
FRED DANIEL MILLS	TVH	TRL04	1
GAVIN FRANK LEROY MOSBY	U	TRL04	1
GESA WILLIAM JOSEPH	TVH	TRL04	2
GRAHAM KYOZO HIRAKAWA	TVH	TRL04	8
GUYAI ECCLES NEWIE	TVH	TRL04	1
HUNIG DARUA	TVH	TRL04	2
JAMAHL TAMWOY	U	TRL04	1
JAMES MILLS	U	TRL04	1
JIM AHMATT	TVH	TRL04	1
JOE HIRAKAWA	TVH	TRL04	24
JOHN SAUB	U	TRL04	1
JORDAN ASSAN	U	TRL04	1
JORDAN SAMPSON	TVH	TRL04	2
JOSEPH THOMAS KING	U	TRL04	1
KEIJI BOWIE	U	TRL04	1
KENNETH JAMES MCKENZIE	TVH	TRL04	11
MICHAEL MASIE MOSBY	U	TRL04	1
MICHAEL STEWART YAMASHITA	TVH	TRL04	1
MORGAN JIM DANIEL	U	TRL04	1
NGUKIS DIDIMESH ASSE	U	TRL04	1
NICHOLAS SAMUKI PEARSON	U	TRL04	1
OSKAR LEWANDROWSKI	U	TRL04	2
PEO HENRY ZITHA	TVH	TRL04	3
SIMON FREDRICK NAAWI	TVH	TRL04	1
	U	TRL04	1
YACOBA WENA	U	TRL04	1
TOTAL			99

iii) No Previous Data-Types

SELLER-NAME	S-TYPE	RELATED-LOG	N-RECORDS
BANKS ROBINSON	TVH	TRL04	1
CONAHARY HIKAKOWA	TVH	TRL04	1
DANNY PRYCE	U	TRL04	1
EDDIE BOWIE	U	TRL04	1
JAMIE SINCLAIRE	U	TRL04	1
JOHN BAKER	TVH	TRL04	1
KINGSLEY JAMES TABUA	TVH	TRL04	1
MITCHELL KINGDON	U	TRL04	1
NELSON SOKI	TVH	TRL04	3
PETER JOHN CHIARELLI	U	TRL04	1
ROBERT MAST	TVH	TRL04	1
SHARN COHN DUFF	TVH	TRL04	1
TOM KINGDON	U	TRL04	2
WESLEY HAMON MATENGA	TVH	TRL04	1
TOTAL			17

iv) Mixed Data-Types

SELLER-NAME	S-TYPE	RELATED-LOG	N-RECORDS
ABDOULLA LENA PETROV	TVH	TRL04	1
ANDREW DARUA	U	TRL04	8
CHARLES MARTIN	TVH	TRL04	10
CHRISTOPHER DARUA	TVH	TRL04	3
DEREK WALTER JOHN BRANK	TVH	TRL04	7
EDWIN JOHN CLARK	TVH	TRL04	3
GEOFFREY DONALD MCKENZIE	U	TRL04	14
	TVH	TRL04	21
JACKSON DARRYL AHWANG	TVH	TRL04	1
JIMMY ATZENI	U	TRL04	9
JOSEPH PAUL BIN JUDA	TVH	TRL04	4
JUSTIN GILLIES	U	TRL04	1
KARA DAVE WARE	TVH	TRL04	1
LUKE S DILLON	TVH	TRL04	21
	U	TRL04	6
MATTHEW STEWART BRUCE	U	TRL04	10
	TVH	TRL04	29
MICHAEL JAMES LLOYD	TVH	TRL04	1
MICK GILLIS	U	TRL04	1
MIROSLAV VACULKA	U	TRL04	2
OMAR BIN DORAHO	TVH	TRL04	1
OWEN DORANTE	U	TRL04	1
PALA RUBU	TVH	TRL04	8
PALCON SARPE SAMAI	TVH	TRL04	1
PHILEMON ANSEY	TVH	TRL04	2
PHILLIP J HUGHES	TVH	TRL04	12
RICHARD EDGAR BILLY	TVH	TRL04	3
ROBERT EDWARD NEWIE	U	TRL04	1
ROBERT JOHN MAST	TVH	TRL04	1
ROBERT LESLIE SLYNEY	U	TRL04	2
RYAN A HUGHES	TVH	TRL04	8
STANLEY LAWRENCE ANSEY	TVH	TRL04	1
	U	TRL04	1
THOMAS FRANCIS FUJII	TVH	TRL04	14
TIBAU TOBY	TVH	TRL04	1
TY KINGDON	U	TRL04	6
TOTAL			216

7. Seller-Name

Application of Data-Rules #1-8D resulted in all 51,121 Docket-Book records being assigned one of the following three DATA-TYPEs: 1. 'PRC', 2. 'TVH' or 3. 'TIB.' However, a final check was undertaken to check the uniqueness of the SELLER-NAME and DATA-TYPE.

First, a check was undertaken of those SELLER-NAMES identified as TVH license holders based on referral to the public register of Torres Strait licenses but currently assigned the DATA-TYPE='TIB'. Based on this check, 68 records (all previously assigned under Data-Rule #6C, #8B or #8D) associated with the following SELLER-NAMEs (Kenneth J McKenzie, Like S Dillon, Matthew S Bruce, Phillip J Hughes, Ryan Hughes, Trent S Butcher and Wade Duff) were updated and re-assigned the DATA-TYPE='TVH' under Data-Rule #9A.

Second, a check was undertaken of those SELLER-NAMES identified as TVH license holders based on other information but currently assigned a DATA-TYPE='TIB'. Based on this check, an additional 24 records associated with the SELLER-NAMEs (Michael G Bruce, Geoffrey D McKenzie, Ty Kingdon and Miroslav Vaculka) were updated and re-assigned the DATA-TYPE='TVH' under Data-Rule #9A.

Third, similar check of SELLER-NAMES identified as TIB license holders but currently assigned a DATA-TYPE='TVH' resulted in 3 records associated with the SELLER-NAME (Kris Levi) updated and re-assigned the DATA-TYPE='TIB' under Data-Rule 9B.

Finally, after completing the previous updates, a check was undertaken to ascertain whether each SELLER-NAME had been assigned to a unique DATA-TYPE. Of the 1,105 unique SELLER-NAMES listed in the Docket-Book data (note, this list may contain misspelt names), all records associated with the majority (1,056, 95.4%) of SELLER-NAMEs were found to be associated with a unique DATA-

TYPE (i.e. 'PRC', 'TIB', or 'TVH), while 49 (4.4%) of SELLER-NAMES were associated with two DATA-TYPEs. A summary listing of these latter dual-assigned records is given in Table 18. In total there are 4,422 Docket-Book records associated with these 49 SELLER-NAMES with a corresponding 181.0 tonnes of catch (with 27.2 tonnes assigned to the TVH and 153.9 tonnes assigned to the TIB respectively) covering all years from 2004 to 2017.

Whether or not each SELLER-NAME should only be assigned to a unique DATA-TYPE remains unknown as it may be possible for a fisher to participant in each sector of the fishery. It is noted that of the SELLER-NAMEs with dual DATA-TYPEs, all were assigned to the DATA-TYPE='TVH' by Data-Rule 5A (c.f. Tables 8 & 9) which is based on the information that the vessel listed on the Docket-

Table 18. Listing by Seller-Name, of the Data-Rule, number of records and whole weight associated with the 51 Seller-Names associated with dual DATA-TYPE.

	DATA-RULE AND DATA-TYPE							
SELLER-NAME	DR-5A TVH	DR-5B TIB	DR-6A TIB	DR-6B TIB	DR-6C TIB	DR-7A TIB	DR-8D TIB	Number Records
ABDOULLA LENA PETROV	23	0	0	0	23	0	1	36
ALLAN MURPHY GARNIER	3	0	0	0	502	0	0	401
ANDREW DARUA	3	0	0	0	195	0	19	85
BILLY MOSES GULIGO	5	89	0	0	293	2	0	132
BRIAN NAMAI	8	0	0	0	8	0	0	7
CAIN ARTHUR DOYLE MAROU	4	0	0	0	61	0	0	35
CHARLES MARTIN	9	0	0	0	620	0	20	296
CHRISTOPHER DARUA	8	0	0	0	1	0	6	11
DAMAL BIN DORAHO	1	0	0	0	2	0	0	2
DEAN JUSTIN SALAM	13	0	0	0	365	0	0	216
DEREK WALTER JOHN BRANK	8	11	0	0	151	0	12	123
EDWIN JOHN CLARK	21	0	0	0	27	0	5	34
ENOCK CHARLIE	1	0	0	0	31	0	0	30
EVRARDUS KAISE	5	0	0	1	502	0	0	183
FAAFETAI NONA	2	0	0	0	438	0	0	174
HALEY ARTHUR BAIRA	1	0	0	0	5	0	0	6
JACKSON DARRYL AHWANG	9	13	0	0	55	0	2	44
JERRY SONGORO	2	151	0	0	392	0	0	240
JIMMY ATZENI	31	0	0	0	22	0	22	35
JOEL KAITAP AUDA	1	0	0	0	3	0	0	4
JOHN JOSEPH SABATINO	2	0	0	0	79	0	0	50
JOSEPH PAUL BIN JUDA	8	0	0	0	59	0	8	51
JULIUS JACK SOROGO	3	0	0	3	29	0	0	27
JUSTIN GILLIES	16	0	0	0	2	0	2	9
KARA DAVE WARE	1	0	0	0	10	0	1	12
MICHAEL GUY BRUCE	23	0	0	0	3	0	0	12
MICHAEL JAMES KEANE	16	6	0	0	51	0	0	48
MICHAEL JAMES LLOYD	11	0	0	0	1	0	1	9
MICK GILLIS	6	0	0	0	5	0	3	5
OLLIE ROBERT DEWIS	10	5	0	0	291	6	0	164
OMAR BIN DORAHO	1	0	0	0	1	0	1	3
OWEN DORANTE	3	0	0	0	462	0	2	260
PALA RUBU	41	739	0	0	688	2	11	591
PALCON SARPE SAMAI	1	0	0	0	2	0	1	3
PAUL SAYLOR	3	0	0	0	11	0	0	13
PHILEMON ANSEY	2	0	0	0	0	1	2	5
RICHARD ALTON NEWIE	8	0	0	0	17	0	0	14
RICHARD EDGAR BILLY	3	0	0	0	30	0	7	21
ROBERT CHARLES PEDDELL	2	0	0	0	477	0	0	247
ROBERT EDWARD NEWIE	41	0	0	0	89	0	3	62
ROBERT JOHN MAST	1	12	0	0	2	0	1	6
ROBERT LESLIE SLYNEY	36	0	0	0	4	0	4	17
RON SAILOR	1	0	0	0	19	0	0	11
ROY KIRK PEARCE	17	0	0	0	77	0	0	56
SCOTTY G RONSON	2	0	0	0	2	0	0	2
STANLEY LAWRENCE ANSEY	138	0	9	0	306	0	5	230
THOMAS FRANCIS FUJII	136	410	4	0	325	7	27	394
THOMAS GAMIA	3	0	0	0	4	0	0	3
TIBAU TOBY	1	0	0	0	1	0	1	3
TOTAL	694	1,436	13	4	6,743	18	167	4,422

Book was a TVH vessel. If one assumes that the vessel listed on the Docket-Book is correct, then it would appear that all SELLER-NAMEs listed in Table 18 have at some time sold catch caught as part of a TVH operation. As noted previously, there are situations where a TIB seller will work on a TVH vessel for a number of weeks and then decide to leave and work on a TIB dinghy or work in between TVH trips. However, also associated with these same SELLER-NAMEs are 86 vessels listed on the Docket-Book which are assigned to the TIB component of the fishery. Note, only 25% of the records (and 32% of the associated catch) listed in Table 18 have a vessel symbol listed on the corresponding Docket-book record. Until this situation can be further clarified, the DATA-TYPE of each record was maintained.

8. Data for Processor 'A'

As mentioned previously in Section 2, between 2013 and 2016 two processors provided aggregate annual data rather than recording the landed catch in the TDB01 Docket-Book. These records are assigned the DATA-TYPE='TIB' under Data-Rule #2. However, for one of these processors (called processor 'A' in the following) a check of the Docket-Book data for these years indicated that there were records where the Client was listed as this processor (c.f. Table 19).

Before 2012 the annual catch estimated from the Docket-Book records where processor 'A' was listed as a Client and the assigned DATA-TYPE='TIB' was generally between 89% and 147% of the average catch received during the period 2004-11. (Note, to avoid reporting the actual catch weight, all catches are represented as the percentage of the average catch during this period). However, Docket-Book receipts decreased substantially (averaging 13% of the catch received in 2004-11) during the period 2013-16 when Aggregate Catch data were provided by the processor directly to AFMA. Nevertheless, adding together the Docket-Book receipts and the Aggregate Catch during these four years indicates that the annual total catch was generally within the range (i.e. between 72% and 138%; average of 107%) of the average annual catch during period 2004-11. However, it remains unknown whether the Docket-Book data for the years 2013-16 are also contained in the Aggregate Data. If they are, then these catches should be removed as duplicates. Further work is required to clarify this.

Finally, it can also be noted that the total catch sold to processor 'A" and assigned to the TIB fishery in 2012 is very small: only 7% of the average during 2004-11. This suggests that the Docket-Book data is likely to be incomplete and that perhaps Aggregate Data for this year still needs to be obtained from this processor. Further work is also required to clarify this.

Table 19. Annual summary of total catch (expressed as a percentage of the average catch over the years 2004-11) assigned to processor 'A' as (i) the Client in the Docket-Book data where the DATA-TYPE='TIB', or (ii) added as additional aggregate data provided by AFMA (and initially received from this processor).

YEAR	Docket-Book Data	Aggregate Data	TOTAL
2004	147%	0%	147%
2005	108%	0%	108%
2006	47%	0%	47%
2007	116%	0%	116%
2008	107%	0%	107%
2009	91%	0%	91%
2010	95%	0%	95%
2011	89%	0%	89%
2012	7%	0%	7%
2013	4%	68%	72%
2014	6%	82%	88%
2015	36%	95%	130%
2016	7%	131%	138%
2017	45%	0%	45%

9. Data-Rules for assigning Data-Type to Docket-Book data

As noted in the Introduction, use of the RELATED-LOG field on the Docket-Book and the creation of the SELLER-TYPE field by AFMA both have utility in helping to identify duplicate catch records in the Docket-Book data. For example, if a seller has been designated as a TVH SELLER-TYPE (and the corresponding vessel as a TVH-Vessel) and the catch has also been reported in the TRL04 logbook then the data listed in the Docket-Book can be interpreted as a duplicate of a catch record associated with the TVH sector. However, as detailed in the previous sections for a large number of records the information within these two fields (i.e. SELLER-TYPE and RELATED-LOG) is missing (unknown) or some of the information is contradictory (e.g. the vessel associated with a TVH seller is not listed in the TVH database).

Given this uncertainty, it is considered prudent to identify a number of data rules for classifying the data as either TIB sector, TVH sector or trading of catch between processors. Once these rules are established, and unless new information comes to hand, they can then be used consistently each year for this task so that new data rules are not created each year on an 'ad-hoc' basis. Based on the analysis outlined in this report, the annual allocation of Docker-Book records currently held by CSIRO, and the associated catch to either the TIB or TVH sectors of the fishery or between processors, is shown in Table 20.

The corresponding DATA-RULES identified in the analysis for allocating each Docket-Book record with a specified DATA_TYPE are listed in Table 21, while a summary, by year, of the number of the number of records and catch associated with each of the DATA-RULES are listed are shown in Tables 22a&22b.

Table 20 Annual summary of (a) the number of records and (b) the corresponding catch associated with each of the DATA-TYPES identified in the data-rules listed in the text.

(a) Number of Records

YEAR	TIB	TVH	PRC	TOTAL
2004	4651	51	0	4702
2005	6671	43	0	6714
2006	4085	28	0	4113
2007	5939	73	19	6031
2008	4870	111	52	5033
2009	3635	0	0	3635
2010	3026	3	72	3101
2011	2958	0	0	2958
2012	1352	252	78	1682
2013	938	262	92	1292
2014	2523	245	85	2853
2015	2475	124	64	2663
2016	2806	60	30	2896
2017	3228	160	15	3403
Total				51,076

(b) Whole Weight (tonnes)

YEAR	TIB	TVH	PRC	TOTAL
2004	232	9	0	241.03
2005	359	12	0	370.01
2006	147	2	0	148.82
2007	259	4	14	278.43
2008	184	4	33	222.39
2009	144	0	0	143.86
2010	141	1	49	190.73
2011	200	0	0	201.17
2012	137	315	203	654.19
2013	91	296	150	536.24
2014	137	225	168	530.76
2015	121	110	125	355.91
2016	118	172	162	452.67
2017	107	127	64	296.92
Total				4623.13

Table 21. Listing of the Data-Rules used in assigning a DATA-TYPE for each record within the Dock-Book data.

RULE	DATA-TYPE	DATA-RULE	N-RECORDS	WHOLE WEIGHT
1	TIB	Records where large TIB vessels recorded their catch in the TVH-TL04 logbook	713	92,800
2	TIB	Annual aggregate data provided by processors in lieu of data not recorded in TB01 Docket-book	10	346,357
3	Processor	Docket-Book records where is Seller-Type = 'PRC'. Also includes data for Pearl Island Seafoods, Argun Seafoods and Trdewinds Seaffods where Seller-Type is Unknown.	507	967,954
3A	TIB	Docket-Book records where is Seller-Type = 'PRC' and Seller-Name='Joseph Dai'	1	10
3B	TVH	Docket-Book records where is Seller-Type = 'PRC' and Seller-Name='Miroslav Vaculka'	6	454
4A	TVH-Business	Docket-Book records where is Seller-Name is a business name associated with the TVH fishery.	507	1,009,847
4B	TIB-Business	Docket-Book records where is Seller-Name is a business name associated with the TIB fishery.	53	30,240
5A	TVH	Unassigned Docket-Book records where is Seller-Type in ('TVH' ,'U') and the Vessel-Symbol is identified as a TVH vessel.	648	190,662
5B	TIB	Unassigned Docket-Book records where is Seller-Type = 'TIB'	4,017	154,348
6A	TIB	Unassigned Docket-Book records where is Related-Log = 'TRL04' and the Vessel-Symbol is a TIB vessel	50	14,079
6B	TIB	Unassigned Docket-Book records where is Related-Log != 'TRL04'	152	24,917
6C	TIB	Unassigned Docket-Book records where is Related-Log = 'U' and Vessel-Symbol is null (i.e. not TVH or F-Symbol)	43,642	2,003,964
7A	TIB	Unassigned Docket-Book records where is Vessel-Type = 'F-Symbol' and Vessel-Symbol not in ('FXYC', 'FWED').	373	38,909
7B	TVH	Unassigned Docket-Book records where is Vessel-Type = 'F-Symbol' and Vessel-Symbol in ('FXYC', 'FWED').	11	18,486
8A	TVH	Unassigned Docket-Book records where is Vessel-Symbol is not null and is considered a TIB vessel	24	20,890
8B	TIB	Unassigned Docket-Book records where is Seller-Name is uniquely associated with either the TIB or TVH fishery.	88	10603.38
8C	TVH	Unassigned Docket-Book records where is Seller-Name is not assigned under 8A or 8B and known TVH Seller	125	25659.17
8D	TIB	Unassigned Docket-Book records where is Seller-Name is not assigned under 8A, 8B or 8C	100	9700.61
9A	TVH	Re-assignment of Docket-Book records where Seller-Name associated with owner of a known TVH vessel	91	10888.87
9B	TIB	Re-assignment of Docket-Book records where Seller-Name associated with owner of a known TIB vessel	3	256
			51,121	4,971,025

Table 22a Annual summary of the number of records associated with each of the DATA-RULES identified in the data-rules listed in the text.

YEAR	DR_1	DR_2	DR_3	DR_3A	DR_3B	DR_4A	DR_4B	DR_5A	DR_5B	DR_6A	DR_6B	DR_6C	DR_7A	DR_7B	DR_8A	DR_8B	DR_8C	DR_8D	DR_9A	DR_9B	TOTAL
Sector	TIB	TIB	PRC	TIB	TVH	TVH	TIB	TVH	TIB	TIB	TIB	TIB	TIB	TVH	TVH	TIB	TVH	TIB	TVH	TIB	
2004	0	0	0	0	0	1	0	50	0	0	46	4428	115	0	0	39	0	23	0	0	4,702
2005	0	0	0	0	0	0	0	43	0	0	0	6513	151	0	0	0	0	7	0	0	6,714
2006	0	0	0	0	0	0	1	26	0	0	1	3958	84	0	2	11	0	30	0	0	4,113
2007	0	0	19	0	0	0	0	73	0	1	5	5894	23	0	0	5	0	10	0	1	6,031
2008	114	0	52	0	0	0	0	111	0	6	0	4746	0	0	0	2	0	1	0	1	5,033
2009	95	0	0	0	0	0	0	0	0	0	6	3534	0	0	0	0	0	0	0	0	3,635
2010	62	0	72	0	0	2	3	1	115	9	32	2796	0	0	0	5	0	3	0	1	3,101
2011	9	0	0	0	0	0	4	0	0	3	0	2940	0	0	0	1	0	1	0	0	2,958
2012	167	0	78	0	0	164	15	50	0	13	0	1151	0	11	13	4	12	2	2	0	1,682
2013	175	0	92	0	0	94	12	147	33	14	0	696	0	0	9	4	4	4	8	0	1,292
2014	32	0	85	1	0	92	10	137	87	3	2	2378	0	0	0	4	6	6	10	0	2,853
2015	25	0	64	0	6	69	5	0	338	1	28	2062	0	0	0	4	23	12	26	0	2,663
2016	0	0	30	0	0	48	3	0	1497	0	32	1269	0	0	0	4	8	1	4	0	2,896
2017	0	0	15	0	0	37	0	10	1947	0	0	1276	0	0	0	5	72	0	41	0	3,403
Total																					51,076

Table 22b Annual summary of the corresponding catch (whole weight, tonnes) associated with each of the DATA-RULES identified in the data-rules listed in the text.

YEAR	DR_1	DR_2	DR_3	DR_3A	DR_3B	DR_4A	DR_4B	DR_5A	DR_5B	DR_6A	DR_6B	DR_6C	DR_7A	DR_7B	DR_8A	DR_8B	DR_8C	DR_8D	DR_9A	DR_9B	TOTAL
Sector	TIB	TIB	PRC	TIB	TVH	TVH	TIB	TVH	TIB	TIB	TIB	TIB	TIB	TVH	TVH	TIB	TVH	TIB	TVH	TIB	
2004	0	0	0	0	0	3	0	6	0	0	3	207	19	0	0	1	0	2	0	0	241.03
2005	0	0	0	0	0	0	0	12	0	0	0	345	12	0	0	0	0	2	0	0	370.01
2006	0	0	0	0	0	0	1	1	0	0	0	138	5	0	1	1	0	2	0	0	148.82
2007	0	0	14	0	0	0	0	4	0	0	2	251	3	0	0	2	0	1	0	0	278.43
2008	10	0	33	0	0	0	0	4	0	0	0	174	0	0	0	0	0	0	0	0	222.39
2009	8	0	0	0	0	0	0	0	0	0	2	134	0	0	0	0	0	0	0	0	143.86
2010	6	0	49	0	0	1	3	0	6	0	17	108	0	0	0	1	0	0	0	0	190.73
2011	1	0	0	0	0	0	2	0	0	0	0	197	0	0	0	0	0	0	0	0	201.17
2012	29	0	203	0	0	258	5	22	0	5	0	97	0	18	12	1	4	0	1	0	654.19
2013	34	0	150	0	0	174	8	109	2	7	0	40	0	0	9	0	3	0	1	0	536.24
2014	2	0	168	0	0	186	6	31	3	2	0	124	0	0	0	0	4	0	4	0	530.76
2015	1	0	125	0	0	103	5	0	11	0	1	101	0	0	0	1	5	1	2	0	355.91
2016	0	0	162	0	0	170	1	0	67	0	1	48	0	0	0	1	2	0	0	0	452.67
2017	0	0	64	0	0	115	0	1	66	0	0	40	0	0	0	1	8	0	3	0	296.92
Total																					4,623.1

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
Draft TRL Fishery Harvest Strategy	Agenda Item For Discussion and Advice

RECOMMENDATIONS

1. **NOTE** that the Torres Strait Tropical Rock Lobster Working Group (TRLWG) considered the draft TRL Harvest Strategy at its meeting on 25 & 26 July 2017 (meeting number 6).

2. **NOTE** the TRLWG recommended that further work be undertaken by the TRLWG and TRLRAG to examine possible options for applying a management trigger under the harvest strategy as the stock approaches the limit reference point to minimise the impacts on traditional inhabitant commercial fishers.

3. **DISCUSS** and **PROVIDE ADVICE** on the likely monitoring and assessment requirements to support a management trigger under the harvest strategy as the stock approaches the limit reference point. This advice should include as far as possible, the likely costs of any additional monitoring and/or assessment work.

4. **NOTE** that this item was tabled with the RAG at meeting no. 21 on 12-13 December 2017. The TRLRAG agreed defer discussion to the next RAG meeting scheduled for March 2018 due to a lack of time to present and discuss the agenda item.

KEY ISSUES

5. The Torres Strait Tropical Rock Lobster Working Group (TRLWG) considered the draft TRL Harvest Strategy at its meeting on 25 & 26 July 2017 (**Attachment A**).

6. The Working Group recommended that further work be undertaken by the Working Group and RAG to examine possible options for including social and/or economic objective in the draft harvest strategy and applying a management trigger under the harvest strategy as the stock approaches the limit reference point to minimise the impacts on traditional inhabitant commercial fishers.

7. Some TRLWG members recommended that the reduction of catch under the draft harvest strategy as the stock biomass move towards the limit reference point should not be uniform across the TIB and TVH sectors. Rather, a trigger point should be included in the draft HS before the limit reference point, at which point priority is given for fishing to the TIB sector over the TVH sector.

8. The Working Group Fisheries Economist noted another option might be to restrict the Fishery to free dive only if a certain trigger point was reached.

9. To assist the TRLWG further examine the cost and benefits of such an approach against objectives of the *Torres Strait Fisheries Act 1984*, RAG advice is sought on the likely:

    a. data and assessment requirements to support the proposed management trigger;

    b. impediments, if relevant, to meeting the data and assessment requirements; and

    c. costs of any new data and assessment requirements.

10. A copy of the draft harvest strategy is at **Attachment B**.

BACKGROUND

11. The draft TRL Harvest Strategy was developed in consultation with the RAG over its last three meetings (meeting no. 18 on 2 3 August 2016; meeting no. 19 on 13 December 2016 and meeting no. 20 on 4 5 April 2017).
12. The draft TRL Harvest Strategy was developed to take into account key fishery specific attributes including:
    a. there is potential for large, unpredictable inter-annual variations in availability and abundance of tropical rock lobster (TRL);

    b. TRL is a shared resource important for the traditional way of life and livelihood of traditional inhabitants, commercial and recreational sectors (RAG, 4-5 April 2017); and

    c. advice from the RAG industry members to maintain stock abundance at recent levels (2005-2015) (RAG, 31 March 2016).

13. The RAG recommended harvest strategy objectives that place greater emphasis on the on the importance of the Fishery for traditional way of life and livelihood of traditional inhabitants. The operational objectives of the Harvest Strategy are to:

    a. Maintain the stock at (on average), or return to, a target biomass point B_{TARG} equal to recent levels (2005-2015) that take account of the fact that the resource is shared and important for the traditional way of life and livelihood of traditional inhabitants and is biologically and economically acceptable.

        - The agreed B_{TARG} is more precautionary than the default proxy B_{MEY} (biomass at maximum economic yield) level as outlined in the Commonwealth Harvest Strategy Policy and Guidelines 2007 (HSP).

    b. Maintain the stock above the limit biomass level (B_{LIM}), or an appropriate proxy, at least 90 per cent of the time.

        - The agreed B_{LIM} is more precautionary than the default proxy HSP B_{LIM}.

c. Implement rebuilding strategies, if the spawning stock biomass is assessed to fall below B_{LIM} in two successive years.

14. The TRLWG considered the draft TRL Harvest Strategy at its meeting on 25 & 26 July 2017 (meeting number 6). Having regard for the comments by members the Working Group:

- **Recognised** that the draft harvest strategy is:
  - designed to inform management decisions for the Torres Strait TRL Fishery;
  - is based on robust fishery independent survey data and stock assessment process;
  - treats the TRL Fishery as a single stock;
  - does not take into account recreational catches on the basis of TRLRAG advice that catches are likely low; and
  - has been subject to rigorous performance testing by the TRLRAG.

- **Recognised** that whilst there may be uncertainty in the level of connectivity between the east coast and Torres Strait TRL stocks, the draft TRL harvest strategy uses the best available data including annual fishery independent survey data, to recommend annual total allowable catches. Future work such as the recently funded larval advection modelling project is likely to improve our understanding of stock connectivity overtime.

- **Requested** (**Action Item 4**) the following be presented at the next TRLWG meeting: a) an overview of the current understanding of stock connectivity between the east coast and the Torres Strait TRL Fishery; and b) the basis for the Queensland east coast TAC.

- **Recommends** that work should continue to examine whether there are cost-effective options for improving estimates of recreational catches in the region;

- **Recommends** that the PZJA work closely with both the Queensland and PNG Governments to ensure complementary management arrangements are adopted in the event that the TRL stock biomass falls below the limit reference point.

- **Recommends** that further work be undertaken by the TRLWG and TRLRAG to examine possible options for including social and/or economic objective in the draft Harvest Strategy and applying a management trigger under the harvest strategy as the stock approaches the limit reference point to minimise the impacts on traditional inhabitant commercial fishers.

ATTACHMENTS

A. Torres Strait Tropical Rock Lobster Working Group meeting record number 6, 25-26 July 2017.

B. Draft Torres Strait Tropical Rock Lobster Fishery Harvest Strategy.

Torres Strait Tropical Rock Lobster Working Group

Meeting Record 6

25 & 26 July 2017

In-session meeting

Note all meeting papers and record available on the PZJA webpage:

www.pzja.gov.au

Australian Government

Australian Fisheries Management Authority

Box 7051, Canberra Business Centre, ACT 2610 / Ph (02) 6225 5555 / Fax (02) 6225 5500 / AFMA Direct 1300 723 621 afma.gov.au

Contents

Meeting participants

Members

Name	Position	Declaration of interest
Alexander Morison	Chair	Nil Member of other MAC's and RAG's.
Dean Pease	AFMA Executive Officer	Nil
Selina Stoute	AFMA Member	Nil
John Ramsay[1]	TSRA Member	Nil
Tom Roberts	Queensland Fisheries	Nil
Darren Dennis	Independent Scientific Member	Nil Previously involved in research projects
Aaron Tom	Industry Member	Wishes to own his own fishing boat and employ crew.
Mark David	Industry Member	TIB licence holder
Terrence Whap	Industry Member	Nil
Luke Dillon[2]	Industry Member	TVH licence holder
Mark Dean[3]	Industry Member	TVH operator
Daniel Takai[4]	Industry Member	Pearl Island Seafood, Tanala Seafood and TIB licence holder
Ian Liviko	(PNG NFA)	Nil
Sevaly Sen	Fisheries Economist	Conducts various FRDC research projects relevant to AFMA fisheries.

1: not in attendance for Agenda Item 4.
2. attended day one only.
3. attended day one and until 11am on day two.
4: attended day two only.

Observers

Name	Position	Declaration of interest
Jerry Stephen	TSRA Deputy Chair TSRA Fisheries Portfolio	TIB licence holder, Native title holder of Ugar.
Charles David	TSRA	Nil
Mariana Nahas	TSRA	Nil
Thomas Namoa	Industry	TIB licence holder
Graham Hirakawa	Industry	TIB licence holder
Maluwap Nona	Chairperson Malu Lamar	TIB licence holder
Harry Nona	Industry	TIB licence holder
Phil Hughes	Industry	TVH licence holder
Brett Arlidge	Industry	General Manager M G Kailis Pty Ltd, holder of TVH licences

[1] Attended the meeting on day two only.

Action items and recommendations

Action Items

Number	Action
1.	Malu Lamar (RNTBC) to provide the Working Group with maps of home reefs for Torres Strait Island communities.
2.	AFMA to provide the objectives of the *Fisheries Management Act 1991* and the *Torres Strait Fisheries Act 1984* to Working Group members and observers.
3.	Malu Lamar (RNTBC) to provide AFMA with a written proposal for any further proposed amendments to the *Torres Strait Fisheries Act 1984.*
4.	The following be presented at the next TRLWG meeting: a) an overview of the current understanding of stock connectivity between the Queensland East Coast and the Torres Strait TRL Fisheries; and b) the basis for the Queensland east coast TAC.

Recommendations

Number	Action
1.	Work should continue to examine whether there are cost-effective options for improving estimates of recreational catches in the region
2.	The PZJA work closely with both the Queensland and PNG Governments to ensure complimentary management arrangements are adopted in the event that the TRL stock biomass falls below the limit reference point.
3.	Further work be undertaken by the TRLWG and TRLRAG to examine possible options for applying a management trigger under the harvest strategy as the stock approaches the limit reference point to minimise the impacts on traditional inhabitant commercial fishers.

Agenda Item 1 - preliminaries

1.1 & 1.2 Apologies / adoption of agenda / declaration of interest

Apologies were received from two industry members. Phillip Ketchell was an apology for the entire meeting and Daniel Takai for day one only. The Working Group also noted an apology from Patrick Mills, Chairperson of the Torres Strait Fisher's Association who was planning to attend the meeting as an Observer.

The Working Group adopted the agenda with no changes and noted written advice from Phillip Ketchell would be tabled at Agenda Item 4.

The Chair noted that there could be potential conflicts of interest for members and observers when providing information and advice on some agenda items. These conflicts should be tabled by members and observers. The Chair noted that the Working Group is a consultative forum of the PZJA that provides advice on the management of the TRL Fishery. The Working Group is not a decision making body.

Representation at meetings

One industry observer noted that the representative for Kaiwalagal (the inner cluster of islands including Thursday Island and Horn Island) had been absent from a number of TRL Resource Assessment Group (RAG) and Working Group meetings. As a result, local industry feel they are not being adequately represented at TRLRAG and Working Group meetings. Preferably proxies should attend if a members cannot.

The AFMA member noted that members are expected to attend meetings and that every effort is made to ensure meeting dates correspond with the availability of members. AFMA will continue to work with members to ensure they can participate and where necessary, confirm whether they are able to continue in the role. Proxies are not used however observers are welcome to attend meetings.

The AFMA member noted the consultative forum representatives were nominated at a meeting on Horn Island in 2015 comprising over 60 stakeholders from across the region. With current appointments due to end this financial year, AFMA welcomes advice on alternative processes for nominating members.

One member raised concern with being referred to as an industry member rather than an island cluster representative. The AFMA member noted that future records can make clear the cluster group from which each member was nominated.

The Chair noted that representatives are bound by Fisheries Management Paper Number One **(Attachment A)** and the role of members is to act in the best interest of the Fishery rather than to advocate for a specific sector of the Fishery. The Chair noted that if there are different views of members they are recorded in the meeting record.

1.3 Action items from previous meetings

The Working Group noted progress against action items from previous meetings. The list of action items and progress is provided in **Attachment B**.

Recreational fishing rules

The Working Group noted an update on the recreational fishing rules for TRL that apply in the Torres Strait Protected Zone as detailed the paper provided **(Action Item 9)**.

Some members noted that the amount of recreational catch is unknown and that work should be undertaken to estimate the recreational take of TRL. The QDAF member noted that a Queensland recreational fishing survey had been undertaken, however there was only one respondent for the Torres Strait and therefore the data provided could not be considered sufficient to be representative of all recreational fishing the region.

Working Group membership

The Chairperson for Malu Lamar (RNTBC) stated that Malu Lamar will not support any recommendation from the Working Group unless Malu Lamar (RNTBC) is recognised as a formal member of the group.

The Working Group noted advice that AFMA was progressing both Malu Lamar's and the TSRA Fisheries Portfolio member's request to become a member on all PZJA consultative forums.

Agenda Item 2 - updates

2.1 Industry

The Working Group noted the following updates provided by industry members and observers:

- Catches have been generally down however there has been some improvement in the months of June and July. The sand inundation of reefs surrounding Mabuiag including Beka Reef have started to clear and seagrass coverage around this area is increasing. The average size of TRL is slightly larger compared to last year.
- Catches around the inner cluster (Thursday Island) have been poor all season. It has not been worthwhile to use a big boat (primary/tender operation). Instead it has been more feasible to fish locally by dinghy.
- It is difficult for members to pass on the information of the RAG and Working Group meetings because the information is complex and the language used in meetings can be difficult to translate to something that is easy to understand and can be shared with fishers.
- Fishers from Iama are again reporting that hookah diving on top of the reef at Warrior and Dungeness reefs is continuing and this has an impact on the local Iama free dive fishers.

Fishing community home reefs

The Working Group noted advice from some industry members that communities continue to see transferrable vessel holder (TVH) operators diving their home reefs. This is of great concern to the communities and shows that the 'gentlemen's agreements' are not effective.

The Malu Lamar (RNTBC) Chairperson stated that home reefs should not be dived by the TVH sector and should be left for the local TIB fishers of that community. Malu Lamar (RNTBC) is currently undertaking a project to map the home reefs of Torres Strait communities and will work with the TVH sector to develop new agreements.

The Working Group noted and welcomed advice from both the Malu Lamar Chairperson and TVH industry members that they will work collaboratively with each other to develop agreements to address community concerns. It was noted that any such agreements could be the basis for an industry code of practice.

The AFMA member noted that upon request, AFMA could support future industry discussions by adjusting industry member travel arrangements alongside PZJA consultative forum meetings.

Action Item 1: Malu Lamar (RNTBC) to provide the Working Group with maps of home reefs for Torres Strait Island communities once finalised.

2.2 AFMA

The Working Group noted the updates provide by the AFMA member as detailed the agenda paper provided. The Working Group discussed the following updates:

Legislative amendments – Torres Strait Fisheries Act 1984

The PZJA has approved for AFMA to request legislative drafters to prepare draft amendments to the *Torres Strait Fisheries Act 1984*, including to allow for mandatory reporting by the TIB sector in the form of a daily fishing log. The drafting will provide the basis for consultation with the communities, industry members and the PZJA consultative forums.

- One industry observer noted that daily fishing logs may not be supported by the TIB sector, and it is preferred for reporting to be mandatory for seafood buyers and processors. TIB fishers don't want complicated rules, they just want to go fishing.

- One industry member suggested that a survey should be sent to each TIB licence holder questioning whether they support or do not support the introduction of mandatory daily fishing logs for the TIB sector.

- The Chairperson for Malu Lamar (RNTBC) noted that mandatory daily fishing logs for the Hand Collectable Fishery targeting bech de mer (BDM) would help support industry to develop the fishery. The Chairperson noted that some species are at risk of overfishing and that accurate catch reporting will be important for the sustainable management of the Fishery.

- The Fisheries Portfolio Member advised that the TIB sector will be discussing these issues in the near future, the sector should create another forum to consider these issues as a collective group and take relevant matters to the PZJA for consideration.

Amendment to the Commonwealth Fisheries Management Act 1991

Amendments to the Commonwealth *Fisheries Management Act 1991* have been proposed to require AFMA to have regard to interests of indigenous and recreational fishers.

The Chairperson for Malu Lamar (RNTBC) requested that a similar review be undertaken of the *Torres Strait Fisheries Act 1984* to check that the interests and recognition of indigenous fishers in the Torres Strait is consistent with the *Fisheries Management Act 1991*.

Action Item 2: AFMA to provide the objectives of the *Fisheries Management Act 1991* and the *Torres Strait Fisheries Act 1984* to Working Group members and observers.

Action Item 3: Malu Lamar (RNTBC) to provide AFMA with a written proposal for any further proposed amendments to the *Torres Strait Fisheries Act 1984.*

2.3 QDAF

The Working Group noted the Queensland Governments *Sustainable Fisheries Strategy* as detailed in the agenda paper and the following updates from the QDAF member:

- Queensland Boating and Fisheries Patrol has undertaken a recruitment round for 20 more fisheries patrol officers for Queensland;
- the Queensland East Coast Tropical Rock Lobster Working Group is likely to be re-established; and
- the Queensland East Coast TRL Fishery has had a very good season with the total allowable catch (195 tonnes) likely to be fully caught by 1 August 2017. Note on 7 September 2017 193.6 t of the 195 t TAC was taken.

2.4 TSRA

The Working Group noted the updates below provided by the TSRA member.

TSRA New Zealand study tour

- The TSRA recently visited New Zealand to learn about the Maori experiences with managing their traditional and commercial fishing interests;
- The TSRA Board will be briefed on the outcomes of the study tour at its meeting in September 2017;
- TSRA is planning to convene a Fisheries Symposium with stakeholders following the TSRA Board meeting to discuss both the study tour and how the TIB may benefit from the Maori experience. The TSRA Portfolio Member noted October or November would be suitable for industry members because it is during the Fishery closure;
- The TSRA can provide resources to establish community economic zones throughout the Torres Strait but ultimately it is up to Traditional Owners to determine how long this process will take.

Additional Government funding for TSRA

- The TSRA has been successful with recent funding bids for the region. The TSRA will receive $16.75 million in new funding this financial year. Of that amount $6 million is to be used for a landing jetty on Prince of Wales with the remainder ($10.75 million) to be used to buyback fishing licences and invest in fisheries infrastructure.
- TSRA has commissioned an audit of fisheries infrastructure across all Torres Strait Island communities. The audit will identify what infrastructure is needed and how money should be invested to support development of fisheries in the region. Infrastructure needs will be considered broadly and could be anything including fuel bowsers, upgrading or building processing facilities and live holding tanks.

Expression on interest to lease TRL TVH licence held by TSRA

- The TSRA Board has agreed to lease-out one of the TVH primary/tender licence packages recently purchased by the TSRA for the 2017/18 fishing season. Expressions of interest will be sought with only Traditional Inhabitants being eligible to apply in the first instance.
- In making its decision the TSRA Board considered three options: (1). lease back to the TVH sector; (2). lease only to the traditional Inhabitants; and (3): retire the licence package. Leasing to a traditional inhabitant would give the licence holder the flexibility to crew the fishing boat with non-traditional inhabitants.
- One industry observer advised that he did not support the leasing-out of the TVH licence. Instead, in his view, the TVH licence should be retired.

2.5 Malu Lamar (RNTBC)

The Working Group noted the following updates from the Malu Lamar (RNTBC) Chairperson:

- in his capacity as Malu Lamar Chairperson, he had also been invited by the TSRA to attend the New Zealand study tour to meet with the Maori and learn from their fisheries experiences. The Maori agreed to provide assistance to Torres Strait Islanders in developing Torres Strait Fisheries;
- Malu lamar is aiming to establish a company two months from now;
- it is Malu Lamar’s aim to empower TIB fishers across the board; and
- Malu lamar is looking forward to engaging with MG Kalis Pty Ltd and others and noted how the New Zealand Iwi work collaboratively across all sectors.

Agenda Item 3 - TRL Harvest Strategy

The Working Group noted the final draft TRL Harvest Strategy recommended by the TRL Resource Assessment Group (TRLRAG) as detailed in the Agenda Item paper and presented by the AFMA Executive Officer. A summary of the presentation is provided below.

Draft TRL harvest strategy recommended by the TRLRAG

- The draft Harvest Strategy (HS) sets out the pre-agreed management actions needed to achieve the Fishery objectives. The HS uses an empirical harvest control rule (eHCR) to determine a recommended biological catch (RBC).
- The major differences between the draft HS compared to the current interim Harvest Strategy are:
    - The draft HS uses an eHCR to calculate the RBC, while the interim HS uses an annual stock assessment to calculate the RBC. The draft HS applies a stock assessment on a three year cycle to review and evaluate performance of the eHCR and check the status of the resource.
    - The draft HS has a suite of pre-agreed decision rules that are designed to maintain the stock on average at the target biomass reference point (B_{TARG}) and to rebuild the stock if it breaches the biomass limit reference point (B_{LIM}) in two successive years. The draft HS B_{TARG} and B_{LIM} are more precautionary than the default Commonwealth Harvest Strategy Policy reference points.
    - The draft HS objectives have been developed to (a) place greater emphasis on the importance of the Fishery to the traditional way of life and livelihood of traditional inhabitants; and (b) maintain the stock on average at a target biomass level equal to recent years (2005-2015).
- The eHCR uses a regression of the 5 last year's data for the pre-season survey index of abundance of juvenile 1+ TRL (weighting 70%); newly recruited 0+ TRL (weighting 10%); the catch per unit effort (CPUE) indices for the TIB sector (weighting 10%) and CPUE indices for the TVH sector (weighting 10%).
- The draft HS decision rules are:
    - **Maximum catch limit** - The eHCR includes a maximum catch limit of 1000 t. Once the HS is implemented the cap will be reviewed after three years using MSE testing with the updated stock assessment model.
    - **Pre-season survey trigger** - If in any year the pre-season survey +1 indices is 1.25 or lower (average number of +1 age lobsters per survey transect) it triggers a stock assessment.
    - **Biomass limit reference point triggered** - If the eHCR limit reference point is triggered in the first year, a stock assessment update must be conducted in March.

- ❖ If after the first year the stock is assessed below the biomass limit reference point, it is optional to conduct a mid-season survey, the pre-season survey must continue annually.

- ❖ If the eHCR limit reference point is triggered two years in a row, a stock assessment must be conducted in December (of the second year).

- **Fishery closure rules** - If the stock assessment determines the stock to be below the biomass limit reference point in two successive years, the Fishery will be closed to commercial fishing.

  - ❖ Management strategy evaluation (MSE) testing of the eHCR has shown that it is extremely unlikely (<1%) for the Fishery to be closed based on its current performance.

- **Re-opening the Fishery** - Following closure of the Fishery, fishery-independent mid-season and pre-season surveys are mandatory. The Fishery can only be re-opened when a stock assessment determines the Fishery to be above the biomass limit reference point.

- Based on the decision rules, there are four alternative possible scenarios that may occur under the application of the eHCR. Graphic representations of the four scenarios were presented to the Working Group **(Attachment C)**.

Comments and advice from Working Group members

1. *Impacts of the East Coast TRL Fishery on the robustness of the harvest strategy*

- Concerns were raised by some members that the impacts of the east coast fishery are not properly taken into account in the harvest strategy. Specifically the impact from how much is caught and when. With the east coast fishery season opening a month earlier (January) concerns were raised that the fishery may be having a bigger impact on spawning by catching berried females.

- Some members raised concerns that if the Torres Strait TRL Fishery is closed because it breaches the limit reference point (B_{LIM}) in two successive years then the Queensland East Coast TRL Fishery and the Papua New Guinea TRL Fishery should also be closed. It was recommended by some member that the PZJA write to the Queensland Minister requesting that they close the east coast fishery in the event that the Torres Strait fishery has to be closed.

- Some members noted that the Torres Strait Fishery is the only fishery conducting fishery independent surveys to determine the status of the resource and estimate a TAC. Some members remain concerned that the East Coast TAC is not based on good science.

- The QDAF member advised that an East Coast TRL Harvest Strategy will be developed as part of the Queensland Government's recently announced reform process.

- The AFMA member noted that the PZJA works with both the PNG Government and QDAF to develop complementary arrangements including Harvest Strategies. For the purposes of the Protected Zone, AFMA will formally seek support from the PNG-National Fisheries Authority on the Harvest Strategy through the Australia and PNG Fisheries Bilateral process under the Treaty.

- The Working Group noted that TRL is a shared stock with the QLD East Coast Fishery however the level of connectivity is uncertain. Irrespective of this uncertainty however the Working Group noted that the pre-season survey provides good data on the level of recruitment to the Torres Strait TRL Fishery and that the Harvest Strategy is designed to use these data to inform the management of the TRL Fishery.

- The Working Group further noted that the recently AFMA funded CSIRO larval advection project is aimed at providing updated information on TRL larval recruitment patterns for the Torres Strait.

2. *Potential for measures to be added as Limit Reference Point is approached to limit impacts on the TIB sector.*

- Some Working Group members recommended that the reduction of catch under the draft harvest strategy as the stock biomass move towards the limit reference point should not be uniform across the TIB and TVH sectors. Rather, a trigger point should be included in the draft HS before B_{LIM} at which point priority is given for fishing to the TIB sector over the TVH sector the TVH sector.

- The Fisheries Economist noted: (1) that there would need to be an agreed HS objective if the TVH sector were to take a larger reduction in the TAC compared to the TIB sector; (2) another option might be to restrict the Fishery to free dive only if a certain trigger point was reached; (3) and that the objective of any triggers would need to be agreed.

- The Malu Lamar Chairperson noted that the report titled 'A fair share of the catch' interprets the order of priority for Torres Strait Fisheries as (1) traditional fishing; (2) community fishing and (3) commercial fishing. The Chairperson noted the report should be considered when developing management arrangements for the Fishery including the draft HS and a legal interpretation of the report and its findings is required.

- The Industry Member from the TVH sector advised they could not agree to any proposal to have different measures applied to the TVH sector until more detail could be provided. The industry member noted that they too needed to make a living.

- Some TIB representatives and observers noted that TVH operators have the option of operating under a dual licence with the East Coast while TIB operators are unlikely to be able to secure endorsement to operate on the East Coast should the TS fishery close.

- An industry observer commented that industry should be left to work through these issues directly with each other.

- The AFMA member noted that the draft harvest strategy takes into account importance of TRL as an important shared resource. Having regard for importance of the resource for traditional fishing the harvest strategy is set to maintain a relative large stock size (target biomass is B_{65}). If the stock size reduces towards the limit reference point, then the harvest strategy process will recommend that the total catch be reduced so that the stock may build.

3. *Taking into account recreational catches*

- Some members questioned whether or not recreational catches were properly accounted for under the harvest strategy and sought advice on any plans to collect reliable estimates of recreational catches.

- The Working Group noted advice that TRLRAG did not recommend accounting for recreational catches at this time because overall catches are likely to be relatively low. One industry member did not support this assumption and considered recreational catches to be higher.

- The Working Group further noted advice that the FinFish Working Group has identified the need to examine whether there are cost-effective options for developing improved estimates of recreational catches in the future.

- The AFMA member noted that it is generally very costly to collect recreational catch data and so a risk based approach is generally required when accounting catches by that sector.

Recommendation

Having regard for the comments by members the Working Group:

1. **Recognised** that the draft harvest strategy is:
   - designed to inform management decisions for the Torres Strait TRL Fishery;
   - is based on robust fishery independent survey data and stock assessment process;
   - treats the TRL Fishery as a single stock;
   - does not take into account recreational catches on the basis of TRLRAG advice that catches are likely low; and
   - has been subject to rigorous performance testing by the TRLRAG.

2. **Recognised** that whilst there may be uncertainty in the level of connectivity between the east coast and Torres Strait TRL stocks, the draft TRL harvest strategy uses the best available data including annual fishery independent survey data, to recommend annual total allowable catches. Future work such as the recently funded larval advection modelling project is likely to improve our understanding of stock connectivity overtime.

3. **Requested** (**Action Item 4**) the following be presented at the next TRLWG meeting: a) an overview of the current understanding of stock connectivity between the east coast and the Torres Strait TRL Fishery; and b) the basis for the Queensland east coast TAC.

4. **Recommends** that work should continue to examine whether there are cost-effective options for improving estimates of recreational catches in the region;

5. **Recommends** that the PZJA work closely with both the Queensland and PNG Governments to ensure complementary management arrangements are adopted in the event that the TRL stock biomass falls below the limit reference point.

6. **Recommends** that further work be undertaken by the TRLWG and TRLRAG to examine possible options for including social and/or economic objective in the draft Harvest Strategy and applying a management trigger under the harvest strategy as the stock approaches the limit reference point to minimise the impacts on traditional inhabitant commercial fishers.

Agenda Item 4 – TRL Management Plan

The Working Group noted advice from the TSRA Fisheries Portfolio Member and Malu Lamar Chairperson that outcomes of the recent TSRA study tour to New Zealand needs to be shared and considered by the TIB sector before proceeding with a plan of management for the fishery. The Working Group however agreed for public consultation outcomes on the draft management plan to be tabled (Agenda Items 4.2, 4.3 and 4.4).

A further summary table was circulated at the meeting which was intended to aid discussion among members on the key issues raised in the public consultation process **(Attachment D)**.

4.1 Revised Sectoral Provisional Allocations

The Working Group noted that the TSRA had purchased two TVH primary/tender licence applications. Based on the provisional allocations assigned to those licences, the revised sectoral allocations that could be made under a quota management plan if they were to be combined with the TIB quota unit allocation is: TIB sector 62.54 per cent and TVH sector 37.46 per cent.

4.2 TRL Plan Public Meeting Outcomes

The Working Group noted the outcomes of public consultation meetings on the proposed TRL Management Plan as detailed in the Agenda Item paper.

One industry member noted that some communities, for example Masig, have not been provided an opportunity to meet with the industry representative for that cluster, to discuss and formulate a position on the management plan to allow them to provide a formal submission.

4.3 TRL Plan Written Submissions

The AFMA member read out the apology letter from the industry member Phillip Ketchell, the letter states that the Torres Strait Fishers Association (TSFA) does not support the proposed draft TRL Management Plan **(Attachment E)**.

The Working Group noted the written submissions received on the draft plan as detailed in the Agenda item paper.

4.4 Native Title Notification – Malu Lamar (RNTBC) Submission

The Working Group noted the native title notification response on the draft plan from Malu Lamar (RNTBC) based on the Agenda Item paper.

The Working Group did not review the full summary on issues raised in the Malu lamar submission noting advice from the Chairperson for Malu Lamar (RNTBC) that the TIB sector and industry members first need to reflect on the recent meetings held with the Maori's before progressing development of the proposed draft management plan.

A single Malu lamar recommendation was noted. That is for the draft plan to provide separate rights and interest between native title holders and traditional inhabitants. Persons who are not native title holders, particularly if their traditional inhabitant identity is derived from the amnesty list, should not be granted TIB licences.

The Chairperson of Malu Lamar (RNTBC) noted the approval process for the grant of traditional inhabitant boat (TIB) licence is out of date and needs to be reviewed. The approval to grant a TIB licence needs to be based on genealogy to determine if a person is eligible to hold the licence. The Chairperson noted that PNG 'amnesty people' and aboriginal people from Cape York are not defined as a Torres Strait Islander under Article 1 of the Torres Strait Treaty.

4.5 Consideration of the draft management plan following public consultation

The Working Group noted advice from the TSRA Fisheries Portfolio Member and Malu Lamar Chairperson that the recent New Zealand study tour provided attendees with greater insight to the benefits and opportunities of quota management and how Maori manage their quota entitlements.

In light of what was learnt from meetings with the Maori and concerns raised about the draft plan through the public consultation, the Fisheries Portfolio Member and Malu Lamar

Chairperson did not support any further discussion on the draft Plan until the TIB sector and native holders more broadly, first meet to consider how their quota entitlements might be managed in order to meet their aspirations from the fishery.

The Fisheries Portfolio Member advised the that TSRA Board will be considering the outcomes of the NZ study tour at its meeting in September and that a work plan will be devised for leading the further consultation with the TIB sector and Malu Lamar. The Fisheries Portfolio Member further advised that the additional consultation may be a two year process with the first TIB meeting possibly occurring in beginning in October to coincide with the TRL Fishery closure. The aim of the TIB sector meeting will be for the sector to gather an understanding of the benefits of the Maori model and to agree on a preferred TRL Fishery management approach for the TIB sector. Additionally the consultation process may also cover issues across all fisheries such as restrictive rules in the Beche de Mer Fishery (7m boat length limit, free dive only).

Some industry members noted that the TVH sector should be included in the discussions about the Maori fisheries model to facilitate their understanding of how it could benefit the Torres Strait and fishery as a whole.

Industry members (TVH included) supported setting aside further development of the draft TRL Management Plan until the Traditional Inhabitant sector has developed preferred options for managing their quota allocation.

Other business – Malu Lamar reform proposal

The Chairperson of Malu Lamar circulated a paper titled 'Torres Strait Fisheries Reform Proposal – Australian Government and Queensland Government Assistance Request, June 2014 (**Attachment F**) to Working Group members at the end of the first meeting day and requested that he be able to present the paper on day two. The Malu Lamar Chairperson sought that it be tabled as it was relevant to the TIB sector in considering future options for managing fishing entitlements, such as TRL quota units.

The Malu Lamar Chairperson did not describe the detail of the paper but instead sought general comment from the Working Group.

The AFMA member advised that the paper is likely to be of some assistance for discussions being planned for the traditional inhabitant sector and Malu Lamar (as advised under Agenda Item 4). The AFMA member noted that the stated Malu Lamar vision includes working in partnership with industry, including the TVH sector and initiatives being progressed such as leasing-back arrangements and drawing on the Maori experience.

The AFMA member further advised that whilst it is helpful to be informed of the Malu Lamar reform proposal it was beyond the terms of reference of the Working Group to provide advice on the steps recommended in the paper as they relate to agreements and funding arrangements requested between Governments.

The Malu Lamar Chairperson advised that native title owners have commercial rights and interest prior to colonisation and that these rights have been recognised by the High Court. Their understanding of the *Akiba Decision* is that native title owners own the resources and this must be recognised. Malu Lamar has no interest in continuing to participate in future working groups and instead will take the Government to court.

The TSRA Fisheries Portfolio member noted that it has been requested on number of occasions for Malu Lamar to become a member of the PZJA. The AFMA member advised that the PZJA has previously requested Malu Lamar to put its proposal in writing but has not yet received response.

Some industry members and observers confirmed their support for the Malu Lamar Chairpersons position, including Malu Lamar becoming a member of the PZJA.

The TSRA member recommended that a legal synopsis of the *Akiba Decision* be formally considered by the PZJA and the precise nature of native title rights determined by the decision be explain to the working groups.

The Malu Lamar Chairperson reiterated his disappointment with the Working Group failing to properly recognise their native title rights and left the meeting.

Section 5 – Proposed Future Management Arrangements

Agenda items under section 5 *Proposed future management arrangements* were not discussed.

The Chair closed the meeting around 11am due to a lack of a quorum following the early departure of another industry member.

Section 5 agenda items were deferred to the next Working Group meeting. The Working Group noted that arrangements would be made out-of-session to reconvene as soon as possible.

Australian Government
Australian Fisheries Management Authority

Torres Strait Tropical Rock Lobster Fishery

Working Draft

Harvest Strategy

December 2017

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CONTENTS

GLOSSARY

Types of reference points:

Reference Point	Description
Metarule	A rule that describes how the RBCs obtained from an assessment should be adjusted in calculating a recommended TAC
Target	Relates to a target reference point as per the HSP. Expressed in terms of biomass
Limit	Relates to a limit reference point as per the HSP. Fishing stops if this reference point is exceeded a specified number of times. Expressed in terms of biomass
MEY	Maximum economic yield occurs when the total profit from the Fishery is maximised
MSY	Maximum sustainable yield is the maximum that can be taken from a stock in perpetuity

Notation:

Notation	Description
B	Spawning biomass level
B_0	The unfished spawning biomass (determined from an appropriate reference point)
F	Fishing mortality rate

Other acronyms:

Acronym	Description
CPUE	Catch per unit effort
HSP	Commonwealth Harvest Strategy Policy and Guidelines 2007
HS	Harvest Strategy
HSF	Harvest Strategy Framework
HCR	Harvest Control Rule
RBC	Recommended Biological Catch
TRLRAG	Tropical Rock Lobster Resource Assessment Group
TRLWG	Tropical Rock Lobster Working Group
TAC	Total Allowable Catch
Tiered approach	A framework that uses different control rules to cater for different levels of uncertainty about a stock
TIB	Traditional inhabitant boat
TVH	Transferrable vessel holder

OVERVIEW

The Torres Strait Tropical Rock Lobster Fishery (the Fishery) Harvest Strategy (HS) sets out the management actions needed to achieve the agreed Fishery objectives. The Fishery HS describes the performance indicators used for monitoring the condition of the stock, the fishery-independent survey and stock assessment procedures and the rules applied to determine the recommended biological catch and the notional total allowable catch each fishing season.

The HS uses a single tier approach with an empirical harvest control rule (eHCR) that is used to determine a recommended biological catch (RBC). The eHCR uses the pre-season survey to estimate an index of abundance of juvenile (1+) and newly recruited (0+) TRL and the catch per unit effort (CPUE) indices for the traditional inhabitant boat (TIB) and transferrable vessel holder (TVH) fishing sectors. The RBC is the best available scientific advice on what the total fishing mortality (landings from all sectors and discards) should be for the stock. The RBC is currently used to monitor the performance of the fishery, in future years it will be used to recommend Total Allowable Catches (an enforced limit on total catches).

The HS meets the requirements of the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2007 (*HSP) by applying a precautionary approach to the reference points and measures to be implemented in accordance with the reference points. This is reflected in the use of proxy reference points that are more precautionary than those specified in the HSP. The eHCR is designed to decrease exploitation rate as the stock size decreases below the target reference point. The HS uses a biomass target reference point equal to recent levels (2005-2015) that take account of the fact that the resource is shared and important for the traditional way of life and livelihood of traditional inhabitants and is biologically and economically acceptable. The HS proxies are B_{LIM} is 32% of B_0, B_{TARG} is 65% of B_0.

Further work for the HS will include the development of a tiered approach. The tiered approach applies different types of control rules to cater for different amounts of data available and to account for changes to uncertainty on stock status. A tiered approach adopts increased levels of precaution that correspond to increasing levels of uncertainty about the stock status, in order to maintain the same level of risk across the different tiers.

The status of the stock and how it is tracking against the HS, is reported to the RAG, Torres Strait Tropical Rock Lobster Working Group (the Working Group) and the Protected Zone Joint Authority (PZJA). The stock assessment is conducted periodically to evaluate performance of the eHCR. The stock assessment includes considerations of the catch rates in current and previous fishing seasons, how the catches compare to the RBCs, stock status indicators in relation to the reference points and an RBC for the upcoming fishing season.

1 BACKGROUND

This Torres Strait Tropical Rock Lobster Fishery (the Fishery) Harvest Strategy (HS) has been developed in accordance with the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2007* (HSP) and consistent with objectives of the *Torres Strait Fisheries Act 1984* (the Act).

The Fishery HS takes into account key fishery specific attributes including:

a) there is potential for large, unpredictable inter-annual variations in availability and abundance of tropical rock lobster (TRL);

b) TRL is a shared resource important for the traditional way of life and livelihood of traditional inhabitants, commercial and recreational sectors (RAG, 4-5 April 2017); and

c) advice from the Tropical Rock Lobster Resource Assessment Group (the RAG) industry members to maintain stock abundance at recent levels (2005-2015) (RAG, 31 March 2016). (NOTE: Working Group advice to be added)

1.1 COMMONWEALTH FISHERIES HARVEST STRATEGY POLICY

The objective of the HSP is the sustainable and profitable use of Australia's Commonwealth fisheries in perpetuity through the implementation of harvest strategies that maintain key commercial stocks at ecologically sustainable levels, and within this context, maximise the economic returns to the Australian community.

To meet the HSP objective, harvest strategies are designed to pursue an exploitation rate that keeps fish stocks at a level required to produce maximum economic yield (MEY) and ensure stocks remain above a limit biomass level (B_{LIM}) at least 90 per cent of the time. Alternative reference points may be adopted for some stocks to better pursue the objective of maximising economic returns across the Fishery as a whole or other fishery specific objectives.

The HSP provides for the use of proxy settings for reference points to cater for different levels of information available and unique fishery circumstances. This balance between prescription and flexibility encourages the development of innovative and cost effective strategies to meet key policy objectives. Proxies must ensure stock conservation and economic performance as envisaged by the HSP. Such proxies, including those that exceed these minimum standards, must be clearly justified.

With a harvest strategy in place, fishery managers and stakeholders are able to operate with pre-defined rules, management decisions are more transparent, and there are likely fewer unanticipated outcomes necessitating hasty management responses. However, due to the inherently natural variability of TRL abundance there may be a need for significant changes in recommended catch on an annual basis.

1.2 DEVELOPMENT OF THE TRL HARVEST STRATEGY

The HS has been developed in consultation with the RAG (meeting no. 18 on 2-3 August 2016; meeting no. 19 on 13 December 2016 and meeting no. 20 on 4-5 April; 2017). The HS has been endorsed by the Working Group meeting no. X on 25-26 July 2017. This HS replaces the interim HS developed for the Fishery in 2008 ~~(Attachment A)~~.

NOTE: TRLWG advice to be provided once TRLRAG advice finalised – this statement is to be updated as required.

2 TRL FISHERY HARVEST STRATEGY

2.1 SCOPE

This HS applies to the whole fishery and it takes into account catch sharing arrangements between Australia and Papua New Guinea (PNG).

The HS outlines the control rules used to develop advice on the recommended biological catch (RBC) and in future years it will be used to recommend Total Allowable Catches (an enforced limit on total catches)[1]. The HS sets the criteria that pre-agreed management decisions will be based on in order to achieve the Fishery objectives.

Overtime the HS may be amended to use a tiered approach to cater for different amounts of data available and different types of assessments (for example mid-year surveys and annual assessments). Underpinning a tiered HS is increased levels of precaution with increasing levels of uncertainty about the stock status. Each tier has its own harvest control rule (HCR) and associated rules that are used to determine a RBC.

2.2 OBJECTIVES

The operational objectives of the Harvest Strategy are to:

a) Maintain the stock at (on average), or return to, a target biomass point B_{TARG} equal to recent levels (2005-2015) that take account of the fact that the resource is shared and important for the traditional way of life and livelihood of traditional inhabitants and is biologically and economically acceptable.

   - The agreed B_{TARG} is more precautionary than the default proxy B_{MEY} (biomass at maximum economic yield) level as outlined in the Commonwealth Harvest Strategy Policy and Guidelines 2007 (HSP).

b) Maintain the stock above the limit biomass level (B_{LIM}), or an appropriate proxy, at least 90 per cent of the time.

   - The agreed B_{LIM} is more precautionary than the default proxy HSP B_{LIM}.

[1] The total allowable catch (TAC) for the Fishery is currently notional and is not used to control harvest. It is used to inform catch sharing arrangements with Papua New Guinea and to inform the status of the stock.

c) Implement rebuilding strategies, if the spawning stock biomass is assessed to fall below B_{LIM} in two successive years.

2.3 RECOMMENDING TACs FROM RBCs

The Recommended Biological Catch (RBC) is the recommended total catch of TRL (both retained and discarded) that should be taken by all sectors of the Fishery. The HSP states that when setting the TAC for the next fishing season the HS should take into account all sources of fishing mortality.

The HS does not include catches taken by non-commercial fishing sectors, for example traditional, recreational or research catches. The RAG recommended at Meeting No.18 on 2-3 August 2016 that non-commercial catches should not be accounted for, because the overall catches are likely to be relatively low and there would be limited impact on the stock assessment. The HS may be updated in the future to account for changing circumstances in the Fishery, the review provisions are described in **Section 2.13**.

> *The total allowable catch (TAC) for the Fishery is currently notional (not enforced) and is not used to control harvest. It is used to inform catch sharing arrangements with Papua New Guinea and to inform the status of the stock.*

2.4 MONITORING

Biological data for the Fishery are monitored by a range of methods listed below. Currently there is no ongoing monitoring strategy in place to collect economic information.

Fishery independent surveys

A key component of the monitoring program is the fishery-independent survey which provides a time-series of relative abundance indices for TRL. Fishery-independent surveys have been conducted in the Fishery since 1989. Historically (1989-2014), mid-season (July) surveys focused on providing an index of abundance of the spawning (age 2+) and juvenile (age 1+) lobsters. Mid-season surveys have been replaced with pre-season (November) surveys (2005-2008; 2014 to current) which focus on providing an index of recruiting (age 1+) lobsters as close as possible to the start of the fishing season to support the transition to quota management and setting of a TAC. Pre-seasons surveys also provide indices of recently-settled (age 0+) lobsters, which may become useful under quota management as they allow forecasting of stock one year in advance.

Catch and effort information

Fishers in the transferrable vessel holder (TVH) sector are required to record catch and effort information in the Torres Strait Tropical Rock Lobster Daily Fishing Log (TRL04). The following data are recorded for each TVH fishing operation: the port and date of departure and return, fishing area, fishing method, hours fished and the weight (whole or tails) of TRL retained. Fishers in the traditional inhabitant boat (TIB) sector voluntarily report catch and effort information to buyers and processors who record the information in the Torres Strait Seafood Buyers and Processors Docket Book (TDB01). Some processors previously (2014-2016) reported aggregate TIB catch information directly to AFMA, these processors are currently reporting with the TDB01 docket book.

2.5 INTEGRATED STOCK ASSESSMENT MODEL

The stock assessment model (termed the 'Integrated Model') (Plagányi *et al.* 2009) was developed in 2009 and is an Age-Structured Production Model, or Statistical Catch-at-Age Analysis (SCAA) (e.g. Fournier and Archibald 1982). It is a widely used approach for providing RBC advice and the associated uncertainties.

The model integrates all available information into a single framework to assess resource status and provide a RBC. The model addresses all of the concerns highlighted in a review of the previous stock assessment approach (Bentley 2006, Ye *et al*. 2006, 2007). The model is fitted to the mid-season and pre-season survey data and TIB and TVH CPUE data. The growth relationships used in the model were revised from the previous stock assessment model (Ye *et al*. 2006) to ensure that the modelled individual mass at age more closely resembled field measurements. The model is compatible as an Operating Model in a Management Strategy Evaluation (MSE) framework to support the management of the Fishery.

The stock assessment model is non-spatial and assumes that the Torres Strait Tropical Rock lobster Fishery stock is independent of the Queensland East Coast Tropical Rock Lobster Fishery stock. A spatial version of the model has been developed as part of an earlier MSE project, and can be used to investigate plausible linkages between these stocks (Plagányi *et al*. 2012, 2013).

The model includes three age-classes only (0+, 1+ and 2+ age lobsters) as it is assumed that lobsters migrate out of Torres Straits in October each year. Torres Strait TRL emigrate in spring (September-November) and breed during the subsequent summer (November-February) (MacFarlane and Moore 1986; Moore and Macfarlane 1984). A Beverton-Holt stock-recruitment relationship is used (Beverton and Holt 1957), allowing for annual fluctuation about the average value predicted by the recruitment curve. The model is fitted to the available abundance indices by maximising the likelihood function. Quasi-Newton minimisation is used to minimise the total negative log-likelihood function (using the package AD Model Builder™) (Fournier *et al*. 2012).

2.6 EMPIRICAL HARVEST CONTROL RULE

The empirical harvest control rule (eHCR) recommended by the RAG uses the pre-season survey 1+ and 0+ indices, both standardised CPUE indices (TVH and TIB), applies the natural logarithms of the slopes of the five most recent years' data and includes an upper catch limit of 1,000 t. The relative weightings of the eHCR indices are 70 per cent pre-season survey 1+ index, 10 per cent pre-season survey 0+ index, 10 per cent TIB sector standardised CPUE and 10 per cent TVH sector standardised CPUE.

The basic formula is:

$$RBC_{y+1} = wt\_s1 \cdot \left(1 + s_y^{presurv,1}\right) \cdot \bar{C}_{y-4,y} + wt\_s2 \cdot \left(1 + s_y^{presurv,0}\right) \cdot \bar{C}_{y-4,y} + wt\_c1 \cdot \left(1 + s_y^{CPUE,TVH}\right) \cdot \bar{C}_{y-4,y} + wt\_c2 \cdot \left(1 + s_y^{CPUE,TIB}\right) \cdot \bar{C}_{y-4,y}$$

Or if RBC_{y+1} > 1000t, TAC_{y+1} = 1000.

Where:

$\bar{C}_{y-4,y}$ is the average achieved catch during the past 5 years, including the current year i.e. from year *y*-4 to year *y*,

$s_y^{presurv,1}$ is the slope of the logarithms of the preseason survey 1+ abundance index, based on the 5 most recent values;

$s_y^{presurv,0}$ is the slope of the logarithms of the preseason survey 0+ abundance index, based on the 5 most recent values;

$s_y^{CPUE,TVH}, s_y^{CPUE,TIB}$ is the slope of the logarithms of the TVH and TIB CPUE abundance index, based on the 5 most recent values;

wt_s1, wt_s2, wt_c1, wt_c2 are tuning parameters that assign relative weight to the preseason 1+ (wt_s1) and 0+ (wt_s2) survey trends compared with the CPUE TVH (wt_c1) and TIB (wt_c2) trends.

2.7 REFERENCE POINTS

The HS reference points are:

a) The unfished biomass B_0 is the model-estimate of spawning stock biomass in 1973 (start of the Fishery). $B_0 = B_{1973}$.

b) The target biomass B_{TARG} is the spawning biomass level equal to recent levels (2005-2015) that take account of the fact that the resource is shared and important for the traditional way of life and livelihood of traditional inhabitants and is biologically and economically acceptable. B_{TARG} is the proxy for B_{MEY}, $B_{TARG} = 0.65\ B_0$.

   - The agreed B_{TARG} is more precautionary than the default proxy B_{MEY} (biomass at maximum economic yield) level as outlined in the (HSP). The RAG noted a B_{TARG} higher that the HSP default was considered important for the Fishery because: 1) the stock: is a shared resource that is particularly important for traditional fishing; 2) the stock has high variability; and, 3) all industry members recommended the HS maintain the stock around the relatively high current levels (RAG meeting no. 17, 31 March 2016 and meeting no. 18, 2-3 August 2016).

c) The limit biomass B_{LIM} is the spawning biomass level below which the risk to the stock is unacceptably high and the stock is defined as 'overfished'. B_{LIM} is agreed to be half of B_{TARG}, $B_{LIM} = 0.32\ B_0$.

   - The agreed B_{LIM} is more precautionary than the default proxy HSP B_{LIM}.

d) If the limit reference point (B_{LIM}) is triggered in two successive years then the Fishery is closed.

e) The target fishing mortality rate F_{TARG} is the estimated level of fishing mortality rate that maintains the spawning biomass around B_{TARG}. $F_{TARG} = 0.15$.

   - $F_{TARG} = 0.15$ is the target fishing mortality rate that corresponds to an optimal level in terms of economic, biological and social considerations (RAG meeting no. 18, 2-3 August 2016).

Rational for reference points

The HSP recognises that each stock/species/fishery will require an approach tailored to the fishery circumstances, including species characteristics. The HSP identifies that for highly variable stocks that may naturally (in the absence of fishing) breach B_{LIM}, the default reference point proxies may not be appropriate. The HSP states 'with highly variable species it is important to develop a harvest strategy that meets the intent of the HSP.' Further, 'stocks that fall below B_{LIM} due to natural variability will still be subject to the recovery measures stipulated in the HSP.' A number of adaptive management approaches may be used to deal with this, such as pre-season surveys to provide estimates of abundance to which the eHCR is applied.

The Fishery is characterised by a highly variable stock where majority of the catch (since 2001 due to the introduction of a minimum size limit) is from a single cohort. The stock assessment model and MSE testing have identified the target biomass should be set between 65 and 80 per cent of the unfished biomass to account for the importance of the stock for the traditional way of life and livelihood of traditional inhabitants and to achieve biological and economic objectives. The HS higher average target biomass level, compared to the default HSP target of 0.48 per cent of unfished biomass, reduces the risk of recruitment being compromised.

The unfished biomass (B_0) is calculated within the stock assessment model, the value of unfished biomass and target biomass have therefore varied over time in response to annual data updates and model parameter settings and estimates. Estimates of unfished biomass and target biomass are particularly sensitive to changes to parameter *h*, which determines the steepness of the stock-recruit relationship, and the input parameter that controls the level of stock-recruit variability.

Independent of variability to the unfished biomass value, the target fishing mortality rate F_{TARG} =0.15 is applied to maintain the spawning biomass around the biomass target reference point (B_{TARG}), which is the average level over the past two decades. This is assumed to be a proxy for B_{MEY} because stakeholders agreed that this target level corresponded to an optimal level in terms of economic, biological and social considerations (TRLRAG meeting no. 18, 2-3 August 2016).

The biomass limit reference point (B_{LIM}) is 32 per cent of unfished biomass. The higher limit reference point, compared to the HSP proxy of 20 per cent of unfished biomass, is supported by recommendations of similar limit reference points for other highly variable species such as forage fish (Pikitch *et al.* 2012). Due to the changing values of unfished biomass and target biomass the value of the limit reference point, taken as half the target reference point, has previously varied between 32 and 40 per cent of unfished biomass.

Recent MSE testing identified that a limit reference point of 40 per cent unfished biomass is too conservative, it would result in the limit reference point being breached more frequently and add unnecessary precautionary to the HS The RAG agreed to set the limit reference point at 32 per cent of unfished biomass with the condition that if the stock falls below the limit reference point in two successive years it triggers a Fishery closure. The eHCR is more precautionary than the HSP criterion to ‘ensure that the stock stays above the limit biomass level at least 90 per cent of the time.’ The HSP states that for highly variable species the risk criterion can be amended to increase the frequency the limit reference point may be breached or by altering the reference point value.

2.8 eHCR AND STOCK ASSESSMENT CYCLE

The eHCR and stock assessment cycle is as follows:

- The eHCR is run in November each year to provide a RBC by 1 December for the following fishing season.
- A stock assessment is run on a three year cycle in March, unless the stock assessment is triggered by a decision rule **(Section 2.10)**. The stock assessment determines the Fishery stock status and evaluates the performance of the eHCR and identifies if any revisions to the eHCR are required.
- If the eHCR needs to be revised, the stock assessment is conducted annually to estimate the RBC until the revised eHCR is agreed.

2.9 DATA SUMMARY

The annual data summary reviews the nominal and standardised catch per unit effort (CPUE) from the TIB and TVH sectors, as well as total catch from all sectors, the size-frequency information provided from a sub-sample of commercially caught TRL and the fishery-independent survey indices of +0 and +1 age lobsters. The data summary is used as an indicator to identify if catches correspond to the RBC, and to monitor CPUE.

2.10 DECISION RULES

The decision rules for the Fishery Harvest Strategy are:

Maximum catch limit

- The eHCR includes a maximum catch limit of 1000 t. Once the HS is implemented the cap will be reviewed after three years using MSE testing with the updated stock assessment model.

Pre-season survey trigger

- If in any year the pre-season survey +1 indices is 1.25 or lower (average number of +1 age lobsters per survey transect) it triggers a stock assessment.

Biomass limit reference point triggered

- If the eHCR limit reference point is triggered in the first year, a stock assessment update must be conducted in March.
    - If after the first year the stock is assessed below the biomass limit reference point, it is optional to conduct a mid-season survey, the pre-season survey must continue annually.
- If the eHCR limit reference point is triggered two years in a row, a stock assessment must be conducted in December (of the second year).

Fishery closure rules

- If the stock assessment determines the stock to be below the biomass limit reference point in two successive years, the Fishery will be closed to commercial fishing.
    - Management strategy evaluation (MSE) testing of the eHCR has shown that it is extremely unlikely (<1%) for the Fishery to be closed based on its current performance.

Re-opening the Fishery

- Following closure of the Fishery, fishery-independent mid-season and pre-season surveys are mandatory. The Fishery can only be re-opened when a stock assessment determines the Fishery to be above the biomass limit reference point **(Attachment A, Figure 5)**.

Based on the decision rules, there are four alternative possible scenarios **(Section 2.11)** that may occur under the application of the eHCR. Graphic representations of the four scenarios are provided in **Attachment A**.

2.11 DECISION RULE SCENARIOS

Scenario 1 – eHCR limit not breached and the eHCR does not require revision

- The eHCR assesses the Fishery to be above the biomass limit reference point.
- The eHCR RBCs appear to remain within ranges tested by management strategy evaluation (MSE).
- The updated stock assessment does not indicate any need for revision of the HCR.
- Application of the eHCR continues unchanged.
- A graphic representation of Scenario 1 is provided in **Attachment A, Figure 1**.

Scenario 2 – eHCR limit not breached, eHCR and stock assessment require revision

- The eHCR assesses the Fishery to be above the biomass limit reference point.
- The eHCR RBCs appear to remain within ranges tested by MSE.
- The updated stock assessment indicates the eHCR recommended TACs are outside the revised ranges tested by MSE, indicating that the eHCR should be revised.
- Annual RBCs need to be set using annual stock assessments until a revised eHCR has been agreed, after which the revised eHCR is applied.

A graphic representation of Scenario 2 is provided in **Attachment A, Figure 2**.

Scenario 3– limit is breached, eHCR is reviewed by stock assessment and the limit is not breached

- The eHCR assesses the Fishery to be below the biomass limit reference point in one year.
- A stock assessment update (March) is required to confirm if the limit has indeed been breached. This assessment update determines that the limit has not been breached.
- If the biomass limit reference point is breached once, discussions will be held on preventative measures to reduce the risk of closure.
- The eHCR RBC is applied and consideration is given to revising the eHCR to prevent future incorrect triggering of the biomass limit reference point.
- The stock assessment continues on a three year cycle, unless triggered to occur by a decision rule.
- A graphic representation of Scenario 3 is provided in **Attachment A, Figure 3**.

Scenario 4 – limit is breached, stock assessment confirms the limit is breached

- The eHCR assesses the Fishery to be below the biomass limit reference point in two successive years.

- A stock assessment update (March) is required to confirm if the limit has been breached. This assessment update determines that the limit has been breached.
- The eHCR assesses the Fishery to be below the biomass limit reference point for a second successive year.
- A second stock assessment update (December) is required to confirm whether the trigger has been breached a second time. This assessment update determines that the limit has been breached a second time.
- The commercial fishery is closed until an assessment update confirms that the stock has recovered to above the limit.
    - If the Fishery is closed to commercial fishing, discussions are held on future management arrangements.
    - Fishery independent mid-season and pre-season surveys are mandatory and conducted on an annual basis. The Fishery will only re-open when the Fishery is assessed to be above the biomass limit reference point by the stock assessment.
    - The eHCR must be revised before being re-implemented to reduce the risk of the Fishery breaching the biomass limit reference point and for the eHCR to incorporate rebuilding requirements.
- A graphic representation of Scenario 4 is provided in **Attachment A, Figure 4**.

2.12 GOVERNANCE

The status of the Fishery and how it is tracking against the HS is reported to the RAG, Working Group and the PZJA as part of the yearly RBC and TAC setting process.

2.13 REVIEW

Under certain circumstances, it may be necessary to amend the harvest strategy. For example if:

- there is new information that substantially changes the status of a fishery, leading to improved estimates of indicators relative to reference points; or
- drivers external to management of the fishery increase the risk to fish stock/s; or
- it is clear the strategy is not working effectively and the intent of the HSP is not being met; or
- alternative techniques are developed (or a more expensive but potentially more cost-effective harvest strategy that includes mid-year surveys and annual assessments is agreed) for assessing the Fishery. The HSF may be amended to incorporate decision rules appropriate for those assessments.

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TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
Justification for a January season start date for the QLD East Coast TRL Fishery	**Agenda Item 7 For Information**

RECOMMENDATIONS

1. The RAG **NOTE** the TRL Working Group at meeting no. 5 held on 5-6 April 2016 set an action item for the RAG to review the advice and justification for opening the Queensland East Coast TRL Fishery on 1 January.
2. The RAG **NOTE** that the season start date for the QLD East Coast Fishery was changed from 1 February to 1 January.
3. The RAG **NOTE** that the QDAF Member has provided a paper for further information **(Attachment A)**.

KEY ISSUES

4. Some Torres Strait Tropical Rock Lobster Working Group members and observers are seeking more information about the advice supporting the change of the season opening from 1 February to 1 January for the QLD East Coast TRL Fishery.

BACKGROUND

NIL.

ATTACHMENT

A. Information paper – Queensland East Coast TRL Fishery season start date

B. Policy relating to individual catch entitlements in the Queensland Tropical Rock Lobster Fishery.

REFERENCES

Biology, larval transport modelling and commercial logbook data analysis to support management of the NE Queensland rock lobster *Panulirus ornatus* fishery.

http://fish.gov.au/reports/Documents/Pitcher_et_al_2005_Biology_etc_TRL_fishery_FRDC_2002_008.pdf

Sustainable Fisheries Strategy 2017–2027

TROPICAL ROCK LOBSTER

RESOURCE ASSESSMENT GROUP (TRLRAG) MEETING No. 22

Agenda Paper – 27-28 March 2018

TITLE: ***Justification for a January season start date for the QLD East Coast TRL Fishery*** **AGENDA ITEM For Information**

Recommendations:

That the TRLRAG:

- **NOTE** the justification for opening the Queensland East Coast TRL Fishery (ECTRLF) one month earlier to 1 January from 1 February;

Key Issues:

- In 2014 the *Fisheries Regulation 2008* (the Regulation) changed the end date of the spawning closure to end at midnight 31 December from midnight 31 January. The start date remained unchanged starting 1 October each year.
- The amendment to the closure date did not remove the closure over the peak spawning months (Oct/Nov/Dec) but reduced the length of the closure to allow industry to take advantage of the high demand period in January.
- The original closure was introduced in 2002 at this time the fishery was not managed under a total allowable catch (TAC) which now restricts the level of catch.
- The justification for the original closure length (in 2002) for the ECTRLF was to protect breeding stock and to bring it in line with the closure in the adjacent Commonwealth managed Torres Strait TRL fishery (same stock as the ECTRLF). Noting the Torres Strait closure is slightly different to the ECTRLF in that there is a total ban between midnight 1 October and midnight 30 November but they allow the take of TRL without hooker apparatus for the months of December and January.
- The October/November closure was originally implemented in Torres Strait to prevent recruitment over-fishing when the size limit was 100 mm tail length. Subsequently, in 2002 due to declining stocks the closure was extended to include December/January (no fishing using hookah equipment) and increased the tail length to 115 mm to allow the stocks to recover.

- Subsequent to these arrangements in Torres Strait the ECTRLF adopted the 4 month closure, largely to align with Torres Strait. As well increase the size limit of the tail length from 100mm to 115 mm to address the recruit over-fishing issue.
- The limited data available indicates the peak spawning period for the ECTRLF occurs in November and occurs in deep water (Pitcher et al 2004). As a result the closure would remain one month either side of the peak spawning period.
- As this fishery is a dive fishery, fishers are restricted to shallower waters reducing their interactions with breeders in deep water.
- If breeders are encountered at any time whilst the fishery is open there is total protection on the take of berried and tar spot lobsters.
- In addition Fisheries Queensland sought the advice from CSIRO TRL scientists. The feedback was supportive in bringing forward the start date of the new season to midnight 31 December considering the fishery is now managed under a TAC and the peak spawning period is in November. In their conclusion they stated the animals that aren't currently caught in January now, are targeted just one month later anyway and with protection of tar spot and berried females and a conservative TAC there was no scientific evidence to not support this proposal.

Background:

The Queensland commercial crayfish and rock lobster fishery is a high-value fishery operating in the northern section of the Great Barrier Reef. The majority of product from the fishery is exported live to China fetching high prices, particularly around periods of Chinese festivals.

In 2009 Fisheries Queensland implemented significant management arrangements for the commercial ECTRL fishery. They included, a Total Allowable Catch (TAC) allocating individual commercial fishers quotas, commercial fishers needing to adhere to quota reporting requirements and fishers having the ability to tranship product between fishery licences held in the same name. A closed season (October to January) was introduced in 2002 following concerns about increasing catch and effort in the fishery. The closure is timed to coincide with the peak spawning period for the target species painted crayfish (Panulirus ornatus) in October and November.

Attachment 1: Policy relating to individual catch entitlements in the Queensland Tropical Rock Lobster Fishery

Responsible officer: Tom Roberts

Position: Manager, Management and Reform

Date: 14 March 2018

Policy relating to individual catch entitlements in the Queensland Tropical Rock Lobster Fishery

Queensland Government
Department of Primary Industries and Fisheries

1. TITLE

Policy relating to individual catch entitlements in the Queensland Tropical Rock Lobster Fishery

2. EFFECTIVE DATE

This policy is effective as of the date of approval by the Deputy Director-General (Fisheries), Department of Primary Industries and Fisheries (DPI&F).

3. PURPOSE OF POLICY

The purpose of this policy is to guide delegates of the chief executive in the administration of licence conditions for the Queensland Tropical Rock Lobster Fishery (the fishery), by establishing:

(i) a formula for the allocation of individual catch entitlements to Commercial Fishing Boat Licences endorsed with the fishery symbol 'R';

(ii) special circumstances that may be considered as reasons to depart from the allocation formula described above;

(iii) a formula for the allocation of catch entitlements to Indigenous Fishing Permits endorsed to operate in the fishery;

(iv) procedures for the reporting of catch, including chain of documentation requirements.

4. BACKGROUND

Target species

The tropical rock lobster (TRL; *Panulirus ornatus*) is the major target species in the fishery. It is distributed throughout most of Queensland, the Torres Strait and Papua New Guinea. Six other TRL species are found in Queensland waters. However, they are far less abundant and contribute only marginally to the total catch.

Commercial sector

The fishery symbol 'R' is described under Chapter 11, Part 2 of the *Fisheries Regulation 2008* (the Regulation). It is attached to 28 Commercial Fishing Boat Licences. The 'R' symbol is subject to the DPI&F Limited Entry Policy.

Indigenous commercial sector

Indigenous Fishing Permits (IFPs) are issued to Indigenous persons to trial commercial fishing activities for a limited period of time, in order to determine whether or not to enter the fishery on a fully commercial basis by obtaining a transferable commercial fishing licence for the fishery.

The area of operation for IFPs is generally tied to the location of Indigenous persons or communities operating under these permits.

Limiting total commercial catch

An Investment and Effort Increase Warning (investment warning) was released for the fishery on 31 May 2001 in response to early concerns about increasing annual catch and effort. Since then, commercial catch and effort in the fishery has continued to expand. The potential for further expansion is exacerbated by the Commonwealth Government's recent buyback of Torres Strait TRL fishing endorsements from a number of operators who previously participated in both the Torres Strait and Queensland fisheries but may now only fish in Queensland.

A stock assessment completed prior to the release of the Combined Fisheries Management Regulatory Impact Statement and draft Public Benefit Test (the Combined Fisheries RIS) in July 2008 indicated that increases in TRL catch and effort in Queensland waters may not be sustainable in the long term and are unlikely to provide maximum economic benefit to the commercial fishing sector. The stock assessment estimated maximum sustainable yield (MSY) at approximately 241 tonnes, however the equilibrium model used in this assessment tends to produce optimistic MSY estimates. A commercial catch limit of 75% MSY was proposed in the Combined Fisheries RIS as an appropriate, conservative limit.

Since the release of the Combined Fisheries RIS, the stock assessment methodology has been reviewed and significant improvements have been made to the assessment. The new assessment estimates MSY at between 191 tonnes and 242 tonnes. In the absence of scientific information to show that one model is more robust than the other, the DPI&F recommended a commercial catch limit of 90% of the average MSY from these models. The DPI&F considered this an acceptable level of risk until more information is available. The Regulation was subsequently amended on 12 December 2008 to include a commercial total allowable catch (TAC) of 195 tonnes.

A competitive TAC system is considered inappropriate for the commercial fishery due to the potential for a 'race to fish', potentially leading to unsustainable concentrations of effort and inconsistent product supply and employment opportunities. Biologically, economically and socially this is not considered optimal. It is therefore considered necessary to establish individual catch entitlements under each commercial licence operating in the fishery. This policy establishes formulas for the allocation of such entitlements as well as reporting systems to enable monitoring of catch under each licence.

Limiting catch under IFPs

The Combined Fisheries RIS proposed a catch limit of 5 tonnes to be distributed amongst IFP operations. This is an amount separate to the commercial TAC and is considered an appropriate level of catch to provide capacity for these operations to develop their fishing businesses in order to transition to the commercial fishery.

5. RELEVANT LEGISLATION

Fisheries Act 1994
Fisheries Regulation 2008

6. CONSULTATION

In July 2008, the DPI&F released the Combined Fisheries RIS, which contained a number of proposals relating to the Queensland Tropical Rock Lobster Fishery, including:

1. Setting a commercial TAC for the fishery of 181 tonnes;
2. Setting a catch limit of five tonnes of TRL (separate to the commercial TAC) for Indigenous fishing operators to take commercially under IFPs;
3. Allocating individual transferable quotas (ITQs) for the commercial fishery;
4. Allowing transhipment of TRL taken under the same quota holding;
5. Introducing licence fees for quota units and removing licence fees for the 'R' fishery symbol;
6. Introducing prior, transhipment and unload notices to monitor the use of commercial ITQs; and
7. Introducing documentation requirements to allow whole-of-distribution chain tracking of commercially caught TRL.

Responses to the Combined Fisheries RIS:

1. Were divided on the introduction of setting a commercial TAC for the fishery at 181 tonnes. Respondents believed that the TAC should be set at a higher level. Subsequent review of the stock assessment model led to the introduction of a higher TAC for the fishery.
2. The majority of respondents supported the proposal to allocate five tonnes of TRL outside of the commercial TAC for commercial Indigenous take under IFPs;
3. The majority of respondents supported the proposal to allocate ITQs for the fishery and generally supported the proposed allocation method, recognising that it would have differential impacts on different operators;
4. The majority of respondents supported the proposal to allow transhipment of TRL taken under the same quota holding;
5. The majority of respondents supported the introduction of licence fees for quota units and the removal of licence fees for the 'R' fishery symbol, with new fees to be phased in over a three year period;
6. The majority of respondents agreed with the proposed system of quota reporting and whole-of-distribution chain tracking of commercially caught TRL.

In order to simplify the legislation and provide a higher level of flexibility in management, the DPI&F is implementing a number of the above proposals outside of legislation. The commercial fishery TAC and licence fees have been implemented by legislation and the remainder of the proposals for the fishery will be implemented via this Policy and licence condition.

The DPI&F has undertaken extensive consultation with fishery stakeholders through the East Coast Tropical Rock Lobster Working Group (ECTRLWG) during the development of the proposals in the Combined Fisheries RIS and regarding the amended process of implementing a number of management arrangements by Policy.

7. INTERPRETATION AND APPLICATION OF POLICY

This Policy applies generally to all management decisions of the chief executive or delegates in relation to setting and monitoring individual catch entitlements in the fishery. It is to be read and applied in conjunction with all relevant policies of the DPI&F under the *Fisheries Act 1994*.

Where factors sufficient to justify departure from the Policy exist, those factors need to be documented by the decision maker.

8. POLICY PROVISIONS

8.1 Allocation of quota to licences endorsed with 'R' fishery symbols

Principles of allocation:

The commercial TAC will be divided between licences with the 'R' fishery symbol based on their fishing history (i.e. recorded catches) both before and after the investment warning.

The following guidelines apply to the allocation of catch units to licences:

- Only holders of a current 'R' fishery symbol will be eligible for quota allocation.
- Quota allocation will be based solely on catch history of the current licence or a ***former licence*** for the current licence in the Queensland commercial fishery area.
- Selected years before and after the investment warning (2001) will be considered in the quota allocation model not only to recognise the intent of the investment warning but also to better reflect recent trends in the fishery.
- No base allocation will be distributed to licences.
- Catch data from sources other than logbook returns will not be considered.
- Only relevant logbook information held by DPI&F will be used to calculate the recorded catch amount for each eligible licence. Relevant logbook information for a relevant year means logbook information received by the chief executive or a former Authority, or the Australian Fisheries Management Authority no later than the following day:
  - 31 May 2001 for a relevant year ending not later than 31 December 2000
  - 30 June 2006 for a relevant year ending not later than 31 December 2005
- Where relevant logbook information records whole live or whole dead TRL catches, the whole TRL weight will be taken as the weight recorded in the logbook.
- Where relevant logbook information records 'tails' as the catch of processed TRL, the weight recorded in the logbook will be converted to a whole weight by multiplying the processed weight by a ***conversion factor***.
- No preference will be given based on the scale of operations.
- No preference will be given based on whether or not an operator holds a Torres Strait TRL endorsement or any other fishing entitlement.
- No preference will be given based on whether an operator participates in the fishery on a part-time or full-time basis.

Initial allocation:

The Regulation provides for up to 195,000 quota units to be allocated, to reflect the fishery TAC of 195 tonnes. Section 605A (3) of the Regulation provides that the value of each quota unit is equal to one kilogram of (whole weight) TRL.

15% of available quota (29,250 quota units) will be held back from the initial allocation to allow for consideration of special circumstances presented in response to the show cause notice, and appeals to the Fisheries Tribunal. Initially, 165,750 units will be allocated to eligible licences based on the average of the:

- three years of highest catch before the investment warning (1995-2001); plus
- year of highest catch after the investment warning (2002-2005); plus
- next highest annual catch during the period 1995-2005.

The formula to calculate the initial quota allocation for each eligible licence is as follows, rounded up to the nearest whole number (IW followed by a numeral refers to the year either before or after the investment warning):

$$\text{TRL units} = \frac{\text{average catch} \times 165\,737.76}{202\,635.924}$$

This will be applied where the:

- "average catch" = (pre-IW1 + pre-IW2 + pre-IW3 + post-IW1 + catch5)/5
- "pre-IW1" is the highest annual recorded catch amount for the period 1995–2001
- "pre-IW2" is the second highest annual recorded catch amount for the period 1995–2001
- "pre-IW3" is the third highest annual recorded catch amount for the period 1995–2001
- "post-IW1" is the highest annual recorded catch amount for the period 2002–2005
- "catch5" is the next highest annual recorded catch amount for the period 1995–2005 which has not already been used in the allocation formula (i.e. not pre-IW1; pre-IW2; pre-IW3 or post-IW1)
- 175 487 is the allocation factor (allowing for rounding up of the initial allocation to bring the total to 175 500)
- 190 879.02 is the sum of the average catch for all eligible licences.

Licence holders will be sent a show cause notice in relation to each Commercial Fishing Boat Licence endorsed with an 'R' fishery symbol, proposing that conditions be included on the licence to set an individual quota and specify reporting requirements. The show cause notice will detail the recorded catch for the licence and the proposed allocation of TRL units based on the final allocation formula. Licence holders will be given 28 days to respond to the show cause notice, providing reasons why the conditions should not be written on the licence, or how and why the conditions should be varied.

Licence holders will be able to request that the proposed allocation set out in the show cause notice be reconsidered on the basis of incorrect logbook information or special circumstances. Licence holders who want the proposed allocation for a licence reviewed must submit a request for reconsideration to DPI&F stating the review reason as well as any other relevant information that may assist with the review. DPI&F will review the proposed allocation and notify the licence holder of the outcome by a decision notice. All DPI&F decisions will be able to be appealed to the Fisheries Tribunal.

The quota year will run from 1 February to 30 September (inclusive) each year. The first quota year will begin on 1 February 2009. Before the start of the first quota year decisions will be made to amend licences by including conditions relating to catch limits and reporting requirements.

Special circumstances:

Special consideration will be given to operators who can demonstrate a special circumstance which has limited the operator's capacity to participate in the fishery during the years included in the allocation formula.

In deciding applications for special circumstances, a decision maker may request further information from the licence holder to determine whether a special circumstance exists and the most appropriate method to adjust the recorded catch history to account for a particular circumstance.

The special circumstances which will be considered include, but are not limited to, the following:

(1) Logbook clarification
In the case that catch recorded in logbook records received by DPI&F does not match an operator's catch records, the applicant may provide supporting documentation to demonstrate logbook errors. Examples of supporting documentation include copies of logbooks, unloading dockets and other information used to prepare annual taxation returns etc.

(2) Event
An applicant would meet an event special circumstance if they are able to demonstrate that for a continuous six month period during the fishing seasons of the years used in the allocation formula no fishing was undertaken under any fishery symbol on the licence because of a specific reason that was out of the control of the operator. These reasons may include illness of the owner or a family member, the boat attached to the licence was destroyed or could not have been used for a commercial purpose or another unforeseeable or uncontrollable reason. The applicant may provide supporting documentation to clarify an event. Examples of supporting documentation include medical certificates, boat insurance claims, receipts from boat repairers etc.

(3) Recent entrant
A licence holder is a recent entrant if they first held the licence or an application to register the licence transfer was made in the period (1 June 1998 to 31 May 2001) prior to the investment warning on 31 May 2001.

(4) Other
Any other special circumstance that reduced the capacity of a licence holder to participate in the fishery during the period used in the allocation formula. The applicant may provide supporting documentation to demonstrate any other event.

Reviewing allocation:

In quota years prior to all applications and appeals being finalised, if any of the 15% of quota units held back for applications and appeals is remaining, this quota will be temporarily distributed to licence holders (based on individual catch shares of allocated units) on 1 July and will be available for use during the remainder of that quota year. This will ensure that all quota units will be available to be used during any fishing season.

If, once all TRL quota applications and appeals have been decided, and any Fisheries Tribunal directions complied with, the final allocation of units is below the fishery TAC, the DPI&F will distribute the remaining units to licence holders, based on individual catch shares of allocated units.

A fishery assessment process will be initiated during 2009, including the development of formal decision rules to vary the fishery TAC based on stock status. If the fishery TAC is varied (either upwards or downwards) to reflect the resource status the value of a quota unit may also be adjusted.

8.2 Allocation for IFPs

There are some Indigenous people in Cape York with intentions or wishes to fish commercially for TRL. A total quantity of 5 tonnes of TRL will be available annually to allow Indigenous fishing operations to take TRL under IFPs. This aligns with government policy to provide economic development and self-determination opportunities for Indigenous persons.

The amount is considered large enough to be divided among several IFPs if necessary.

Principles of allocation:

The following guidelines apply to the allocation of catch quota to IFPs:

- An allocation of catch quota will only be available through IFPs.
- If, at any time, the total catch of TRL authorised under IFPs is less than 5 tonnes, consideration will be given to increasing the catch share under those IFPs to completely allocate up to 5 tonnes of available quota. Preference will generally be given to those IFPs that have been in existence for more than 1 year and are assessed as being most likely to achieve commercial viability.

8.3 Transhipment of TRL under 'R' symbols

The Combined Fisheries RIS proposed to allow the transhipment of live and dead TRL between commercial fishing boats operating under the same quota holding or held in the same name, without the requirement for a carrier boat licence. This proposal recognises the remoteness of the fishery and provides for increased cost efficiency in transporting fishery product.

Currently, live TRL is transported by aeroplane and boat and containers of tails are shipped by transport vessels to Cairns. The ability for TRL to be moved in this way will continue.

Requirements for reporting of transhipments are detailed in section 8.4 (Reporting under 'R' symbols).

8.4 Reporting under 'R' symbols

This policy introduces prior, transhipment and unload notices to monitor the use of commercial ITQs. These reporting mechanisms are detailed below. Licence conditions will be amended prior to the commencement of the first quota year to administer the reporting requirements.

The quota reporting system will consist of:
- a prior notice (and amendment prior notice if required) where the fisher notifies their intent to unload TRL at a specified time and place;
- a transhipment notice if unloading TRL to a transport vessel (boat or plane other than a commercial fishing boat operating under a licence held by the quota holder);
- an unload notice given at the point of unloading, declaring the amount of TRL taken which is subsequently deducted from the quota.

Prior and amendment prior notices

Prior notices are to be submitted to the chief executive using the Automated Interactive Voice Response (AIVR) System. Fishers will be able to submit an amendment prior notice in certain circumstances. Although making a late amendment is seen as a possible way of impeding enforcement processes, an amendment can be made only up to specified cut-off times. After that time a boat will be required to return to the notified landing place and be available for inspection if required.

The details to be given in a Prior Notice are:
- the commercial fishing boat licence number
- the 'fisher personal identification number' (shortened to 'fisher PIN')
- the place by reference to a numerical code referencing a location, or by reference to the latitude and longitude, of the place at which the authorised boat will land (the 'landing place')
- whether it is intended to unload any TRL from an authorised boat when the authorised boat will be at the landing place (this cannot be amended - if fishers change their intention to unload they will have to give a new prior notice and wait the required time (see below) before unloading any catch)
- the estimated time, in hours, at which the authorised boat will reach the notified landing place ('landing time')
- the number of whole TRL on board each authorised boat at the time the prior notice is given
- if TRL are being possessed in tail form on any or all authorised boats, the number of containers (or cartons) containing TRL tails.

A prior notice must ordinarily be given or amended before an authorised boat enters within half a nautical mile of the landing place. This area is known as the prior notice limits. The prior notice must be given immediately before the boat moves into or from within prior notice limits toward its landing place. Exceptions to this requirement include:
- if a boat enters prior notice limits to unload TRL for transport by air as long as a transhipment notice (see below) is given.

- if the boat will not be landing at any time that it is within the prior notice limits such as when a boat is simply steaming through a prior notice area in the course of fishing.

In addition to this, the prior notice must be given no later than:
- three hours before the vessel will reach its nominated landing place if this is equal to or north of latitude 10°41'S (Cape York)
- six hours before the vessel will reach its nominated landing place if this is south of latitude 10°41'S.

The landing time and/or landing place given in a prior notice may only be amended if:
- prior notice gave the landing place as north of latitude 10°41'S one hour or more before the estimated time of landing given in the original notice
- prior notice gave the landing place as south of latitude 10°41'S three hours or more before the estimated time of landing given in the original notice.

The quantity of TRL reported in a prior notice may only be amended one hour or more before the estimated landing time given in the original notice, regardless of the landing place given in the original notice. The quantity of TRL on board when a boat reaches the landing place must correlate with the prior notice(s).

If TRL is transhipped to another commercial fishing boat held by the same licence holder, the boat carrying the TRL is required to give a prior report for all TRL on board which is to be landed by that boat.

There is provision for another person to give the notice on behalf of the licence holder.

Transhipment notice

A transhipment notice must be given as soon as possible after the TRL is transferred to a transport provider. If the transport provider is an aeroplane a transhipment notice must be given before the aeroplane departs from the place where the TRL was transferred.

The transhipment notice must contain the following information:
- the commercial fishing boat licence number
- the fisher PIN
- if TRL is to be transported by a transport provider that is a boat, the transport vessel identity which is referenced by its ***identification code***
- if TRL is to be transported by a transport provider that is an aeroplane, the identity of the transport company using a numerical code that references the company name
- the landing place referenced by a numerical code or by its latitude and longitude
- the date the transport provider will land
- the number of TRL in whole form that were transferred to the transport provider
- if tailed TRL is to be transported, the number of containers transferred to the transport provider.

The following additional requirements also apply specific to the mode of transport:
- If transported by aeroplane, the TRL from each quota account must be identified by the boat mark.
- If transported by another transport vessel, the vessel must hold a carrier boat licence if TRL from different quota accounts is being transported.
- Tailed TRL may only be offloaded to motherships if each container is identified with the boat mark of the licence under which the TRL was taken.

Unload notice

An unload notice shall be given each time TRL is unloaded that is the subject of prior or transhipment notices. When a prior notice has been given stating an intention to unload TRL (other than via transhipment), all TRL must be unloaded before the vessel can resume fishing in the fishery. However, if a transhipment notice has been given a vessel can start fishing immediately.

An unload notice must be given as soon as practicable after the TRL has been unloaded from the vessel, transport vessel or aeroplane, providing the weight of tailed TRL (by certified or verified scale) or the number of small and large bins of whole TRL, to be converted to a weight by DPI&F. A separate notice must be given each time TRL is unloaded which is usually for each buyer or before they are put into storage.

Whole TRL must be unloaded in small or large bins which refer to the following:

- A small bin refers to a Nally stakanesta crate no. 10; and
- A large bin refers to a Nally IH004 vented basket.

For each small bin of TRL reported in an unload notice, the DPI&F will deduct 22 kilograms of quota from the Holder's quota account. For each large bin of TRL reported in an unload notice, the DPI&F will deduct 30 kilograms of quota from the Holder's quota account. The amount of quota to be deducted for each small and large bin reported will be reviewed by the DPI&F prior to the start of the 2010 fishery season.

A fisher can arrive one hour either side of the landing time. If the vessel arrives early the vessel must remain at the landing place until the landing time nominated in the prior notice has passed before any TRL is unloaded. This allows a fisheries inspector to inspect the catch.

Consequently, TRL can only be unloaded and weighed at places where a fisheries officer can inspect proceedings. Once the landing time has passed, fishers do not have to unload at the landing place nominated in the prior notice. However, they must still unload within the same defined port area. If the landing place is not in a defined port area, then within 0.5 nm of the landing place. This allows an inspector to easily find the vessel should it move from the original landing place for any reason.

The following details are to be provided in an unload notice:

- the commercial fishing boat licence number
- the fisher PIN
- if asked, the prior notice or transhipment notice receipt number for the fish unloaded
- the exact weight of TRL in tail form (a conversion factor of 2.7 will be applied to this weight prior to quota deduction)
- the number of small bins of whole TRL (each small bin will be deemed to weigh 22 kilograms for the purpose of quota deduction)
- the number of large bins of whole TRL (each large bin will be deemed to weigh 30 kilograms for the purpose of quota deduction)

Unnotifiable landing notice

Sometimes it may not be possible to give a prior notice. In these cases an unnotifiable landing notice is proposed. These situations may include extreme weather conditions, a medical emergency, fire, or when all the relevant equipment on board the authorised boats has been destroyed or is unusable and cannot be replaced or fixed during the notifying period.

8.5 Documentation requirements to allow whole-of-distribution-chain tracking of commercially caught TRL.

Documentation arrangements for the fishery will require buyers and other people commercially involved in the fishery to keep a documentation chain enabling quota lobster to be tracked as they move through the commercial sector to the end consumer. This scheme shall apply whenever the TRL is in Queensland's jurisdiction regardless of whether or not it originated in the Queensland fishery.

This whole-of-distribution chain documentation system addresses the concerns about black market activities emerging from such high value fish in the marketplace. This system offers an effective regime capable of being audited over extended periods and is less costly than other approaches such as tagging.

This system's operational aspects are similar to those adopted nationally to manage abalone. Documentation always accompanies the product and can be inspected. This system has already been implemented in other Queensland fisheries such as the Coral Reef Fin Fish Fishery and Spanish Mackerel Fishery. It requires that certain records be kept for commercial TRL trade in Queensland. Those records are essentially the consignment notes, tax invoices and delivery dockets or similar documentation widely in use in legitimate commercial fisheries transactions at this time. Formally incorporating these requirements enables the use of such documents in enforcing and auditing the quota system for these fish species.

The requirements to keep documentation will include the following:

- A licensed fisher must complete a separate catch disposal record (CDR) for each consignment of lobsters sold to a buyer or put into storage.
- The CDR forms a written record of the information given in notices and can be cross-checked against information in the prior or transhipment and unloaded notices. Licensed buyers must sign the CDR if the TRL are taken in the fishery.
- Those who buy and sell TRL in Queensland (other than for sale to an end user) including restaurants, hotels and fish shops, will be required to keep a fish transfer record for five years. The record will include details such as the origin, name and authority number or address, transaction date, TRL quantities and their processed form.
- A fish import record will be required for TRL brought into Queensland or Queensland waters from other sources or landed in Queensland from fisheries in other jurisdictions such as Torres Strait.
- Where TRL are being transported in Queensland, they must be accompanied by a fish carriage record that includes the identity of the TRL owner and source and destination of the lobsters.
- People storing TRL must keep a record of the person's name for whom the TRL is being stored. A monthly stocktake must also be made documenting the name of the person to whom the TRL belong, their authority number, the time and date, and weight of TRL by product form.

9. MECHANISMS TO IMPLEMENT POLICY PROVISIONS

Under section 63 (Amendment of authority) of the *Fisheries Act 1994* the chief executive may amend an authority, including the conditions stated in the authority, by issuing the authority holder with a show cause notice that:

(a) states the proposed amendment; and
(b) states the reasons for the proposed amendment; and
(c) outlines the facts and circumstances forming the basis of the reasons; and
(d) invites the holder to show, within a stated time of at least 28 days, why the authority should not be amended.

The DPI&F will undertake a show cause process beginning in December 2008 to amend conditions on Commercial Fishing Boat Licences endorsed with 'R' fishery symbols to introduce TRL quota and reporting conditions relating to the use of quota.

Prior to the show cause process, the DPI&F will consult with authority holders in relation to recorded catch history, special circumstances and the provisions of this Policy.

10. DEFINITIONS

Conversion factor means the factor which is applied to convert TRL reported as 'tails' to a whole weight for the purpose of determining catch history or for quota deduction. The conversion factor to be applied is 2.7 which reflects a recovery rate of 37%.

Former licence means a licence that was surrendered in exchange for the issue or amendment of the current licence.

Identification code, for a transport vessel, means the sequence of numbers that is to be used to identify the vessel and is—
(a) nominated by the chief executive; and
(b) published on the DPI&F's website.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
Setting of hookah closures	**Agenda Item 8 For Discussion and Advice**

RECOMMENDATIONS

1. The RAG **NOTE** the TSRA Deputy Chair and Fisheries Portfolio Member requested to discuss the setting of moon-tide hookah closures for the TRL Fishery at TRLRAG meeting no. 21 on 12-13 December 2017.
2. The RAG **NOTE** that TSRA will be providing a meeting paper for this agenda item for discussion and advice.

KEY ISSUES

3. At TRLRAG meeting no. 21 on 12-13 December 2017 the RAG Chair noted that the TSRA observer requested to discuss the setting of moon-tide hookah closures for the Fishery and wanted the RAG to consider if a second moon-tide closure should be implemented during the months February to September.
4. The RAG Chair recommended the TSRA observer provide a paper to the RAG prior to the next meeting to support an informed discussion on the topic.
5. A copy of the current Torres Strait Tropical Rock Lobster Fishery Moon Tide Hookah Closure Calendar 2018 is provided at **Attachment A.**

BACKGROUND

NIL.

ATTACHMENTS

A. Torres Strait Tropical Rock Lobster Fishery Moon Tide Hookah Closure Calendar 2018.

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

Torres Strait Tropical Rock Lobster Fishery Moon Tide Closures 2018

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KEY

● **New Moon**

○ **Full Moon**

Fishery Closure

Hookah Closure

Australian Government | TSRA www.tsra.gov.au

Tropical Rock Lobster Resource Assessment Group

27-28 March 2018, Thursday Island

Agenda Item 6: TRL moon-tide hookah closures

Recommendations:

That the Tropical Rock Lobster (TRL) WG consider implementing a second hookah closure period each month in the TRL Fishery:

- For the remainder of the 2018 TRL season, effective from the first proposed new period of 13 April 2018 (Attachment A)
- For consideration prior to each season as an additional effort control in years with Total Allowable Catches (TAC) set below historical catch averages.

Background:

Between 2003 and 2012, the PZJA implemented annual interim management arrangements (including the moon-tide closure) in the TRL Fishery. In 2013 the PZJA did not implement interim arrangements. Moon-tide closures were reintroduced in the 2014 season and seasons since as an interim effort control until such time as the fishery progressed to output controls under a Management Plan.

It appears that moon-tide closures are effective in reducing the overall effort in the TRL fishery.

The closures also allow free-divers improved access to the stock by allowing them to work the favourable tides in these periods without competing against those using hookah apparatus.

The TRL RAG has recommended the setting of a low TAC of 299 tonnes in the 2018 season. It has also discussed that future seasons (2-3 years) have a likelihood of low TACs, relative to historical catches in the fishery.

Issue:

- The proposed new hookah closure periods would result in two closure periods each month, three days before and after the new (Dark) moon and full moon. (Attachment A).

- An additional hookah closure is an important consideration for the 2018 season, due to the potential likelihood that catch limits will exceed the TAC.

- To ensure catches in future years remain within the sustainability limits of the TAC, the use of an additional hookah closure period should be determined prior to the opening of the season based on considering historical catches against the likely TAC.

The proposed extra week closure is to further contribute to the:

1. Sustainability of TRL Industry. The 2018 season is one of the lowest TAC years ever and it is yet unclear to the influences contributing to the reduced stock abundance.

2. Provide for improved access to the fishery for free-divers, due to the favourable tides for free-diving in the proposed closure periods. Hookah divers would still be capable of working during two Neap Tides a Month (first quarter and second quarter).

3. Contributing towards an overall reduced effort all round in TRL Industry. As this fishery is currently controlled only through effort controls, measures such as this ensure the effort in the fishery is constrained as to not exceed the sustainability limits set by management.

Torres Strait Tropical Rock Lobster Fishery Moon Tide Closures 2018

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KEY

● **New Moon**

○ **Full Moon**

Fishery Closure

Hookah Closure

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-18 March 2018
OTHER BUSINESS	Agenda Item 9 For Discussion

RECOMMENDATIONS

1. That the RAG **NOMINATE** any further business for discussion.

TROPICAL ROCK LOBSTER RESOURCE ASSESSMENT GROUP (TRLRAG)	MEETING No. 22 27-28 March 2018
DATE AND VENUE FOR NEXT MEETING	**Agenda Item 10** **For DISCUSSION**

RECOMMENDATIONS

1. That the RAG **NOMINATE** a date and a venue for the next meeting.

Summary of Preliminary Responses to Reports querying the TRL RBC for 2018

Éva Plagányi, Michael Haywood, Rob Campbell, Mark Tonks, Roy Deng, Nicole Murphy, Kinam Salee

CSIRO Oceans and Atmosphere, Queensland BioSciences Precinct (QBP), St Lucia, Brisbane,

Queensland, and Aspendale, Victoria, 3195

Report for TRLRAG, March 2018

SUMMARY CONCLUSION: Based on analysis of past data, we conclude that it is too early for fishers to make a call as to the entire season for Torres Strait (TS) tropical lobster (TRL) over the full area and considering all sectors of the fishery. Our results suggest it is unlikely that the good catches of 2+ animals is sustainable through the rest of the season when a switch to fishing 1+ recruits will occur, and there remain concerns that the recruiting cohort is unlikely to be above average. There is currently no firm basis to support an alternative to the survey prediction of a below average recruiting age class when averaged over the entire TS region. All indications from available data and the stock assessment suggest that the spawning biomass is currently below average and a precautionary approach is needed to ensure the longer-term sustainability of the stock.

Below is a short summary to justify this conclusion, supported by the Plagányi et al. (2018) report and the following Appendices:

Appendix 1 –Catch and Effort in the Torres Strait rock lobster fishery

Appendix 2 – Length Frequency analyses

Appendix 3 – Summary of TRL movement studies

Appendix 3 – Midyear survey pros and cons

1. Catch and CPUE at the start of season

- Appendix 1 prepared by Rob Campbell summarises the latest available catch and effort data for the fishery and provides a comparison of the annual trends in catch, effort and catch-rates in the three months of December, January and February so that the relative performance of the fishery since December 2017 can be assessed.
- The reported TIB catches for December 2017 and January 2018 are higher than in recent years. For the respective months, the catch in December-17 is the highest since 2014 while the catch in January-18 is the highest since 2012. On the other hand, the catch in February-18 similar to that reported in the previous two years.

- Factors may have influenced the higher catches in December and January include increased reporting (compulsory new TDB02 CDR logbook), increased effort (difficult to check given this is voluntary information) in the fishery, increased stock abundance (catch rates for the first three months are mid-range in the distribution of catch rates). However, within any fishing season CPUE can be highly variable across the different months of the season. There are also several seasons where CPUE was initially high but then declined substantially throughout the season (e.g. 2004, 2008 and 2011, c.f. Figure 1 below). A longer time-series of data will be needed to ascertain whether the 2018 season will follow such a trend

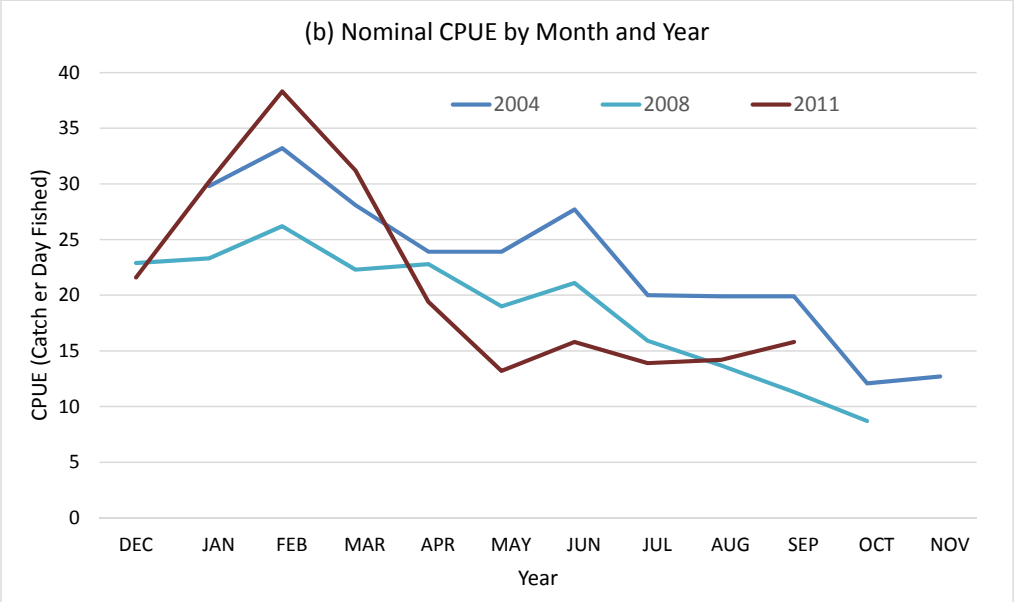

Figure 1 (corresponds to Fig. 5b from Appendix 1). Nominal CPUE (kilograms per day fished) by month for the TIB sector for selected fishing seasons.

- Higher abundance in selected areas – concerns re localised depletion. In recent years sand incursions may have been influencing the distribution and availability of lobsters to the fishery. A shift back to more favourable conditions in some areas may have occurred recently. The data indicate particularly higher catch rates in recent months in some regions (e.g. Badu, Cumberland and to some extent in Mt Adolphus) which isn't fully consistent with anecdotal reports received and could be discussed further at the RAG.
- For the TVH sector, no meaningful summary of total effort and related catch rates was possible. Compared to the catch for February in previous years, the catch in 2018 is currently the lowest since 2010 and is slightly below the average catch for February of 31.8 tonnes taken over all years between 1994 and 2017, but not all data may have been available at the time of analysis.
- No information from the PNG sector is available to date.
- It is not unexpected to find spatial hotspots of abundance as has been the case in previous years, and likely to increasingly be so with fishers becoming more mobile

- There are several factors which might explain increased effort as well as increased reporting this season

2. Length Frequency Analyses

- The length frequency data from the November 2017 survey were plotted as shown below (Fig 2.). The von Bertalanffy growth curve was then applied to this distribution to illustrate the expected size distribution of this cohort in January 2018. This distribution was then compared with the actual observed size distribution of lobsters caught in January 2018 (data kindly provided by Kailis). As per Figure 2 below, this highlights that the January catches are comprised mostly of animals from an older cohort, i.e. non-migrants from the previous year's 2+ cohort.
- Our length frequency (90-140 mm CL) and sex ratio analysis (mostly male) show these animals represent the 2+ cohort from the previous year so are not an index of abundance of the new 1+ cohort which is usually only accessible (due to size) to fishers from about March.
- The sex-disaggregated length frequency plot for January (Fig. 3) clearly highlights that in 2018, as in previous years, almost all the large lobsters caught are male. This further confirms that these animals are non-migrant survivors from the previous year because most of the females migrate out of the region to spawn. Comparison of changes in the length frequency and sex ratio of the catch during the year shows the progression of the fishery each year from a focus on "left-over" 2+ animals to fishing the new cohort, which constitutes the bulk of the annual catch. A more complete set of length frequency and sex ratio comparisons is given in Appendix 2 of this document, and additional information in Appendix 3 further supports these points.

3. Movement and local depletion

- Appendix 3 provides a summary of movement information for TRL, concluding that larger (2+) lobsters in Torres Strait show high reef fidelity throughout most of the year, although they are highly nomadic within a reef system.
- There is aso a movement of 1+ lobsters onto the shallow reefs in Torres Strait soon after the annual breeding migration
- A study on local depletion indicated low levels of local movement and high reef fidelity among shallow reef 2+ lobsters (Skewes *et al.*, 1997)
- Hence if there are local hotspots of lobster abundance that are fished, these areas will be replenished to some extent by lobsters from the surrounding reef system but high catches are unlikely to be maintained in an area unless there is a high abundance of 1+ recruits "growing" into the fishery. The survey indicated a low 1+ abundance and the movement and site fidelity information supports that there is unlikely to be movement of any additional animals from neighbouring areas.

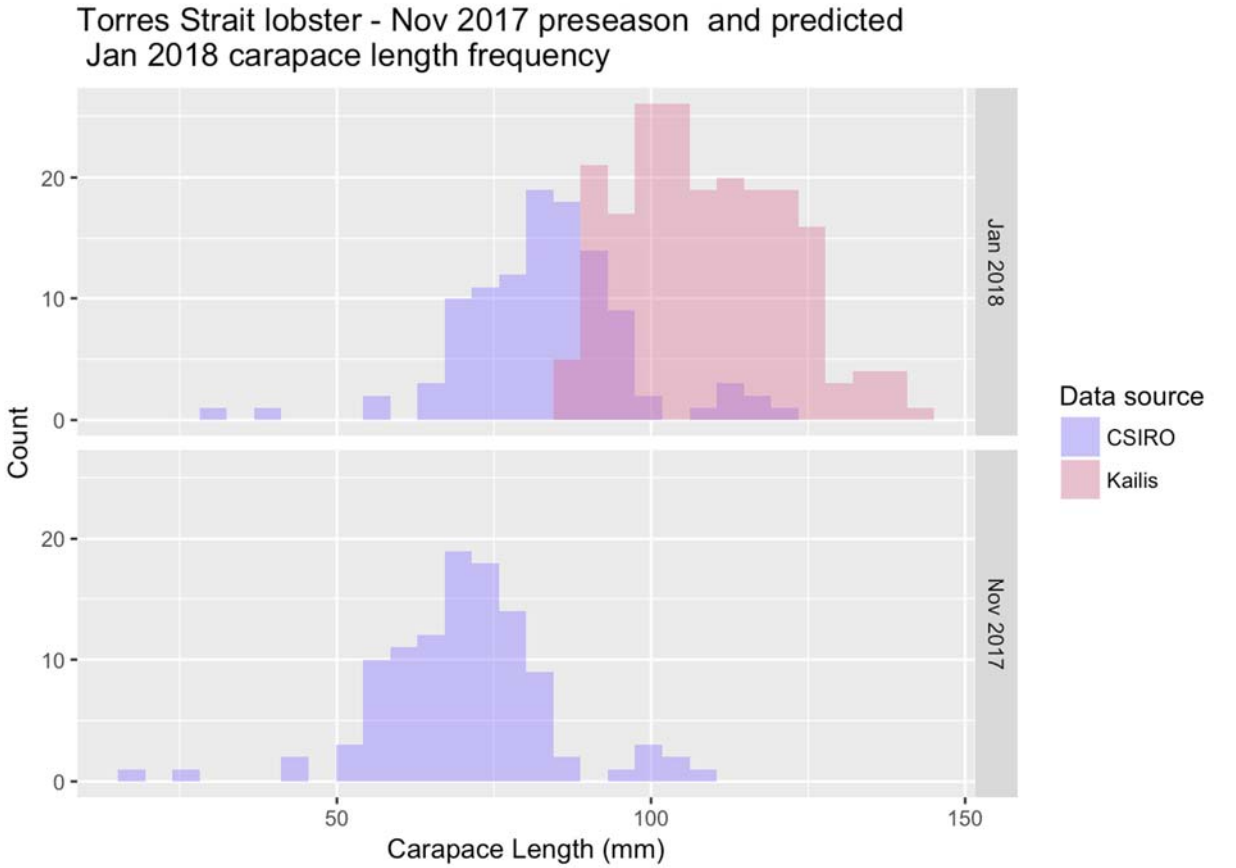

Fig. 2. Comparison between observed length frequency sample from January 2018 catches, and predicted length frequency of 1+ cohort recruiting to fishery in 2018, with the latter predicted based on applying the expected average growth rates to the November 2017 survey-observed frequencies.

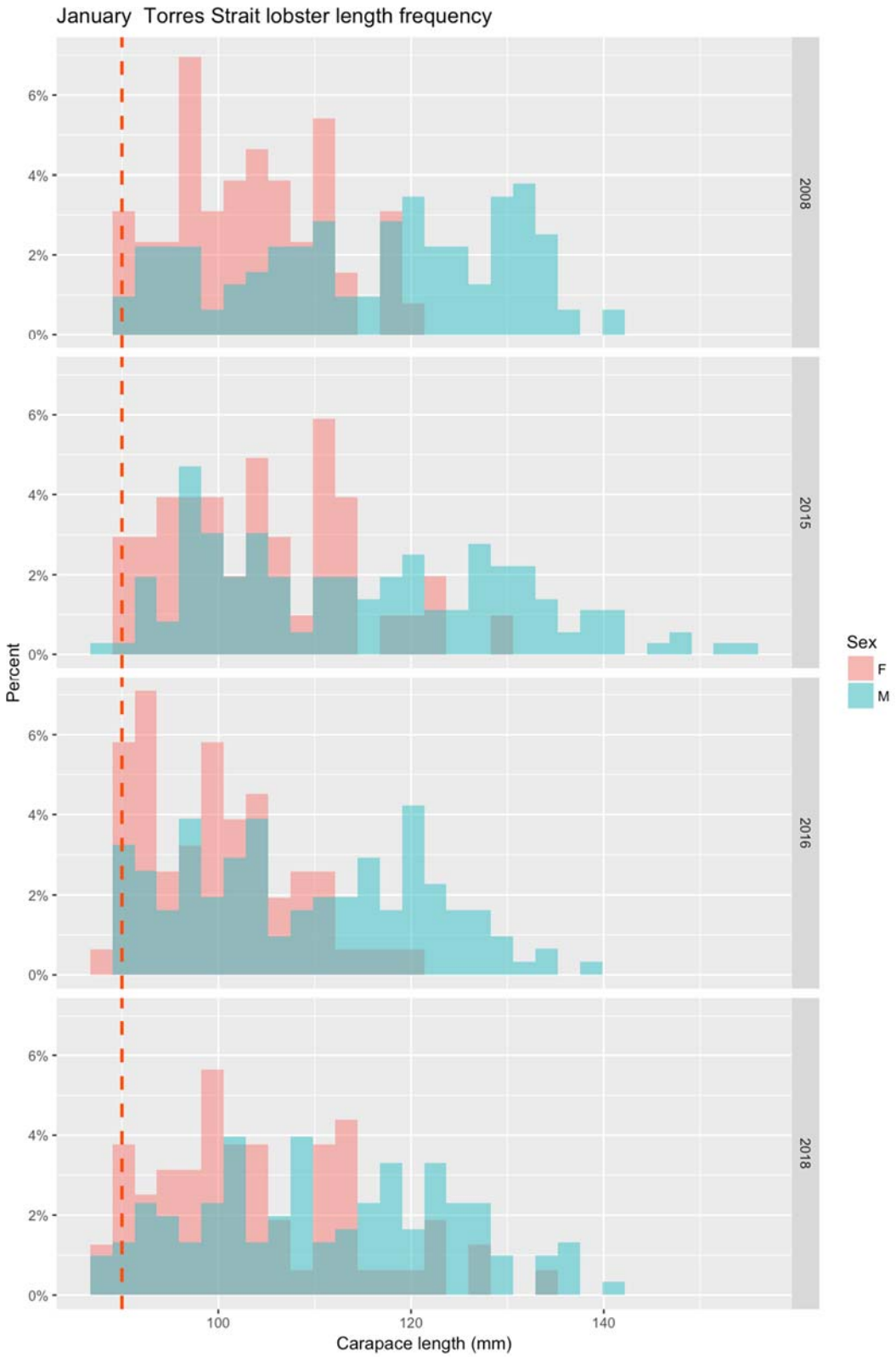

Fig. 3. Sex-disaggregated length frequency (percentage of sample having a carapace length (mm) as shown) from catch samples shown for January from each of the years as indicated, and with pink shading representing females and blue shading males. The dashed vertical line represents the legal size limit.

4. The November 2017 Preseason survey

- Survey is considered representative although it is acknowledged that the number of sites has been reduced in recent years (due to reduced funding) compared with past years (Fig. 4) and hence it is possible that some hotspots will be missed, but on average previous analyses have shown it still provides a reliable index of overall stock abundance, albeit with slightly larger associated standard error (see also Figs 5.10-5.11 in Plagányi et al. 2018).
- If changes to the current preseason survey suggested because of concern about habitat changes additional sites could be re-introduced that were dropped off (extra costs to add survey sites –additional charter days), and these should ideally be chosen to match old sites and boost sampling in targeted areas eg around Warrior

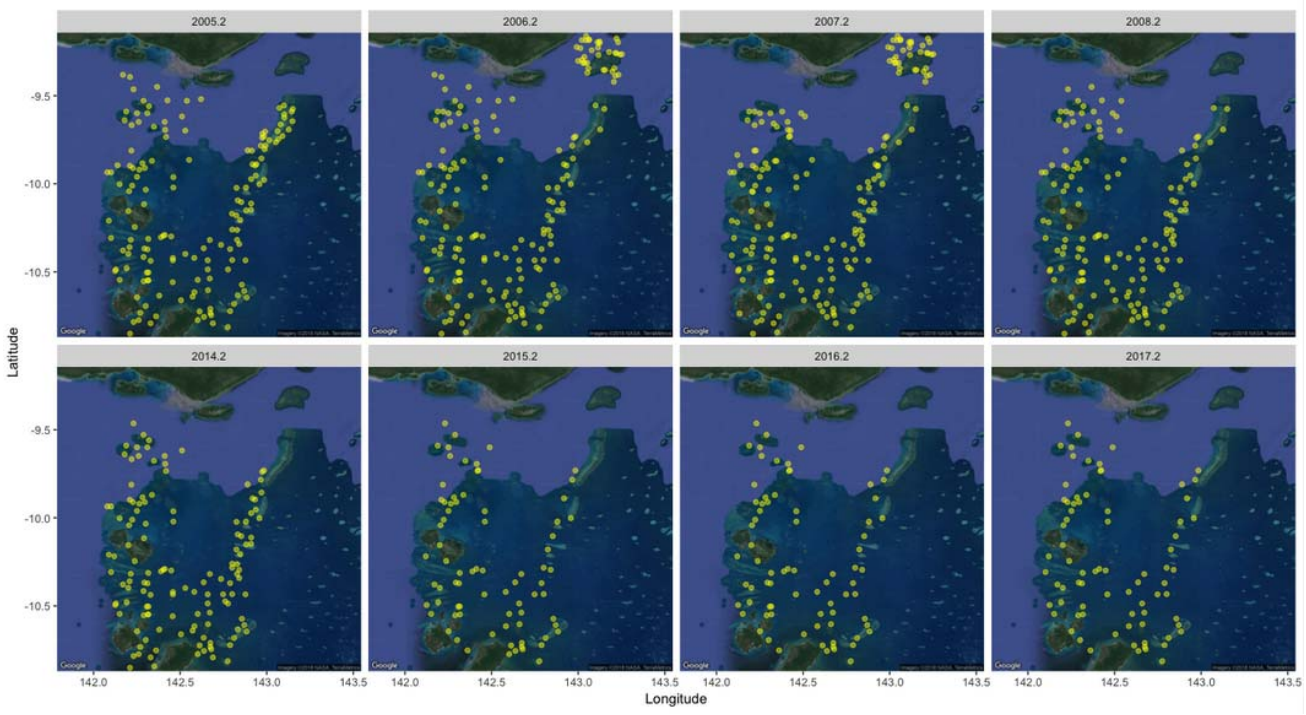

Fig. 4. Pre-season survey sites between 2005 and 2017. Number of sites pre-season survey sites reduced from >130 (2005-2014) to <80 (2015-2017). Note that pre-season surveys were not conducted during 2009-2013 (source: Fig. 5.7 in Plaganyi et al. 2018)

- Previous analysis suggested fairly high site fidelity of settled 1+ and 2+ lobsters (see Appendix 3) hence don't expect major deviations from survey predictions, apart from understandably missing some hotspots
- Timing of settlement – recent anomalous environmental conditions may have altered timing of settlement eg of 1+ lobsters so that some were missed during the survey, but this is considered unlikely given the size frequency analyses as described above
- The survey reported very low 0+ abundance but there are anecdotal reports from fishers observing lots of 0+ animals – these reports need to be considered after first comparing the definition of size of 0+ lobsters with that of fishers

- It is as expected that the preseason survey will not count many 2+ lobsters as they have either migrated or moved into deeper water at that time – hence observations of 2+ lobsters being caught in December/January are not inconsistent with the survey results.

5. Habitat Changes

- Over the recent period there have been a number of anomalous environmental events, and large impacts due to changing habitat. Current reports that sand has moved out of an area resulting in favourable habitat for lobsters can therefore partially explain high abundance of lobsters in localised areas.
- Analysis of the 2017 survey data for comparison with the historical series suggests there does appear to be some increase in seagrass cover around Moa and Badu and marginally around Maubiag in 2017, but not as high as in 2014. There doesn't seem to be any obvious signal in the sand plot. The survey isn't extensive enough to provide detailed habitat information but this does suggest that on average there weren't any major habitat changes observed during the survey (Fig. 5.13-5.16 in Plaganyi et al. 2018 milestone report).

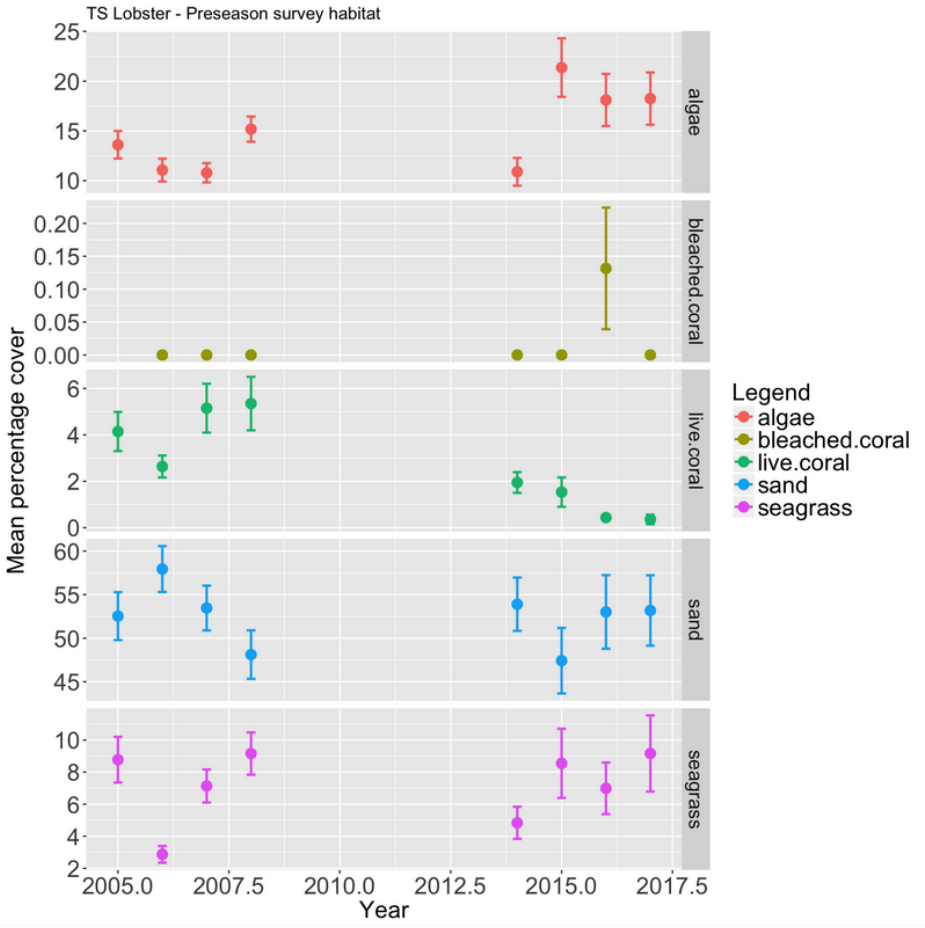

Fig. 5. Mean percent covers of abiotic and biotic categories recorded during pre-season surveys in Torres Strait during 2005-2008; 2014-2017. Error bars represent standard errors. (Source Fig. 5.14 in Plagányi et al. 2018)

6. Stock Assessment

- The stock assessment outputs depend primarily on the survey 1+ index of abundance, but also account for longer terms trends in spawning biomass and 0+ abundance so as to ensure the longer-term sustainability of the stock with a very low risk of stock depletion in line with the stakeholder-agreed management objectives. The latest December 2017 stock assessment was conducted in an identical fashion to previous years, calibrated to maintain spawning biomass at a pre-agreed level and utilising an F=0.15 which yielded a RBC of 299t with 90% confidence interval 196-401t – as previously the large confidence interval reflects uncertainties around data and stock status given that it is difficult to forward predict the yield from highly variable single cohort fisheries such as TRL. However, despite a number of other external factors influencing fishing effort as well as the TAC being a nominal one only, there is a generally good correspondence between the model-based RBC (used to inform setting a nominal TAC) and the final catch (Fig. 6).
- The stock assessment is acknowledged to be precautionary in response to feedback and buy-in from stakeholders, and has in the past output RBCs which are closely in line with current stock abundance and hence vary dramatically from year to year. In contrast, the current empirical Harvest Control Rule (eHCR) being proposed seeks to dampen inter-annual variability in catches and hence recommends a higher RBC based on recent average performance (and would similarly set a lower RBC in good years that the stock assessment) – the eHCR comparable value for 2018 is 519t, but does not correspond to the management process currently agreed by stakeholders. Certainly it suggests that the RBC for 2018 could have been set higher with an acceptable level of risk if that was the management method currently adopted, but we strongly disagree with switching methods based on comparing RBCs. Moreover, as discussed at the last TRLRAG, the eHCR to date has had to rely on time series with missing values (for both the Preseason survey and TIB CPUE), whereas after the 2018 preseason survey, a complete time series of 5 data points will be available, as required by the eHCR.
- If the 2018 catch is double the RBC value of 299t, the stock assessment model suggests the fishing mortality will be double the target level
- The stock assessment recommendations are also based on the predictions that the spawning biomass this year (and possibly next year) is likely to decrease to low levels similar to the low levels during the past 2 low abundance periods (around 2001 and 2006).
- The stock assessment over-estimated the number of 0+ in the Nov 2017 preseason survey (because it was difficult to fit the low observations which also had a high associated standard error) and hence the forward projection for next year may be slightly over-optimistic, but it is also worth bearing in mind that the survey observations suggest that next year's recruiting age class may also not be a huge one.

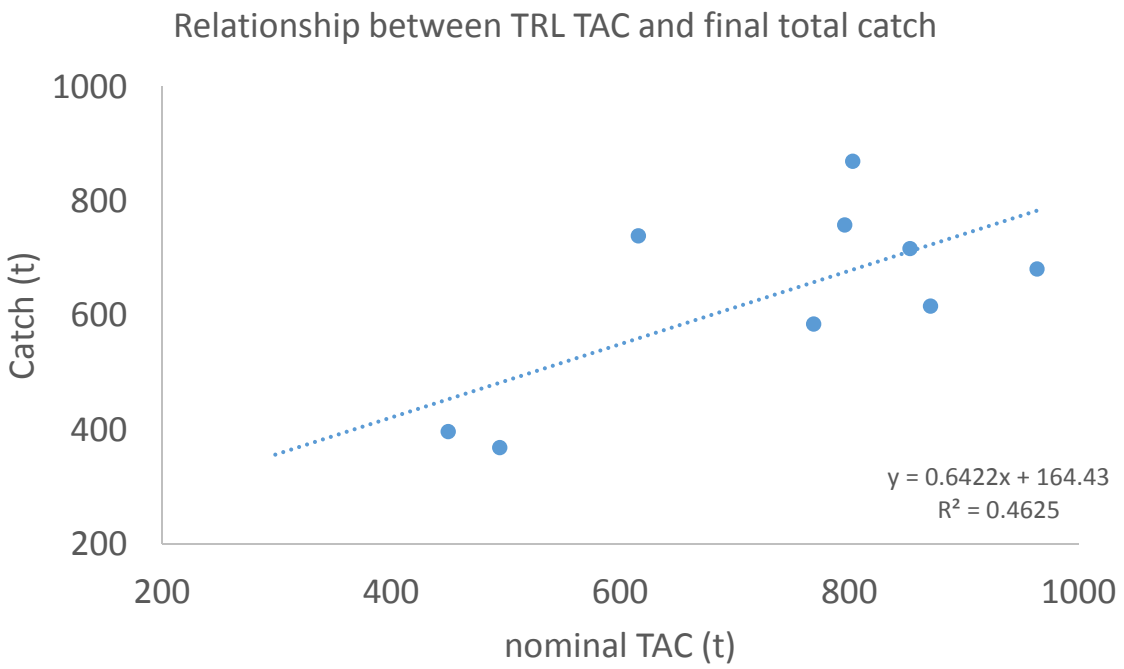

Fig. 6. Plot of the relationship between the TRL stock assessment model RBC, which informed a nominal TAC, and the total final catch (from all sectors – TIB,TVH,PNG), for years since 2009.

7. Midyear Survey

Appendix 4 provides a summary of some pros and cons regarding the suggestion to conduct a midyear survey to increase understanding of the current status of the fishery

Acknowledgements

We are grateful to Darren Dennis for kindly sharing insights into the history of the fishery based on his long history of involvement. Many thanks to the many stakeholders who have contributed information and perspectives on the current status of the fishery. Thanks also to M.G. Kailis for providing length sample measurements at short notice.

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Appendix 1 - Catch and Effort in the Torres Strait Rock Lobster Fishery

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March 2018

1. Introduction

This paper provides a short summary of the catch and effort in the Torres Strait Rock Lobster (TSRL) fishery. In particular it provides a comparison of the annual trends in catch, effort and catch-rates in the three months of December, January and February so that the relative performance of the fishery since December 2017 can be assessed.

2. TIB-Sector

Data

A new logbook, known as the Torres Strait Catch Disposal Record (TDB02), was introduced in the TSRL fishery at the start of November 2017. This logbook, with is mandatory to complete, records the catch weight of lobsters landed at the completion of all fishing trips. As well as information related to the fish receiver, the logbook also records information related to the fisher (name, boat symbol, etc), the sector of the fishery that the fisher operated (e.g. TIB or TVH) and the process state of the catch (e.g. whole, live or tailed). Additional information related to fishing effort (e.g. days fished, number of fishers) together with the area fished and methods used is currently only optional. The TDB02 logbook replaces the Torres Strait Seafood Buyers and Processors Docket Book (TDB01) which had been used in the TIB sector to record the catch sold by fishers at the end of a fishing trip. Completion of this docket-book had only been voluntary.

Data related to the TDB02 CDR logbook was obtained from AFMA on 13 March 2018 while the last batch of data related to the TDB01 docket-book was obtained from AFMA in late October 2017. In the data summaries presently in the paper, all data up until the end of November 2017 is taken from the TDB01 docket-book while all data since December 2017 is taken from the TDB02 CDR logbook. The TDB01 docket-book data is likely to be incomplete to some extent for the last few months up until November 2017, while the degree of completeness of the TDB02 data since December 2017 remains uncertain (though it is assumed to be highly high for at least December 2017 and January 2018 with late returns likely still to be entered for February 2018).

Data Summaries

The following summaries are presented in Tables 1-4 and Figures 1-4.

Nominal Catch

The TDB02 CDR logbook records the sector of the fishery that the landed catch was caught within. This data field was used to select catches associated with the TIB-sector and hopefully, this prevents the potential double counting of catches which had been an issue with the TDB01 docket-book. Data rules used to separate TIB, TVH and processor related catches in the docket-book are outlined in Campbell and Pease (2018).

1a. Total catch (kilograms, whole weight), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

1b. Total catch (kilograms, whole weight), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

Effort

Due to the voluntary nature of provision of effort data in the new TDB02 CDR logbook, together with overall voluntary nature of the TDB01 docket-book, the information related to effort in the TSRL fishery is more limited than that for catch. The following data summaries present information related to those logbook and docket-book records where the number of days fished was recorded. The annual percentage of TIB-related records where effort has not been recorded is shown in Figure 2.

2a. Total effort (number of days fished), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

2b. Total effort (number of days fished), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

Catch-per-unit Effort

Due to the more limited amount of effort data noted above, the following data summaries present information related only to those logbook and docket-book records where the relevant measure of effort was recorded. Two measures of fishing effort were used: i) number of days fished, and ii) number of fisher days (defined as the multiple of the number of days fished and the number of fishers, both of which can be recorded).

3a. Nominal catch-per-unit effort (kilograms, whole weight, per days fished), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

3b. Nominal catch-per-unit effort (kilograms, whole weight, per days fished), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

4a. Nominal catch-per-unit effort (kilograms, whole weight, per fisher days), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

4b. Nominal catch-per-unit effort (kilograms, whole weight, per fisher days), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

Table 1 Recorded Catch

(a) Total catch (kilograms, whole weight), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	15,542	24,309	35,574	17,737	30,356	28,516	26,449	18,976	12,873	24	25	21,648	232,031
2005	15,098	50,625	58,221	47,575	56,758	43,061	34,474	23,682	16,088	314	71	12,507	358,474
2006	9,447	24,018	26,814	19,091	18,380	9,814	9,910	7,672	2,747	0	51	19,002	146,946
2007	24,941	24,716	62,040	29,185	33,759	29,025	23,193	13,907	8,920	0	0	10,435	260,122
2008	13,461	31,237	36,127	24,110	16,711	14,805	23,516	9,277	5,969	18	0	9,716	184,947
2009	13,273	20,547	23,103	23,733	15,647	13,242	15,393	7,811	4,819	529	0	5,764	143,862
2010	6,198	21,259	15,829	14,995	12,180	16,348	19,073	17,001	9,782	1,610	0	6,929	141,203
2011	18,215	30,141	49,767	20,400	23,990	18,686	18,856	8,858	3,218	0	0	9,036	201,168
2012	13,403	19,028	24,718	19,606	9,689	22,874	11,194	10,836	1,996	0	0	3,080	136,423
2013	851	9,896	8,332	12,899	11,551	10,134	11,582	8,955	9,832	0	0	6,688	146,130
2014	8,992	12,390	26,237	19,135	17,160	11,398	11,767	11,722	6,498	126	0	12,480	204,568
2015	5,775	19,350	13,182	16,700	10,469	27,784	8,031	7,189	4,569	172	0	6,177	196,303
2016	6,962	23,572	16,243	10,340	15,255	15,030	11,165	10,011	4,828	98	75	5,147	266,106
2017	8,290	23,339	15,831	11,697	14,959	7,476	9,730	10,803	4,075	155	0	12,153	118,508
2018	11,137	23,634											

(b) Total catch (kilograms, whole weight), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

YEAR	Unknown	Turu Cay	Deliver Island	Northern Section	Bramble Cay	Anchor Cay	Western	Mabuiag	Badu	Thursday Island	Central	Warrior	Warraber	Mt Adolphus	Great NE Channel	South East	Darnley	Cumber-land	Total
DEC																			
2004	0	3268	0	0	233	0	0	6323	2756	3477	368	2818	326	317	866	0	750	92	21648
2005	0	7	0	0	0	21	0	2038	1024	1565	574	3828	1065	0	234	0	1266	871	12507
2006	0	141	0	574	0	0	0	4006	726	3861	575	5614	1853	384	214	0	669	78	19002
2007	0	0	0	0	0	0	0	613	991	1401	526	2044	1270	596	569	0	1510	914	10435
2008	0	0	0	0	0	0	0	418	197	6462	343	996	541	0	647	39	0	0	9716
2009	0	0	0	9	0	0	0	37	10	4555	0	21	617	20	313	0	128	0	5764
2010	0	113	0	0	0	0	0	1187	397	4182	290	67	292	0	401	0	0	0	6929
2011	726	0	0	0	0	14	0	1719	339	4294	221	69	1164	168	127	0	195	0	9036
2012	1676	0	0	221	13	0	0	1040	39	91	0	0	0	0	0	0	0	0	3080
2013	707	25	0	73	0	0	0	2730	2084	458	0	0	547	0	64	0	0	0	6688
2014	1573	0	79	19	0	0	0	2040	3065	5014	80	0	554	18	38	0	0	0	12480
2015	915	0	0	0	0	0	0	169	1635	1945	0	1087	425	0	0	0	0	0	6177
2016	1835	0	0	9	33	0	0	63	182	2289	225	0	362	0	134	0	0	15	5147
2017	1558	12	0	219	0	0	0	0	1254	2447	84	4853	301	23	1006	0	169	227	12153
2018																			
JAN																			
2004	0	7	0	162	0	0	0	5573	3675	3286	106	33	1849	586	106	159	0	0	15542
2005	0	310	0	0	12	25	0	5321	1653	3191	233	2587	328	410	171	0	797	60	15098
2006	0	0	0	427	0	0	0	935	774	1590	493	754	1808	83	646	50	874	1012	9447
2007	0	130	76	1171	0	0	0	8138	997	6830	306	2764	1332	365	469	94	1256	191	24941
2008	0	0	0	29	0	0	0	646	1490	5090	129	1430	2002	808	300	0	998	538	13461
2009	0	83	0	9	0	0	0	397	60	7283	228	2706	1352	38	967	0	0	0	13273
2010	955	0	0	0	0	0	0	0	149	3441	101	229	490	0	286	0	547	0	6198
2011	2020	0	0	239	0	24	0	6364	4037	3712	584	0	659	0	412	0	163	0	18215
2012	1676	58	0	47	0	0	0	3251	3441	3568	640	0	339	0	139	0	244	0	13403
2013	788	0	0	0	0	0	0	0	0	62	0	0	0	0	0	0	0	0	851
2014	670	0	0	311	0	0	0	5208	974	787	0	0	1043	0	0	0	0	0	8992
2015	1176	0	0	588	0	0	0	362	1658	1641	119	0	180	0	52	0	0	0	5775
2016	1034	0	0	0	0	0	0	77	2447	2837	0	199	368	0	0	0	0	0	6962
2017	2695	132	0	0	7	0	0	33	365	4656	29	202	120	0	52	0	0	0	8290
2018	1504	102	0	30	0	0	0	0	2015	4131	114	1739	380	85	883	0	9	147	11137
FEB																			
2004	38	99	0	1076	0	0	0	7387	1961	10959	25	37	939	344	50	0	1394	0	24309
2005	134	43	0	387	0	0	0	22301	4441	13837	508	3657	865	409	2128	0	1257	559	50625
2006	240	21	70	168	0	0	102	3465	3902	5979	581	1620	3466	1846	320	75	609	1209	24018
2007	99	0	0	1199	0	0	0	2847	2839	8901	917	1951	2871	888	309	0	872	128	24716
2008	0	0	0	0	0	0	0	3038	6091	14700	353	1968	2646	760	290	0	1186	126	31237
2009	0	67	132	212	0	0	0	1862	143	8994	68	4610	2966	0	1264	0	0	0	20547
2010	980	0	0	200	0	0	0	743	342	17475	87	216	236	0	548	61	371	0	21259
2011	6351	122	0	91	0	0	29	11473	5024	5959	29	0	180	154	301	135	294	0	30141
2012	1954	34	0	87	0	0	0	9629	4562	2302	107	0	171	0	27	0	154	0	19028
2013	5730	0	0	0	0	0	0	1019	0	65	737	1680	242	125	297	0	0	0	9896
2014	1627	0	0	0	0	0	0	5058	2702	1427	263	0	1044	187	82	0	0	0	12390
2015	3486	2	0	809	0	0	0	2411	3735	4726	306	2384	1028	400	22	27	0	0	19350
2016	2946	13	0	0	0	72	99	190	4094	14646	0	319	815	0	291	0	33	0	23572
2017	2060	2054	0	0	19	0	0	47	2882	10370	4415	663	723	0	47	0	58	0	23339
2018	9078	203	0	414	0	0	0	219	6130	5943	3	209	7	754	625	50	0	0	23634

Figure 1. Total catch (kilograms, whole weight) for the three months December, January and February, by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

Table 2. Recorded Number of Days Fished

(a) Total effort (number of days fished), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	458	627	847	601	1,025	834	926	768	430	2	2	728	7,248
2005	519	1,124	1,313	1,119	1,378	1,195	1,066	802	588	12	14	454	9,584
2006	392	955	1,060	788	823	428	418	256	100	0	2	667	5,889
2007	1,125	981	1,954	846	1,127	878	757	517	409	0	0	433	9,027
2008	577	1,132	1,597	1,041	879	675	1,443	651	464	2	0	555	9,016
2009	954	1,344	1,054	1,506	1,233	910	1,284	1,222	841	31	0	428	10,807
2010	426	1,242	970	880	777	861	962	953	566	21	0	321	7,979
2011	515	743	1,275	988	1,727	881	1,104	518	186	0	0	597	8,534
2012	1,050	1,267	1,314	1,471	652	1,639	657	183	60	0	0	26	8,319
2013	1	91	42	69	75	34	37	72	72	0	0	293	786
2014	395	1,134	1,546	1,324	1,147	1,057	1,082	1,010	550	6	0	1,325	10,576
2015	632	1,901	1,358	1,068	1,141	1,320	1,038	794	766	12	0	581	10,611
2016	596	1,808	2,238	1,185	1,690	1,218	877	803	489	10	7	355	11,276
2017	697	1,717	1,543	1,030	962	684	725	1,000	585	12	0	452	9,407
2018	636	585											

(b) Total effort (number of days fished), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

YEAR	Unknown	Turu Cay	Deliver Island	Northern	Bramble Cay	Anchor Cay	Western	Mabuiag	Badu	Thursday Island	Central	Warrior	Warrabe r	Mt Adolphu	Great NE Channel	South East	Darnley	Cumber-land	Total
DEC																			
2004	0	57	0	0	5	0	0	188	118	146	40	100	7	17	41	0	21	2	728
2005	0	1	0	0	0	1	0	61	36	96	29	138	48	0	13	0	45	22	454
2006	0	7	0	9	0	0	0	51	30	212	52	63	69	31	21	0	21	3	667
2007	0	0	0	0	0	0	0	20	46	81	20	25	49	46	13	0	74	21	433
2008	0	0	0	0	0	0	0	12	5	443	5	9	31	0	28	3	0	0	555
2009	0	0	0	1	0	0	0	1	1	333	0	4	62	1	15	0	4	0	428
2010	0	7	0	0	0	0	0	14	6	222	24	2	25	0	19	0	0	0	321
2011	46	0	0	0	0	2	0	22	16	370	15	0	97	11	12	0	4	0	597
2012	4	0	0	2	2	0	0	5	1	12	0	0	0	0	0	0	0	0	26
2013	0	0	0	0	0	0	0	57	118	4	0	0	114	0	0	0	0	0	293
2014	27	0	6	2	0	0	0	188	686	250	1	0	155	2	8	0	0	0	1325
2015	16	0	0	0	0	0	0	5	320	113	0	32	95	0	0	0	0	0	581
2016	3	0	0	0	3	0	0	7	23	265	3	0	24	0	24	0	0	3	355
2017	10	0	0	3	0	0	0	0	15	144	9	152	14	2	73	0	20	10	452
2018																			
JAN																			
2004	0	1	0	6	0	0	0	135	120	125	4	74	42	15	3	7	0	0	458
2005	0	5	0	0	1	1	0	143	78	139	16	14	17	15	7	0	21	2	519
2006	0	0	0	14	0	0	0	48	22	95	21	81	77	3	22	4	34	38	392
2007	0	6	1	28	0	0	0	157	73	476	32	41	64	18	35	5	54	8	1125
2008	0	0	0	1	0	0	0	28	64	209	7	57	89	51	11	0	53	23	577
2009	0	4	0	2	0	0	0	207	7	530	7	15	55	1	75	0	0	0	954
2010	13	0	0	0	0	0	0	0	1	287	10	0	52	0	27	0	21	0	426
2011	48	0	0	3	0	2	0	57	66	224	23	0	48	0	40	0	4	0	515
2012	30	9	0	1	0	0	0	65	435	405	59	0	25	0	14	0	7	0	1050
2013	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2014	0	0	0	6	0	0	0	186	83	2	0	0	118	0	0	0	0	0	395
2015	31	0	0	15	0	0	0	65	324	131	10	0	48	0	8	0	0	0	632
2016	9	0	0	0	0	0	0	6	338	116	0	6	121	0	0	0	0	0	596
2017	0	32	0	0	3	0	0	4	30	602	5	1	16	0	4	0	0	0	697
2018	17	71	0	0	0	0	0	0	47	287	3	78	41	6	73	0	6	7	636
FEB																			
2004	0	0	0	18	0	0	0	135	60	391	1	87	6	8	4	0	4	0	627
2005	0	3	0	11	0	0	0	342	117	363	26	54	82	2	32	0	32	21	1124
2006	0	1	2	4	0	0	2	128	153	278	40	76	102	92	16	5	22	39	955
2007	0	0	0	25	0	0	0	64	105	393	73	54	109	64	14	0	30	11	981
2008	0	0	0	0	0	0	0	57	188	618	15	68	75	44	14	0	53	4	1132
2009	0	1	1	3	0	0	0	457	4	607	2	13	98	0	91	0	0	0	1344
2010	14	0	0	6	0	0	0	57	23	1038	6	0	30	0	32	9	14	0	1242
2011	127	6	0	1	0	0	1	182	126	247	1	0	13	8	22	1	8	0	743
2012	12	1	0	12	0	0	0	579	470	155	14	23	12	0	2	0	10	0	1267
2013	19	0	0	0	0	0	0	7	0	7	19	0	2	10	4	0	0	0	91
2014	4	0	0	0	0	0	0	560	334	44	27	0	139	19	7	0	0	0	1134
2015	48	2	0	32	0	0	0	261	851	390	12	132	135	19	6	10	0	0	1901
2016	7	0	0	0	0	4	3	10	641	841	0	7	211	0	79	0	2	0	1808
2017	9	4	0	0	3	0	0	28	219	1202	88	121	31	0	5	0	7	0	1717
2018	15	0	0	1	0	0	0	14	90	373	1	8	1	15	63	4	0	0	585

Figure 2. Total effort (number of days fished), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

Table 3. Recorded Catch-per-Unit-Effort (Kilograms per Number of Days Fished)

(a) Nominal catch-per-unit effort (kilograms, whole weight, per days fished), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	29.8	33.2	28.1	23.9	23.9	27.7	20.0	19.9	19.9	12.1	12.7	28.1	25.3
2005	26.6	39.4	38.6	40.5	39.2	34.4	31.5	28.5	23.8	26.1	5.0	21.5	34.4
2006	20.8	22.5	22.9	22.4	19.2	20.7	21.0	27.8	23.2	0.0	25.5	22.6	22.0
2007	19.3	21.9	25.4	28.4	24.6	25.4	21.7	23.5	21.6	0.0	0.0	22.9	23.7
2008	23.3	26.2	22.3	22.8	19.0	21.1	15.9	13.7	11.3	8.7	0.0	16.3	19.9
2009	13.9	15.3	21.8	14.1	11.4	14.0	10.1	6.0	5.5	13.3	0.0	13.4	12.6
2010	14.5	17.1	16.3	17.0	14.0	17.9	17.8	17.7	17.3	76.6	0.0	21.6	17.2
2011	30.2	38.3	31.2	19.4	13.2	15.8	13.9	14.2	15.8	0.0	0.0	14.1	20.4
2012	11.4	13.3	15.7	11.9	14.1	11.1	11.5	40.7	19.2	0.0	0.0	55.3	13.5
2013	34.5	48.1	76.4	104.7	61.1	101.9	95.9	103.6	28.0	0.0	0.0	18.2	52.5
2014	19.1	9.4	11.0	11.6	8.4	8.0	7.3	10.5	11.4	21.0	0.0	8.4	9.9
2015	7.5	8.4	6.8	11.1	6.8	7.6	6.0	7.1	5.0	9.3	0.0	8.7	7.6
2016	6.7	10.8	6.4	7.7	7.7	9.9	9.7	10.1	7.2	8.2	9.2	7.7	8.4
2017	7.6	12.0	8.8	8.8	13.5	10.9	12.1	10.0	5.8	10.3	0.0	22.7	
2018	13.8	22.3											

(b) Nominal catch-per-unit effort (kilograms, whole weight, per days fished), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

YEAR	Unknown	Turu Cay	Deliver Island	Northern Section	Bramble Cay	Anchor Cay	Western	Mabuiag	Badu	Thursday Island	Central	Warrior	Warraber	Mt Adolphus	Great NE Channel	South East	Darnley	Cumber-land	Total
DEC																			
2004	0	57.3	0	0	46.4	0	0	32.4	23	19.9	9.2	32	38.2	18.6	20.2	0	35.7	45.8	28.1
2005	0	7.4	0	0	0	21.1	0	32.3	19.8	15.3	18.9	19.7	15.8	0	14.2	0	28.1	37.5	21.5
2006	0	20.1	0	45.8	0	0	0	28.1	19.4	15.4	11.1	38.1	25.4	12.4	9.5	0	31.8	26.1	22.6
2007	0	0	0	0	0	0	0	30.7	21.2	12.4	20.2	32.4	25.9	12.9	43.7	0	20.4	43.5	22.9
2008	0	0	0	0	0	0	0	19.2	39.3	13.6	68.5	39.8	17.4	0	21	13.1	0	0	16.3
2009	0	0	0	9	0	0	0	36.7	9.9	13.7	0	2.3	10	20.2	20	0	31.9	0	13.4
2010	0	16.1	0	0	0	0	0	84.7	66.1	18.8	12.1	16.8	11.7	0	21.1	0	0	0	21.6
2011	7.9	0	0	0	0	6.8	0	78.1	21.2	11	14.7	34.1	11.7	15.2	8.5	0	48.6	0	14.1
2012	8.3	0	0	110	6.6	0	0	207.6	38.2	7.6	0	0	0	0	0	0	0	0	55.3
2013	0	0	0	0	0	0	0	47.9	17.1	6.3	0	0	4.8	0	0	0	0	0	18.2
2014	7	0	13.1	9.7	0	0	0	10.9	4.5	20	79.5	0	3.6	8.7	4.7	0	0	0	8.4
2015	13.4	0	0	0	0	0	0	33.7	5.1	13.6	0	34	4.5	0	0	0	0	0	8.7
2016	7.9	0	0	0	10.8	0	0	6.2	6.3	7.7	6.8	0	11.7	0	5.6	0	0	5	7.7
2017	39.8	0	0	73.1	0	0	0	0	50.1	17	9.3	31.9	17	11.6	12	0	8.4	19.2	22.7
2018	0																		
JAN																			
2004	0	7.2	0	27	0	0	0	40.3	30.5	20.6	26.5	0	22.7	34.2	24.7	22.7	0	0	29.8
2005	0	38.1	0	0	11.5	24.4	0	35.1	19.8	18.4	14.6	33.8	19.3	27.3	18.6	0	36.6	30	26.6
2006	0	0	0	30.5	0	0	0	18.6	25.1	16.1	23.5	22.2	17.5	27.6	26.9	12.6	25.7	26.6	20.8
2007	0	4.2	11.7	41.8	0	0	0	37.2	13	13.2	9.5	33.5	18.4	20.3	13.4	18.7	23.3	23.9	19.3
2008	0	0	0	29.2	0	0	0	23.1	23.3	24.4	18.5	34.9	22.5	15.8	27.3	0	18.8	23.4	23.3
2009	0	20.7	0	4.7	0	0	0	1.9	8.5	13.7	32.6	47.5	24.6	37.5	12.5	0	0	0	13.9
2010	73.4	0	0	0	0	0	0	0	147.9	12	10.1	15.2	9.4	0	10.6	0	26	0	14.5
2011	17.9	0	0	79.5	0	12	0	87.2	61.2	16.1	25.4	0	13.7	0	10.3	0	40.7	0	30.2
2012	13.3	6.4	0	28.6	0	0	0	50	7.8	8.7	10.8	0	13.5	0	7.5	0	34.8	0	11.4
2013	34.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34.5
2014	0	0	0	51.7	0	0	0	27.8	11.4	28.7	0	0	8.8	0	0	0	0	0	19.1
2015	5	0	0	39.2	0	0	0	5.6	5.1	12.4	11.8	0	3.7	0	6.5	0	0	0	7.5
2016	1.4	0	0	0	0	0	0	12.7	6.8	9.6	0	33.1	2.5	0	0	0	0	0	6.7
2017	0	4.1	0	0	2.4	0	0	8.2	12.2	7.4	5.7	59.9	7.5	0	12.9	0	0	0	7.6
2018	8.1	1.4	0	0	0	0	0	0	37.1	12.8	19.6	21.6	9.3	14.2	10.3	0	1.4	21	13.79
FEB																			
2004	0	0	0	59.8	0	0	0	50.9	32.7	23.5	24.5	0	28	42.9	12.5	0	282.5	0	33.2
2005	0	14.4	0	23.4	0	0	0	61.9	33.6	26.9	19.5	42	10.5	81.6	65	0	39.3	26	39.4
2006	0	21	34.9	41.9	0	0	50.6	25.8	23.1	17.3	14.5	30	29.1	18.6	20	14.9	27.7	31	22.5
2007	0	0	0	45.4	0	0	0	31.8	26.1	19.3	12.6	25.7	20.2	12.8	18.8	0	29.1	11.7	21.9
2008	0	0	0	0	0	0	0	35.2	32.3	23.1	23.5	36.4	33.4	17.3	20.7	0	22.4	31.4	26.2
2009	0	66	130.3	70.4	0	0	0	4	35.6	14.8	34	67.8	30.3	0	13.9	0	0	0	15.3
2010	70	0	0	33.3	0	0	0	13	14.8	16.8	14.5	16.6	7.9	0	17.1	6.7	26.5	0	17.1
2011	38.4	20.3	0	90.4	0	0	28.9	62.8	39.9	23.5	28.3	0	13.8	19.3	11.6	133.6	36.7	0	38.3
2012	29.2	33.4	0	7.3	0	0	0	16.3	9.2	14.5	7.7	0	14.2	0	7.8	0	15.4	0	13.3
2013	11	0	0	0	0	0	0	145.4	0	9.3	38.8	73	120.5	12.5	74.1	0	0	0	48.1
2014	5.3	0	0	0	0	0	0	8.9	8.1	32.4	9.7	0	7.5	9.9	11.7	0	0	0	9.4
2015	11.1	1.1	0	22.2	0	0	0	9.2	4.3	11.7	25.5	18.1	7.6	21	3.7	2.7	0	0	8.4
2016	12.4	0	0	0	0	18.1	32.8	15	6.3	16.2	0	45.4	3.7	0	3.7	0	16.4	0	10.8
2017	7.3	512.1	0	0	6.4	0	0	1.4	11.4	8.3	50.1	5.5	23.3	0	9.4	0	8.3	0	12
2018	9.6	0	0	0	0	0	0	15.6	57.8	15.5	2.6	26.1	6.9	44.8	9.4	12.5	0	0	22.3

Figure 3. Nominal catch-per-unit effort (kilograms, whole weight, per days fished), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

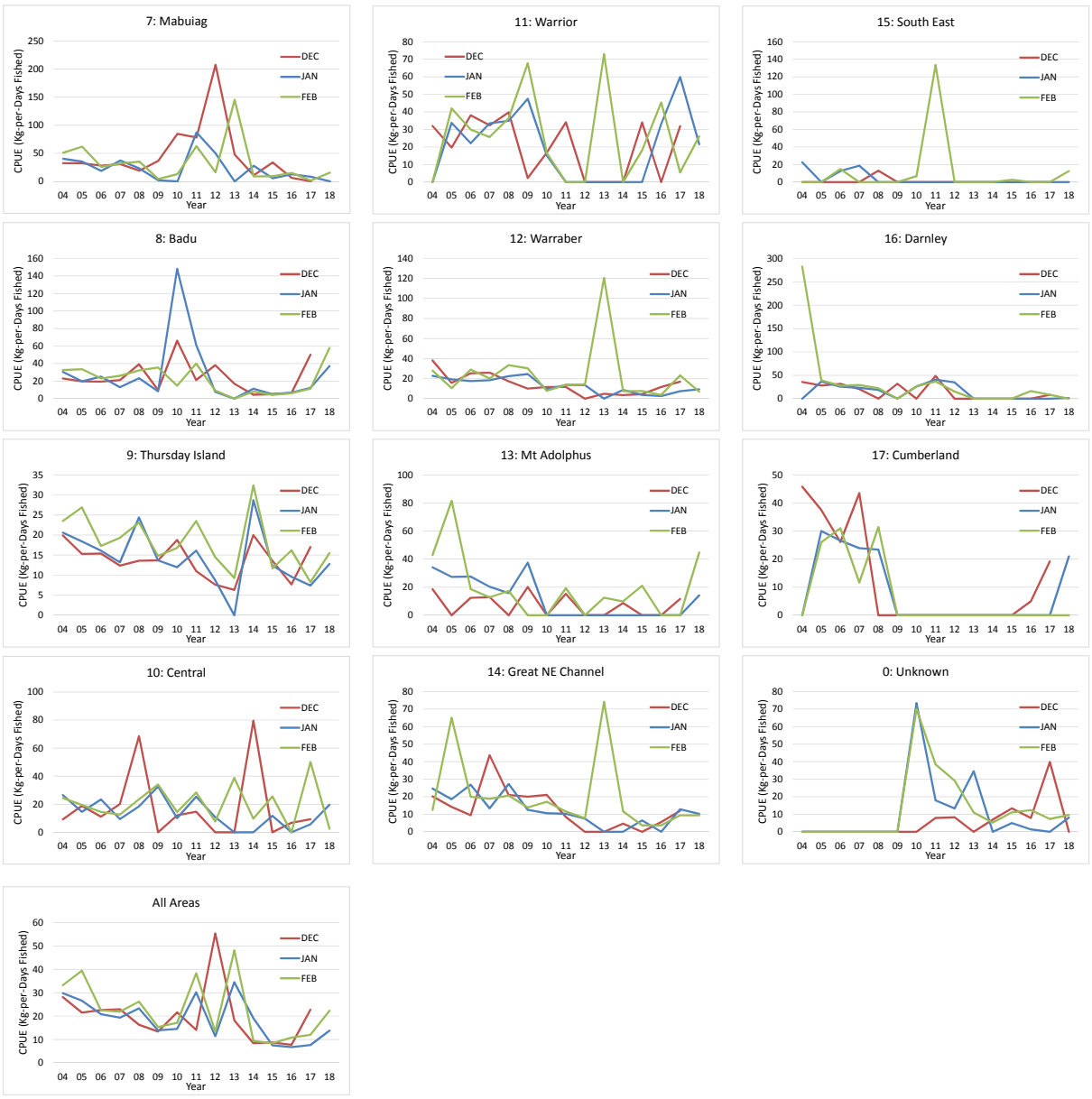


Table 4. Recorded Catch-per-Unit-Effort (Kilograms per Number of Fisher Days)

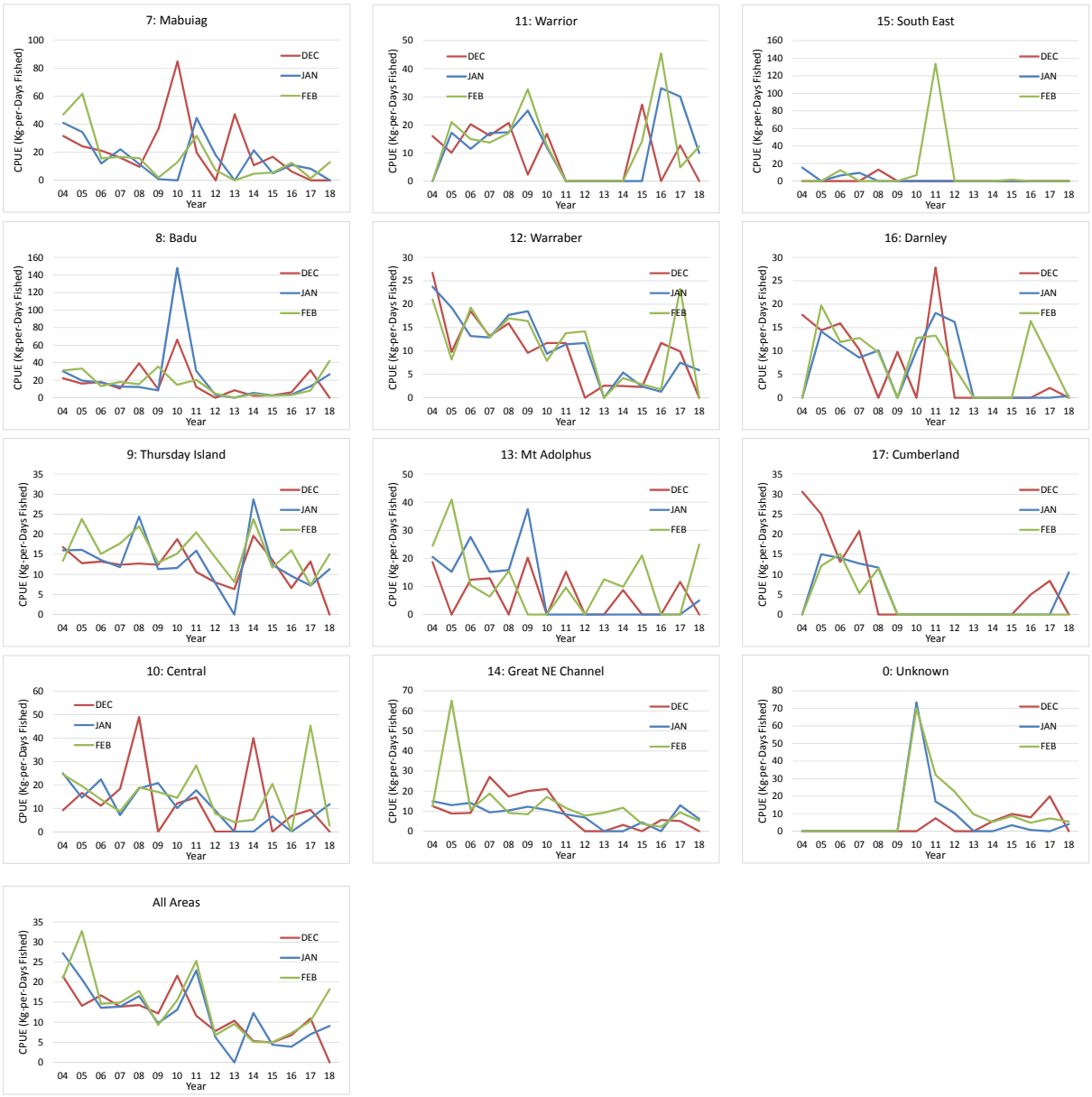
(a) Nominal catch-per-unit effort (kilograms, whole weight, per days fisher days), by year and month, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	27.2	21.0	25.7	19.9	18.7	21.4	16.1	13.5	16.0	6.1	12.7	21.4	25.2
2005	20.7	32.7	28.7	28.3	28.3	25.7	23.8	19.7	17.2	20.9	4.7	14.1	34.4
2006	13.6	14.6	14.0	13.3	13.2	14.8	13.9	23.2	15.7	0.0	25.5	16.7	22.0
2007	13.9	14.9	17.5	19.2	17.6	17.1	16.3	17.7	15.0	0.0	0.0	13.9	23.8
2008	16.5	17.8	16.4	16.4	14.9	15.1	15.4	9.4	9.2	8.7	0.0	14.3	20.1
2009	9.8	9.3	18.1	8.7	7.4	10.8	6.0	3.3	3.4	7.4	0.0	12.2	11.9
2010	13.1	15.5	15.1	15.4	13.3	15.7	14.9	16.4	15.1	73.1	0.0	21.6	16.6
2011	22.9	25.3	17.7	10.9	7.1	9.1	6.9	11.6	14.7	0.0	0.0	11.6	20.2
2012	6.3	6.8	7.9	4.5	5.6	4.1	3.8	10.5	10.9	0.0	0.0	7.8	10.3
2013	0.0	9.6	9.9	16.2	16.7	3.9	0.0	0.0	10.5	0.0	0.0	10.4	16.8
2014	12.3	5.1	5.4	5.9	4.4	4.4	4.2	6.5	9.5	21.0	0.0	5.3	9.7
2015	4.4	5.0	3.7	6.3	4.0	4.1	3.5	4.3	3.0	9.3	0.0	5.0	7.5
2016	3.9	7.3	3.5	4.7	4.6	6.7	7.6	7.6	5.7	8.2	9.2	6.8	8.5
2017	7.0	10.3	8.6	8.2	12.7	9.5	11.1	8.0	4.7	8.9	0.0	10.9	
2018	9.1	18.2											

(b) Nominal catch-per-unit effort (kilograms, whole weight, per days fisher days), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.

YEAR	Unknown	Turu Cay	Deliver Island	Northern Section	Bramble Cay	Anchor Cay	Western	Mabuiag	Badu	Thursday Island	Central	Warrior	Warraber	Mt Adolphus	Great NE Channel	South East	Darnley	Cumber-land	Total
DEC																			
2004	0	30.5	0	0	23.2	0	0	31.6	22.3	16.8	9.2	16	26.7	18.6	12.5	0	17.7	30.6	21.4
2005	0	0	0	0	0	21.1	0	24.3	16.2	12.8	16.6	10.1	9.8	0	8.8	0	14.4	25	14.1
2006	0	15.2	0	25.8	0	0	0	21.1	18.1	13.2	11.1	20.2	18.5	12.4	9.1	0	15.9	13.1	16.7
2007	0	0	0	0	0	0	0	16.1	10.6	12.4	18.3	16.2	13.2	12.9	27.1	0	10.3	20.8	13.9
2008	0	0	0	0	0	0	0	9.6	39.3	12.7	49	20.7	15.9	0	17.3	13.1	0	0	14.3
2009	0	0	0	9	0	0	0	36.7	9.9	12.4	0	2.3	9.6	20.2	20	0	9.8	0	12.2
2010	0	16.1	0	0	0	0	0	84.7	66.1	18.8	12.1	16.8	11.7	0	21.1	0	0	0	21.6
2011	7.4	0	0	0	0	6.8	0	19.8	12.3	10.6	14.7	0	11.7	15.2	7.8	0	27.8	0	11.6
2012	0	0	0	0	6.6	0	0	0	0	8	0	0	0	0	0	0	0	0	7.8
2013	0	0	0	0	0	0	0	47.1	8.6	6.3	0	0	2.6	0	0	0	0	0	10.4
2014	5.7	0	7.2	9.7	0	0	0	10.8	2.3	19.6	40	0	2.5	8.7	3.1	0	0	0	5.3
2015	9.8	0	0	0	0	0	0	16.8	2.6	13.6	0	27.2	2.3	0	0	0	0	0	5
2016	7.9	0	0	0	10.8	0	0	6.2	6.3	6.6	6.8	0	11.7	0	5.6	0	0	5	6.8
2017	19.9	0	0	36.5	0	0	0	0	31.3	13.2	9.3	12.7	9.9	11.6	5.1	0	2.1	8.4	10.92
2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JAN																			
2004	0	0	0	27.1	0	0	0	41	30.3	16	24.9	0	23.7	20.5	14.9	15.4	0	0	27.2
2005	0	22.4	0	0	11.5	24.4	0	34.4	19.6	16.1	14.6	17.2	19.3	15.2	13	0	14.2	15	20.7
2006	0	0	0	15.2	0	0	0	12	17.3	13.6	22.4	11.5	13.2	27.6	14.1	6.3	11.3	14.1	13.6
2007	0	2.1	11.7	21.7	0	0	0	22.1	12.6	11.8	7.1	17.1	12.9	15.2	9.4	9.4	8.6	12.7	13.9
2008	0	0	0	14.7	0	0	0	11.5	12.2	24.4	18.5	17.4	17.7	15.8	10.4	0	10.1	11.7	16.5
2009	0	20.7	0	4.7	0	0	0	0.9	8.5	11.3	20.8	25.1	18.5	37.5	12.2	0	0	0	9.8
2010	73.4	0	0	0	0	0	0	0	147.9	11.6	10.1	12	9.4	0	10.6	0	10.1	0	13.1
2011	16.9	0	0	39.8	0	12	0	44.4	30.6	15.9	17.7	0	11.4	0	8.4	0	18.1	0	22.9
2012	10.2	10.4	0	28.6	0	0	0	18	3.4	7.8	9	0	11.7	0	6.8	0	16.2	0	6.3
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	25.9	0	0	0	21.4	5.7	28.7	0	0	5.4	0	0	0	0	0	12.3
2015	3.4	0	0	7.5	0	0	0	5	2.6	12.4	6.6	0	2.4	0	4.4	0	0	0	4.4
2016	0.7	0	0	0	0	0	0	10.9	3.5	9.6	0	33.1	1.3	0	0	0	0	0	3.9
2017	0	2.1	0	0	2.4	0	0	8.2	13.1	7.2	5.7	30.1	7.5	0	12.9	0	0	0	7
2018	4	0.8	0	0	0	0	0	0	26.8	11.3	11.7	10	5.9	5	6.1	0	0.4	10.5	9.08
FEB																			
2004	0	0	0	59.8	0	0	0	47	31.1	13.4	24.5	0	21	24.5	12.5	0	0	0	21
2005	0	3.9	0	23.4	0	0	0	61.6	33.3	23.8	19.5	21	8.2	40.9	65	0	19.7	12.1	32.7
2006	0	10.5	23.3	21	0	0	33.8	15.6	13.3	15.1	13.8	15	19.3	10.4	10.7	12.4	11.9	15.1	14.6
2007	0	0	0	23.2	0	0	0	16.7	18	17.7	8.6	13.7	12.9	6.4	18.8	0	12.8	5.3	14.9
2008	0	0	0	0	0	0	0	15.8	15.6	22	18.9	17.1	17	15.5	9.1	0	9.7	11.5	17.8
2009	0	66	130.3	35.3	0	0	0	2	35.6	12.9	17	32.7	16.4	0	8.5	0	0	0	9.3
2010	70	0	0	33.3	0	0	0	13	14.8	15.2	14.5	12.7	7.9	0	17.1	6.7	12.8	0	15.5
2011	32.1	20.3	0	45.4	0	0	28.9	31.7	20.4	20.5	28.3	0	13.8	9.6	11.6	133.6	13.3	0	25.3
2012	22.6	0	0	7.3	0	0	0	7.2	4.7	14.2	7.7	0	14.2	0	7.8	0	6.4	0	6.8
2013	9.6	0	0	0	0	0	0	0	0	8.1	4.1	0	0	12.5	9.2	0	0	0	9.6
2014	5.3	0	0	0	0	0	0	4.7	4.1	23.8	5.1	0	4.2	9.9	11.7	0	0	0	5.1
2015	8.7	1.1	0	7.7	0	0	0	5.6	2.2	11.7	20.4	14.2	2.9	21	3.7	1.4	0	0	5
2016	4.8	0	0	0	0	18.1	32.8	12.5	3.2	16	0	45.4	1.8	0	2.2	0	16.4	0	7.3
2017	7.3	512.1	0	0	6.4	0	0	1.4	8.2	7.3	45.3	4.9	23.3	0	9.4	0	8.3	0	10.3
2018	5.5	0	0	0	0	0	0	12.9	42	15	2.6	12.3	0	24.9	5.2	0	0	0	18.22

Figure 4. Nominal catch-per-unit effort (kilograms, whole weight, per days fisher days), by year and area fished, of rock lobsters recorded in the TDB01 and TDB02 logbooks and attributed to the TIB-sector of the TSRL fishery. Data summaries are shown for the three months December, January and February.



Comments

As indicated in Table 1a, the reported catches for December 2017 and January 2018 are higher than in recent years. For the respective months, the catch in December-17 is the highest since 2014 while the catch in January-18 is the highest since 2012. On the other hand, the catch in February-18 similar to that reported in the previous two years. Several factors may have influenced the higher catches in December and January:

a. Increased reporting. As the new TDB02 CDR logbook is compulsory it remains unknown whether this may have led to an increase in the reporting of catch in the TIB sector of the fishery, as the previous TDB01 Docket-Book was voluntary. Note, it is assumed that the reporting of catches on the new CDR has eliminated instances of the double-counting of catches in the TIB sector (as was the situation with catches reported in the previous Docket-Book) though this still needs to be checked and confirmed.
b. Increased effort in the fishery. Unfortunately this is difficult be checked given the voluntary (and therefore limited) nature of this information. According to the data presented in Table 2a the recorded number of days fished was high in December 2017 than in the previous year, but the percentage of records where effort was recorded was also higher. If it is assumed that records with effort are representative of all records, then some measure of effort can be obtained by dividing the total catch each month by the catch-per-effort for that month. Using the catch-per-days fished, the related estimate of effort in each month is given in the Table 5. According to these estimates, the monthly effort in the three month since December 2017 has been less than the effort in the corresponding months in recent years.

   Table 5. Estimates of monthly effort (number of days fished) in the TIB-sector based on dividing total catch by the corresponding nominal catch rate.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004	522	732	1266	742	1270	1029	1322	954	647	2	2	770
2005	568	1285	1508	1175	1448	1252	1094	831	676	12	14	582
2006	454	1067	1171	852	957	474	472	276	118		2	841
2007	1292	1129	2443	1028	1372	1143	1069	592	413			456
2008	578	1192	1620	1057	880	702	1479	677	528	2		596
2009	955	1343	1060	1683	1373	946	1524	1302	876	40		430
2010	427	1243	971	882	870	913	1072	961	565	21		321
2011	603	787	1595	1052	1817	1183	1357	624	204			641
2012	1176	1431	1574	1648	687	2061	973	266	104			56
2013	25	206	109	123	189	99	121	86	351			367
2014	471	1318	2385	1650	2043	1425	1612	1116	570	6		1486
2015	770	2304	1939	1505	1540	3656	1339	1013	914	18		710
2016	1039	2183	2538	1343	1981	1518	1151	991	671	12	8	668
2017	1091	1945	1799	1329	1108	686	804	1080	703	15		535
2018	808	1166										

c. Higher abundance of lobsters. This would result in higher catch rates and higher catches. Assuming catch rates can be used as an index of relative availability, then we can compare the catch rates since December-17 provided in Tables 3 and 4 (and shown in Figures 3 and 4) with comparative periods in previous years. Using days-fished as the measure of effort, and the nominal catch rate across all areas combined, the related CPUE for December-17 is the highest since 2012, the CPUE in January-18 is the highest since 2014, and the CPUE in February-18 is the highest since 2013. A similar increase in catch–rates in recent months is noted where fisher-days is used as the measure of effort.
d. Nominal CPUE (catch-per days fished) by fishing season (beginning in December of the previous year) and month for the TIB sector is displayed in Figures 5a&b. It is evident that for the 2018

fishing season the catch rates for the first three months are mid-range in the distribution of catch rates shown. Furthermore, within any fishing season CPUE can be highly variable across the different months of the season. There are also several seasons where CPUE was initially high but then declined substantially throughout the season (e.g. 2004, 2008 and 2011, c.f. Figure 5b). A longer time-series of data will be needed to ascertain whether the 2018 season will follow such a trend.

Figure 5a. Nominal CPUE (kilograms per day fished) by month for the TIB sector for all fishing seasons (except 2013 when catch rates were very high) between 2004 and 2017.

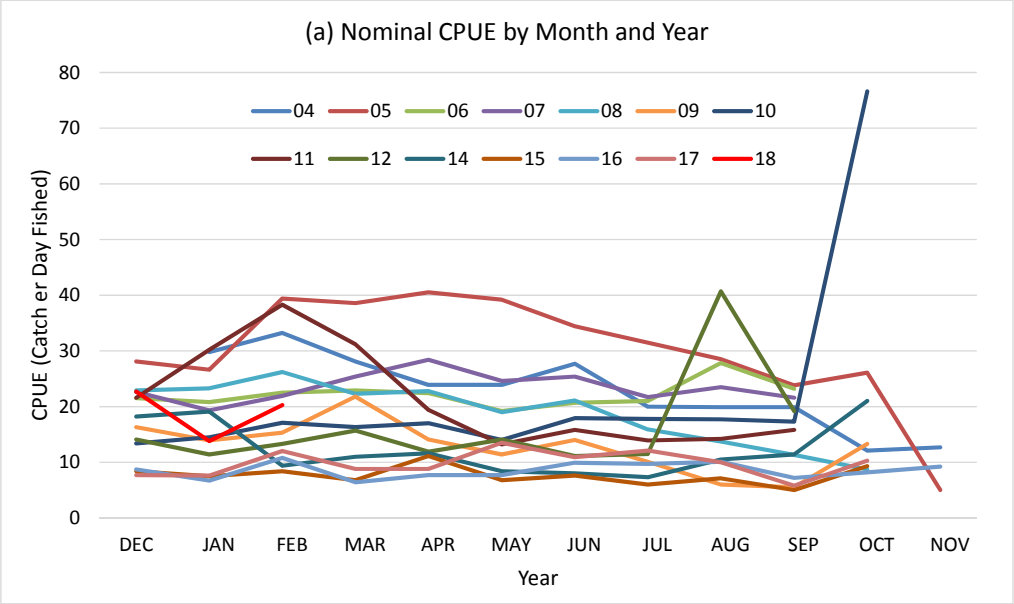
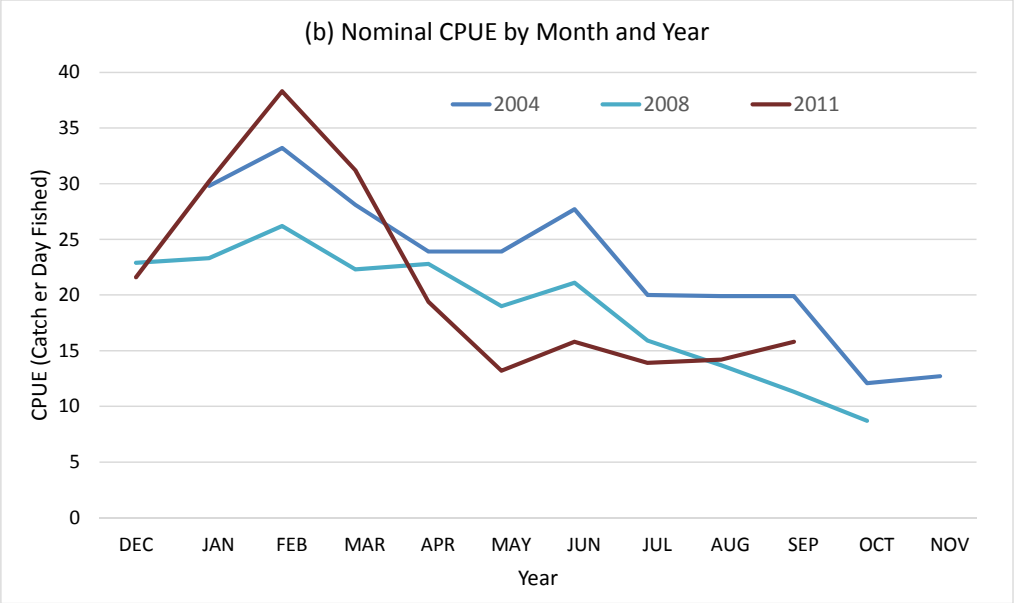


Figure 1b. Nominal CPUE (kilograms per day fished) by month for the TIB sector for selected fishing seasons.



e. Higher abundance in selected areas. The high catch rates observed in recent months may be due to a high availability of lobsters in selected areas. It has been noted in recent years that sand incursions may have been influencing the distribution and availability of lobsters to the fishery. A shift back

to more favourable conditions in some areas may have occurred recently. The nominal catch rates for selected areas of the fishery are shown in Figure 3 and 4 and indicate particularly higher catch rates in recent months in some regions (e.g. Badu, Cumberland and to some extent in Mt Adolphus)

3. TVH Sector

Data

Together with the catch landed by the TIB-sector of the TSRL fishery, the new Torres Strait Catch Disposal Record (TDB02), introduced in the TSRL fishery at the start of November 2017, also records the catch landed by the TVH-sector. However, unlike for the TIB-sector, catch and effort data related to the TVH sector also continues to be recorded in the Torres Strait Tropical Rock Lobster Fishery Daily Fishing Log (TRL04).

Data related to the TDB02logbook was obtained from AFMA on 13 March 2018 while the last batch of data related to the TRL04 logbook was obtained from AFMA in late October 2017. In the following data summaries all data up until the end of November 2017 is taken from the TRL04 logbook while all data since December 2017 is taken from the TDB02 CDR logbook. The TRL04 logbook data is likely to be incomplete to some extent for the last few months up until November 2017, while the degree of completeness of the TDB02 data since December 2017 remains uncertain (though it is assumed to be highly high for at least December 2017 and January 2018 with late returns likely still to be entered for February 2018).

Data Summaries

The following summary is presented in Table 6 and Figure 6.

Nominal Catch

6 Total catch (kilograms, whole weight), by year and month, of rock lobsters recorded in the TRL04 and TDB02 logbooks and attributed to the TVH-sector of the TSRL fishery.

Unlike for the TIB-sector, a summary by area fished was not possible as the majority of the TVH data obtained from the TDB02 logbook did not record the associated area. Indeed, of the 56 TVH records (with a catch of 31.3 tonnes) the area fished was recorded for only 16 records (with an associated catch of 4.6 tonnes). Similarly, information on fishing effort (number of days fished) was also only recorded for 15 records. As such, no meaningful summary of total effort and related catch rates was deemed possible.

Commentary

From Table 6 the TVH catch landed in February-18 (as recorded on the TDB02 CDR logbook and entered into the AFMA databased as of 12 March 2018) is 28.672 tonnes. How complete the catch data for this month remains unknown, however, due to the longer trip length for TVH vessels in comparison to TIB-vessels it is likely that this catch estimate will increase once all the data for February is collated. Compared to the catch for February in previous years, the catch in 2018 is currently the lowest since 2010 and is slightly below the average catch for February of 31.8 tonnes taken over all years between 1994 and 2017.

Table 6. Total catch (kilograms, whole weight), by year and month, of rock lobsters recorded in the TRL04 and TDB02 logbooks and attributed to the TVH-sector of the TSRL fishery.

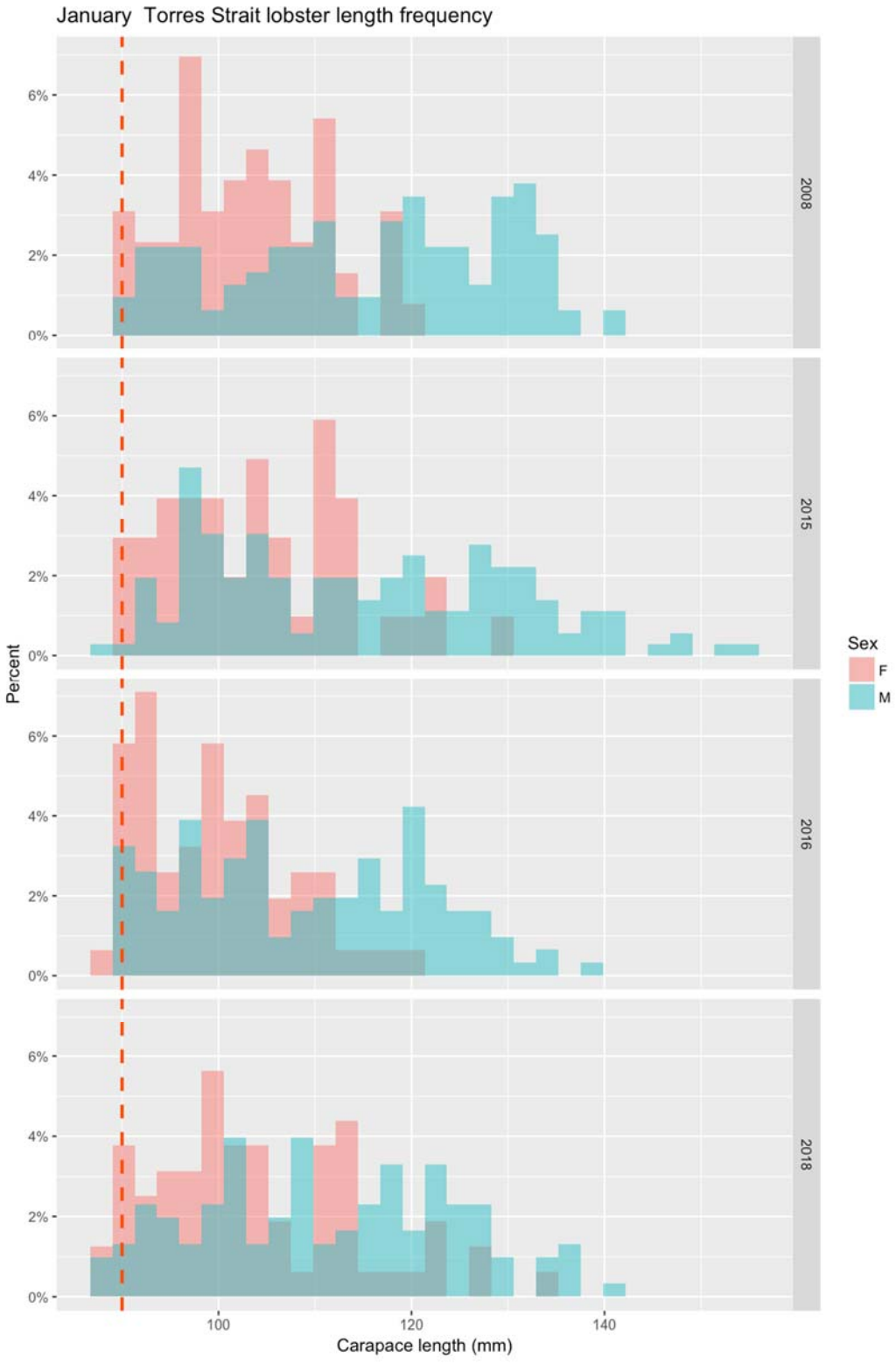
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1994	6,769	8,096	10,754	22,075	19,076	15,985	10,523	14,306	12,478	0	0	2,945	123,006
1995	1,284	7,175	4,401	9,095	11,363	10,355	8,154	13,896	18,274	81	0	16,965	101,042
1996	18,104	17,331	24,966	15,628	25,444	16,310	23,966	28,395	23,763	0	0	32,948	226,855
1997	33,059	20,529	25,319	15,876	39,297	16,159	34,470	36,755	17,011	27	0	36,538	275,040
1998	27,370	40,942	31,893	31,566	38,612	32,591	42,430	45,835	23,437	0	182	14,699	329,556
1999	6,356	4,408	14,583	10,490	10,087	13,982	6,968	5,549	6,442	0	0	16,232	95,097
2000	10,836	12,758	17,737	9,830	16,622	17,147	16,977	9,029	3,101	0	2,103	12,720	128,862
2001	17,760	4,767	9,274	1,880	8,886	8,569	6,801	5,592	3,596	95	27	1,828	69,076
2002	373	13,728	13,816	12,283	21,454	17,559	20,364	27,148	18,624	0	0	2,337	147,687
2003	3,475	41,304	34,444	36,962	43,108	53,102	58,258	56,149	29,660	0	0	4,949	361,411
2004	452	58,965	73,180	57,142	70,551	79,438	65,766	48,014	22,625	0	0	4,984	481,118
2005	398	108,962	106,276	73,510	59,475	53,618	60,103	51,795	30,814	0	0	25	544,977
2006	0	22,512	24,860	17,491	14,798	11,490	21,952	16,756	5,589	0	0	0	135,448
2007	0	20,768	41,389	47,980	62,933	48,836	26,689	13,633	6,368	0	0	0	268,596
2008	0	12,285	17,166	10,334	10,809	7,997	15,482	16,819	9,545	0	0	0	100,438
2009	0	13,905	18,881	12,748	10,479	13,408	7,824	10,345	3,470	0	0	0	91,061
2010	0	27,311	32,164	29,202	29,192	30,315	44,734	52,026	37,670	0	0	0	282,614
2011	0	69,994	85,730	83,334	65,515	62,084	61,867	45,097	29,913	0	0	0	503,533
2012	0	39,228	59,636	51,696	35,159	39,807	69,718	48,959	26,280	0	0	0	370,482
2013	0	55,428	41,275	45,929	45,030	41,502	56,818	47,621	28,058	0	0	0	361,661
2014	0	47,338	36,706	30,230	42,088	38,160	39,061	23,418	16,185	0	0	0	273,186
2015	0	32,992	21,166	24,051	17,623	16,745	14,460	19,782	5,891	0	0	0	152,709
2016	750	46,101	31,830	24,474	40,200	42,871	28,854	18,851	9,079	0	0	690	243,700
2017	1,051	37,432	17,478	17,701	23,982	19,559	16,105	12,939	2,801	0	0	34	149,082
2018	0	28,672											
Avg 94-17	5,335	31,844	33,122	28,813	31,741	29,483	31,598	27,863	16,278	8	96	6,162	242,343

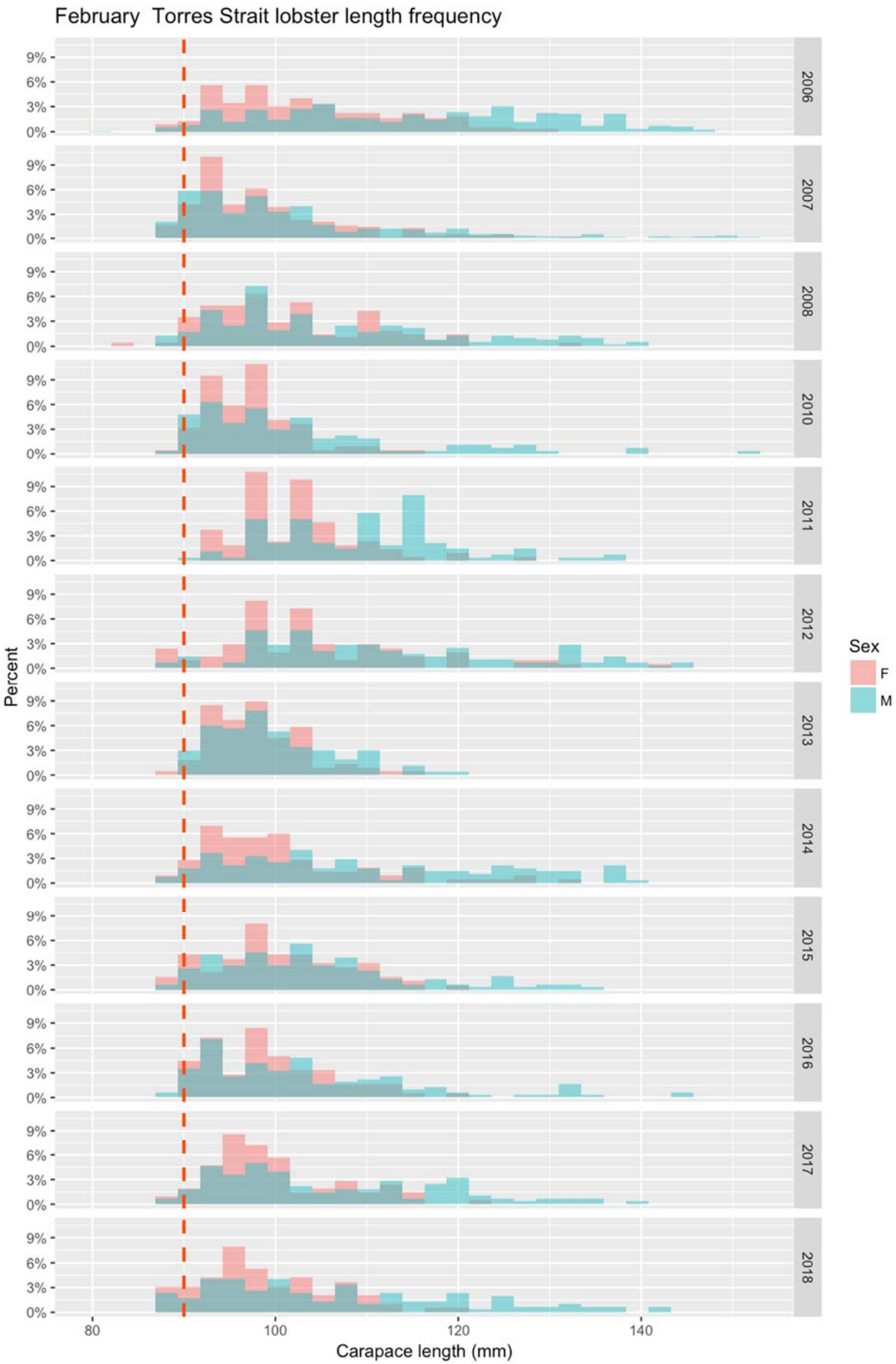
Reference

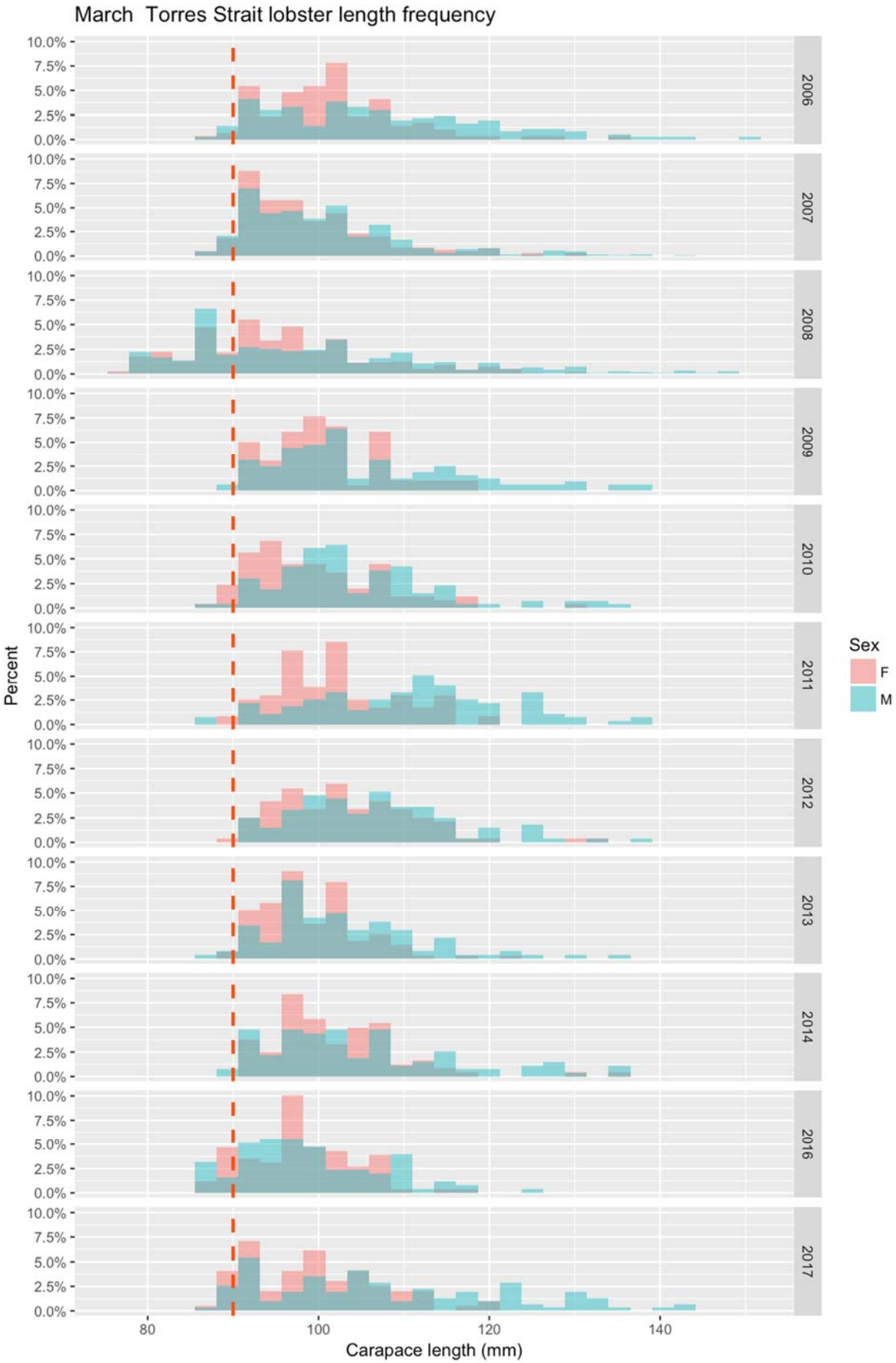
Campbell, R. and Pease, D. (2018) Separating TIB, TVH and processor catch records from docket-book data - 2017 Update. Working paper presented to the 21st meeting of the Torres Strait Rock Lobster Resource Assessment Group, held 12-13 December 2017, Cairns.

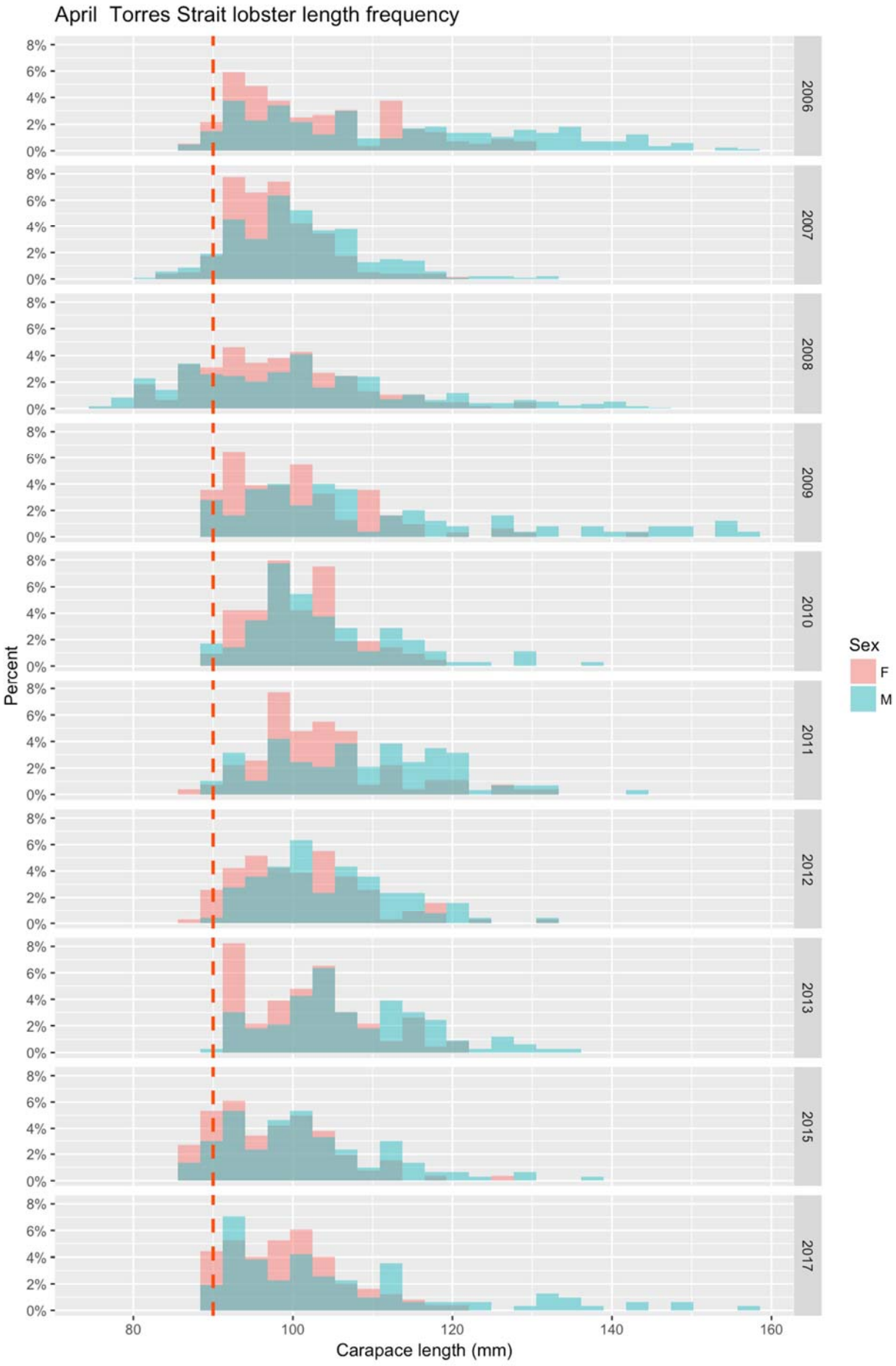
Appendix 2 – Length Frequency Plots for TRL

The first set of figures shows the sex-disaggregated length frequency of the catches for selected months in each of the years as indicated.

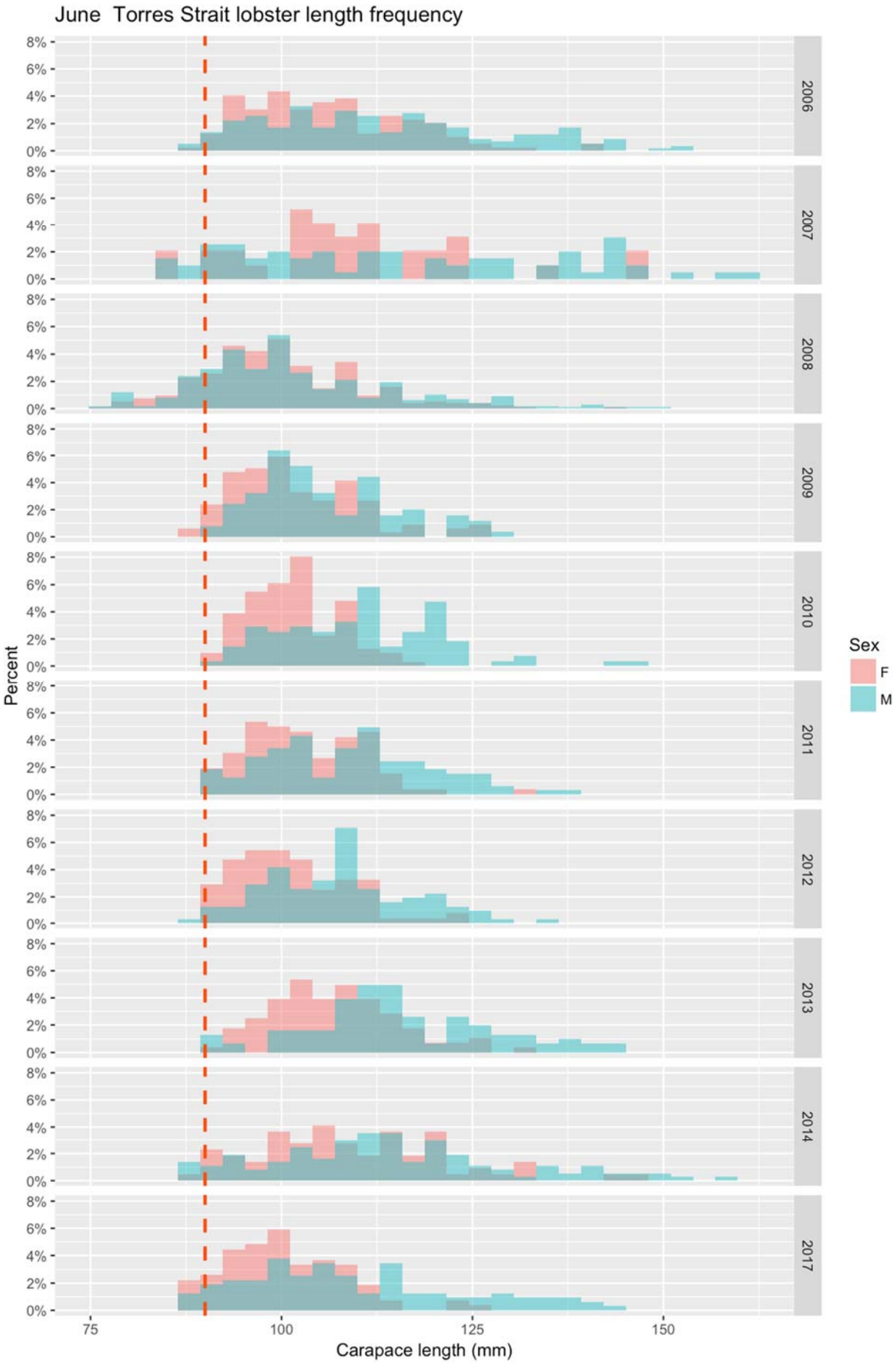


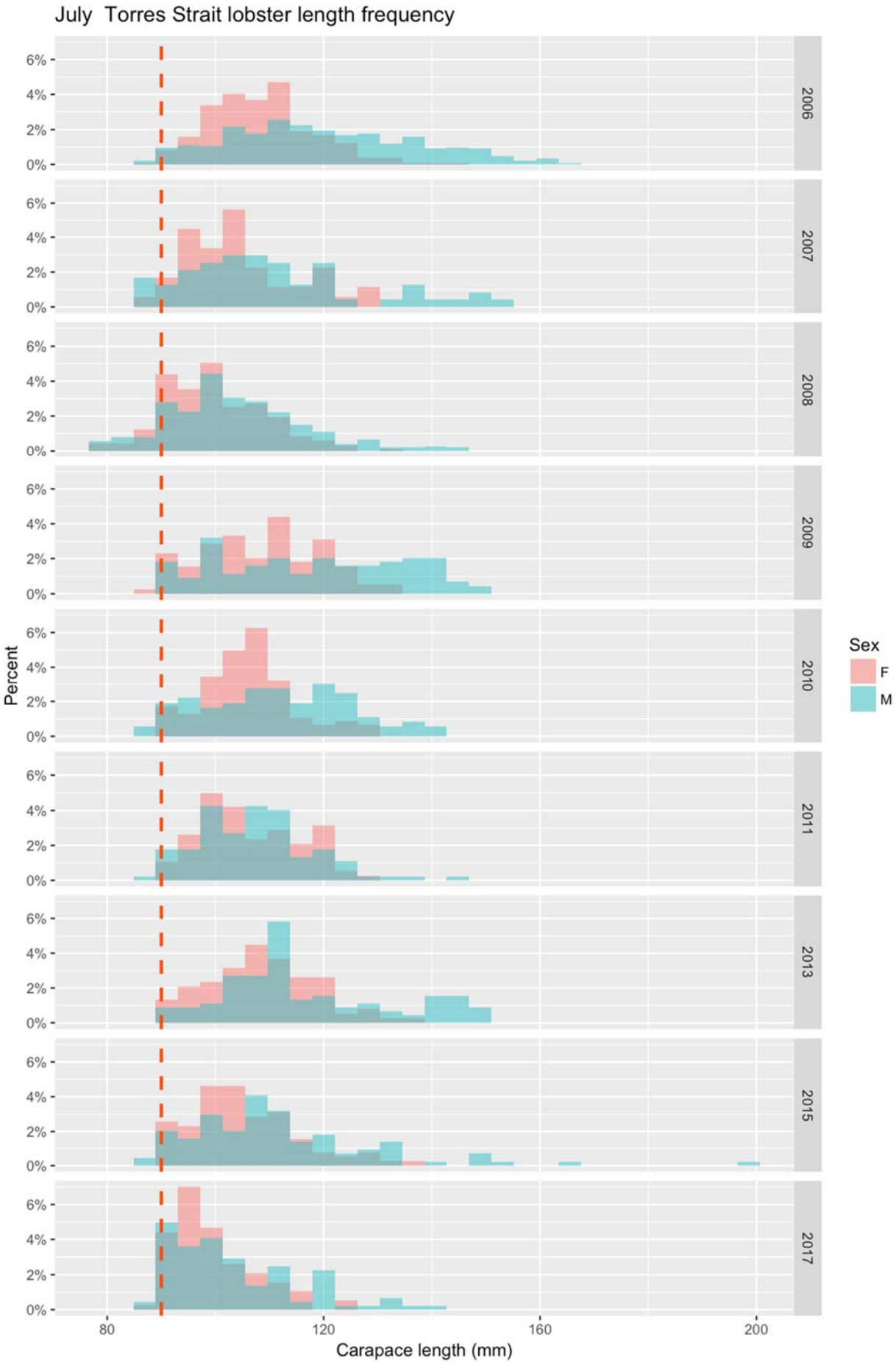

February Torres Strait lobster length frequency
Percent
9%
6%
3%
0%
2006
2007
2008
2010
2011
2012
2013
2014
2015
2016
2017
2018
80
100
120
140
Carapace length (mm)
Sex
F
M

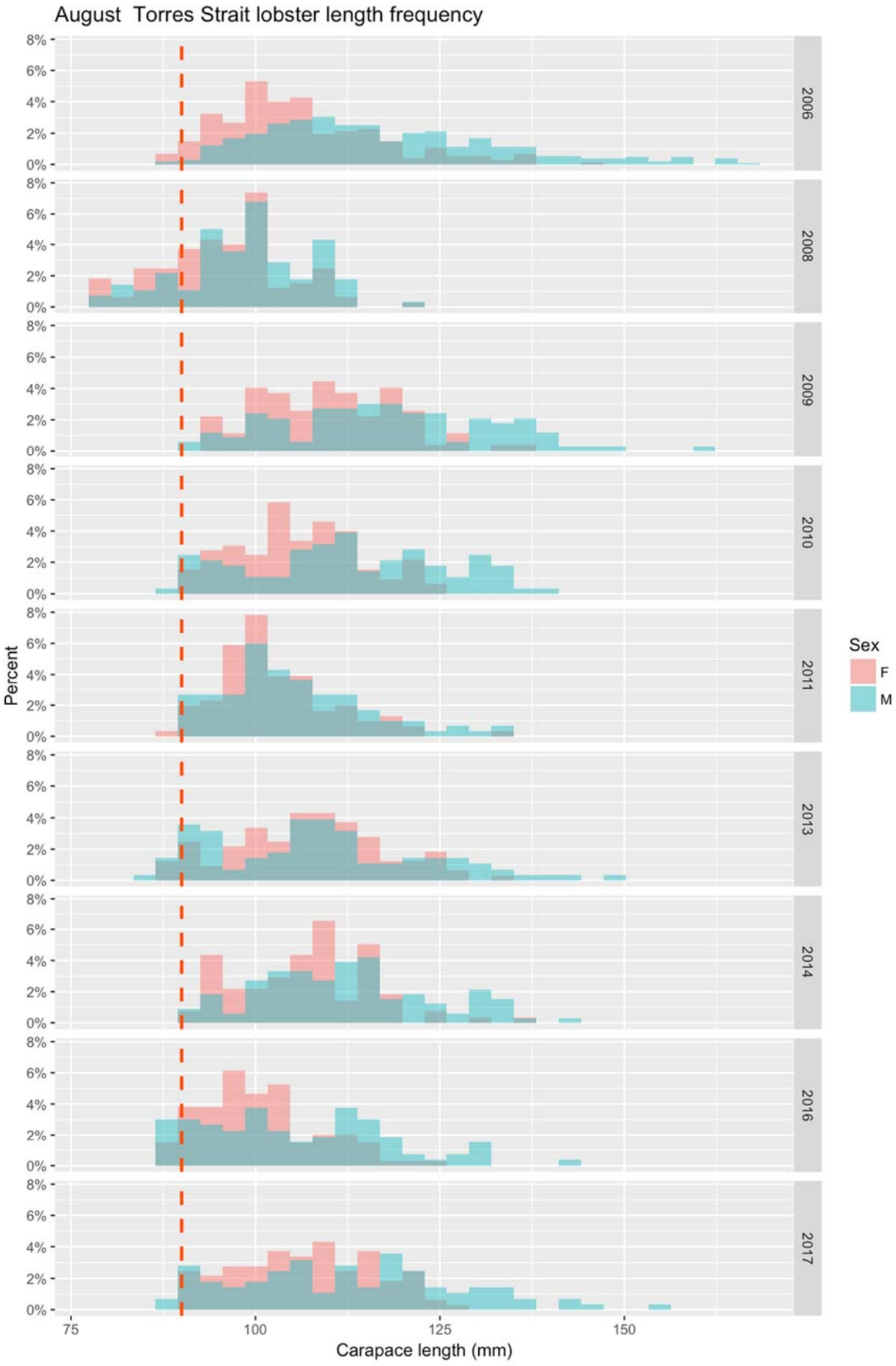

March Torres Strait lobster length frequency
Percent
10.0%
7.5%
5.0%
2.5%
0.0%
2006
2007
2008
2009
2010
2011
2012
2013
2014
2016
2017
80
100
120
140
Carapace length (mm)
Sex
F
M

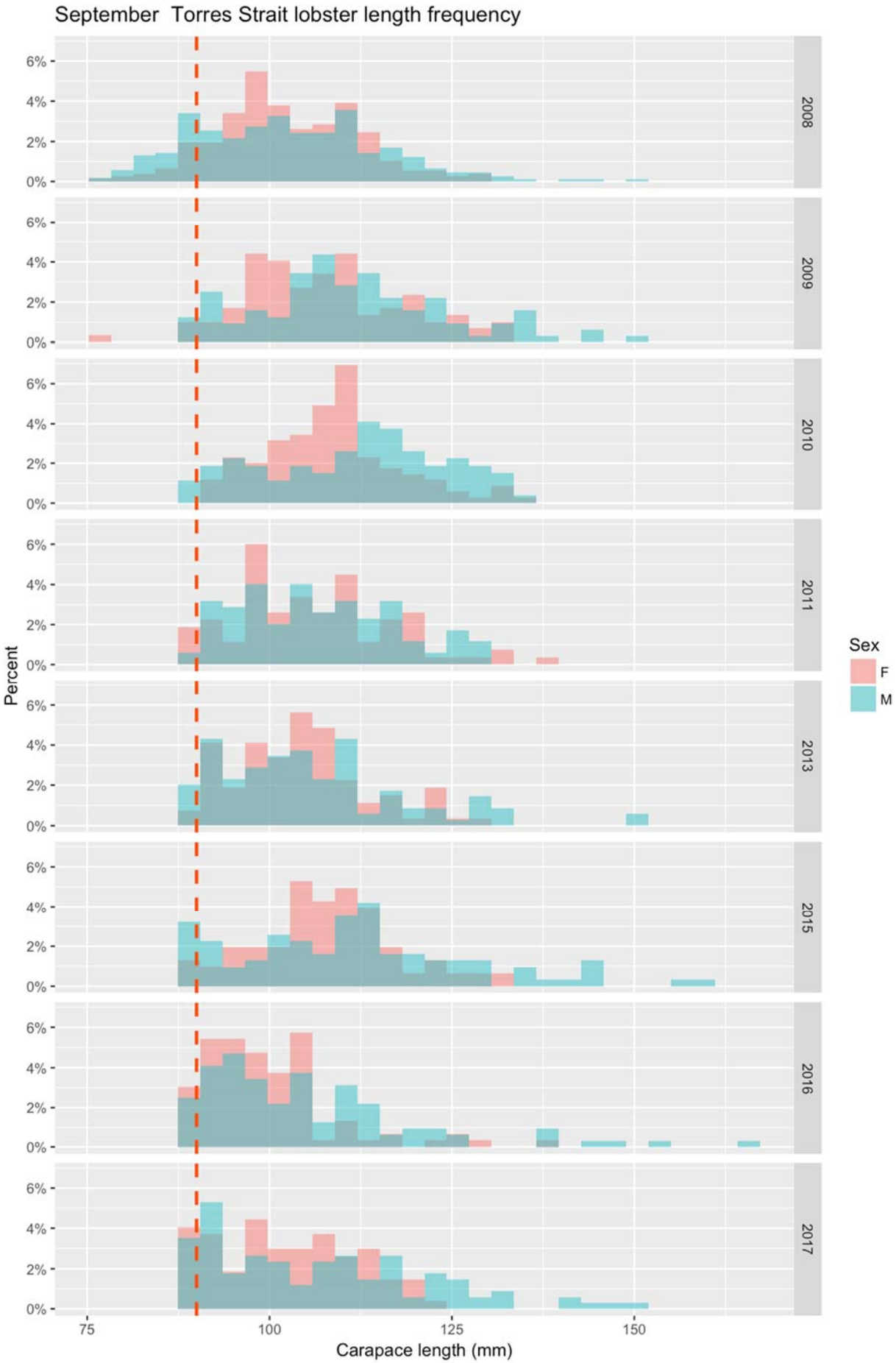

April Torres Strait lobster length frequency
Percent
8%
6%
4%
2%
0%
2006
2007
2008
2009
2010
2011
2012
2013
2015
2017
80
100
120
140
160
Carapace length (mm)
Sex
F
M


May Torres Strait lobster length frequency
Percent
12%
8%
4%
0%
2007
2008
2009
2010
2011
2012
2013
2014
2015
2017
90
110
130
150
Carapace length (mm)
Sex
F
M

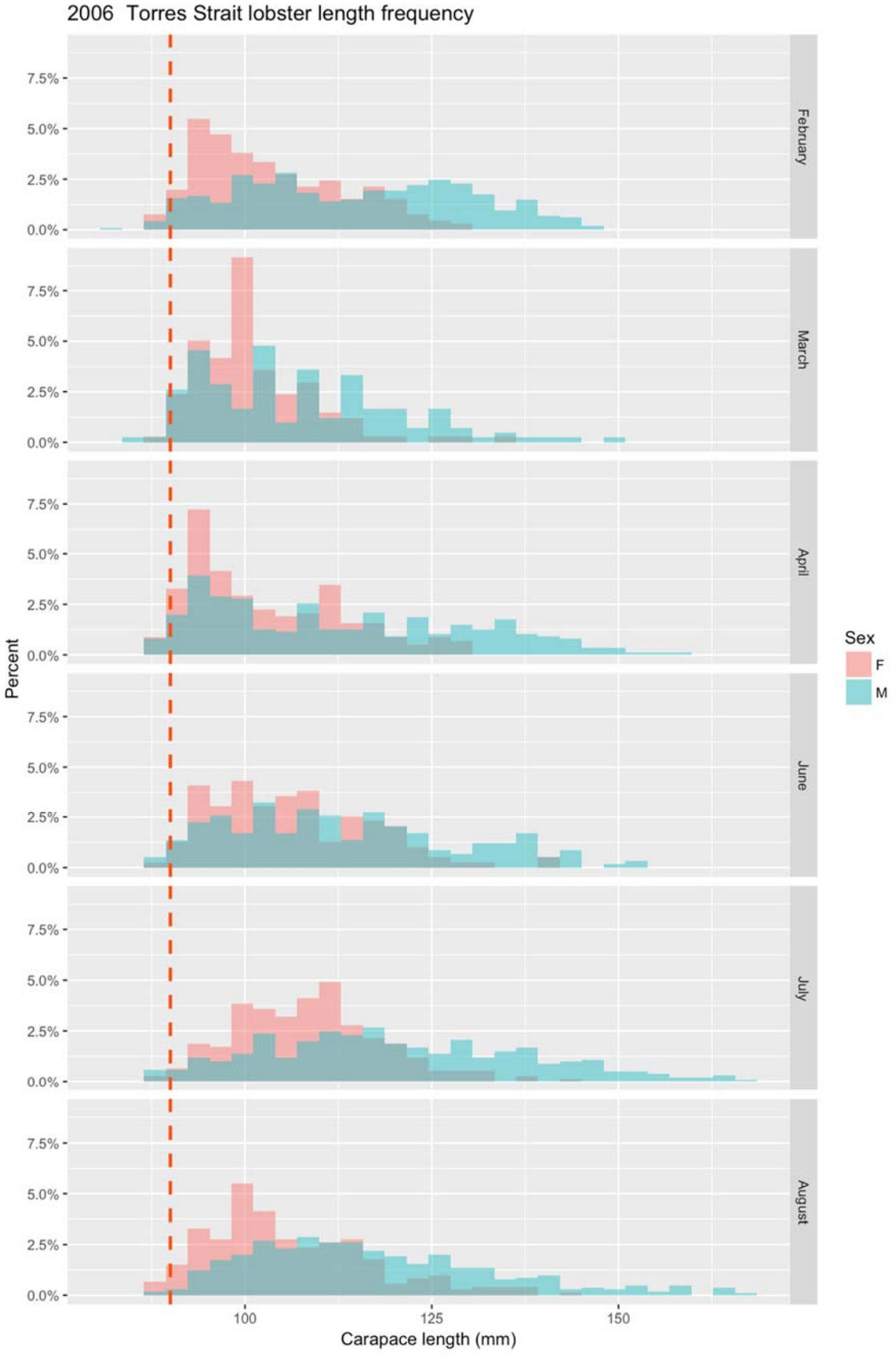

June Torres Strait lobster length frequency
Percent
8%
6%
4%
2%
0%
2006
2007
2008
2009
2010
2011
2012
2013
2014
2017
75
100
125
150
Carapace length (mm)
Sex
F
M

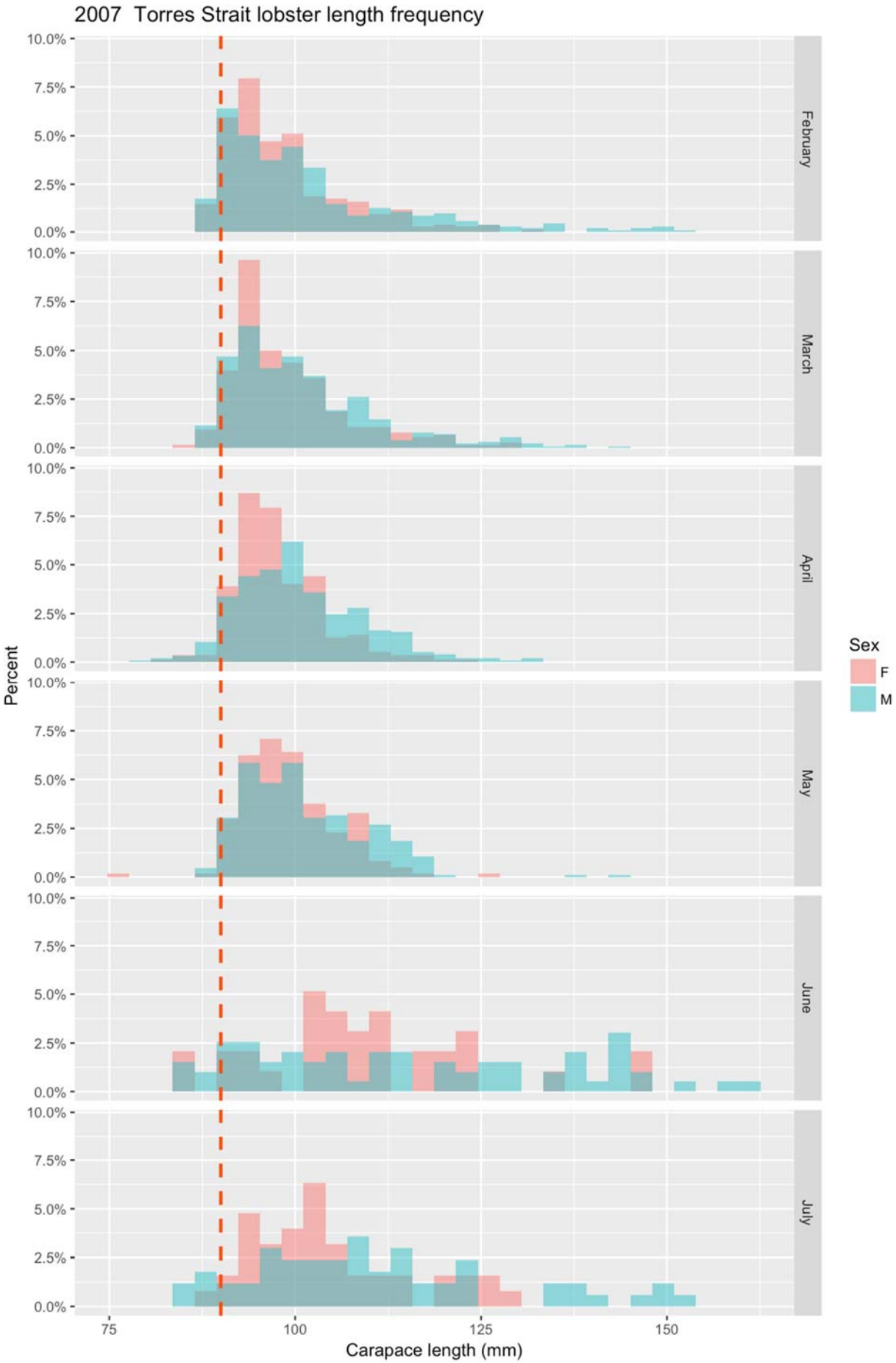

July Torres Strait lobster length frequency
Percent
6%
4%
2%
0%
2006
2007
2008
2009
2010
2011
2013
2015
2017
80
120
160
200
Carapace length (mm)
Sex
F
M

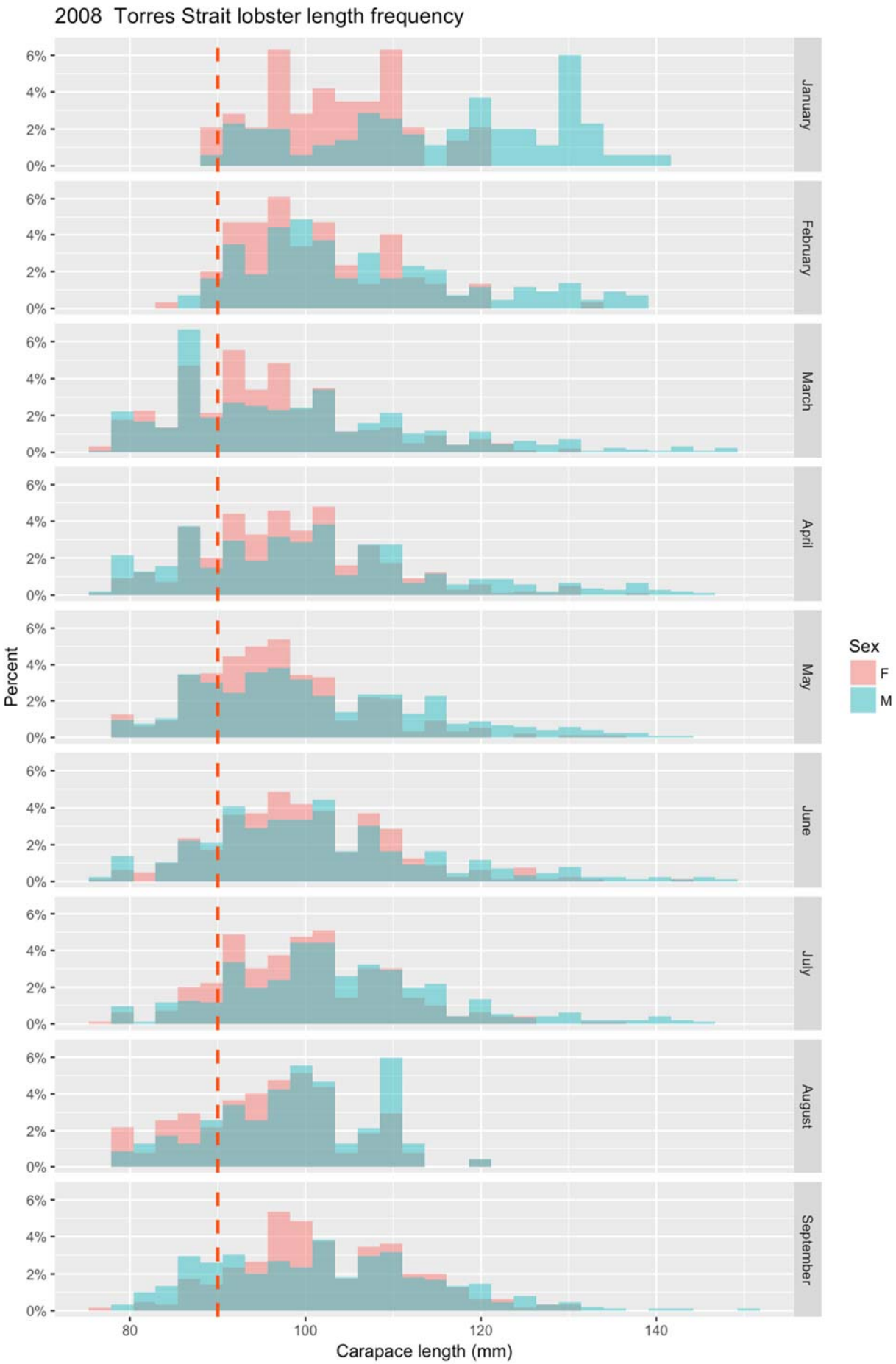

August Torres Strait lobster length frequency
Percent
8%
6%
4%
2%
0%
2006
2008
2009
2010
2011
2013
2014
2016
2017
75
100
125
150
Carapace length (mm)
Sex
F
M

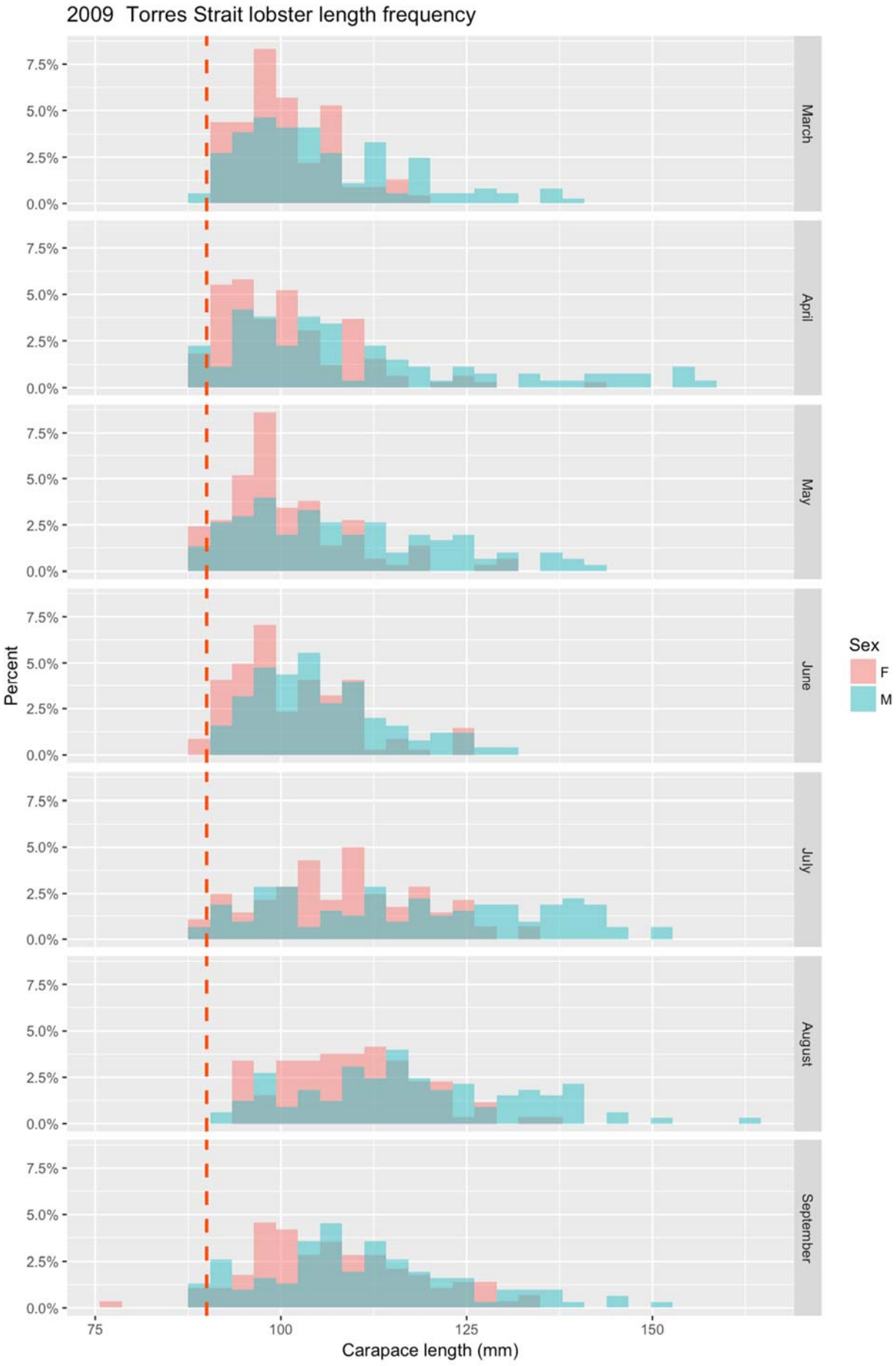

September Torres Strait lobster length frequency
Percent
6%
4%
2%
0%
2008
2009
2010
2011
2013
2015
2016
2017
75
100
125
150
Carapace length (mm)
Sex
F
M

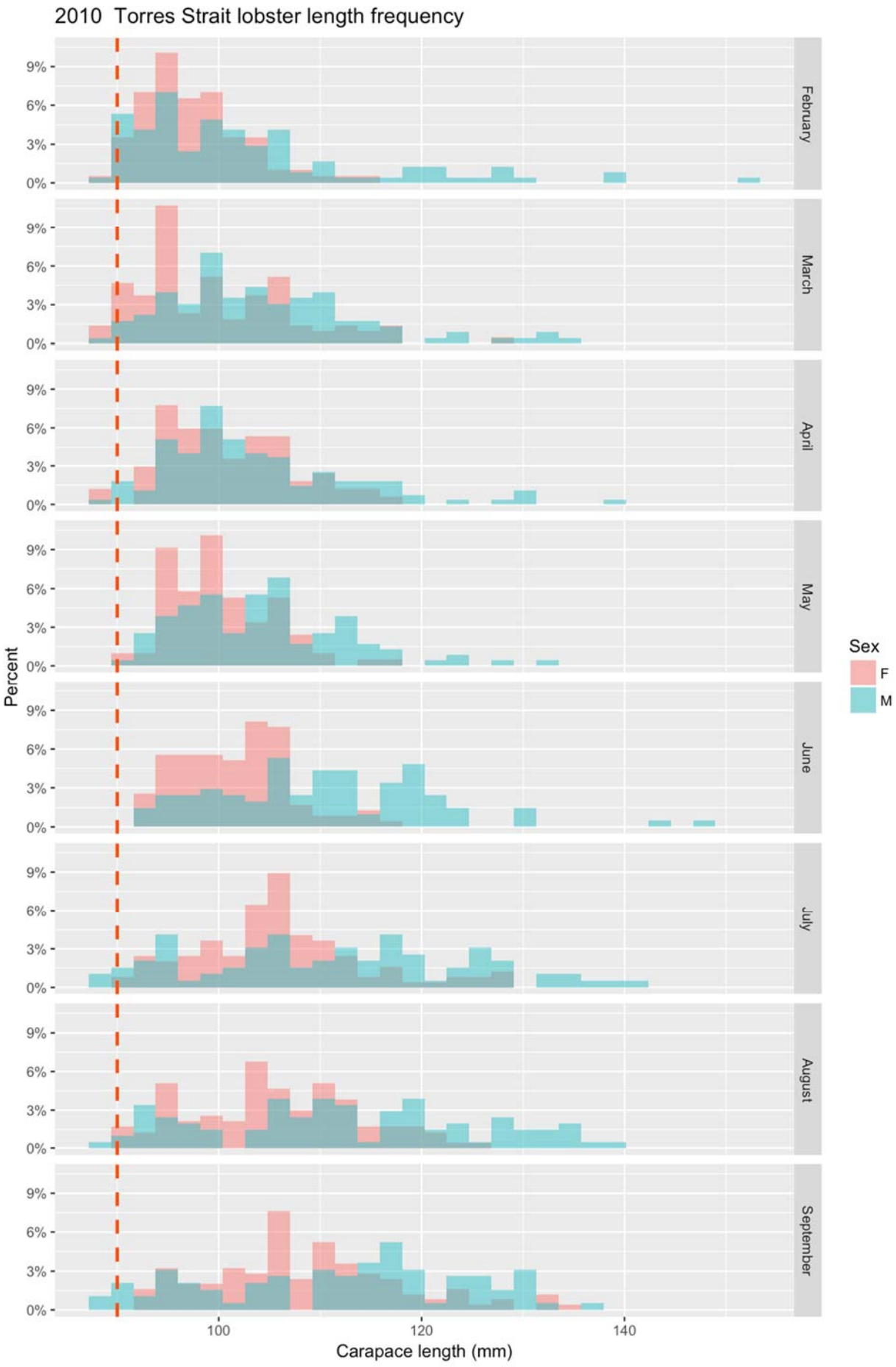
The second set of plots compares the length frequency (from catch samples) during different months of the year, for each of the years as shown.

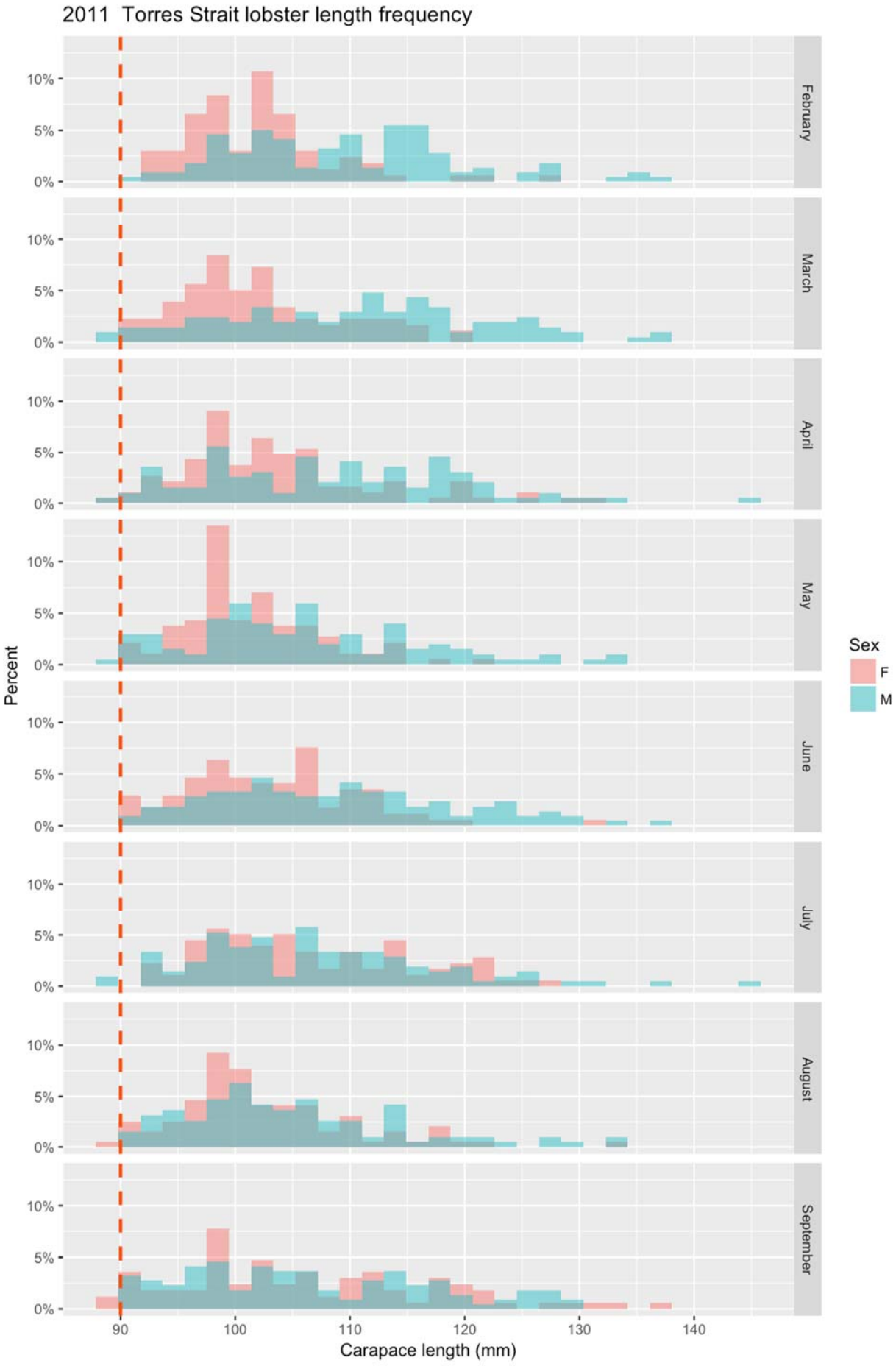



2007 Torres Strait lobster length frequency
Percent
10.0%
7.5%
5.0%
2.5%
0.0%
February
March
April
May
June
July
75
100
125
150
Carapace length (mm)
Sex
F
M

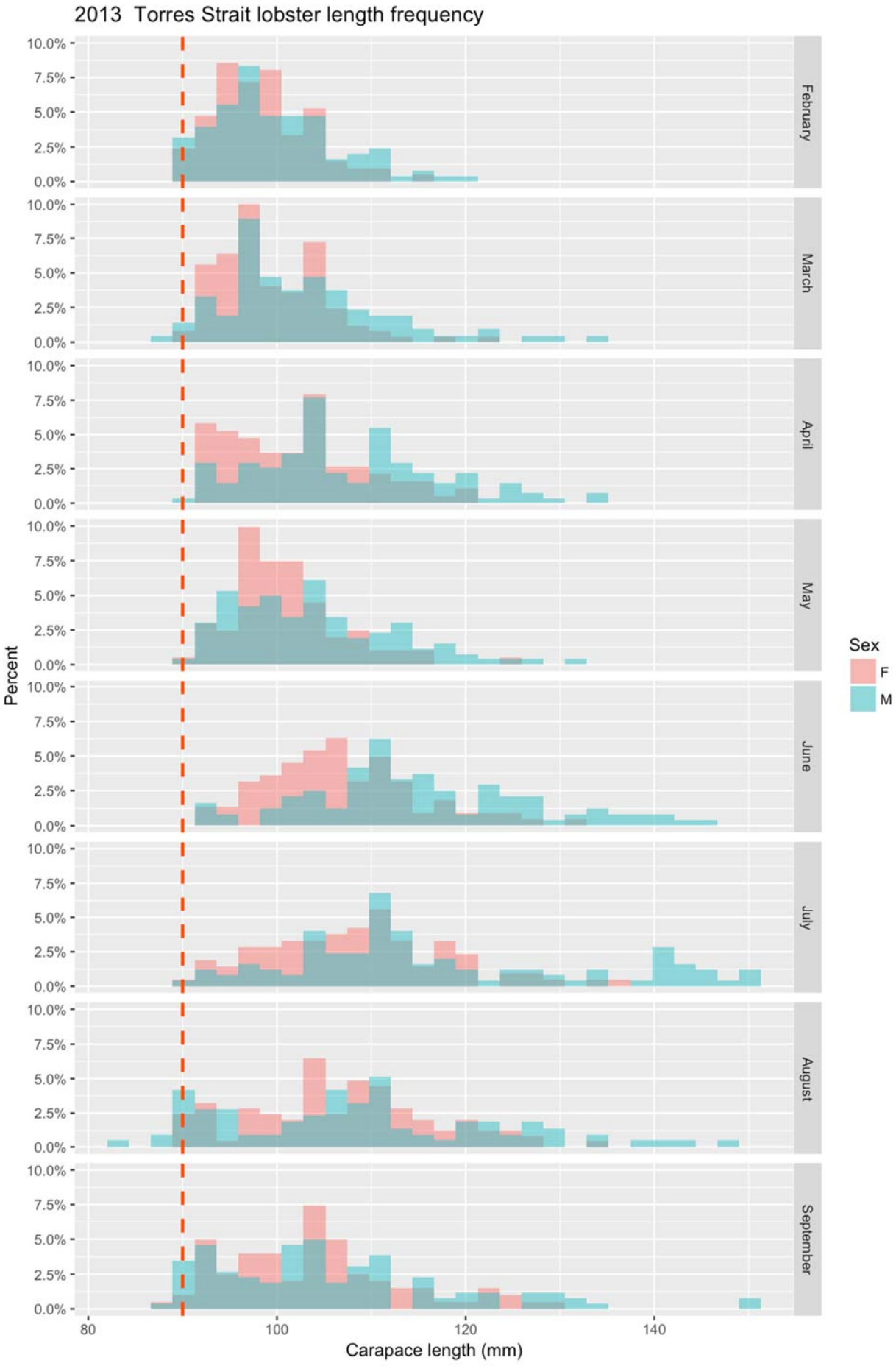

2008 Torres Strait lobster length frequency
Percent
6%
4%
2%
0%
January
February
March
April
May
June
July
August
September
Sex
F
M
80
100
120
140
Carapace length (mm)

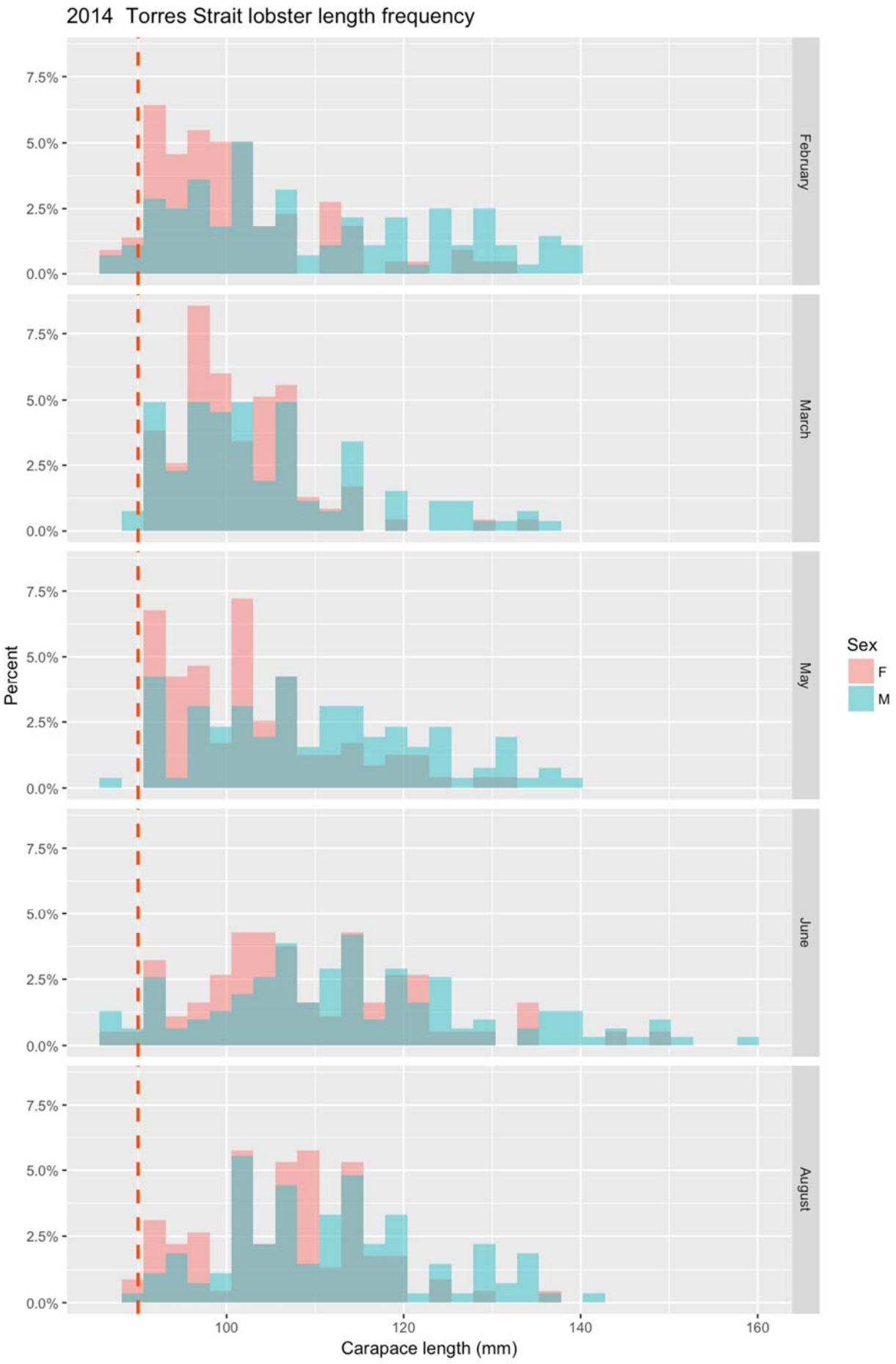

2009 Torres Strait lobster length frequency
Percent
7.5%
5.0%
2.5%
0.0%
March
April
May
June
July
August
September
75
100
125
150
Carapace length (mm)
Sex
F
M

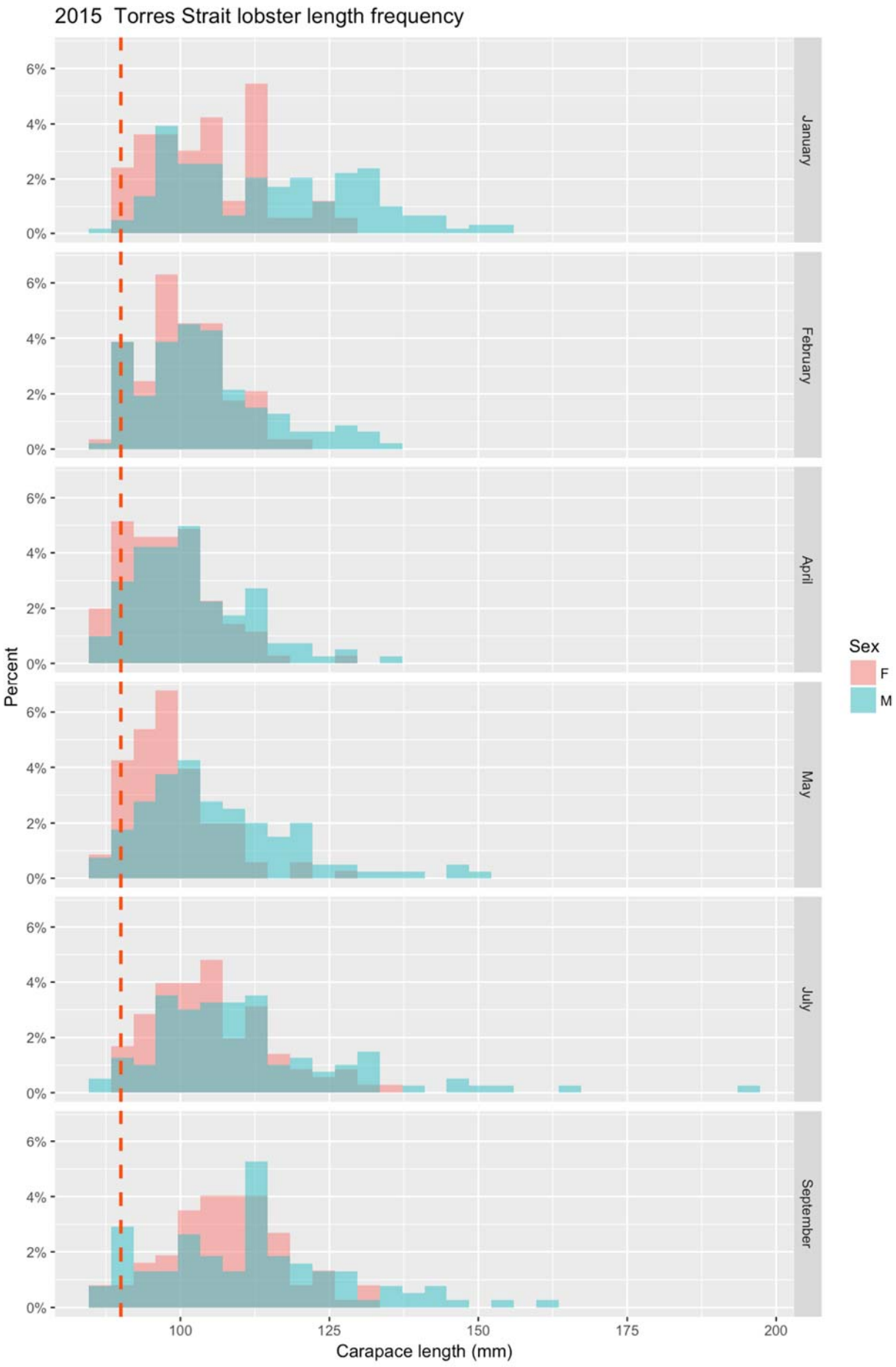

2010 Torres Strait lobster length frequency
February
March
April
May
June
July
August
September
9%
6%
3%
0%
Percent
100
120
140
Carapace length (mm)
Sex
F
M

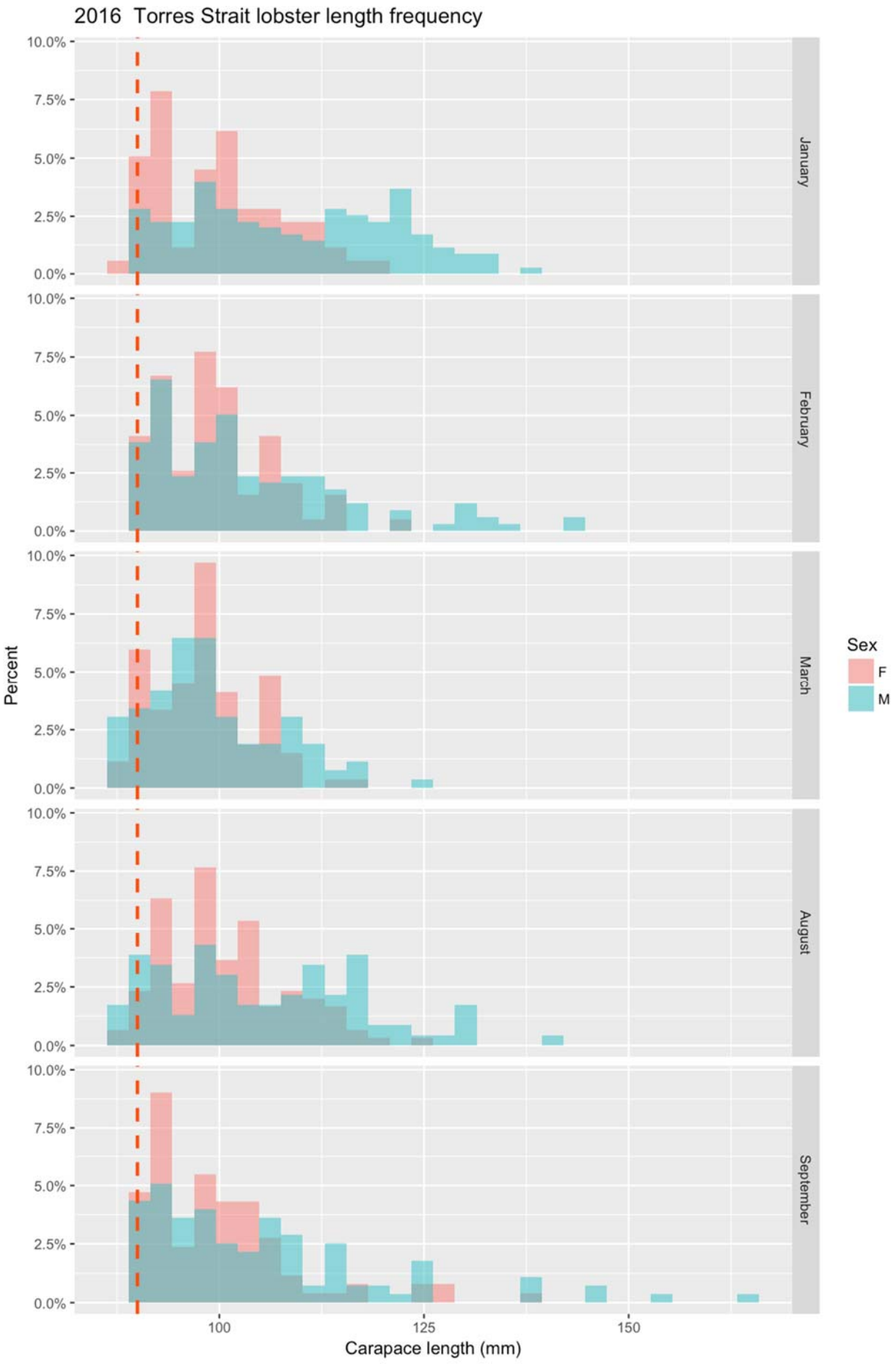

2011 Torres Strait lobster length frequency
February
March
April
May
June
July
August
September
10%
5%
0%
Percent
90
100
110
120
130
140
Carapace length (mm)
Sex
F
M

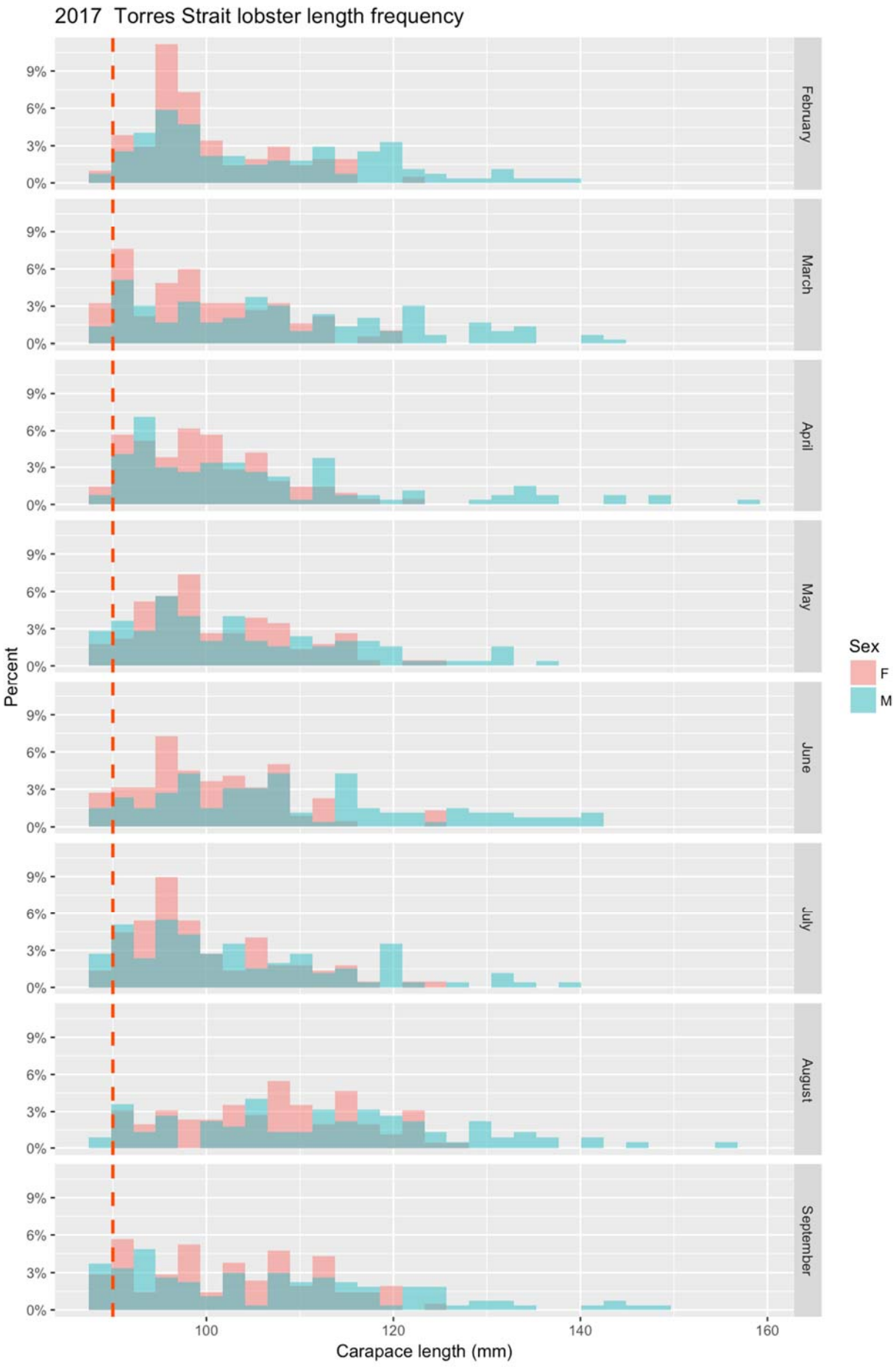

2012 Torres Strait lobster length frequency
Percent
7.5%
5.0%
2.5%
0.0%
February
March
April
May
June
90
100
110
120
130
140
Carapace length (mm)
Sex
F
M


2013 Torres Strait lobster length frequency
Percent
10.0%
7.5%
5.0%
2.5%
0.0%
February
March
April
May
June
July
August
September
80
100
120
140
Carapace length (mm)
Sex
F
M

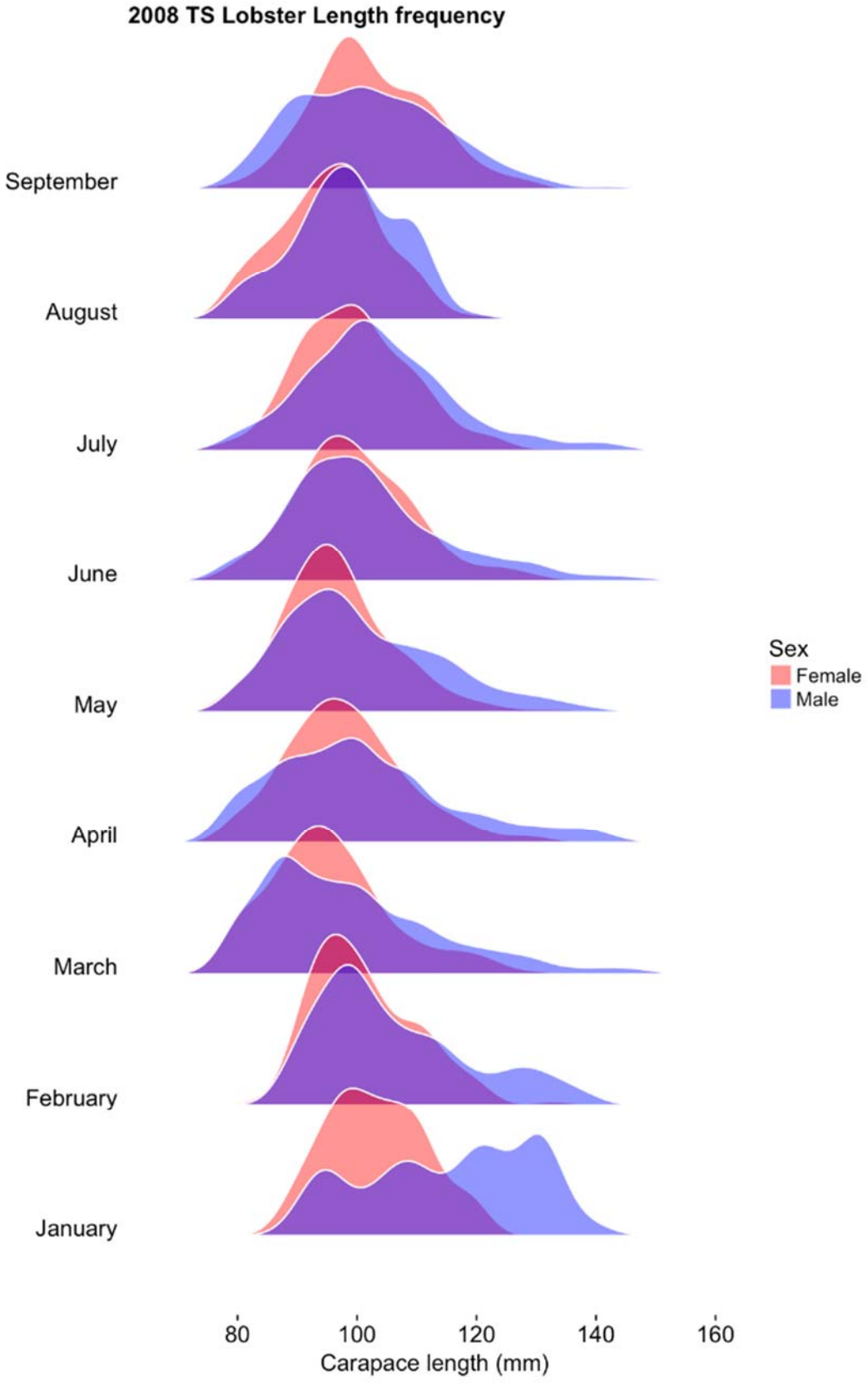

2014 Torres Strait lobster length frequency
Percent
7.5%
5.0%
2.5%
0.0%
February
March
May
June
August
100
120
140
160
Carapace length (mm)
Sex
F
M

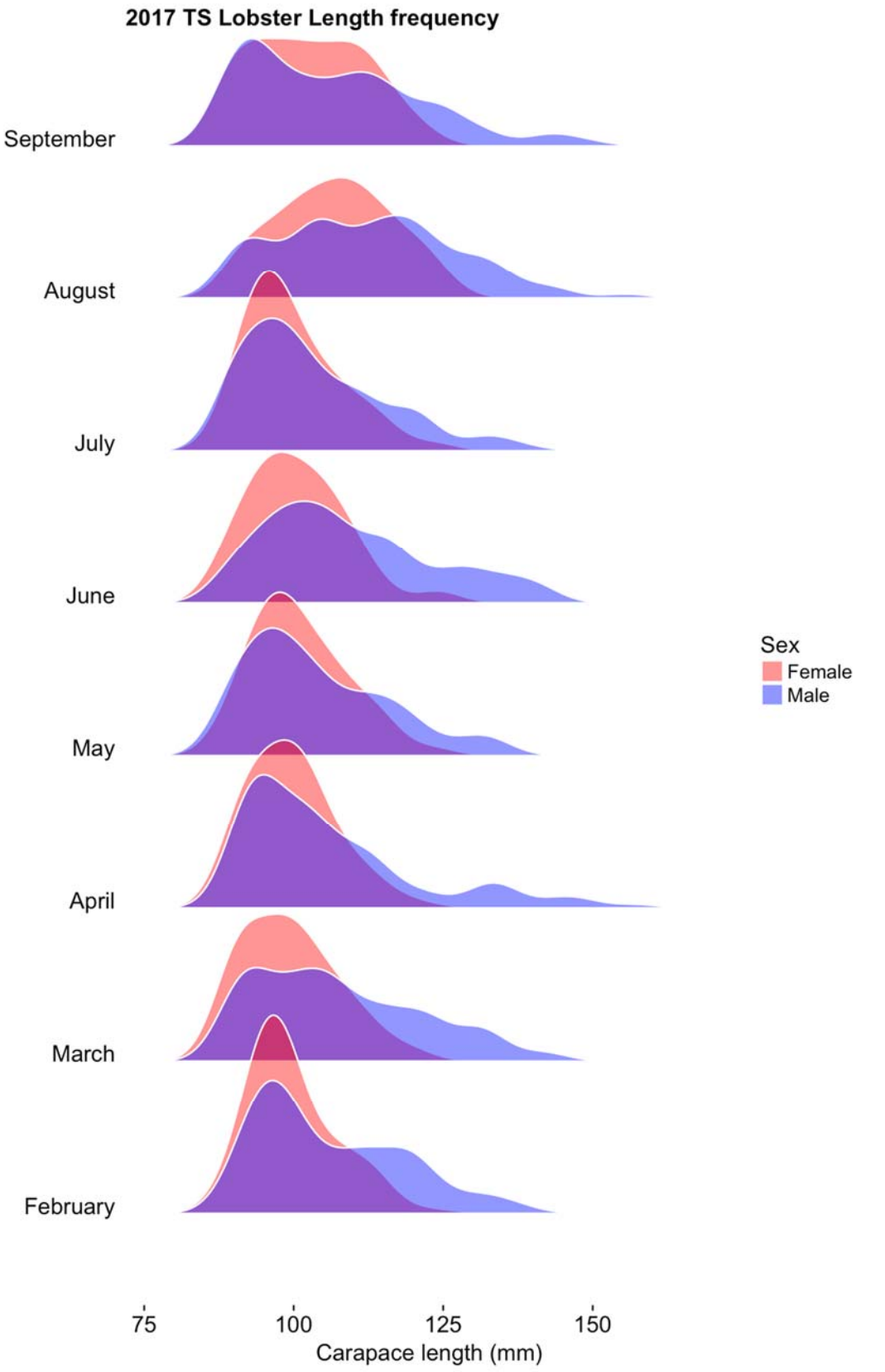

2015 Torres Strait lobster length frequency
January
February
April
May
July
September
Percent
0%
2%
4%
6%
100
125
150
175
200
Carapace length (mm)
Sex
F
M


2016 Torres Strait lobster length frequency
Percent
10.0%
7.5%
5.0%
2.5%
0.0%
January
February
March
August
September
100
125
150
Carapace length (mm)
Sex
F
M


2017 Torres Strait lobster length frequency
February
March
April
May
June
July
August
September
9%
6%
3%
0%
Percent
100
120
140
160
Carapace length (mm)
Sex
F
M

Examples of smoothed plots using ridge lines package, which assists in tracking changes in length frequency over a fishing season.




2017 TS Lobster Length frequency
September
August
July
June
May
April
March
February
Sex
Female
Male
75
100
125
150
Carapace length (mm)

APPENDIX 3 – COPY OF CHAPTER 3 FROM MSE FINAL REPORT

(Source: Plagányi ÉE, Deng, R., Dennis, D., Hutton, T., Pascoe, S., van Putten, I., Skewes, T. (2012) An integrated Management Strategy Evaluation (MSE) for the Torres Strait tropical rock lobster *Panulirus ornatus* fishery. *CSIRO/AFMA Final Project Report* no. 2009/839. 233pp.)

3. MOVEMENT AND MIGRATION OF ORNATE ROCK LOBSTERS (*PANULIRUS ORNATUS*) IN TORRES STRAIT

3.1 Introduction

Movements of lobsters within and out of Torres Strait have been the subject of various research programs conducted by CSIRO and the PNG National Fisheries Authority since the early 1980s. Early research was targeted at describing the movement of lobsters out of Torres Strait on the annual breeding migration, and the relationship between the Torres Strait and Queensland east coast populations (Moore and MacFarlane, 1984; Bell *et al.*, 1987). Limited research was targeted at determining small scale movement patterns of lobsters in the context of habitat use (Trendall *et al.*, 1989) and local depletion issues (Skewes *et al.*, 1997).

Much of the information on movement patterns has been investigated and documented using large scale tagging operations. Several of these have been carried out in the past and are summarized in Table 1. Overall recapture rates were low (6%), even for lobsters tagged on reefs in Torres Strait (8.6%), which probably reflected the low fishing pressure during that time. Another feature of Torres Strait reef tagging studies is that most of the recaptures were made at or near the tagging site (76.7%), even for recaptures up to two years after tagging indicating a high degree of reef fidelity by resident lobsters. In any case, the movements inferred by tagged lobsters from these studies formed the basis for determining much of the biology and ecology of lobsters in Torres Strait and on the Queensland east coast (Figure 1).

A key finding of the early tagging studies was that the Torres Strait and Queensland east coast lobster populations do not interact, and that the east coast lobsters generally tend to settle on inshore reefs and then move offshore in a SE direction as they mature (Figure 1) (Bell *et al.*, 1987). However, it is likely that lobsters north of the green zone on the Queensland east coast may move northward into Torres Strait; possibly even joining the breeding migrations.

Movements of lobsters in Torres Strait can be generally categorized as three types: breeding migrations out of Torres Strait (August/September); small-scale movements of lobsters within Torres Strait; and recruitment of juveniles onto Torres Strait fishing grounds.

3.2 Breeding Migrations

Early tagging studies showed that lobsters from the PNG and Australian fisheries participate in an annual breeding migration into the Gulf of Papua (GoP) and to Yule Island (Moore and MacFarlane, 1984; Bell *et al.*, 1987). There is no evidence of a return migration to the Torres Strait fishing

grounds after the breeding season (Moore and MacFarlane, 1984; CSIRO, unpublished data) although there is some anecdotal evidence of a movement of limited numbers back onto central Torres Strait reefs.

Research on the timing and population characteristics of migrating lobsters found that all female 2+ lobsters and most 2+ males migrate eastwards out of the Torres Strait fishing grounds in early August and early September each year, with the departure spread over 4 to 8 weeks (Skewes *et al.*, 1994, Figure 2).

Table 1. Summary of tagging studies undertaken on *Panulirus ornatus* populations in Torres Strait and on the Queensland east coast.

Date	Description and area	No. tags	No. recaptured	Movements
1975-1980[1]	Daru fishery and Warrior Reef to Tudu Island	4549	537	158 with >2 km movements; 33 within Torres Strait (including 15 easterly movements during Aug-Dec), 110 to the Gulf of Papua (during the migration) and 15 to Yule Island.
1975-1980[1]	Gulf of Papua (trawl)	1021	85	All recaptured in GoP east of tag site along the migratory pathway.
1975-1980[1]	Yule Island fishery	479	100	All recaptured at Yule Island.
1980-1983[2]	West Torres Strait reefs	2300	55	6 (4-15 km) movements within TS mostly to the south, 1 by trawler in the Great NE Channel (from Mabuiag Is), 7 by trawlers in the GoP (from Mabuiag and Long Rf).
1980-1983[2]	Queensland east coast	9632	300	24 with > 4 km movements, mostly to the SE.
1984 (July-Aug)[3]	Daru fishery	?	?	4 to the GoP and 2 to Yule Island.
1984 (May-June)[3,4]	West Torres Strait reefs	2510	124	18 >5 km movements, 13 generally south (juveniles) and 5 northeast, up to 38 km (mature).
1984 (Sept-Oct)[3,4]	Great NE Channel (trawlers)	2456	57	6 to reefs close by, 12 in GNEC to the NE, 36 to GoP, 3 to Yule Island.
1985 (June-Oct)[5]	Tudu Island and Marakai Reefs	1095	185	12 >5 km movements (to Warrior Rf), 3 to GoP (captured by trawlers).

1. Moore and MacFarlane, 1984; 2. Bell *et al.*, 1987; 3. Prescott *et al.*, 1986; 4. Bell *et al.*, 1986; 5. Trendall *et al.*, 1989

More females than males migrate, with male to female ratios of from 1:1.5 to 1:2.9 recorded among migratory aggregations (MacFarlane and Moore, 1986). As the sub-adult population in Torres Strait has a sex ratio close to unity (Moore and MacFarlane, 1984), the migration would bias the sex ratio of the population remaining in Torres Strait toward males.

Migrating lobsters were targeted by trawlers in the GoP and the Great North-east Channel (GNEC) until the practice was banned in 1984 (Williams, 1986). Lobsters migrating through the GNEC were also the target of some research to determine their destination and source. The results of this research showed that these lobsters do, in part at least, participate in the GoP migration, however, lobsters tagged in west Torres Strait prior to the migration were not found in the GNEC that season, despite substantial fishing effort, therefore the source of these migrating lobsters is still uncertain (Bell *et al.*, 1986; Prescott *et al.*, 1986).

Although the migration of breeding lobsters into the GoP was well documented, the source of breeding lobsters that are known to reside in east Torres Strait remains unknown. The size of this breeding population was the subject of research in the early 1990s, when diver and submersible surveys were done in this area (Pitcher *et al.*, 1996) however, successive surveys failed to find a persistent breeding population in relatively high densities as expected. As there are no juveniles found in this area they must migrate there from somewhere else, and the west Torres Strait population is the most likely source, although this is still uncertain.

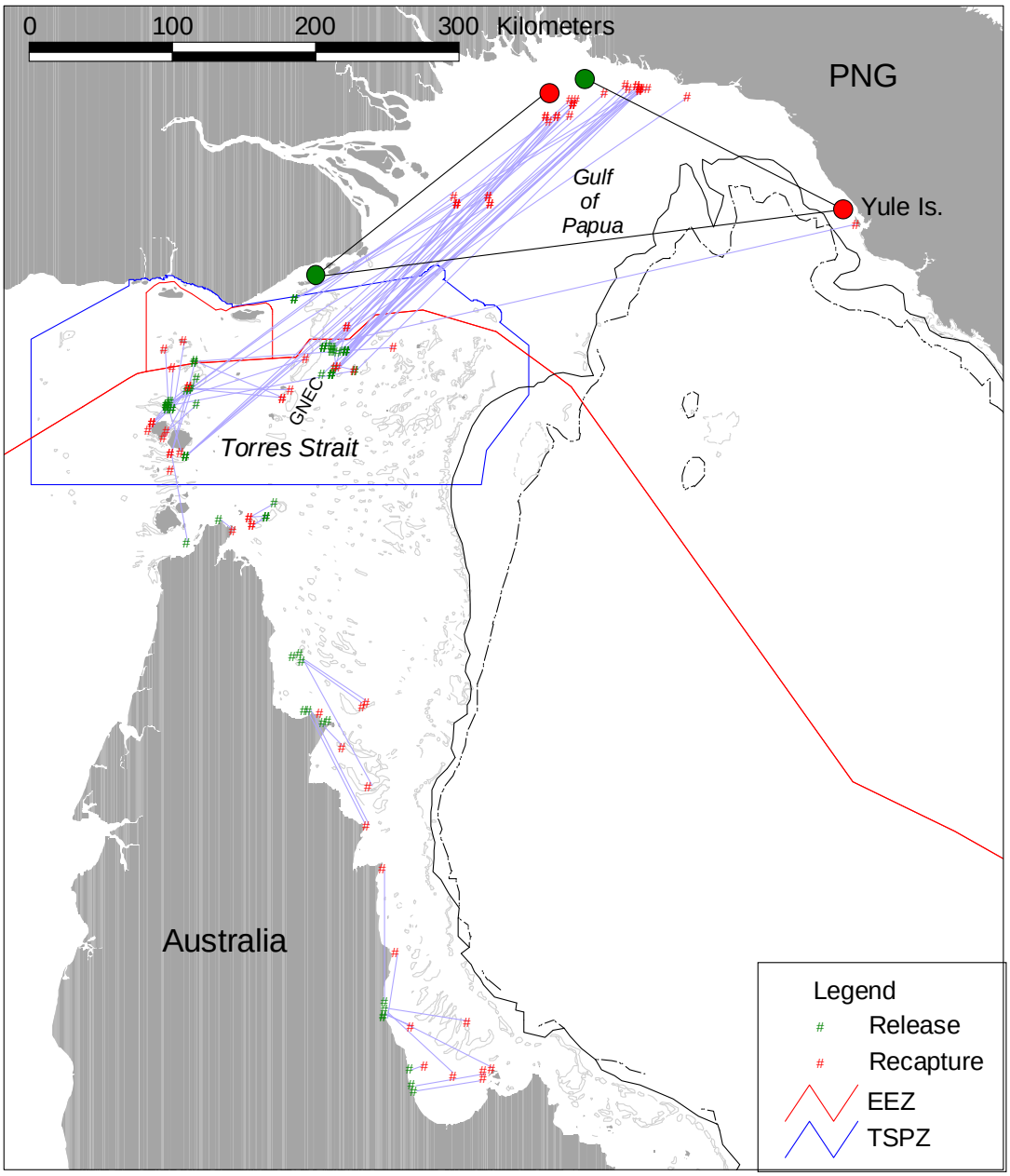


Figure 1. Map showing movements of tagged lobsters that had moved greater than 4 km. Small dots represent individual lobster tag and recapture locations with inferred movements illustrated by blue lines; large dots illustrate groups of larger numbers of tag and recapture data (where individual location data is not known) and inferred. movement patterns illustrated by black lines. Note pathways unknown.

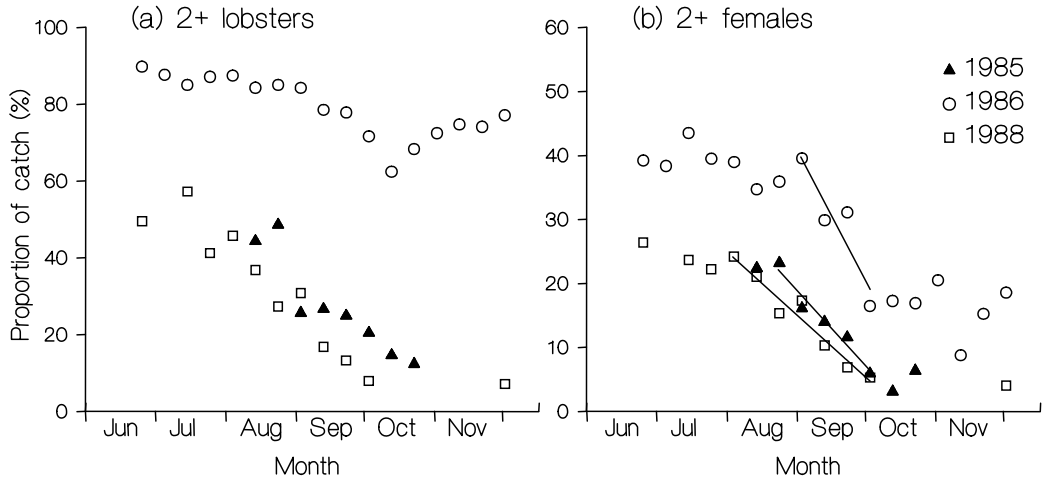


Figure 2. Temporal changes in percentage of the Torres Strait *Panulirus ornatus* catch that were (a) 2+ year old lobsters and (b) 2+ year old female lobsters, in 1985, 1986 and 1988 (10-day intervals). Lines (fitted by eye) show the decline in the proportion of 2+ female lobsters in the catch due to the migration for each year (from Skewes *et al.*, 1994).

3.3 Movements within Torres Strait

While there is anecdotal evidence of movements of lobsters within Torres Strait throughout the year, the high proportion of tagged lobsters caught close to the tagging site, even after substantial periods of time, indicates a high degree of reef fidelity (Moore and MacFarlane, 1984, Bell *et al.*, 1987), although lobsters were found to be highly nomadic within a reef system (Trendall and Bell, 1989). A study on local depletion also indicates low levels of local movement and high reef fidelity among shallow reef 2+ lobsters (Skewes *et al.*, 1997). However, there is persistent reliable anecdotal evidence of movements of mature (2+) lobsters in deeper water probably foraging for areas of preferred food items such as small molluscs. Further anecdotal evidence suggests that 2+ lobsters move and aggregate just prior to the migration. The movement patterns, source and destination of theses lobster are unknown.

3.4 Recruitment Movements

Tagging studies showed small scale (10s of kms) movements of smaller 1+ lobsters that were assumed to represent a movement of recruiting lobsters onto adult habitat (Bell *et al.*, 1987). This movement was also inferred from size frequency and CPUE data gathered in the PNG fishery (Moore and MacFarlane, 1984). A study on local depletion of shallow reef populations also concluded that there was a movement of 1+ lobsters onto the shallow reefs in Torres Strait soon

after the annual breeding migration (Skewes *et al.*, 1997). These recruiting lobsters were generally thought to originate in the surrounding deeper habitat areas (Bell *et al.*, 1987; Skewes *et al.*, 1997)

There has been some speculation of a movement of smaller recruiting lobsters from south-east Torres Strait to the main Torres Strait fishery but this is unproven. Most movements of smaller lobsters during tagging studies in Torres Strait have been to the south (Bell *et al.*, 1986; Bell *et al.*, 1987) however, there have been some tag returns from the Dugong Island area to Kai Damun Reef in south-east Torres Strait showing small westerly movements that may indicate movements of recruiting lobsters from nursery areas to adult habitat.

3.5 Discussion and Conclusions

In the context of catch sharing, movements of lobsters from Australian waters to the PNG fishery are of particular interest. As to these types of movements, there is no current evidence to suggest that there is any significant movement of lobsters from Australian fishing grounds into the PNG fishery, and in fact, no lobster tagged in west Torres Strait has ever been returned from the PNG dive fishery, despite considerable fishing effort and reasonably high program awareness. While this would suggest that there is no movement, the amount of tagging in the far northern section of the Australian fishery was low, and there is some evidence of an easterly movement of non-migratory lobsters in the PNG fishery (from Sigabaduru to Saibai; Moore and MacFarlane, 1984), therefore we cannot categorically rule this out. Also, some fishers have reported a decline in lobster CPUE a couple of months before the migration in the northern Australian fishing grounds that may represent a movement of lobsters out of the Australian fishery. However, this is not supported by PNG and Australia logbook CPUE data (Figure 3). In any case, if there is a large scale movement of lobsters from the Australian to the PNG fishing grounds, it is likely to occur over a relatively short time period and be relatively transient in nature. Therefore, the fishing pressure on those lobsters by PNG fishers is likely to be low.

From the studies on lobster migration and movement in the Torres Strait, we may conclude:

- Torres Strait rock lobsters migrate out of Torres Strait to the GoP to breed; Queensland east coast lobsters do not participate in this migration and move generally southeast towards the outer barrier reef.
- During the breeding migration, most 2+ lobsters leave Torres Strait between mid-August and late-September each year, principally to the Gulf of Papua, and do not return.
- Larger (2+) lobsters in Torres Strait show high reef fidelity throughout most of the year, although they are highly nomadic within a reef system.

- There are probably some movements of 2+ lobsters in deeper water within Torres Strait before the migration. However, there is no evidence of a large-scale movement of 2+ lobsters from the Australian to the PNG fishery.
- There is some evidence of a movement of juvenile (1+) lobsters onto shallow reefs soon after the breeding migration each year. However, these are probably small scale movements from local juvenile nursery grounds to the preferred adult habitat.

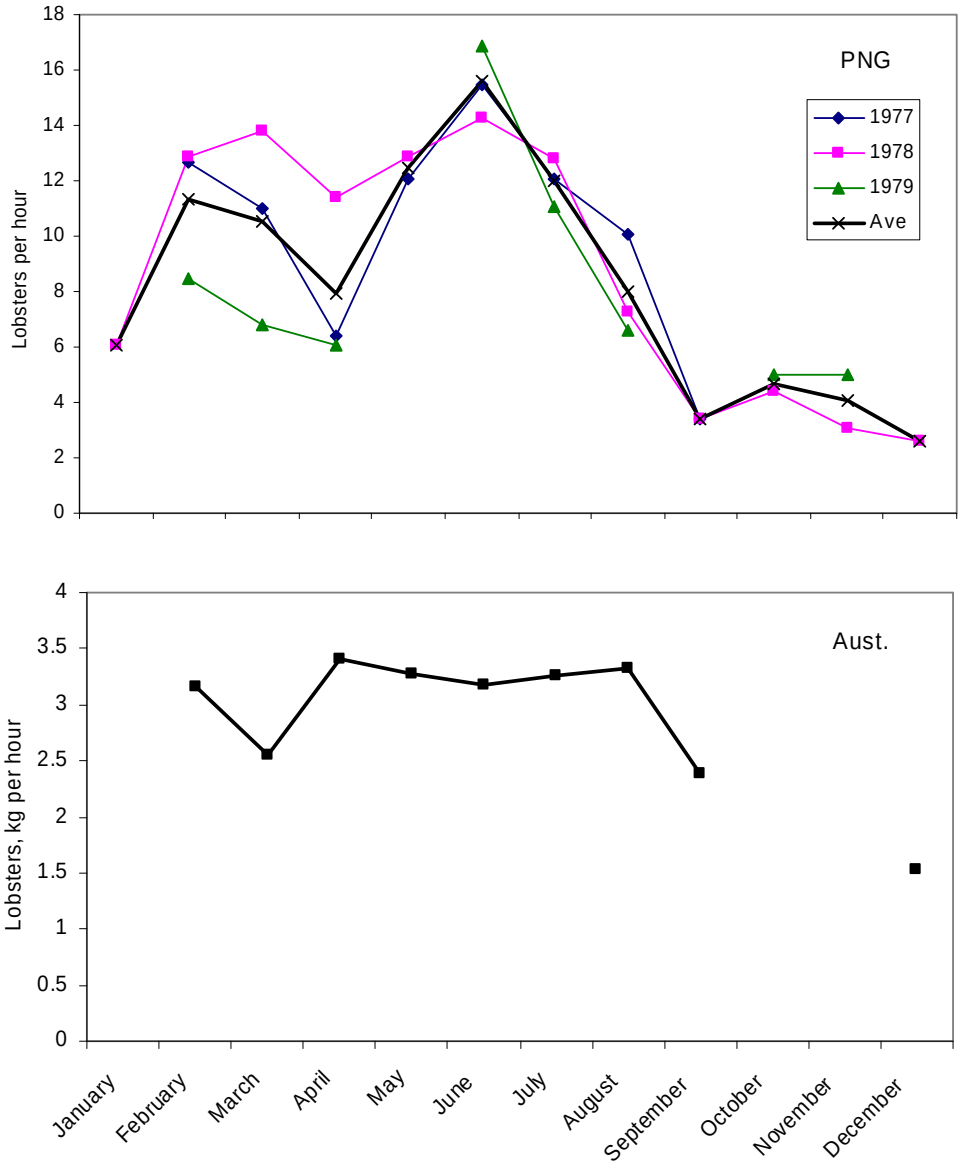


Figure 3. Monthly CPUE data for the PNG (Moore and MacFarlane, 1984) and Australian (CSIRO, unpublished data) fisheries.

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Appendix 4 - Mid-year survey pros and cons

Pros

- On the ground assessment of 1+ and 2+ abundance and size before migration will provide a solid scientific basis for cross-checking and validating the Preseason survey results, or alternatively highlighting that changes in the fishery are occurring which may necessitate a revision of survey and assessment protocols.
- In addition this provides an index of the 2+ abundance to more accurately inform on stock status and for comparison with CPUE data, which will be useful in again cross-checking how well the CPUE data reflect 2+ abundance given recent changes in some fishing practices.
- Compare 2018 June survey to previous mid-year surveys (75 sites). We propose that about 40 sites are critical.

Cons

- Cost – charter $75k. Wages? Flights?
- Surveying sites that may have already been fished – not that different to previous surveys
- If we are confident of CPUE data and think it does provide a good proxy for spawning biomass? If so, perhaps not worth doing

Logistics

- We can be ready to do a survey in June which coincides with timing of other mid-year surveys
- Probable dates 1st -14th June – tides best at this time (or could possibly do May).
- Kerra Lynn available (same vessel used in 2017 preseason survey)
- Survey staff – Mark Tonks, Mick Haywood, Nicole Murphy, Kinam Salee
- Cost will be the same as the pre-season survey because spatial coverage is similar

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Torres Strait rock lobster (TRL) 2017 fishery surveys, CPUE and stock assessment

AFMA Project 2016/0822

Éva Plagányi, Rob Campbell, Mark Tonks, Mick Haywood, Roy Deng, Nicole Murphy, Kinam Salee

March 2018

Australian Fisheries Management Authority
Thursday Island

DRAFT REPORT FOR TRLRAG, MARCH 2018

Australian Government

Australian Fisheries Management Authority

CSIRO Oceans and Atmosphere

Citation

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Important disclaimer

Contents

Figures

Tables

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Executive summary

The Torres Strait TRL fishery provides an important source of income for greater than 400 Torres Strait islanders and many island communities; and also supports a non-islander sector, based on ~11 licensed primary vessels. The TRL stock is shared with adjacent fisheries in PNG and on the northern Queensland coast. The Australian and PNG Torres Strait catch has averaged 684 t live weight since 1989. The Australian Torres Strait catch is important economically to all sectors, and primarily supports a lucrative export market for live lobsters to China (Hutton et al. 2016, Plagányi et al. 2017). Given its significant traditional, economic and social importance there is a need to address the long-term biological sustainability of the stock through research supporting management decisions.

Annual fishery-independent monitoring of the Torres Strait ornate rock lobster (TRL) *Panulirus ornatus* population has been carried out during 1989 to 2017. These surveys, conducted mid-year (June) up until 2014 and pre-season (November) during 2005-2008 and from 2014-2017, provide the only long-term information on the relative abundance of recruiting (1+) lobsters. Prior to the introduction of mandatory logbooks in the TVH sector and subsequently the docket book system in the TiB sector these surveys also provided the only long-term information on the relative abundance of fished (2+) lobsters.

Pre-season population surveys of recruiting (1+) lobster abundance were identified by the TRL RAG as critical to support the move to a quota managed system (QMS) proposed in 2005. As a result annual pre-season surveys were conducted during 2005-2008, in addition to mid-year surveys, and have replaced midyear surveys since 2014, to provide managers with information on the abundance and biomass of fishery recruits and the likely stock biomass available to be fished each year. These data sets are integral to the outputs of the fishery model developed to assess fishery status and to forecast stock size and inform the Recommended Biological Catch (RBC). In addition, these data are essential inputs to an empirical Harvest Control Rule (eHCR) that is being developed for TRL.

The 8th annual pre-season population survey was conducted in November 2017. The sample design employed during the 2017 pre-season survey was consistent with previous surveys. A total of 77 sites (down from the original 140) were allocated to the established sampling strata. Measured belt transects (500 m by 4 m) were employed as the primary sampling unit. At the completion of each transect a diver recorded; the number of lobsters caught (and measured), the number and age-class of those observed but not caught, depth, visibility, distance swum, numbers of pearlshell (*Pinctada maxima*) and holothurian species observed, and percent covers of standard substratum and biota (including seagrass and algae species) categories.

The strong correlation obtained in previous work between the mid-year and pre-season lobster abundance indices motivated reducing the scale of the pre-season surveys to include only the 74 mid-year lobster survey sites. This reduces the overall cost of research for management. Recruiting (1+) lobster indices calculated using all sites were strongly correlated with indices calculated using only the 74 mid-year survey sites. Hence when only one annual index is used there is little difference in stock forecasts and RBC using either index. However, the standard errors of the

indices using only mid-year sites were ~30% greater than for indices calculated using all sites. Hence, there is greater uncertainty in the mid-year only forecasts. Nevertheless, supplementary survey site data from industry run surveys could address this shortfall or possibly increase precision of the pre-season abundance estimates.

The distributions of recently-settled (0+) and recruiting (1+) lobsters were similar to previous pre-season surveys however both were significantly less abundant throughout most sampling stratums resulting in the lowest (0+) and (1+) pre-season indices recorded. The South East stratum had average (0+) and (1+) abundance indices while the western stratums, TI Bridge, Mabuiag and Buru were well below average and down significantly from the 2016 survey. The size distribution of lobsters sampled during 2017 was similar to previous pre-season surveys in that it was comprised mostly of (1+) lobsters, however significantly less recently-settled (0+) lobster were observed. Since 2014 there have been very few legal size lobsters in the sampled population. Unusually there were no (2+) lobster found in Reef Edge stratum during this survey. The modal size of recruiting (1+) lobsters recorded since 2014 has been generally decreasing.

The population surveys were initially designed to provide accurate and precise indices of 1+ and 2+ lobster abundance, and 0+ lobsters were rarely observed during mid-year surveys as they only settle in June. Hence, refined sampling would likely provide better estimates of 0+ abundance. Although all 0+ lobsters observed during the pre-season surveys are recorded, it is not known how many are missed due to their small size and cryptic behaviour. Nevertheless, if the percentage of lobsters observed has remained constant throughout the study period, the density indices should be a reliable indicator of relative recruitment strength one year in advance. As for recruiting lobsters, additional future industry-run surveys could provide greater certainty about strength of the 0+ year-classes, and even earlier forecasting of stock size and TAC.

Over the recent period there have been a number of anomalous environmental events, and large impacts due to changing habitat. Current reports that sand has moved out of an area resulting in favourable habitat for lobsters can therefore partially explain high abundance of lobsters in localised areas. Analysis of the 2017 survey data for comparison with the historical series suggests there does appear to be some increase in seagrass cover around Moa and Badu and marginally around Maubiag in 2017, but not as high as in 2014. There doesn't seem to be any obvious signal in the sand plot. The survey isn't extensive enough to provide detailed habitat information but this does suggest that on average there weren't any major habitat changes observed during the survey.

For the Torres Strait rock lobster fishery there are currently two sources of catch and effort data, those for the TVH and TIB sectors. The TRL04 Logbook data from the TVH sector is believed to provide a relatively complete and good source of catch and effort data for this sector. Improvements in compliance to ensure that all fields in the Logbook are completed (e.g. area fished and hours fished) would improve the utility of these data. Also, a better recording of the locations of the fishing effort (i.e. at the tender level) would also improve the accuracy of the data for standardising catch rates. On the other hand, the data for the TIB sector is less complete and the measure of effort (days fished) is less accurate and incomplete in many instances. However, given the potential for this sector to grow in importance in future years there is a need to assess the utility of these data to provide a useful index of resource abundance.

The results presented above indicate that while the TIB-based indices have the potential to capture the major trends stock abundance, they likely lack the detail required to track finer inter-annual trends in abundance. There are several reasons for this outcome. In particular, the measures of catch and effort in the TIB data are coarser (trip-based) compared to the tender-hours based data for the TVH data. Indeed, for the TIB data it remains unknown how many hours per trip fishing actually occurred and whether there are differences between the different sellers and trends over the years.

With the introduction of the new Torres Strait Catch Disposal Record it is hoped that the improvements seen in data recording will continue. While the recording of several data fields (e.g. Fisher Name, Fisher Type, Boat Symbol, and catch details) will be mandatory in the new form, it is also essential that the other fields in the voluntary sector of the form (e.g. detailing fishing effort and methods) are completed if the required information is to be available for standardising the TIB catch and effort data. As with the TVH data, continued effort needs to be placed on ensuring the completeness and accuracy of these data if they are to be used on a continuing basis.

The TRL integrated stock assessment model was again used to inform an RBC for the 2018 fishing season. The TRLRAG agreed that if the fishery transitions to using an empirical Harvest Control Rule (eHCR) to inform the Recommended Biological Catch (RBC), then the stock assessment would only need to be conducted every three years. However until such time as this is formally adopted, the stock assessment model is being used to inform the RBC.

The full details of the stock assessment model are provided in this report. A schematic summary of the model and inputs used to inform on trends in the abundance of the different age classes is given at the end of this summary. The data updates include the latest (Nov 2017) pre-season survey results, the catch total for 2017, and revisions and updates to the commercial CPUE (TVH & TIB) data series. The Reference case model presented here is fitted to the TVH CPUE Main Effects Int1 option and the standardised Seller+QA CPUE TIB series.

The model predictions for 2018 are not optimistic because they are based mostly on the preseason survey 1+ index, which is the lowest of the 8 values recorded thus far. The model fits the 1+ Preseason survey data reasonably well, but overestimates the 0+ index for 2017. The model reasonably fits the recent CPUE series for both sectors, but is unable to satisfactorily fit the 2015 CPUE data for TVH in particular.

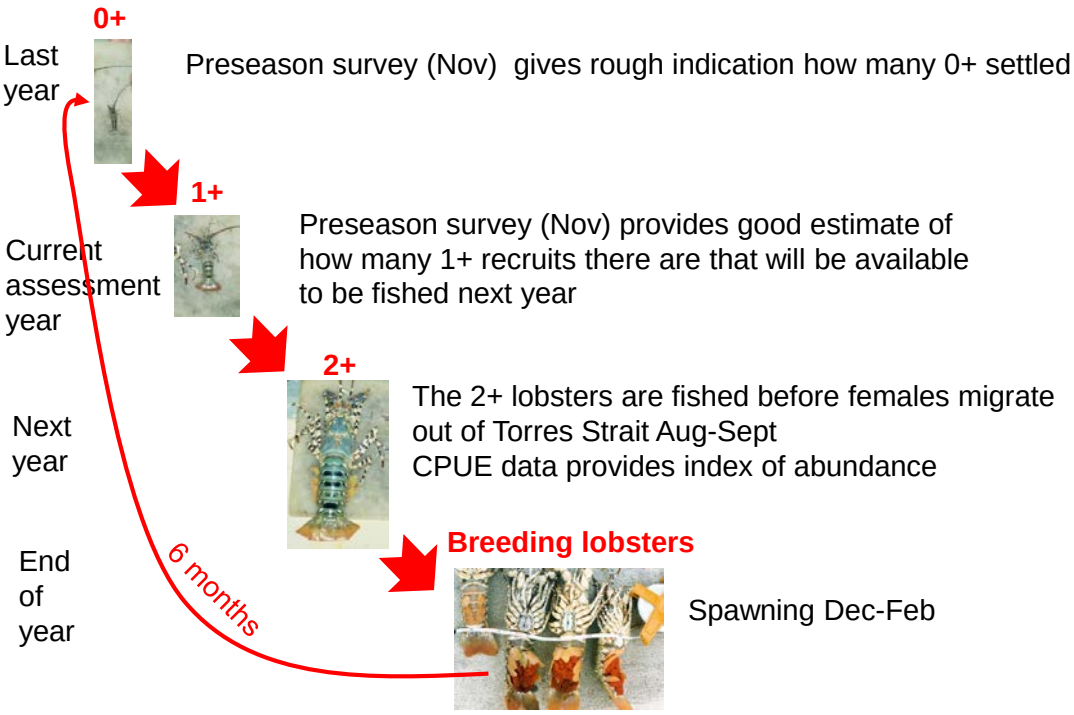
The 2017 stock-recruit residual is again seen to be lower than the average value, and is lower than that estimated for at least the past decade. Applying the reference case model straightforwardly with the updates as described, suggests a RBC (2018) of 299t [90% CI 196-401t]. The stock is currently estimated to be at 76% of the pristine (1973) spawning biomass level but is expected to fluctuate widely about the average target spawning biomass level, and to decline further in 2018 (down to 59%).

The stock assessment outputs depend primarily on the survey 1+ index of abundance, but also account for longer terms trends in spawning biomass and 0+ abundance so as to ensure the longer-term sustainability of the stock with a very low risk of stock depletion in line with the stakeholder-agreed management objectives. The latest December 2017 stock assessment was conducted in an identical fashion to previous years, calibrated to maintain spawning biomass at a pre-agreed level and utilising an F=0.15 which yielded a RBC of 299t with 90% confidence interval 196-401t – as previously the large confidence interval reflects uncertainties around data and stock

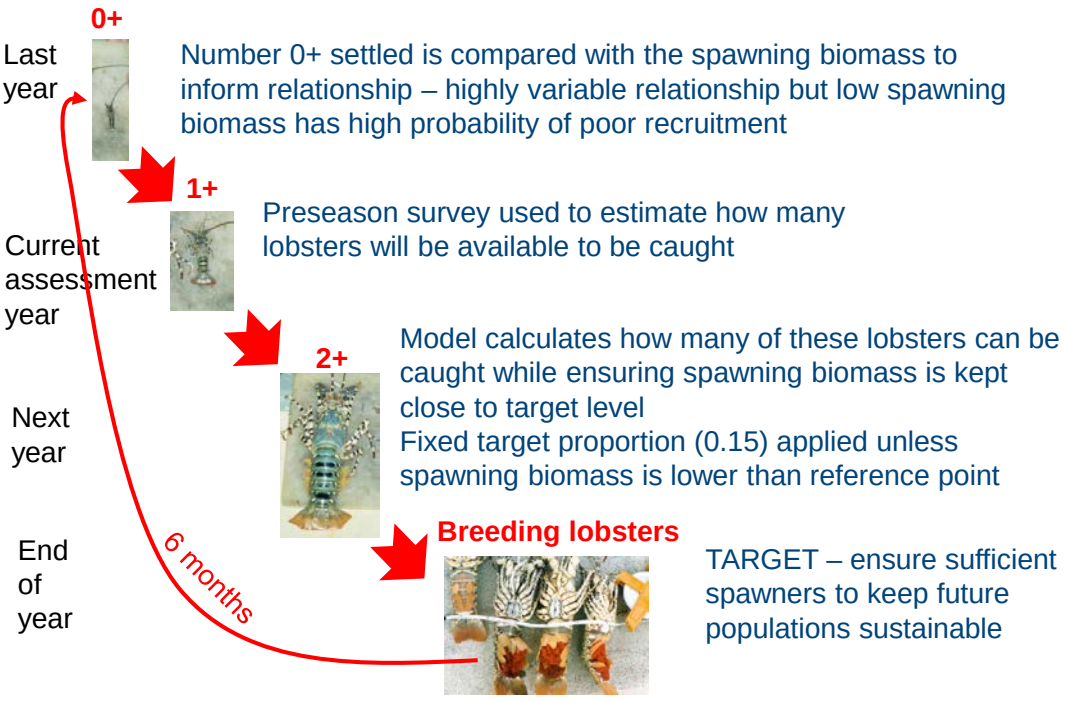
status given that it is difficult to forward predict the yield from highly variable single cohort fisheries such as TRL.

The stock assessment is acknowledged to be precautionary in response to feedback and buy-in from stakeholders, and has in the past output RBCs which are closely in line with current stock abundance and hence vary dramatically from year to year. In contrast, the current empirical Harvest Control Rule (eHCR) being proposed seeks to dampen inter-annual variability in catches and hence recommends a higher RBC based on recent average performance (and would similarly set a lower RBC in god years that the stock assessment) – the eHCR comparable value for 2018 is 519t, but does not correspond to the management process currently agreed by stakeholders.

Summary of Life Cycle and Assessment



Assessment Basics



Chapter 1 Torres Strait Tropical Rock Lobster Catch Data and Length Frequency Summary

Table 1-1. Torres Strait Tropical Rock Lobster Fishery catch and total allowable catch for the years 2013 to 2017.

Year	TIB Catch (t)	TVH Catch (t)	PNG Catch (t)	Total Catch (t)	Global TAC (t)	Catch as % of TAC
2013	146.1	361.7	108.3	616.1	871	71%
2014	204.6	273.2	261.2	739.0	616	120%
2015	196.3	152.7	235.7	584.7	769	76%
2016	266.1	243.7	248.0	757.8	796	95%
2017	106.4	149.0	113.0	368.4	495	74%

**Catch is whole weight*

Number of active vessels 2017

- Number of active TIB's (primary and tenders) 2017: No vessel symbols recorded in Docketbook, though 248 distinct Seller Names
- Number of active TVH (primary and tenders) 2017: 10 primary vessels (by name), 34 tenders

Table 1-2. Torres Strait Tropical Rock Lobster Fishery TIB sector catch by zone for 2017 (refer to map of TIB zones below).

TIB Area	Area Name	TIB Catch (Kgs)	TIB Area	Area Name	TIB Catch (Kg))
0	Unknown	12,325	11	Warrior	959
1	Turu Cay	2,220	12	Warraber	1,906
2	Deliverance Island	0	13	Mt Adolphos	722
3	Northern Section	383	14	Great NE Channel	3036
4	Bramble Cay	347	15	South East	0
5	Anchor Cay	0	16	Darnley	118
6	Western	0	17	Cumberland	62
7	Mabuiag	307	18	Seven Reefs	0
8	Badu	14,771	19	Don Cay	10
9	Thursday Island	63,119	20	Barrier	0
10	Central	6,071	21	GBR	0

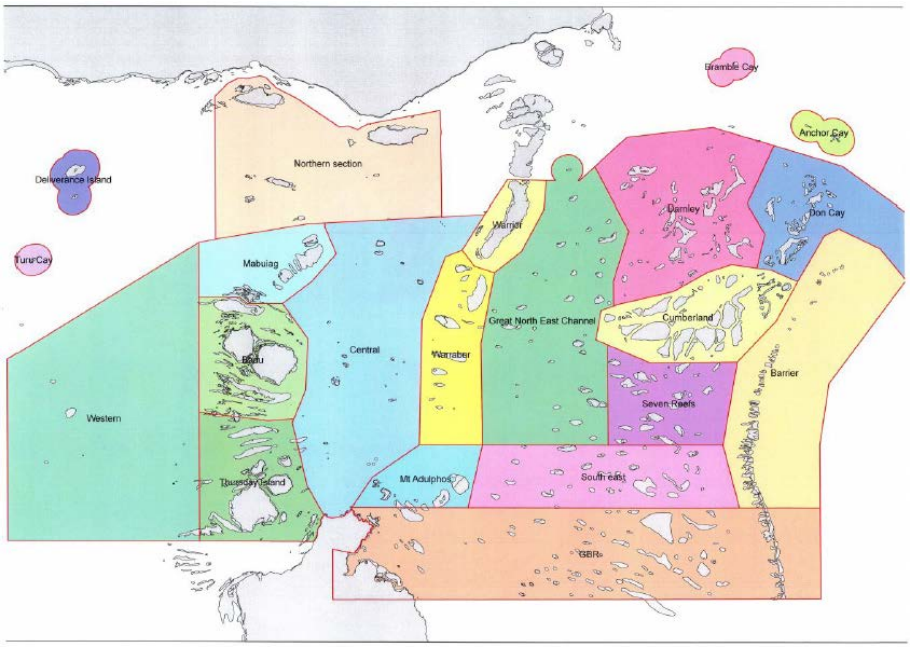


Table 1-3. Torres Strait Tropical Rock Lobster Fishery TVH sector catch by zone for 2017 (refer to map of TVH zones below).

TVH Area	Area Name	TVH Catch (Kgs)	TVH Area	Area Name	TVH Catch (Kgs)
0	Unknown	108	10	Northern section	51,226
1	Badu	489	11	Seven Reefs	183
2			12	South East	130
3	Central	4,572	13	Thursday Island	2,691
4	Cumberland	2,307	14	Warraber	29,646
5	Darnley	423	15	Warrior	28,109
6	Don Cay	0	16	Western	0
7	Great NE Channel	0	17	Kirkaldie	20,499
8	Mabuiag	7436	18	PNG	430
9	Mt Adolphos	799	19	GBR	0

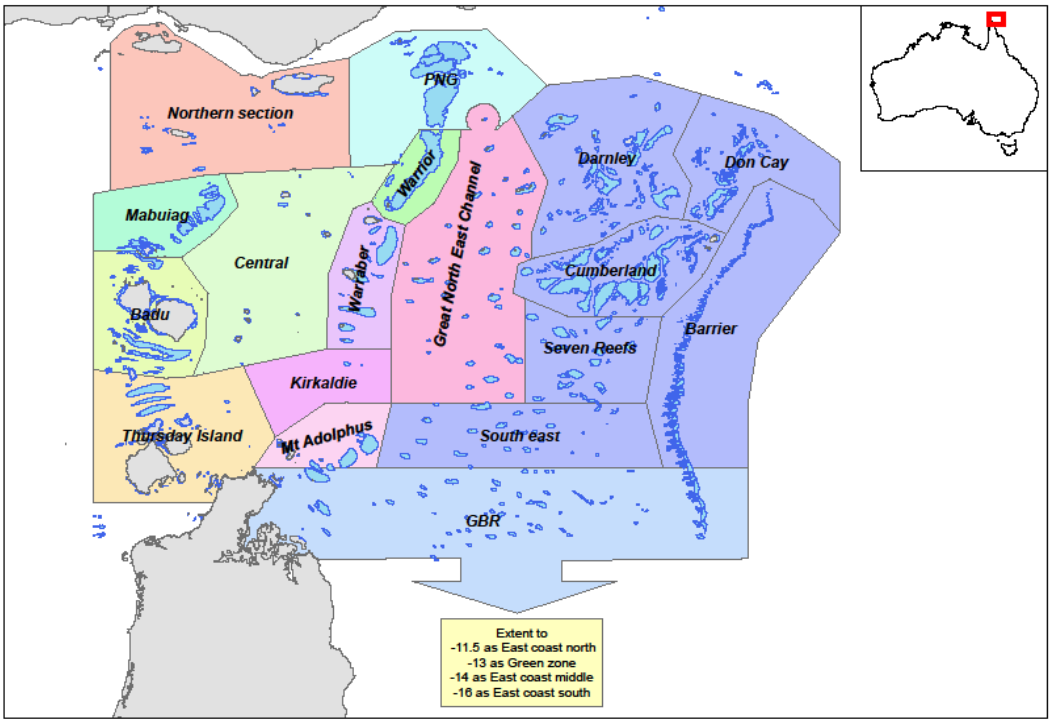


Figure 1-1 Map of fishery zones

Chapter 2 Estimation of Total Annual Effort in the Torres Strait Rock Lobster Fishery

2.1 TVH Fishery

Data Summary

Catch and effort data for the TVH sector of the Torres Strait rock lobster fishery is recorded in the TRL04 Logbook. The structure of the data is shown in Figure 2-1. For each vessel-day there can be multiple shots (up to 4) with each shot consisting of up to 8 tenders. Each tender has a catch recorded by diving method (hookah, free or unknown) and the catch is recorded by processed form (whole, tailed or unknown). The data was aggregated so that each record refers to the catch for a unique vessel-day, shot, tender and diving method (also known as a tender-set). Between 2004 and 2017 there are a total of 38,274 TVH records or tender-sets.

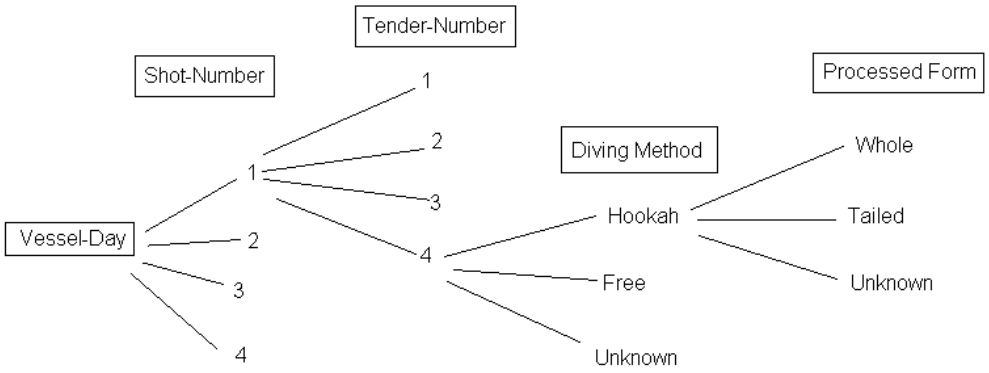


Figure 2-1. Structure of the TVH data

The distribution of these 38,274 records by year and month are given in Table 2-1. It is apparent that there has been little if any effort during October and January since 2004.

Effort is recorded as “Hours-Fished” which records the duration of the fishing trip for each tender-set. The distribution of hours fished for all records is shown in Figure 2-2. Unfortunately the fishing effort has not been completed for all tender-sets (c.f. Figure 2-3), with the number of hours fished recorded for only 35,871 (93.7%) of the 38,274 records. The number of recorded hours fished was between 0.15 hours and 96 hours, though the majority were less than 12 hours of the 337 records where the hours fished was greater than 12, most (315) recorded 24 hours which was assumed to be a day’s fishing. All records where the hours-fished was greater than 12 hours were considered suspect due to possible recording errors and as such only those records where the hours-fished was 12 hours or less were included in the analysis. A further two records where effort was less than 0.5 hours were also excluded. This left a total of 35,534 records (92.8% of all tender-sets) having a recorded effort between 0.5 and 12 hours for further analysis.

Table 2-1. Number of TVH tender-sets by year and month.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	24	607	712	571	662	761	729	633	395	0	0	106	5200
2005	13	662	615	543	519	538	552	533	323	0	0	4	4302
2006	0	409	436	361	286	206	349	289	92	0	0	0	2428
2007	0	288	427	446	542	489	402	184	91	0	0	0	2869
2008	0	133	222	113	161	96	159	175	152	0	0	0	1211
2009	0	148	227	174	201	200	125	163	70	0	0	0	1308
2010	0	255	333	302	324	292	309	294	253	0	6	0	2368
2011	0	286	384	371	322	380	356	310	261	0	0	0	2670
2012	0	166	344	371	311	336	318	264	201	0	0	0	2311
2013	0	461	383	414	424	324	374	385	243	0	0	0	3008
2014	0	357	404	297	433	408	445	274	291	0	1	0	2910
2015	0	419	408	441	355	313	253	357	137	0	0	0	2683
2016	12	500	444	315	379	349	323	191	141	0	0	9	2663
2017	7	397	254	322	383	310	292	277	101	0	0	0	2343
Total	56	5,088	5,593	5,041	5,302	5,002	4,986	4,329	2,751	0	7	119	38,274

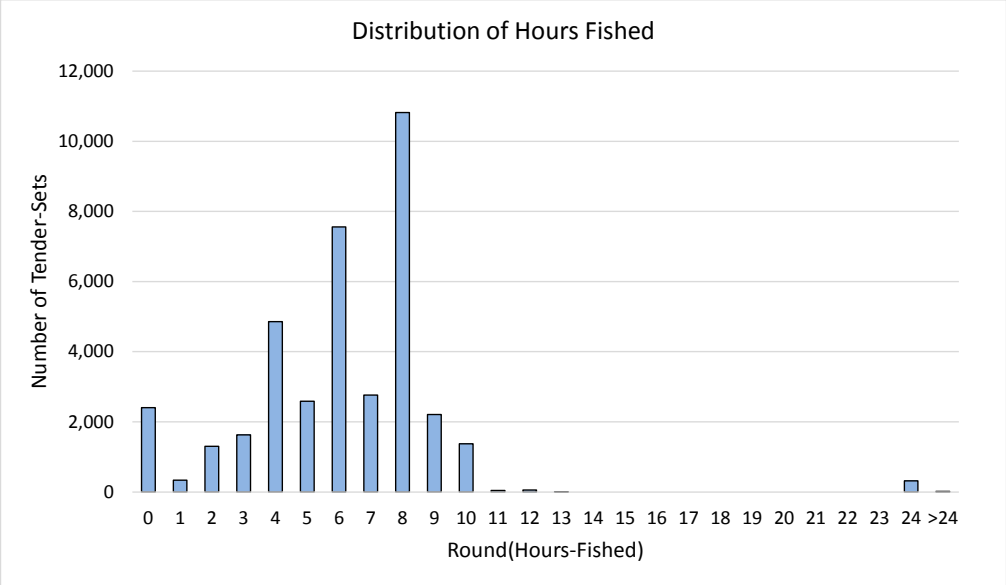


Figure 2-2. Distribution of effort for the 38,274 TVH records between 2004 and 2017.

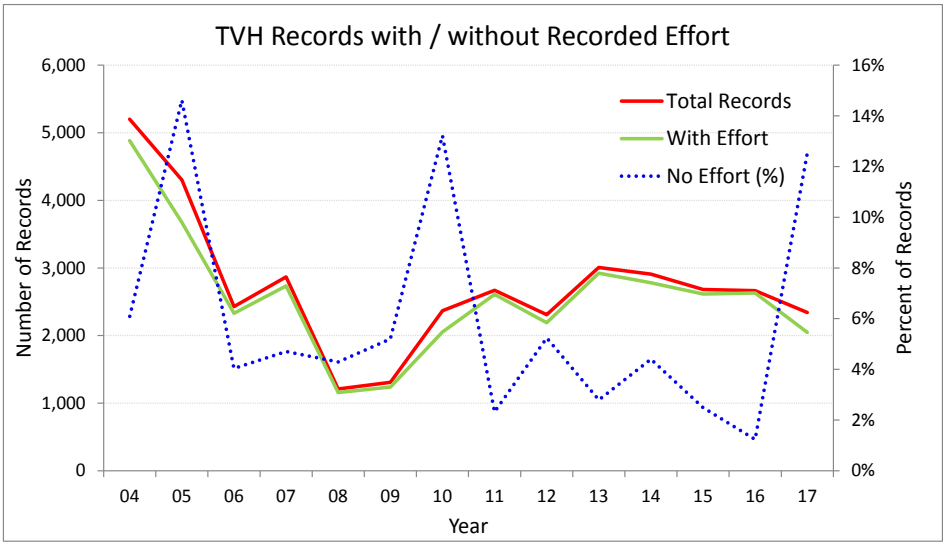


Figure 2-3. The total number of TVH catch records each year and the number of records for which the corresponding effort data is available. The percentage of records for which no effort is recorded is also shown (right hand axis).

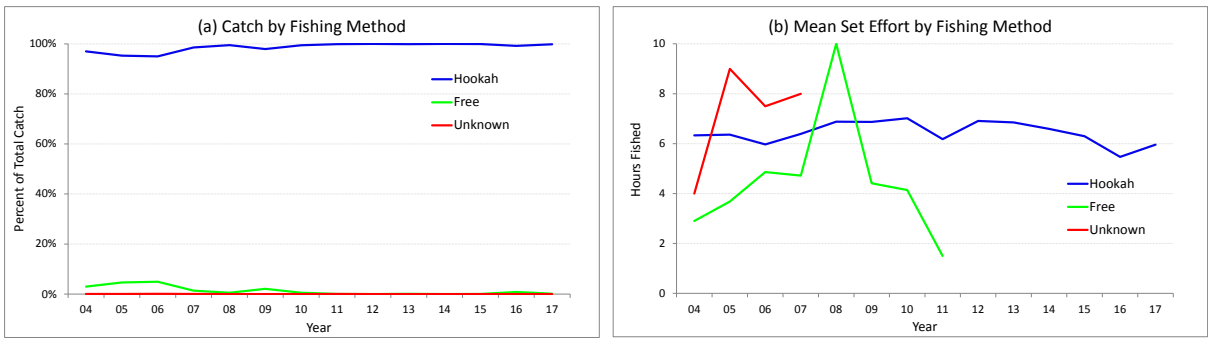


Figure 2-4. (a) The percent of total TVH catch each year caught by each fishing method, and (b) the mean number of hours fished per tender-set for each fishing method.

Finally, the percent of total TVH catch each year caught by each fishing method, and the mean number of hours fished per tender-set for each fishing method are shown in Figure 2-4.

Estimate of Annual Effort

Given the above data preparation and filtering the following process was adopted for estimating the total annual effort:

First, an annual listing of the number of TVH records against the number of hours fished was prepared (c.f. Table 2-2, Figure 2-5). Records listed against zero hours fished pertain to those where the effort was either not recorded or was outside the 0.5 to 12 hour band used. The total number of tender-sets for each year is also shown in this table.

For those records where the hours-fished was recorded the total number of hours fished for these tender-sets was totalled. This result is shown as the Total Hours in Table 2-2.

To account for those records where the hours-fished was not recorded, the total calculated in the previous section was adjusted as follows:

$$Total\ Hours\ (Adj) = Total\ Hours * \frac{\sum_{i=0}^{12} NumberRecords_i}{\sum_{i=1}^{12} NumberRecords_i}$$

This assumes that the distribution of hours -fished for those records where effort was not recorded is similar to the distribution of hours -fished for those records where effort was recorded. Again, for each year this result is shown as the Total Hours -Adj in Table 2-2.

Table 2-2. Annual listing of (a) the number of TVH records against the number of hours fished. – rounded to the nearest integer, and (b) unadjusted and adjusted total number of hours fished.

(a)

Hours-Fished	04	05	06	07	08	09	10	11	12	13	14	15	16	17	Total
0	320	631	99	138	52	68	435	205	180	88	129	68	33	294	2,740
1	61	48	37	14	15	10	10	21	5	15	21	23	32	26	338
2	188	135	102	76	24	22	36	88	40	54	75	94	183	184	1,301
3	396	286	198	100	34	66	34	58	44	87	64	73	117	70	1,627
4	607	598	354	424	129	92	215	610	263	341	201	245	525	251	4,855
5	399	231	255	282	86	120	94	145	73	170	124	457	97	53	2,586
6	727	482	445	587	128	180	389	464	326	420	970	549	1145	749	7,561
7	422	266	182	199	129	132	126	118	187	324	329	195	118	36	2,763
8	1622	1293	596	638	375	378	677	728	951	1080	744	747	390	598	10,817
9	337	251	37	267	143	127	91	70	207	318	129	186	17	32	2,212
10	69	81	123	144	94	113	261	156	30	111	95	44	5	50	1,376
11	7	0	0	0	2	0	0	1	4	0	24	1	1	0	40
12	45	0	0	0	0	0	0	6	1	0	5	1	0	0	58
Total Tender-Sets	5,200	4,302	2,428	2,869	1,211	1,308	2,368	2,670	2,311	3,008	2,910	2,683	2,663	2,343	38,274
0.5 to 12 hours	4,880	3,671	2,329	2,731	1,159	1,240	1,933	2,465	2,131	2,920	2,781	2,615	2,630	2,049	35,534

(b)

Total Hours	30,627	22,829	13,775	17,403	7,996	8,484	13,547	15,216	14,721	19,994	18,296	16,464	14,359	12,190	225,899
Total Hours - Adj	32,636	26,752	14,361	18,282	8,355	8,949	16,595	16,481	15,964	20,597	19,145	16,892	14,539	13,939	243,486

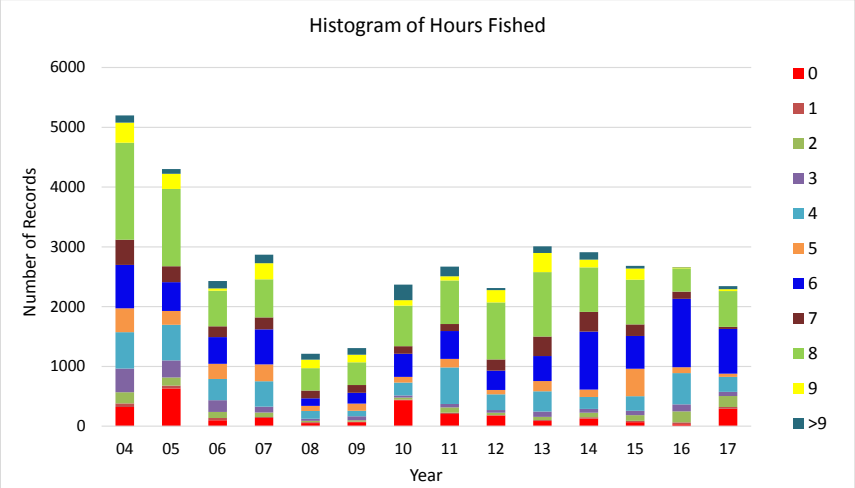


Figure 2-5. Estimates of unadjusted and adjusted total number of hours fished and number of tender-sets for the TVH sector each year.

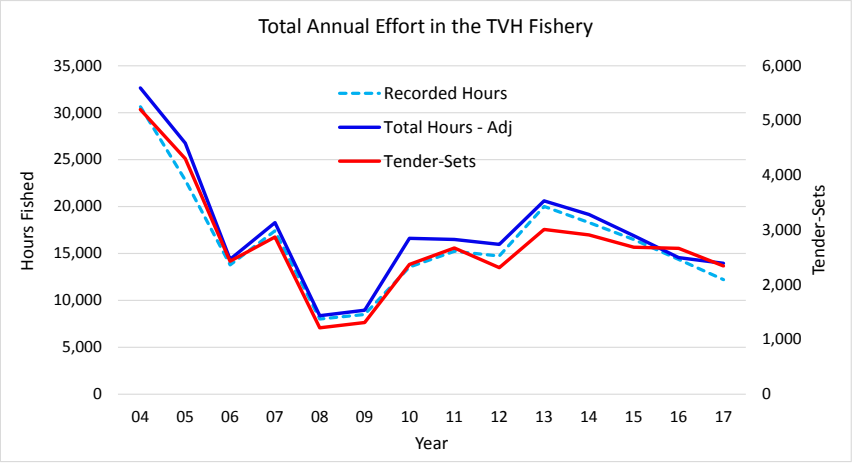


Figure 2-6. Estimates of TRL04 Logbook recorded and adjusted total number of hours fished and number of tender-sets for the TVH sector each year.

The results of the above process are shown in Figure 2-6. Note that the final adjusted effort shown for each year (Total Hours-Adj) is only an estimate as it is difficult to know how accurate the recording of this effort is in the logbook (which is understood to relate to the time away from the

primary vessel). Nevertheless, the trends in both the annual effort measured in hours fished or number of tender-sets are similar.

2.2 TIB Fishery

Docket-book Coverage

The Buyers and Processors Docket-Book (TDB01), used in the TIB sector of the Torres Strait rock lobster fishery, records the catch sold by fishers (known as sellers on the docket-book) at the end of a fishing trip. However, unlike the logbook for the TVH sector of fishery, which requires catch and effort data to be recorded for individual fishing operations related to each vessel tender, the docket-book requires only aggregate catch and effort data to be recorded at the end of each trip. In particular, the docket-book records the transaction date, the name of the seller together with details of the catch (in weight) and the price obtained. Additional information is also provided regarding the vessel, the number of crew, the number of days fished and the fishing methods used. This information therefore provides a measure of both the catch and effort for a given seller (or fisher) during a fishing trip.

However, there are a number of issues with the docket-book system which create problems with using this data for estimating the total catch and effort in the TIB fishery. These issues include:

i. The requirement that completion of the docket-book is only voluntary,
ii. The fact that catches recorded in the docket-book can also be reported elsewhere, including the TVH logbook,
iii. The fact that processors can also record catches in the docket-book, essentially creating duplicates.

Given the duplication of catch information from both the TVH sector and processors which occurs in the docket-book data, several filters are applied to this data to remove these duplicates. Further to these issues, during some years several TIB boats only recorded their catch in the TVH-related logbook (TRL04) and these catch records need to be transferred to the TIB database. Finally, between 2013 and 2016 two processors reported aggregate annual catch data as these catches were not being recorded in the TDB01 Docket-Book. Each processor reported the catch for tailed and whole lobsters separately, so that for each year two data records were added to the Docket-Book data for each processor to account for these additional catches.

TIB Summary

Considerable effort has gone into understanding the nature of both the TDB01 Docket-Book and TRL04 Logbook data so as to identify the catch records that should be assigned to the TIB fishery. A full description of the approach and data-rules used to identify and remove these duplicate records from the Docket-Book data is described in Campbell and Pease (2017). A total of 49,130 catch records have now been attributed to the TIB fishery covering the years 2004 to 2017. A few Docket-Book records (37) having a zero catch of lobsters are not included in this total as it is assumed that other species may have been targeted on these trips.

Table 2-3. Number of distinct TIB Record Nos by year and the related catch by data source. Note, PRC relates to the aggregate catch provided by several processors.

	Record	Catch by Data Source			Total Catch	
Year	Numbers	TDB01	TRL04	PRC	(kg)	Tonnes
2004	4,642	232,031	0	0	232,031	232
2005	6,664	358,474	0	0	358,474	358
2006	4,082	146,946	0	0	146,946	147
2007	5,939	260,122	0	0	260,122	260
2008	4,869	174,724	10,223	0	184,947	185
2009	3,635	135,898	7,964	0	143,862	144
2010	3,024	135,517	5,686	0	141,203	141
2011	2,954	200,144	1,025	0	201,168	201
2012	1,352	107,391	29,032	0	136,423	136
2013	940	57,157	33,562	55,411	146,130	146
2014	2,521	135,450	2,456	66,662	204,568	205
2015	2,470	118,066	1,333	76,904	196,303	196
2016	2,810	118,726	0	147,380	266,106	266
2017	3,228	106,356	0	0	106,356	106
Total	49,130	2,287,000	91,283	346,357	2,724,640	2,725

The number of catch records and the associated estimate of the total catch of rock lobsters in the TIB sector each year and by data source is shown in Table 2-3 and Figure 2-7. Between 2004 and 2007 all catch is sourced from the TDB01 Docket-Book, and the number of catch records each year varied between 4,082 and 6,664. After this time, and between 2008 and 2015, a portion of the total catch attributed to the TIB sector was recorded in the TRL04 Logbook, and while the total related catch was usually small (<10 tonnes) this catch represented over 20% of the total TIB catch in both 2012 and 2013. Finally, between 2013 and 2016 a significant portion of the total TIB catch (between 33% in 2014 and 55% in 2016) was attributed to the aggregate catch data provided by several processors (as this catch was not recorded in the Docket-Book). Whether or not other catches were also not been recorded in the Docket-Book during these or in other years remains unknown.

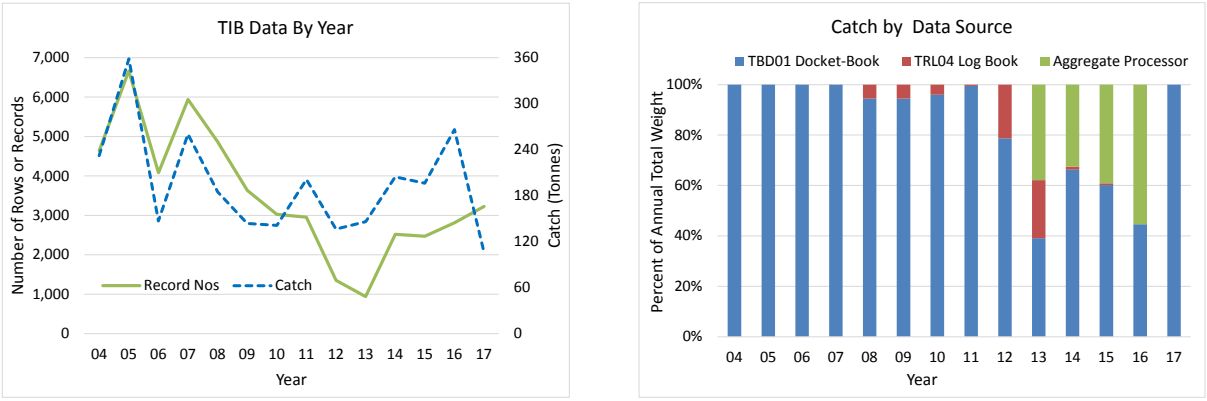


Figure 2-7. Number of TIB data rows, distinct TIB Record Numbers, and associated catch (in tonnes) per year.

Data Preparation

The catch and effort information recorded in the TDB01 Docket-Book is associated with a unique Record-No (i.e. the corresponding record number of the page in either the TDB01 Docket-Book or TRL04 Logbook on which the catch and effort data is recorded). While there are usually multiple catch records associated with a given Record-No (given that the catch is separately recorded by process form and perhaps grade), the structure of the docket-book would seem to indicate that

there should be a unique Record-No for each vessel, date and seller-name. However, investigation of the data indicates that there are often multiple Record-Nos associated for a given vessel, date and seller-name. The reason for these multiple records remains unknown, but is likely to be due to mis-recording of the date (and possibly other data fields). Whatever the reason, for the following analysis it was assumed that the multiple records for some vessel, date and seller-names is due to the mis-reporting of the date, and that each Record-No indeed pertains to a separate trip for each seller.

Unlike the TVH data where the measure of effort is hours-fished, the measure of effort recorded in the Docket-Book data is coarser, being days-fished. Furthermore, and as noted above, it has been assumed that each Record-No relates to the catch and effort of a single fisher (or seller) during a given trip, i.e. it is assumed that the measure of effort (days fished) associated with each Record-No also pertains to the actual effort expended by that seller in obtaining the recorded catch.

For the TIB attributed catch not-recorded in the Docket-Book there is no corresponding effort information in days fished. However, the TRL04 Logbook allows for fishing effort to be recorded as the number of hours fished. For the 713 records attributed to the TIB sector the hours fished varied between 1 and 11 with a mode at 6 hours (43% of records). If one considers these fishing efforts correspond to a single day's fishing then one could set the effort equal to one day for all these 713 records. However, a comparison of the annual CPUE (kg/day) between these logbook records with the CPUE for records in the Docket-Book (where days-fished is also 1) indicates that the former are, on average, three times higher. This indicates that the nature of the operations for these larger TIB vessels is substantially different from those of the typical TIB vessel. The example, more than one tender is often associated with each catch Record for the larger vessels recording their catch on the TRL04 Logbook. As such, for the following analysis the effort for these Records was assumed to remain unknown. Similarly, the number of days fished to attribute to the aggregate annual catch data provided by the processors also remains unknown.

Estimate of Annual Effort

As with the TVH data, in order to account for the under-reporting of effort relating to all trips in the TIB database, the following process was adopted for estimating the total annual effort:

1. First, an annual listing of the number of 48,441 TIB Records included in the TDB01 Docket-Book against the number of days fished was prepared (c.f. Table 2-4). Note: trips of duration greater than 2-3 days have been recorded and whether these are correct remains uncertain. The associated histogram of the number of days fished is shown in Figure 2-8.
2. For the 42,860 Records where the days-fished has been recorded the total number of days fished was calculated as follows:

$$Total\ Days = \sum_{i=1}^{16} Number\_Records_i * Days\_Fished_i$$

   For each year this result is shown as the Total Days in Table 2-4.

To account for the 5,581 Docket-Book Records where the days-fished had not been recorded, the total calculated in the previous section was adjusted as follows:

$$Total\ Days\ (Adj1) = Total\ Days * \frac{\sum_{i=0}^{16} Number\_Records_i}{\sum_{i=1}^{16} Number\_Records_i}$$

This assumes that the distribution of days-fished for those Records where effort was not recorded is similar to the distribution of days-fished for those Records where effort was recorded. Again, for each year this result is shown as the Total Days-Adj1 in Table 2-4.

Finally, to account to the effort associated with those catches which had not been recorded in the TDB01 Docket-Book (i.e. those catches recorded in the TRL04 Logbook or provided in aggregate form for some years by processors), a final estimate of the total number of days fished each year was calculated as follows:

$$Total\ Days\ (Adj2) = Total\ Days(Adj1) * \frac{Total\ TIB\ Catch}{Effort\ Associated\ Catch}$$

where *Effort Associated Catch* relates to the total catch pertaining to the 48,441 Docket-Book Records included in Step 1. Again, this assumes that for catches not recorded in the Docket-Book the relationship between catch and effort is similar to those catches recorded in the Docket-Book. The result is shown as the Total Days-Adj2 in Table 2-4.

Table 2-4. (a) Annual listing of the number of Docket-Book Records against the number of days fished. (b). Unadjusted and adjusted total number of days fished each year.

Days-Fished	04	05	06	07	08	09	10	11	12	13	14	15	16	17	Total
0	708	436	363	349	106	92	14	223	210	596	466	654	820	544	5,581
1	3227	5321	3156	4914	4107	2876	2663	2445	661	131	1503	1290	1612	2549	36,455
2	368	417	269	398	320	271	127	86	108	19	222	201	182	64	3,052
3	130	202	145	134	121	134	99	61	64	6	131	150	95	30	1,502
4	91	96	61	48	39	65	30	44	41	6	68	58	35	13	695
5	56	98	52	67	37	52	11	32	25	3	40	49	14	17	553
6	13	41	3	5	8	13	3	23	36	2	12	12	11	4	186
7	13	26	15	6	9	17	11	11	16	0	24	11	10	5	174
8	12	10	9	8	4	5	2	7	10	0	15	8	5	0	95
9	13	5	1	2	0	0	0	3	5	0	6	10	22	2	69
10	2	5	3	3	1	7	1	8	2	0	0	0	0	0	32
11	3	0	0	0	3	5	1	1	7	0	0	0	0	0	20
12	0	5	0	1	0	2	0	0	0	0	0	0	0	0	8
13	4	1	1	2	0	0	0	0	0	0	0	0	0	0	8
14	2	1	1	1	0	0	0	1	0	0	0	0	0	0	6
15	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
16	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
Total Records	4,642	6,664	4,082	5,939	4,755	3,540	2,962	2,945	1,185	763	2,487	2,443	2,806	3,228	48,441

(b)

Total Days	5,512	8,325	4,942	6,890	5,637	4,741	3,521	3,539	1,908	238	3,226	2,922	2,845	2,981	57,227
Total Days - Adj1	6,504	8,908	5,424	7,320	5,766	4,868	3,538	3,829	2,319	1,087	3,970	3,990	4,020	3,585	65,127
Associated Catch	232,031	358,474	146,946	260,122	174,724	135,898	135,517	200,144	107,391	57,157	135,450	118,066	118,726	106,356	2,287,002
Total Catch	232,031	358,474	146,946	260,122	184,947	143,862	141,203	201,168	136,423	146,130	204,568	196,303	266,106	106,356	2,724,639
Total Days -Adj2	6,504	8,908	5,424	7,320	6,103	5,153	3,686	3,849	2,946	2,780	5,996	6,634	9,009	3,585	77,897

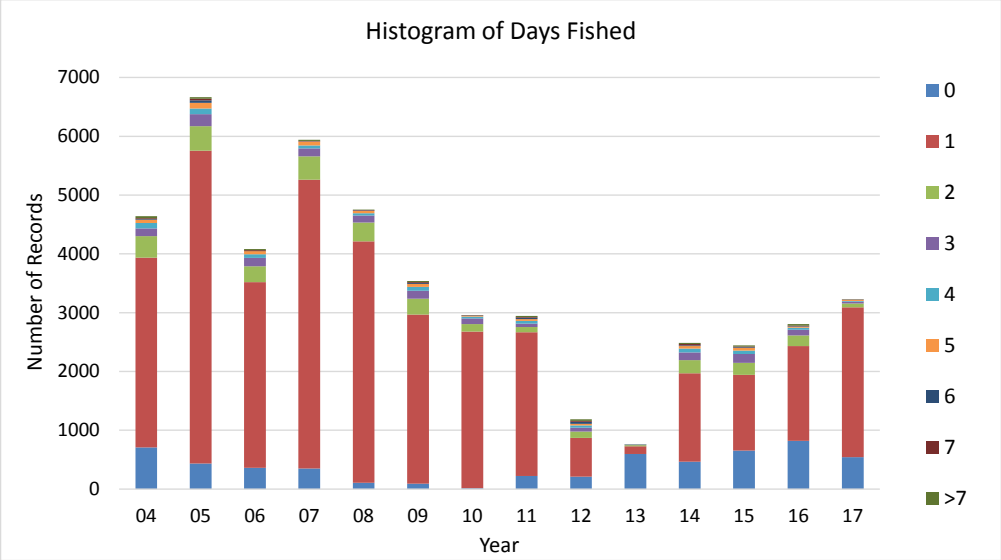


Figure 2-8. Histogram of the number of days fished for TIB related records.

The results of the above analyses are shown in Figure 2-8. Note that the final adjusted effort shown for each year (Total Days-Adj2) is only an estimate and it is difficult to know how accurate this estimate is for each year. For example, the relatively low effort estimate for 2013 is no doubt influenced by the small amount of data available for that year – only 167 Docket-Book records had effort recorded, while the high effort estimate for 2016 is influenced by the high proportion (55%) of the catch provided in aggregate form (again for which no effort information was available). Finally, the time-series of annual effort is premised on the total TIB catch data being adequately captured by various formats (TDB01 Docket-book, TRL04 Logbook, processors) and if this data is not complete given the caveats on the data mentioned previously then this this will impact on the annual estimate of total effort.

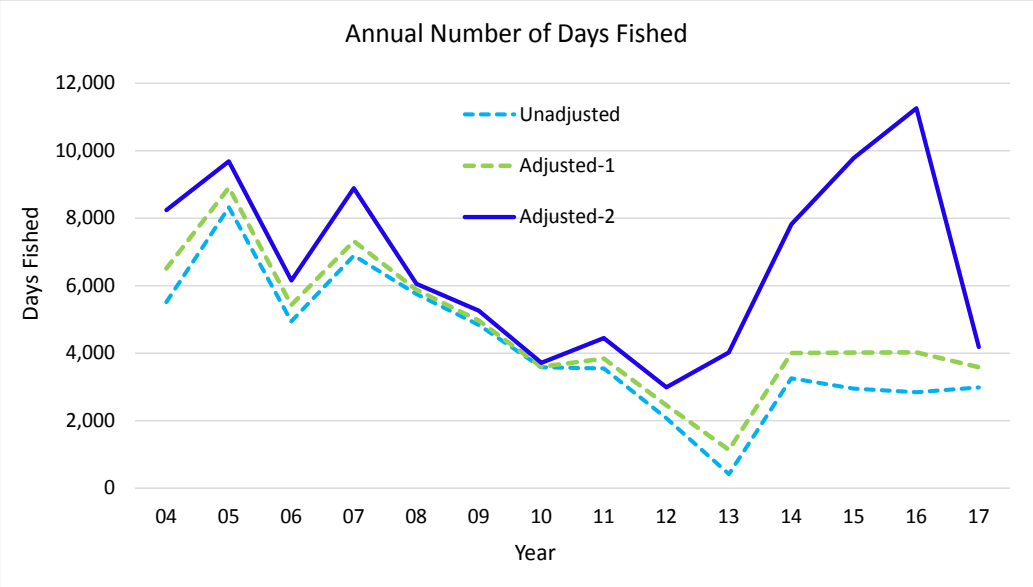


Figure 2-9. Estimates of unadjusted and adjusted total number of days fished each year in the TIB sector.

Chapter 3 Use of TVH Logbook Data to construct an Annual Abundance Index for Torres Strait Rock Lobster

3.1 TVH Data

The Torres Strait Tropical Rock Lobster Fishery Daily Fishing Log (TRL04) is used to record the catches taken in the TVH sector of the Torres Strait rock lobster fishery. Logbook data obtained from AFMA consists of 96,215 individual catch records for the TVH rock-lobster fishery for the 24 years from 1994 to 2017. The structure of the data is shown in Figure 3-1. For each vessel-day there can be multiple shots (up to 4) with each shot consisting of up to 8 tenders. Each tender has a catch recorded by diving method (hookah, free or unknown) and the catch is recorded by processed form (whole, tailed or unknown). The data was aggregated so that each record refers to the catch for a unique vessel-day, shot, tender and diving method. This gave 68,777 records.

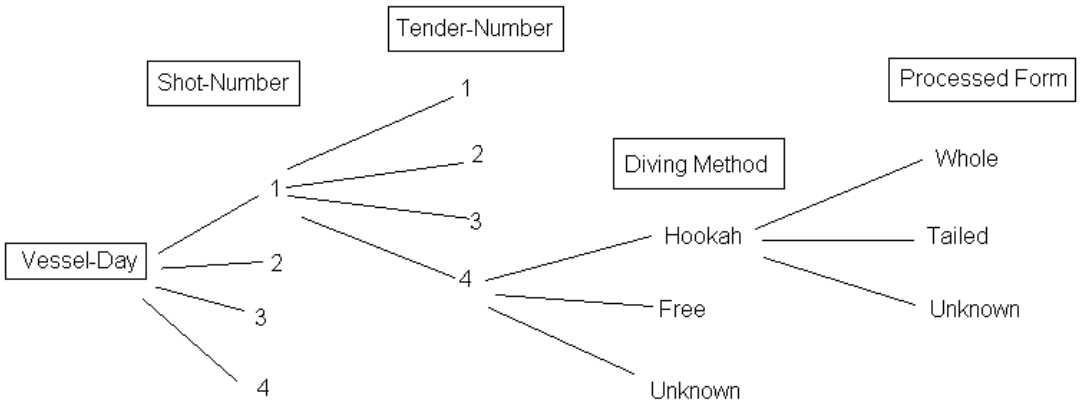


Figure 3-1. Structure of the TVH data.

The distribution of these 68,777 catch records by year and month, diving method, processed state of catch and MSE-area are given in Table 3-1 to Table 3-3. There has been little if any effort during October and November before 2006 and since 2006 there has been little effort in the months October-to-January. As such the analysis was limited to the 8 months between February and September. Similarly the analysis was also limited to those records with a known MSE-area (i.e. areas designated A0 and A99 were excluded) though areas 201 and 202 were combined (to provide a better data coverage, and designated as area 110) and area 401 (GBR) was also excluded.

In the past CPUE has been recorded as the catch-per-tender-set. However, as there can be multiple shots-per-day the duration of a tender-set can obviously vary and each tender-set cannot be assumed to be equivalent to a tender-day. The catch data also contains a field “Hours-Fished”

which records the duration of the fishing trip for each tender-set and this was deemed to be a better measure of tender effort than assuming

Table 3-1. Number of TVH catch records by year and month.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1994	84	105	236	448	347	364	227	310	270			54	2445
1995	23	116	123	147	185	220	121	239	238	3		220	1635
1996	366	237	447	247	378	264	356	517	411			324	3547
1997	383	232	307	239	598	333	438	538	327	18		598	4011
1998	445	739	551	484	486	587	553	603	493		9	231	5181
1999	117	98	262	242	208	214	161	132	146			235	1815
2000	196	240	349	215	328	370	342	232	99		66	274	2711
2001	375	97	223	65	259	270	206	174	119	9	1	87	1885
2002	26	285	365	295	401	400	360	492	398			89	3111
2003	100	461	488	393	490	518	527	596	413			176	4162
2004	24	607	712	571	662	761	729	633	395			106	5200
2005	13	662	615	543	519	538	552	533	323			4	4302
2006		409	436	361	286	206	349	289	92				2428
2007		288	427	446	542	489	402	184	91				2869
2008		133	222	113	161	96	159	175	152				1211
2009		148	227	174	201	200	125	163	70				1308
2010		255	333	302	324	292	309	294	253		6		2368
2011		286	384	371	322	380	356	310	261				2670
2012		166	344	371	311	336	318	264	201				2311
2013		461	383	414	424	324	374	385	243				3008
2014		357	404	297	433	408	445	274	291		1		2910
2015		419	408	441	355	313	253	357	137				2683
2016	12	500	444	315	379	349	323	191	141			9	2663
2017	7	397	254	322	383	310	292	277	101				2343
Total	2,171	7,698	8,944	7,816	8,982	8,542	8,277	8,162	5,665	30	83	2,407	68,777

Table 3-2. Annual number of TVH catch records by diving method and TVH catch by processed state.

Diving Method			Total	Catch by Processed State (kg)			Total		
Hookah	Free	Unknown	Records	Tails	Whole	Unknown	Catch	%Tails	%Whole
1,505	136	804	2,445	123,006	0	0	123,006	100.0%	0.0%
947	59	629	1,635	100,407	635	0	101,042	99.4%	0.6%
1,609	87	1,851	3,547	219,045	7,810	0	226,855	96.6%	3.4%
1,890	112	2,009	4,011	273,151	1,880	8	275,040	99.3%	0.7%
2,681	169	2,331	5,181	310,635	18,922	0	329,556	94.3%	5.7%
1,412	38	365	1,815	88,416	6,681	0	95,097	93.0%	7.0%
2,330	114	267	2,711	118,824	10,038	0	128,862	92.2%	7.8%
812	26	1,047	1,885	66,347	2,729	0	69,076	96.0%	4.0%
1,721	10	1,380	3,111	108,216	39,471	0	147,687	73.3%	26.7%
3,958	104	100	4,162	255,447	105,964	0	361,411	70.7%	29.3%
5,045	154	1	5,200	317,467	163,651	0	481,118	66.0%	34.0%
4,101	199	2	4,302	484,497	60,480	0	544,977	88.9%	11.1%
2,307	119	2	2,428	108,909	26,539	0	135,448	80.4%	19.6%
2,829	39	1	2,869	207,463	61,133	0	268,596	77.2%	22.8%
1,205	6	0	1,211	63,378	37,060	0	100,438	63.1%	36.9%
1,281	27	0	1,308	51,322	39,729	10	91,061	56.4%	43.6%
2,356	12	0	2,368	67,817	214,797	0	282,614	24.0%	76.0%
2,668	1	1	2,670	171,469	332,064	0	503,533	34.1%	65.9%
2,311	0	0	2,311	65,282	305,198	2	370,482	17.6%	82.4%
3,006	2	0	3,008	61,631	300,030	0	361,661	17.0%	83.0%
2,910	0	0	2,910	42,105	230,961	120	273,186	15.4%	84.5%
2,682	1	0	2,683	22,479	130,231	0	152,709	14.7%	85.3%
2,642	21	0	2,663	42,714	200,986	0	243,700	14.7%	85.3%
2,340	3	0	2,343	23,885	125,163	0	149,048	16.0%	84.0%
56,548	1,439	10,790	68,777	3,393,912	2,422,152	140	5,816,203	58.4%	41.6%

Table 3-3. Number of TVH catch records by MSE-area.

	Northern	Mabuiag	Badu	Thurs Is.	Central	Warrior	Warraber	Kirkaldie	Adolphus	East TS	East TS	GBR	East Coast		
YEAR	A101	A102	A103	A104	A105	A106	A107	A108	A109	A201	A202	A401	A0	A-99	TOTAL
1994	51	257		11	119	252	926	64	89	106	177	1		392	2445
1995	106	289	2	41	83	187	487	111	26	36	32	4	8	223	1635
1996	620	1152	2	11	51	269	719	41	37	1	32		4	608	3547
1997	425	1324	21	21	73	524	881	4	21	52	33	2		630	4011
1998	463	1681	51	130	107	661	1042	160	16	31	45			794	5181
1999	158	457	34	33	66	254	348	177	17	14	30	15		212	1815
2000	137	252	66	48	51	825	605	229	59	7	22	35	5	370	2711
2001	42	70	5	44	26	712	366	83	40	3	41	44	4	405	1885
2002	107	278	18	176	44	692	592	718	48		17	16	4	401	3111
2003	808	719	115	317	344	404	432	832	96	7	49	3	3	33	4162
2004	921	766	209	163	551	344	980	970	205	11	58	4	9	9	5200
2005	682	588	164	196	164	203	511	1680	90	3	18	1	2		4302
2006	301	332	21	130	187	300	440	355	276	34	48	4			2428
2007	362	417	42	146	134	323	367	980	62	10	24	2			2869
2008	227	63	6	91	53	238	240	206	48	2	31	3	1	2	1211
2009	272	42	5	80	145	371	231	47	26	23	59	7			1308
2010	493	138	101	102	31	197	206	997	43	12	32	14	2		2368
2011	389	111	34	83	17	159	430	1406	25		14		2		2670
2012	417	217		14	46	155	1166	267	18	5	5	1			2311
2013	719	239	34	16	63	168	469	1267	6	6	21				3008
2014	777	263	15	27	165	268	786	445	47	14	93		10		2910
2015	176	173	45	5	116	876	660	486	25		121				2683
2016	72	12	62	7	202	681	454	950	18	131	60		14		2663
2017	727	108	9	43	67	401	461	422	15		74		11		2343
Total	9,452	9,948	1,061	1,935	2,905	9,464	13,799	12,897	1,353	508	1,136	156	79	4,079	68,777

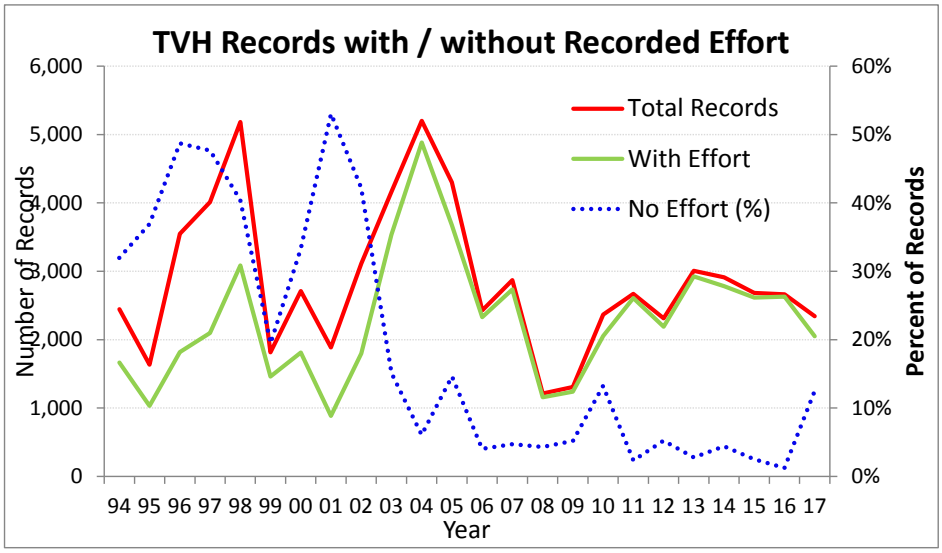


Figure 3-2. The total number of TVH catch records each year and the number of records for which the corresponding effort data is available. The percentage of records for which no effort is recorded is also shown (right hand axis).

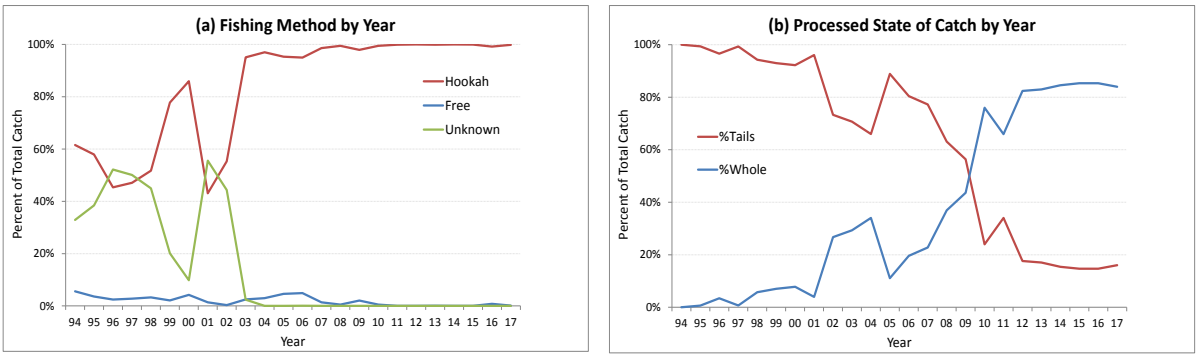
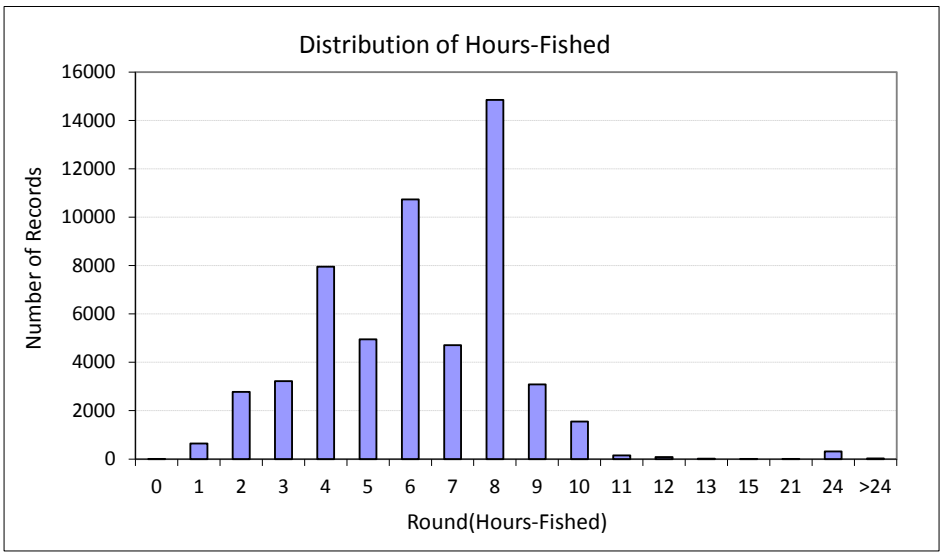
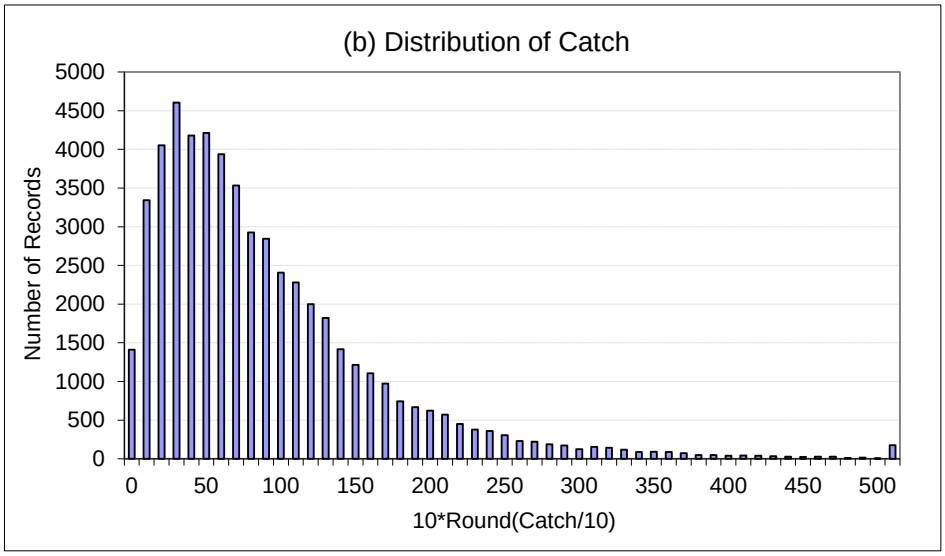


Figure 3-3. The percent of total TVH catch each year (a) caught by each fishing method, and (b) landed as Tails or Whole weight.





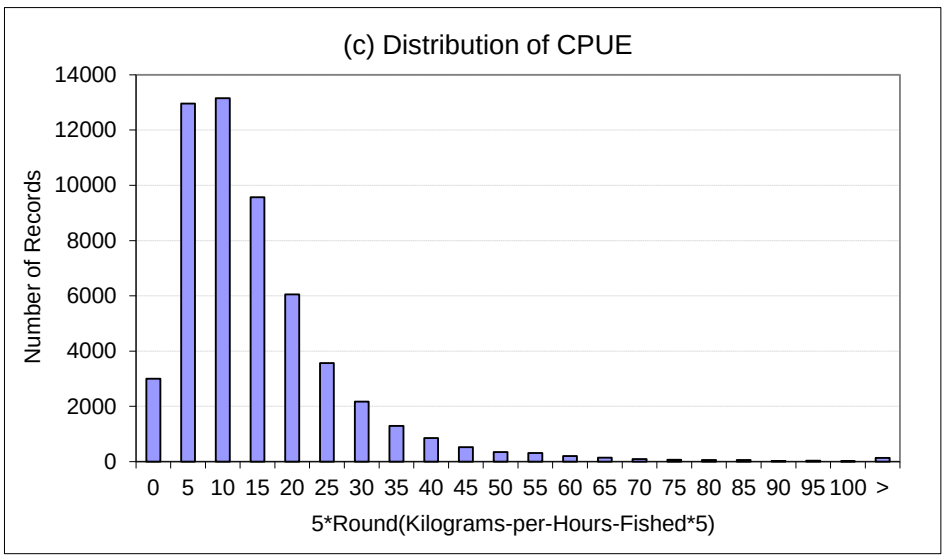


Figure 3-4. Distribution of (a) effort, (b) catch and (c) CPUE for the 55,061 records for which effort was recorded on TVH logbooks.

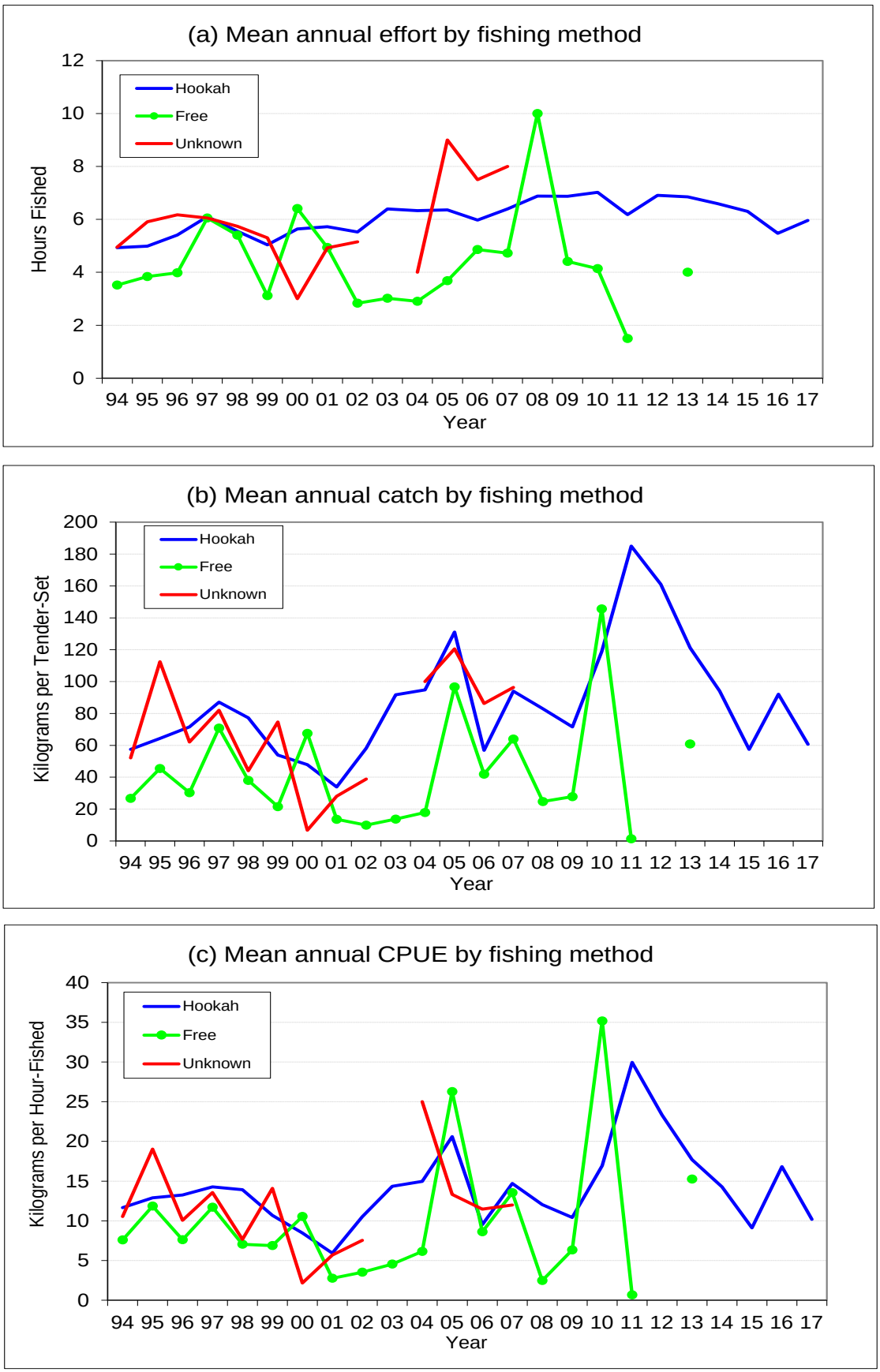


Figure 3-5. Mean (a) effort, (b) catch and (c) CPUE by fishing method and year for the 50, 126 unique vessel-day, shot, tender and diving method records for which this effort was between 0 and 12 hours and areas and months restricted as described in the text.

each tender-set is equivalent to a day's effort. However, unfortunately this field has not been completed for all tender-sets, with the number of hours fished recorded for only 55,061 (80.1%) of the 68,777 records. (Note, the proportion of records where the effort was not recorded was less than 5% for most years since 2006, but was 13% in 2010 and again increased to 12.5% in 2017, c.f. Figure 3-2). The distribution of hours fished for these records is shown in Figure 3-4. The number of recorded hours fished was between 0.15 hours and 96 hours, though was 12 hours or less for 99.4% of all records. All records where the recorded hours-fished was greater than 12 hours were considered suspect due to possible recording errors and as such only those records where the hours-fished was 12 hours or less were included in the analysis. The five records where effort was less than 0.5 hours were also excluded. Note, the number of hours fished was recorded as 24 hours for 315 records and was assumed to represent a "day's" fishing.

After applying each of the following filters to the data:

- Exclude MSE-areas 0, 401 and -99
- Exclude Month<2 and Month>9
- Exclude Hours-Fished less than 0.5 hour and greater than 12 hours

the number records included in the data for further analysis was reduced to 50,126. The mean (a) effort, (b) catch and (c) CPUE by fishing method and year for these records are shown in Figure 3-5.

3.2 GLM Analysis

Fitted Data

Of the 50,126 records selected above for analysis it was noted that there were a small percentage of records (638 or 1.27%) where the catch was zero. The inclusion of such records in the GLM analyses can cause problems. The percentage of such records each year is shown in Figure 3-5a and varies from a high of 4.48% in 1998 to a low of 0.39% in 1999. Nevertheless, apart from the four years when this percent was greater than 2% there does not appear to be a trend in the percentage of zero catches in the data over time. As such, and as recommended for the analyses undertaken previously, these zero catch records were excluded from the analyses. Note, to retain the zero-catch records in the analysis a two-stage analysis of the data can be undertaken where one first models the probability of obtaining a positive catch following by a separate analysis where one models the size of the positive catch. The results of each analysis can then be combined to obtain the required standardised CPUE index. Such an approach was not considered appropriate for this data due to the small percentage of zero-catch records in the data.

Further inspection of the data also indicated a number of records having a very high CPUE (kilograms of catch per hour fished) value and which could be considered outliers in the data, possibly due to errors in either the recording of the catch or effort. To exclude these possibilities the 27 records having a CPUE>150 kgs/hour were deleted from the data (cf. Figure 3-6a). Finally, due to the observation that Vessel-Names and Vessel-Symbols are not always matched (likely due to the switching of licences between vessels) a combination of Vessel-Name and Vessel-Symbol was adopted to identify vessels in the data. Of the 97 vessels identified in this manner in the selected data, only the data pertaining to the 47 vessels which had fished for 3 or more years and

for which there were more than 50 data records were included in the analysed data (c.f. Figure 3-6b). Combined with the other two filters the total number of records remaining in the data for analysis was 44,658.

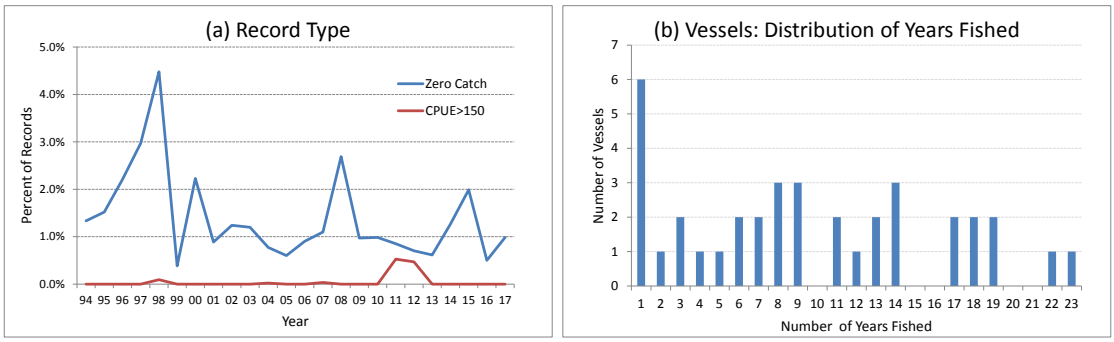
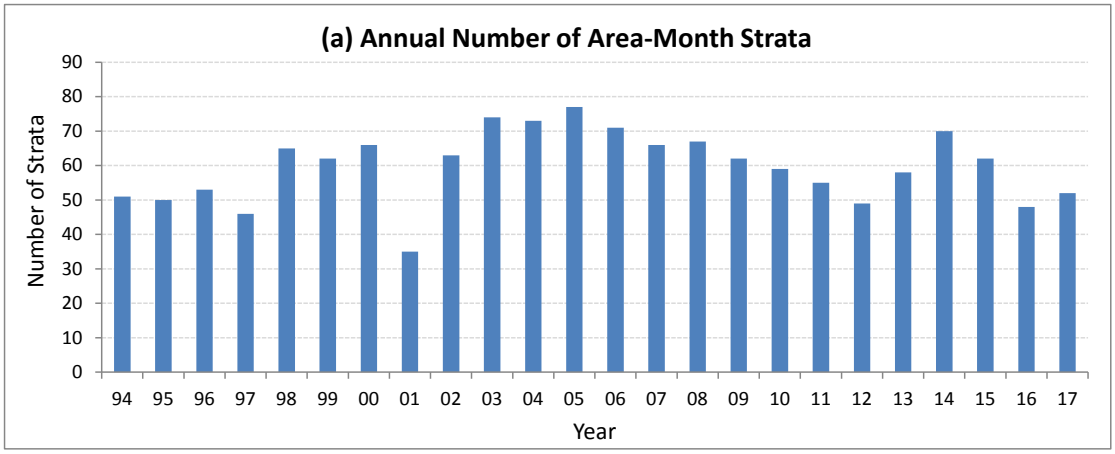


Figure 3-6. (a) Percentage of records in the data, by year, where either the catch is zero, or the CPUE>150 kg/hour, and (b) histogram of the number of vessels (distinguished by vessel symbol) by the number of years they have fished in the fishery.

The number of *Area-Month* strata fished each year and the number of vessels fishing each year in the data selected for inclusion in the GLM analyses is shown in Figure 3-7 while a bubble plot displaying the number of observations for each vessel each year in this data is shown in Figure 3-8. A summary of the number of observations and nominal CPUE (kilograms per hour) within each *Year*Area*, *Year*Month* and *Area*Month* strata is provided in Appendix C.



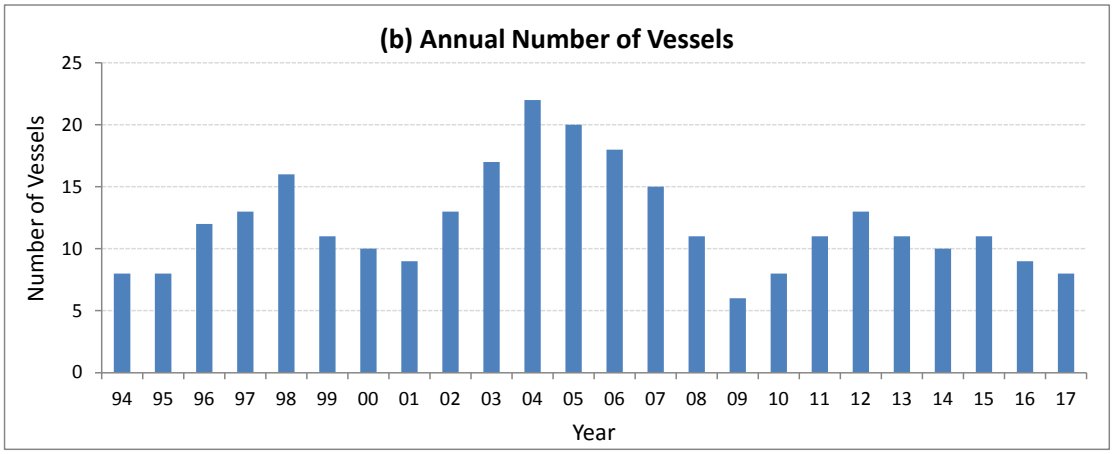


Figure 3-7(a) Number of *Area-Month* strata fished each year and (b) the number of vessels fishing each year in the data selected for inclusion in the GLM analyses.

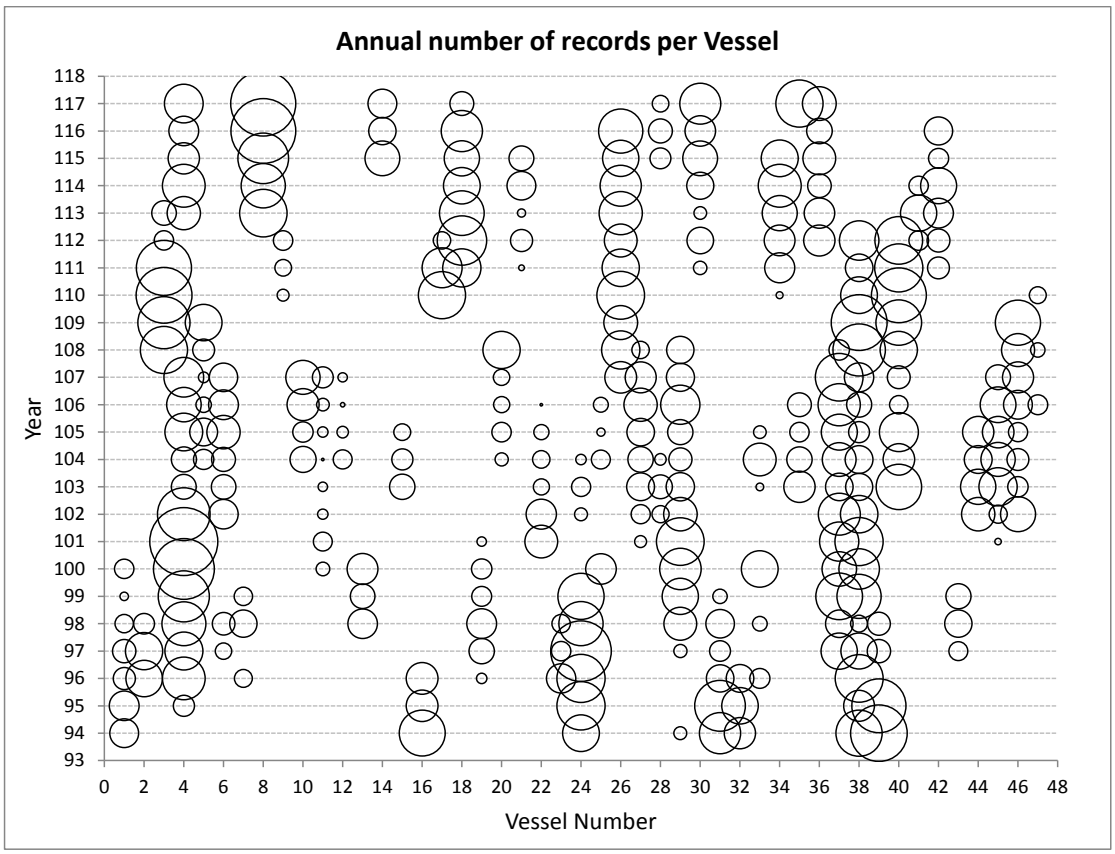


Figure 3-8. Bubble plot displaying the number of observations for each vessel each year in the data selected for inclusion in the GLM analyses.

GLM Models

Several different General Linear Models (GLMs) were adopted for analysing the data in order to obtain a standardised index of stock abundance in each year.

Main Effects Model

In order to explore the impact of each fitted effect, the first set of analyses were based on the following model where no interactions between main effects were included:

CPUE = Intercept + Year + Month +Area + Vessel +Fishing-Method
+ Proportion of Catch Landed as Tails + Southern Oscillation Index
/ distribution = gamma, link = log

= *I + Y + M + A + V + F + P + SOI* / dist= gamma, link=log

The SAS GENMOD procedure was used to fit the model. All effects *Year, Month, Area*, *Vessel* and *Method* (Hookah, Free and Unknown) were fitted as class variables except for the SOI index which

was fitted as a continuous variable. The *Proportion-Tails* was also fitted as a class variable with each record classified as one of the following five levels: (<20%, 20% to <40%, 40% to <60%, 60% to <80%, >=80%). A log-gamma distribution was assumed for the distribution of CPUE values. The annual index and abundance was determined using the method described in the section below.

For each of the main effects, a measure of the impact of each level on the modelled CPUE was obtained by taking the exponent of the estimated parameter for each level. The impact of each level was then compared to the impact of a reference level. For each main effect these reference levels were:

Month	September
Area	Eastern Torres Strait
Method	Hookah diving
Vessel	Vessel with the largest number of records
Proportion-tails	>80%

Finally, the annual influence of each of the main effects on the resulting index of abundance was calculated using the method described in Bentley et al (2012).

As shown in Campbell (2004) a bias in the annual abundance index can result when there is an unequal number of observations within each spatial-temporal strata used for calculating the abundance index. In order to overcome this problem a weighting of the observations needs to be incorporated when fitting the data to the GLM. Each observation was therefore weighted such that the sum of the weights for all observations in each of the *Year-Month-Area* strata was the same for all strata. Furthermore, in order to account for the weighting given each observation in determination of the annual influence of each main effect the sum of the weights for all observation within a given level was used instead of just the number of observations.

Interactions Models

The second set of analyses was undertaken in order to explore whether the inclusion of 2-way interactions between the main spatial-temporal effects improved the model fit to the data. Specifically, the following five models were examined:

Int-1:

*CPUE = Intercept + Year +Month + Month*Area*

+ Vessel +Fishing-Method + Proportion-Tails + SOI

/ distribution = gamma, link = log

Int-2A:

*CPUE = Intercept + Year*Month + Month*Area*

+ Vessel +Fishing-Method + Proportion-Tails + SOI

/ distribution = gamma, link = log

Int-2B:

*CPUE = Intercept + Year*Area + Month*Area*

+ Vessel +Fishing-Method + Proportion-Tails + SOI

/ distribution = gamma, link = log

Int-2C:

*CPUE = Intercept + Year*Month +Year*Area*

+ Vessel +Fishing-Method + Proportion-Tails + SOI

/ distribution = gamma, link = log

Int-3:

*CPUE = Intercept + Year*Month +Year*Area + Month*Area*

+ Vessel +Fishing-Method + Proportion-Tails + SOI

/ distribution = gamma, link = log

where * indicates an interaction between the related effects. The inclusion in these 2-way interactions allows for the relative distribution of the resource between the different areas and months to be different between years.

Derivation of Annual Index

Using the results from each GLM an annual abundance index was constructed based on the standardised CPUE.

For the model which included the three 2-way interactions the standardised CPUE within each Year-Month-Area strata was calculated as follows:

$$stdCPUE(year = y, month = m, area = a) = \exp(I + Y.M_{ym} + Y.A_{ya} + M.A_{ma} + F_h + V_{ref} + P_{ref})$$

where $Y.M_{ym}$, $Y.A_{ya}$, $M.A_{ma}$, F_h, V_{ref} and P_{ref} are the parameters estimates relating to each of the terms included in the model. Note, due to the over-parameterization inherent in the GLM both F_h=0, V_{ref} =0 and P_{ref}=0 as these respectfully to relate the last levels in each of the *Fishing-Method*, *Vessel* and *Proportion-Tails* factors included in the model. In total there are 1840 (=23 years x 8 months x 10 areas) *Year-Month-Area* strata. As the standardised-CPUE is taken as an index of the density of fish within each strata, an index of the abundance of lobsters across the fishery in each year and month is given by:

$$Index(year = y, month = m) = \frac{1}{\sum_{a=1}^{NA} Area_a} \sum_{a=1}^{NA} Area_a . stdCPUE(y, m, a)$$

where $Area_a$ is the spatial size of each of the *NA Area* effects included in the GLM. Finally, an index of abundance for each year can be obtained by taking the average of the *NM* monthly indices in each year.

$$Index(year = y) = \frac{1}{NM} \sum_{m=1}^{NM} \left[\frac{1}{\sum_{a=1}^{NA} Area_a} \sum_{a=1}^{NA} Area_a . stdCPUE(y, m, a) \right]$$

Finally, a relative annual abundance index, B_y, was calculated such that the mean index over all years equals 1, i.e.:

$$B_y = \frac{Index(year = y)}{\frac{1}{NY}\sum_{i=1}^{NY} Index(year = i)}$$

Two different sets of spatial sizes, $Area_a$, were used in calculating the above abundance index. These were:

1. The total spatial size of the each MSE area shown in Figure 3-9.
2. The spatial extent of each MSE area which had been fished between 1994 and 2013. This was based on the number of 0.1x0.1-degree squares in which a fishing operation had been reported in each area during this period. For those squares which included more than one MSE area, the square was apportioned between the different areas based in the total number of records in each area.

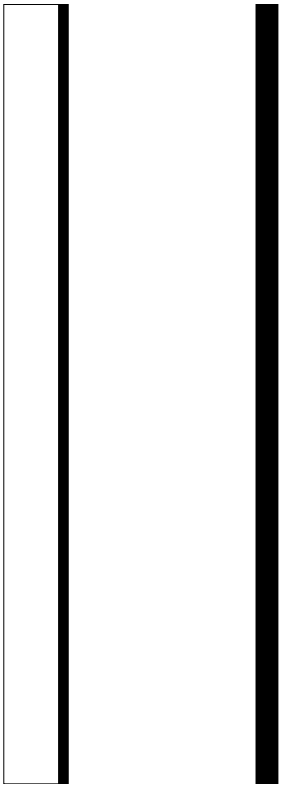


Figure 3-9. Map of the MSE regions used as the area effects in the GLM.

In order to ascertain the spatial size of each MSE area used in the GLM-analysis, the number of 0.1x0.1-degree squares fished (based on the location of the mother ship recorded in the TVH logbook) within each region was determined for each year (c.f. Table 3-4). Across the entire Torres-Strait region the number of squares fished each year has varied between 31 (in 1995) and 101 (in 2004). Across all years, the maximum and mean number of squares fished within each area was determined together with the number of unique squares fished and the spatial size of each area in 10,000 hectares. Each size metric for each area was then expressed as a percentage of the combined total across all areas. These calculations are shown in Table 3-4 and displayed in Figure 3-10. For each area the relative sizes based on the maximum and mean number of squares fished are similar and for the GLM analysis the size of each area was taken to be the mean of these two metrics (see GLM area in Table 3-4).

The derivation of the abundance index based on the GLMs which included less than three 2-way interaction terms is similar to that shown above. However, it can be noted that for those models which do not included an interaction with the Year effect (i.e. the main effects and Int-1 models), the relative abundance index, B_y, reduces to the simpler form:

$$B_y = \frac{\exp(Y_Y)}{\frac{1}{NY}\sum_{i=1}^{NY}\exp(Y_i)}$$

where Y_i , *i=1, NY* are the parameters estimates relating to *NY Year* effects included in the model. In these situations the abundance is independent of the relative size of each *Area* effect included in the GLM.

Table 3-4. Number of 0.1x0.1-degree squares fished (based on location of mother ship) within each MSE areas used in the GLMs fitted to the TVH data.

	N_01	N_02	N_03	N_04	N_05	N_06	N_07	N_08	N_09	N_10	
Year	Northern	Mabuiag	Badu	Thurs Is.	Central	Warrior	Warraber	Kirkaldie	Adolphus	East TS	Total
1994	2	6	0	1	5	1	3	1	1	14	34
1995	4	5	1	2	3	1	4	1	1	9	31
1996	5	6	1	3	3	2	3	1	1	7	32
1997	4	6	5	8	2	2	4	1	1	17	50
1998	5	6	5	6	5	2	4	1	3	13	50
1999	4	6	5	4	3	2	4	1	2	14	45
2000	6	6	4	9	3	2	4	1	2	6	43
2001	4	4	2	5	3	2	5	1	3	4	33
2002	4	5	4	8	3	2	4	3	2	3	38
2003	12	8	7	17	14	7	8	7	6	4	90
2004	14	11	9	12	15	7	10	4	6	13	101
2005	13	10	7	14	13	5	10	6	5	6	89
2006	15	10	5	10	14	5	6	4	5	15	89
2007	13	10	4	9	12	5	5	4	4	8	74
2008	12	6	3	5	9	4	7	2	4	9	61
2009	15	4	2	6	8	6	6	3	4	10	64
2010	11	4	5	9	6	2	4	5	6	6	58
2011	8	3	3	4	2	2	6	3	3	4	38
2012	13	6	0	5	6	2	10	1	4	3	50
2013	9	7	1	1	7	2	6	2	1	4	40
2014	12	4	1	4	9	1	7	3	5	7	53
2015	6	3	3	3	11	6	5	4	4	7	52
2016	5	3	2	2	8	4	7	4	4	5	44
2017	8	4	1	1	7	4	5	4	3	6	43
Total	204	143	80	148	171	78	137	67	80	194	1302
mean	8.50	5.96	3.33	6.17	7.13	3.25	5.71	2.79	3.33	8.08	54.25
max	15	11	9	17	15	7	10	7	6	17	114
unique	28	13	14	27	35	11	12	12	8	60	220
mean	15.7%	11.0%	6.1%	11.4%	13.1%	6.0%	10.5%	5.1%	6.1%	14.9%	100.0%
max	13.2%	9.6%	7.9%	14.9%	13.2%	6.1%	8.8%	6.1%	5.3%	14.9%	100.0%
unique	12.7%	5.9%	6.4%	12.3%	15.9%	5.0%	5.5%	5.5%	3.6%	27.3%	100.0%
GLM area	14.4%	10.3%	7.0%	13.1%	13.1%	6.1%	9.6%	5.6%	5.7%	14.9%	100.0%

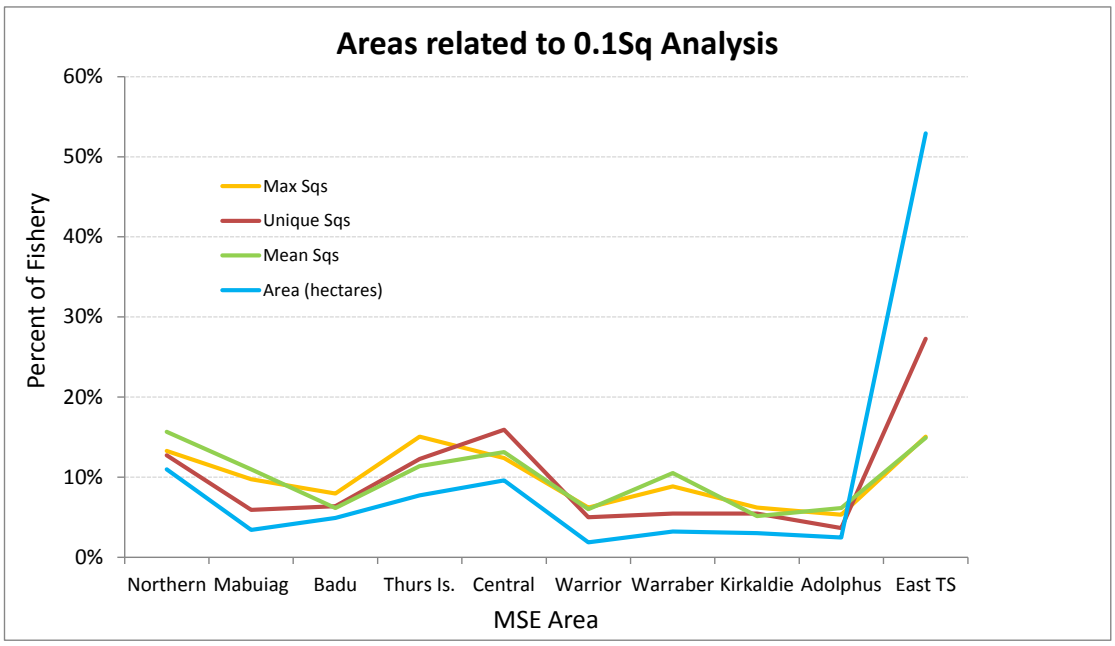


Figure 3-10. Relative size of each MSE Area (expressed as a percent of the combined areas) based on the size of each Area as specified in Table 4.

3.3 Results

Standardising Effects

Statistics for the Type 3 contrasts computed for each fitted effect indicated that each effect was highly significant. The relative impact of each level for all effects fitted to each GLM model is shown in Figure 3-11. For each effect the values have been scaled so that the influence of each level is relative to that of the last level (i.e., Month=Sep, Area=Eastern TS, Method= Hookah and Proportion-Tails >80%). For those models which included interactions the Quarter and Area effects were determined by calculating the mean effect across all Year, Month and Area strata respectively.

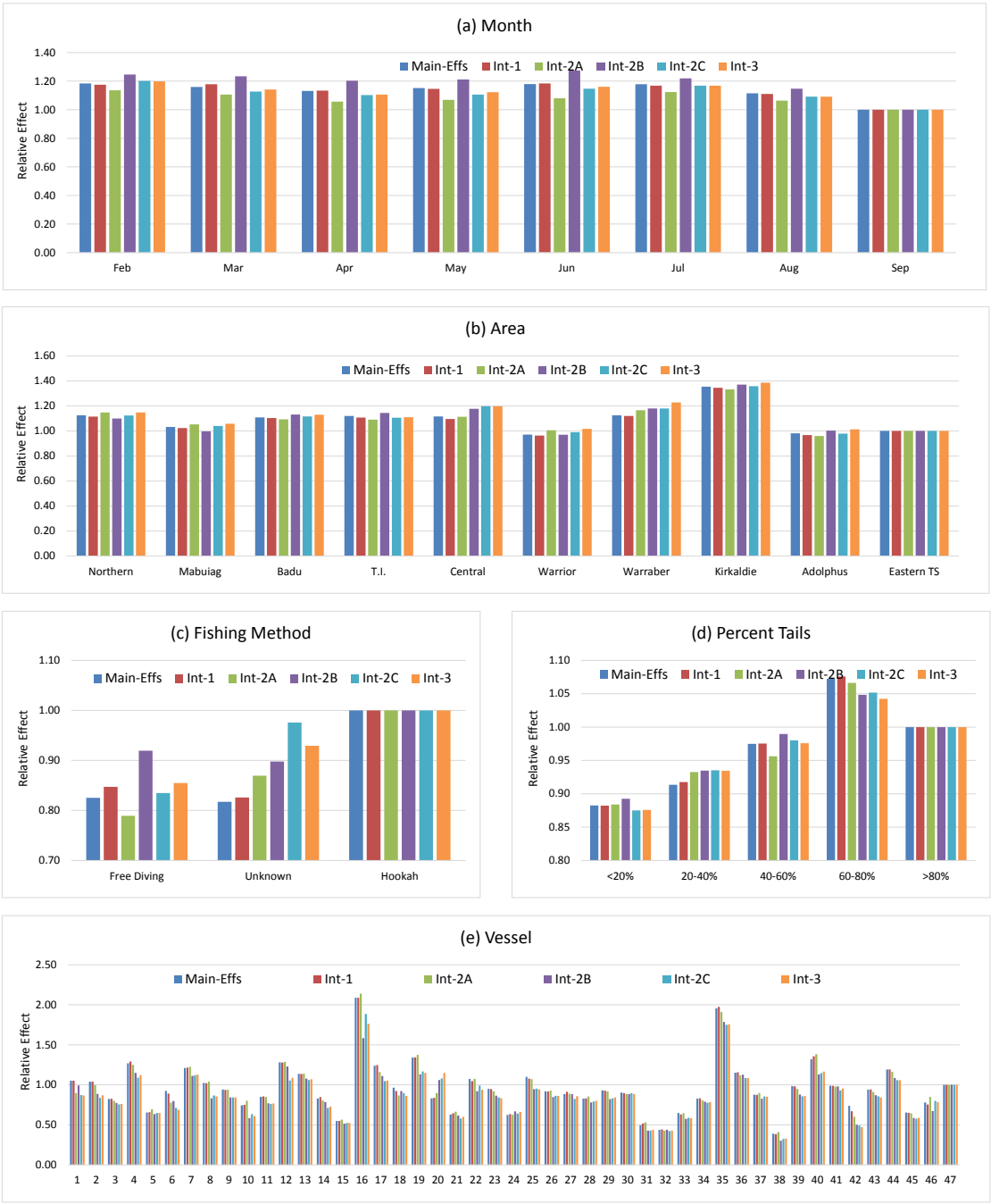


Figure 3-11. The relative impact of each level for each main effect fitted to the each GLM model.

Relative CPUE is relatively constant across the eight months of the year and displays only small variation across the six GLM models, though the CPUE in September is the lowest across all models (c.f. Figure 3-11a). Taking the average of the relative effect across the results for the six models for each month indicates that the CPUE during February to August is between 11-17% higher than the CPUE in September. The greatest variation (as measured by the standard deviation, σ) between models in the relative CPUE across all months is between the results for the 2Ints-A (σ=0.04) and 2Ints-B models (σ =0.09). For all other models σ=0.06.

The relative CPUE across the various areas included in the GLM also displays little variation across the six GLM models, though there is some degree of variation across the ten areas (c.f. Figure 3-11b). Taking the mean of the relative effect across the results for the six models for each area

indicates that the relative CPUE is, on average, lowest in Mt Adolphus (98%), Warrior (99%) and Eastern TS (100%) and highest in Kirkaldie (136%), Warraber (117%) and Central (115%).

Unlike the previous results, the relative CPUE across the three fishing methods displays some variation across the six GLM models (c.f. Figure 3-11c). For example, the relative effect of the free-diving method relative to hookah diving varies between 79% and 92% while that for the unknown method varies between 82% and 98%. Across all models, the CPUE for hookah fishing is found to be around 15% higher than for free diving and 11% higher than for unknown method. This latter result is to be expected if this fishing method is a combination of the two other fishing methods

The relative CPUE across all models is similar for each category of the proportion of the catch which is tails with the relative CPUE generally increasing as the *Proportion-Tails* increases in the catch (c.f. Figure 3-11d). However, the highest CPUE is found for those catches which include 60-80% tails. Across all models, the relative CPUE within each *Proportion-Tails* category is 88%, 93%, 98%, 106% and 100% respectively. Finally, there is substantial variation in the relative CPUE across the 47 vessels included in the GLM models, though the relative effect of each vessel is less sensitive to the GLM model used (c.f. Figure 3-11e). Across all models, the relative fishing power across the fleet varies more than four-fold from 36% to 192% of the standard vessel and the distribution of these effects is shown in Figure 3-12.

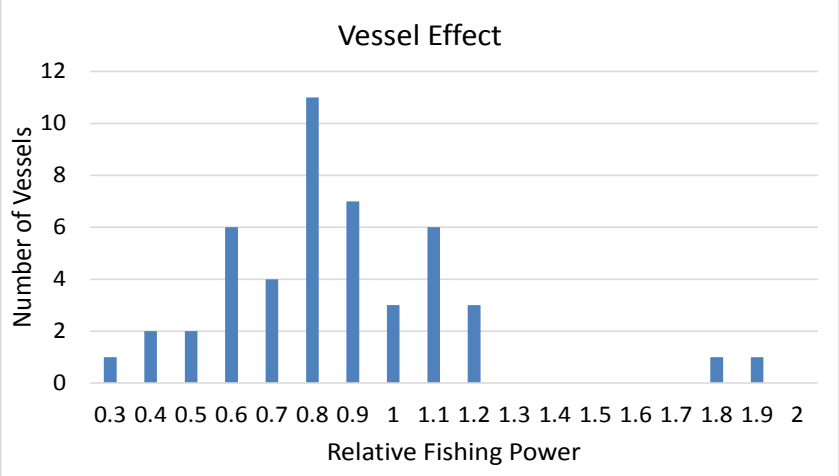


Figure 3-12. Histogram of the distribution of the relative fishing power of the 47 vessels included in the GLM models.

The monthly value of the SOI was fitted as a simple continuous linear term and the estimated influence of this effect on CPUE based on the results from three of the fitted GLM models is shown in Figure 3-13. Note, the influence of SOI on CPUE cannot be estimated for several models as the related parameter is aliased when the GLM model includes a *Year.Month* interaction term. The influence of the SOI is seen to be similar for the three models shown in Figure 3-13, with negative values of the SOI (El Nino conditions) decreasing CPUE while positive values of the SOI (La Nina conditions) increasing CPUE. This indicates that oceanographic conditions may have influenced the high CPUEs experienced in the fishery in 2011 (when the mean SOI value was 12.7) and the low CPUE experienced in the fishery in 2015 (when the mean SOI value was -10.8). However, based on the results shown in Figure 3-13 the influence on CPUE of the conditions prevailing in these years should have been only 6-7%. Further exploration of the influence of this and other environmental variables is warranted.

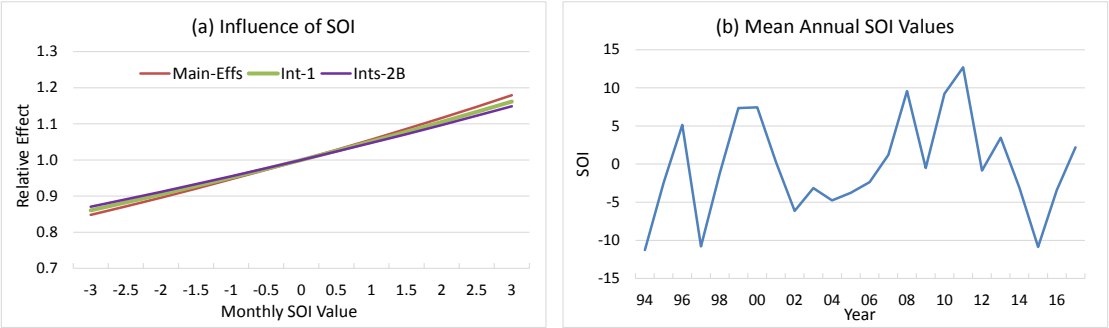


Figure 3-13. (a) Relative influence of the values of the SOI on CPUE and (b) mean annual values of the SOI since 1994. (Note, SOI value for 2017 only mean from Jan to Nov).

Annual Abundance Indices

The relative abundance indices based on each of the six GLM models listed in the previous section are listed and displayed in Table 3-5 and Figure 3-14 respectively. Relative to the nominal index, each of the standardised indices is similar but is higher at the start of the time-series and lower after 2012. The reasons for these differences can be investigated using the annual influence of each main effect which is shown in Figure 3-15 for the Main-Effects and Int-1 models. The influence on the annual index is seen to be greatest for the *Vessel* effect followed by the *Proportion-Tails* effect, with the influence of each effect showing an opposing trend over time. The change in the influence of the *Proportion-Tails* effect correlates with the shift from the catch being all tails to now being predominantly whole (c.f. Figure 3-3b), which decreases CPUE (c.f. Figure 3-11d) while the change in the influence of the *Vessel* effect is most likely due to an (expected) increase in the relative fishing power of vessels over time. The relative influence of the *Vessel* effect is seen to be greatest towards the start and end of the time-series and explains the divergence seen between the nominal and standardised indices at these times.

The influence of the other effects is seen to be relatively small. For the *Area* and *Month* effects this is likely to be due to the equal weighting given to each *Year-Month-Area* strata in the GLM model analysis. The small but positive trend in the influence of the *Method* effect over the time-series also relates to the fact that there may have been a slight increase in the proportion of catches using hookah diving over time (c.f. Figure 3-3a) which has the highest CPUE (c.f. Figure 3-11d)

Table 3-5. Annual abundance indices for Torres Strait rock lobsters based on the standardised CPUE from the weighted GLM models. The nominal CPUE is also shown for comparison.

Year	Nominal	Main-Effs	Int-1	Int-2A	Int-2B	Int-2C	Int-3
94	0.89	1.39	1.39	1.31	1.45	1.38	1.35
95	0.96	1.31	1.29	1.25	1.35	1.30	1.30
96	0.93	0.93	0.94	0.96	0.94	0.94	0.96
97	1.03	1.17	1.16	1.09	1.19	1.12	1.09
98	0.98	1.05	1.05	1.05	1.09	1.09	1.10
99	0.76	0.64	0.64	0.67	0.63	0.66	0.66
00	0.62	0.63	0.63	0.71	0.59	0.67	0.68
01	0.44	0.48	0.47	0.48	0.50	0.50	0.51
02	0.76	0.70	0.69	0.67	0.62	0.58	0.59
03	1.02	1.07	1.06	1.04	1.04	1.02	1.01
04	1.09	1.16	1.16	1.16	1.05	1.05	1.05
05	1.48	1.47	1.48	1.43	1.43	1.37	1.40
06	0.68	0.68	0.69	0.68	0.66	0.64	0.65
07	1.08	0.97	0.97	0.96	0.95	0.96	0.95
08	0.86	0.84	0.84	0.86	0.90	0.92	0.90
09	0.62	0.64	0.64	0.64	0.67	0.68	0.68
10	1.23	1.15	1.17	1.26	1.21	1.27	1.31
11	2.10	1.80	1.80	1.92	2.05	2.15	2.14
12	1.63	1.44	1.44	1.42	1.33	1.33	1.30
13	1.26	1.21	1.22	1.26	1.21	1.29	1.29
14	1.03	0.93	0.94	0.93	0.91	0.90	0.90
15	0.63	0.60	0.59	0.56	0.54	0.53	0.52
16	1.18	1.03	1.04	1.06	1.00	1.00	1.02
17	0.74	0.69	0.69	0.67	0.70	0.66	0.64
Mean	1.00	1.00	1.00	1.00	1.00	1.00	1.00

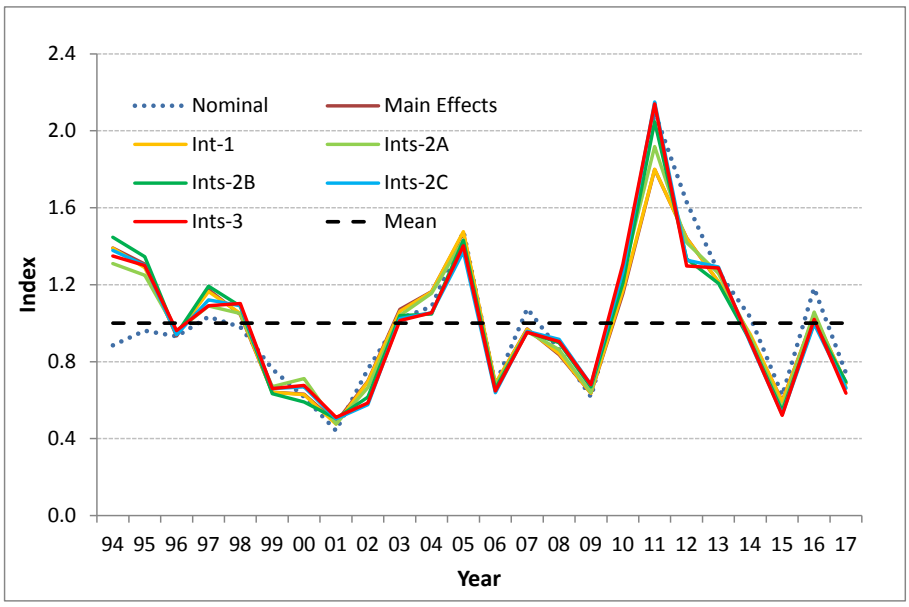


Figure 3-14. Annual abundance indices for Torres Strait rock lobsters based on the standardised CPUE from the Main-Effects and several interaction models. The nominal CPUE is also shown for comparison.

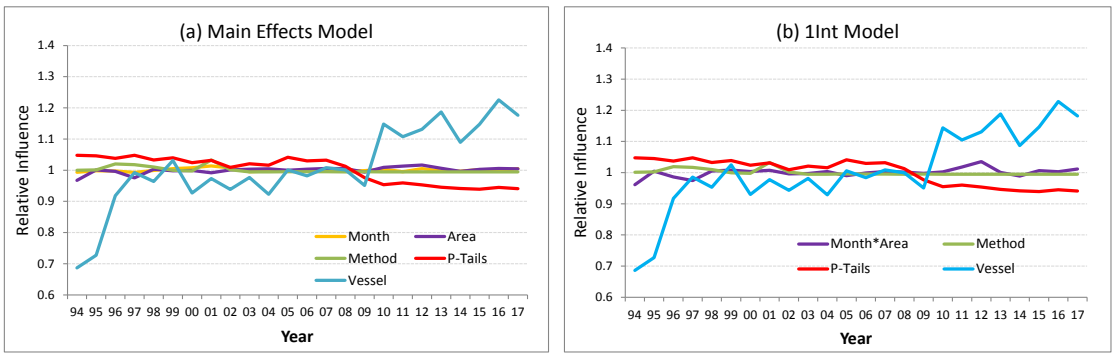


Figure 3-15. Annual influence of the fixed effects fitted to (a) the Main-Effects model and (b) the Int-1 model.

Table 3-6. Criteria for assessing the goodness-of-fit of each GLM.

GLM	Main	Int-1	Int-2A	Int-2B	Int-2C	Int-3
N-records	44,658	44,658	44,658	44,658	44,658	44,658
df	94	157	316	356	452	515
Deviance	20,553	20,165	18,764	17,965	17,951	16,765
Chi-sq	21,987	21,160	19,068	17,889	17,883	16,477
likelihood	-171,115	-170,631	-168,805	-167,707	-167,687	-165,972
AIC	342,419	341,576	338,242	336,126	336,090	332,973
BIC	343,237	342,943	340,993	339,226	339,207	337,457
N-Strata	1,920	1,920	1,920	1,920	1,920	1,920
Imputed	0	0	10	64	74	74

Several criteria for assessing the goodness-of-fit for each of the GLM models are shown in Table 3-6. For each criteria shown (where smaller is better) there is an improvement in the fit between each successive model implying that the model which includes all three 2-way interactions provides the best fit to the data. The Int-3 model has considerably greatly flexibility in accounting for inter-annual changes in the distribution of the resource across the different months and areas in comparison to the Main-Effects model which assumes that these distributions are the same for all years. However, the number of parameters (515) estimated in the full interaction model Int-3 is considerably greater than the number of parameters (94) estimated in the Main-Effects model. A consequence of the increase in the number of parameters is that the number of observations on which some of the parameters rely to be estimated can be small (or in some instances zero). A small number of observations increases the likelihood that the corresponding parameter is poorly estimated (or more importantly biased).

Histograms of the number of observations per 2-way strata (for which a separate parameter was estimated) are shown in Appendix C. For 31 (13.4%) of the 240 *Year*Area* strata the number of observations was less than 10 (with 8 of these strata having zero observations) while only two of the 192 *Year*Month* strata had less than 10 observations (being zero for one strata). On the other hand, the number of observations was greater than 34 for all of the 80 *Area*Month* strata. For those strata for which the number of observations is zero, the related standardised CPUE for these strata needs to be imputed. (Note, the number of strata for which the standardised CPUE needs to be imputed for each model is shown in Table 3-6.) For this purpose, the corresponding value using the Int-1 model was used as this model allows the standardised CPUE to be calculated within all strata.

For the Int-3 and Int-2C models, the number of *Year-Month-Area* strata where no observations were available for estimating the related model parameters (which then needed to be imputed)

was 74 (or 3.8% of the 1920 number of strata in total). For the Int-2B model the number of imputed strata was 64. On the other hand, the number of imputed strata for the Int-2A model was only 10 (or 0.5% of all strata). While it is can be considered best practice to select an abundance index where no parameters have had to be estimated (i.e. the Main-Effects or Int-1 models), the small number of estimated parameters in the Int-2A model reduces the likely bias in the corresponding index.

3.4 Concluding Remarks

The above analyses, and the resulting indices of annual abundance, are based on the number of assumptions about the data and how these data describe fishing behaviour in the fishery. In particular, if there are features of the fishery which are not adequately captured by the data used in these analyses then the GLMs will not be able to standardise the CPUE for these particular features.

For example, even though the inclusion of interactions allows the model the freedom to the resolve differences in the distribution of the resource across the different areas within different years, the model has no ability to resolve changes in the fishery which may take place within any given area (or month). In particular, the GLM assumes that within each year the distribution of fishing effort within any area is random. However, it is possible that with the introduction of new technologies (such as GPS) that over time fishers have been able to more precisely target their fishing effort to sub-regions of preferred habitat (and higher abundance) within a given area. (Note, the location of fishing effort currently recorded in the logbook is the location of the primary vessel and not the associated tenders which can disperse themselves quite widely). Such 'effort creep' would result in higher catches and higher CPUE compared to the situation where no new technologies were available. While the fitted GLM models used in the analyses described in this report appear to capture increases in the fishing power of the fleet due to changes in the vessels leaving and entering the fishery, continual increases in the fishing power over time for individual vessels that remain in the fishery will not be captured by the available data and fitted models and as such could result in continual biases in the calculated indices of abundance.

To help overcome this problem it would be useful to further investigate whether or not there have been increases in fishing power over time which are not currently captured by the data. With such information in hand one could then decide whether the data currently available adequately captures the strategies used in the fishery. If not, there needs to be a further discussion as to what additional data may need to be collected so that these aspects of the fishery can be taken into account in the statistical analyses used to standardise the data. Of course, this is a discussion that is pertinent to all fisheries.

Finally, the catches and catch-rates achieved in a fishery are also likely to be influenced by changes in oceanographic and environmental conditions which are likely to change on both a seasonal and inter-annual basis. While the current analyses attempt to model the influence of the monthly value of the Southern Oscillation Index (used to distinguish El Nino and La Nina conditions) on catch rates, the influence of such environmental changes is likely to require a broader understanding of oceanographic processes that impact on the fishery (including delayed effects such as those which influence recruitment and which sub-sequentially propagate through the

fishery over time) and again it would be useful to discuss how such processes can be incorporated into these models.

The use of standardised CPUE as an index of resource abundance is an important input to the stock assessments for many fisheries. This is particularly the situation for those fisheries where fishery independent surveys of the resource are not available or feasible (such in fisheries for highly migratory species such as tunas and billfish). However, as noted above the accuracy of these indices is premised on a number of assumptions, particularly the ability of the logbook data used in the analyses to readily capture the important aspects of the fishery which influence catch rates. In these instances, and where possible, it is useful to incorporate fisheries independent data into the stock assessments. In particular, annual indices of resource status based on fishery independent surveys are usually seen as an important adjunct to the fishery dependent data, and where possible their inclusion in the stock assessment is highly recommended. Where such surveys are not available then attention needs to be paid to ensuring that the logbook data from the fishery captures the information necessary to adequately standardise the catch rates in the fishery as discussed above.

For the Torres Strait rock lobster fishery there are currently two sources of catch and effort data, those for the TVH and TIB sectors. The logbook data from the TVH sector is believed to provide a relatively complete and good source of catch and effort data for this sector, though improvements in compliance to ensure that all fields in the logbook are completed (e.g. area fished and hours fished) would improve the utility of these data. Also, a better recording of the locations of the fishing effort (i.e. at the tender level) would also improve the accuracy of the data for standardising catch rates. On the other hand, the data for the TIB sector is considered to be less complete and the measure of effort (days fished) is less accurate and incomplete in many instances. While the utility of these data to provide a useful index of resource abundance has been investigated elsewhere (Campbell et al, 2017), again greater effort needs to be placed on ensuring the completeness and accuracy of these data for such purposes.

Chapter 4 Use of TIB Docket-Book Data to construct an Annual Abundance Index for Torres Strait Rock Lobster

4.1 Introduction

The Torres Strait Seafood Buyers and Processors Docket Book (TDB01), until recently was used in the TIB sector of the Torres Strait rock lobster fishery to record the catch sold by fishers (known as sellers on the Docket-Book) at the end of a fishing trip. It was replaced on 1 December 2017 by the mandatory Torres Strait Catch Disposal Record TDB02. However, unlike the Daily Fishing Log (TRL04) used in the TVH sector of fishery, which requires catch and effort data to be recorded for individual fishing operations related to each vessel tender, the Docket-Book required only aggregate catch and effort data to be recorded at the end of each trip. Nevertheless, both sets of catch and effort data recorded in each sector of the fishery have proven useful in constructing abundance indices for the fishery, and are now integral and equal weighted components of the Harvest Control Rule used to help determine an appropriate annual TAC. This document provides the latest update of the data and analyses undertaken for constructing the abundance index based on the Docket-Book data for the TIB sector (see Campbell et al, 2014, 2015, 2016).

4.2 Estimation of Total TIB Catch

A copy of the DB01 Docket-Book is shown in Appendix D. The docket-book records the transaction date, the name of the seller together with details of the catch (in weight) and the price obtained. Additional information is also provided regarding the vessel, the number of crew, the number of days fished and the fishing methods used. This information therefore provides a measure of both the catch and effort for a given seller (or fisher) during a fishing trip and hence can be used to gain a measure of the catch rate (weight of lobsters caught per day fished) during that trip.

However, there are a number of issues with the Docket-Book system which create problems with using this data for estimating the total catch and effort in the TIB fishery. These issues include:

i. The requirement that completion of the docket-book is only voluntary,

ii. The fact that catches recorded in the docket-book can also be reported elsewhere, including the TVH logbook,

iii. The fact that processors can also record catches in the docket-book, essentially creating duplicates.

Given the duplication of catch information from both the TVH sector and processors which occurs in the docket-book data, several filters have been developed and applied to this data in an attempt to identify and remove these duplicates. Further to these issues, several large TIB boats for a period of time only recorded their catch in the TVH-related logbook (TRL04) and these catch records need to be transferred to the TIB database. This occurred because some TIB operators

believed the TRL04 Logbook was mandatory, though they later became aware reporting for TIB is currently voluntary.

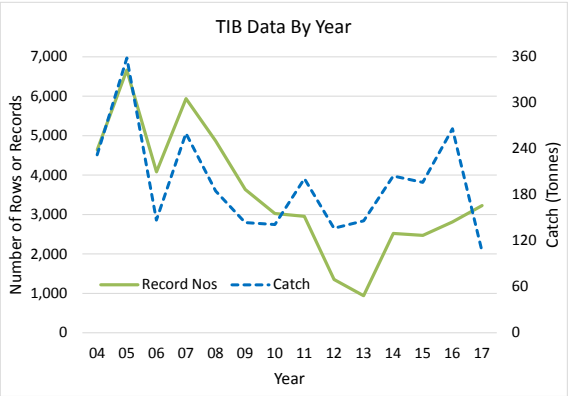
Finally, between 2013 and 2016 two processors reported aggregate annual catch data to AFMA as these catches were also not being recorded in the TDB01 Docket-Book. Each processor reported the catch for tailed and whole lobsters separately, so that for each year two catch records were added to the TIB database for each processor to account for these additional catches.

Considerable effort has gone into understanding the nature of both the TDB01 Docket-Book and TRL04 Logbook data so as to identify the catch records that should be assigned to the TIB sector of the fishery. A full description of the approach and data-rules used to identify and remove these duplicate records from the Docket-Book data is described in Campbell and Pease (2017). A total of 49,130 catch records have now been attributed to the TIB fishery covering the years 2004 to 2017. A few Docket-Book records (37) having a zero catch of lobsters are not included in this total as it is assumed that other species may have been targeted on these trips. Note, a catch record for the purpose of the data summarised in this report pertains to the catch and effort information provided on a single page in either the TDB01 Docket-Book or TRL04 Logbook and for which a unique Record-Number (Record-No) is attributed. Within the TIB database there are usually multiple rows of catch information associated with each catch record (defined by its unique Record-No) as the catch is separately recorded by process form and perhaps grade.

The number of catch records and the associated estimate of the total catch of rock lobsters in the TIB sector each year, and by data source, is shown in Table 4-1 and Figure 4-1. Between 2004 and 2007 all TIB related catch is sourced from the TDB01 Docket-Book, and the number of catch records each year varied between 4,082 and 6,664. After this time, and between 2008 and 2015, a portion of the total catch attributed to the TIB sector was recorded in the TRL04 Logbook. While the related catch was usually small (<10 tonnes) this catch nevertheless represented over 20% of the total TIB catch in both 2012 and 2013. Finally, between 2013 and 2016 a significant portion of the total TIB catch (between 33% in 2014 and 55% in 2016) was attributed to the aggregate catch data provided by several processors (as this catch was not recorded in the Docket-Book).

Table 4-1. Number of distinct TIB Record Nos by year and the related catch by data source. Note, PRC relates to the aggregate catch provided by several processors.

	Records by Data Source			Total	Catch by Data Source			Total Catch	
Year	TDB01	TRL04	PRC	Records	TDB01	TRL04	PRC	(kg)	Tonnes
2004	4642	0	0	4,642	232,031	0	0	232,031	232
2005	6664	0	0	6,664	358,474	0	0	358,474	358
2006	4082	0	0	4,082	146,946	0	0	146,946	147
2007	5939	0	0	5,939	260,122	0	0	260,122	260
2008	4755	114	0	4,869	174,724	10,223	0	184,947	185
2009	3540	95	0	3,635	135,898	7,964	0	143,862	144
2010	2962	62	0	3,024	135,517	5,686	0	141,203	141
2011	2945	9	0	2,954	200,144	1,025	0	201,168	201
2012	1185	167	0	1,352	107,391	29,032	0	136,423	136
2013	763	175	2	940	57,157	33,562	55,411	146,130	146
2014	2487	32	2	2,521	135,450	2,456	66,662	204,568	205
2015	2443	25	2	2,470	118,066	1,333	76,904	196,303	196
2016	2806	0	4	2,810	118,726	0	147,380	266,106	266
2017	3228	0	0	3,228	106,356	0	0	106,356	106
Total	48,441	679	10	49,130	2,287,000	91,283	346,357	2,724,640	2,725



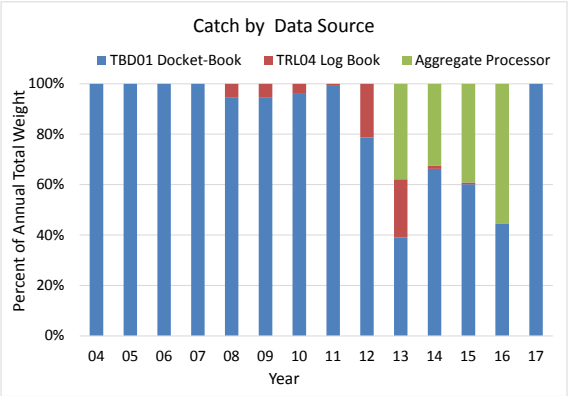


Figure 4-1. (a) Number of distinct TIB catch records and associated catch (in tonnes) by year, and (b) the proportion of the annual TIB catch by data source.

Table 4-1 indicates that the TIB data for 2017 is seen to be sourced entirely from the Docket-Book data (the first time since 2007). This change was the result of ongoing requests by AFMA for the Docket-Book to be used for the recording all catches. While it has been noted that a substantive portion of the total TIB catch was reported in aggregate form between 2013 and 2016, and which helps to explain the lower number of Record-Nos during this period, the large reduction in Record-No in 2012 and 2013 appears anomalous. Whether or not other catches were also not been recorded in the Docket-Book during these or in other years remains unknown.

4.3 The TIB Docket-Book Data

The number of distinct vessel-symbols and seller-names associated with the 49,130 TIB catch records identified above is 1,167 and 2,322 respectively. However these numbers are inflated due to different spellings and mistakes often associated with a single vessel-symbol or seller-name. Attempts have been made to correct these names, and as a result the number of distinct vessel-symbols and seller-names has been reduced by nearly half, to 656 and 1,084 respectively. However, the percentage of all records (and total catch) without a vessel-symbol remains high at 72.3% (and 73.6% respectively). On the other hand, only 1.3% of all records (and 3.5% of the total catch) have no associated seller-name.

The frequency of the fishing methods associated with all Record Nos is shown in Table 4-2. Just over 41% of all records, and 39.5% of the total catch, are associated with hookah-diving, while free diving and lamp fishing are associated with 26% and 4.8% of the total catch respectively. Smaller amounts of the catch are also associated with the handling and trolling, and for around 2.5% of all records the catch is associated with some combination of these five fishing methods. However, the catch method for 11.8% of all catch records (and 26.2% of the total catch) remains unknown.

The distribution of all Record Nos (and catch) across each of the 21 TIB areas (shown in Figure 4-2) is given in Table 4-3. Around 42% of the records and slightly over a quarter (27.2%) of the catch have come from the Thursday Island region, with another 17.7% and 10.0% of the total catch coming from the Mabuiag and Badu regions respectively. Ten of the 21 regions each account for less than one-percent of the total catch over all years (and only 1.4% in total). However, across all records the region fished remains unknown for 7.6% of all records (and 20.7% of the total catch).

Table 4-2. Number of TIB catch records (and associated catch in kilograms) by fishing method.

METHOD	N-recs	%	Catch	%
HOOKAH DIVING	20357	41.4%	1,075,159	39.5%
FREE DIVING	17380	35.4%	719,588	26.4%
UNKNOWN	5792	11.8%	714,749	26.2%
LAMP FISHING	4435	9.03%	130,658	4.80%
FREE DIVING-LAMP FISHING	371	0.76%	25,661	0.94%
FREE DIVING-HOOKAH DIVING	243	0.49%	25,262	0.93%
DIVING UNSPECIFIED	214	0.44%	15,897	0.58%
HANDLINING-FREE DIVING	141	0.29%	7,182	0.26%
HOOKAH DIVING-LAMP FISHING	31	0.06%	3,139	0.12%
TROLLING-FREE DIVING	44	0.090%	1,293	0.047%
HANDLINING	30	0.061%	812	0.030%
UNKNOWN-HOOKAH DIVING	18	0.037%	933	0.034%
FREE DIVING-HOOKAH DIVING-LAMP FISHING	11	0.022%	1,485	0.055%
HANDLINING-TROLLING-FREE DIVING	18	0.037%	561	0.021%
UNKNOWN-FREE DIVING	13	0.026%	419	0.015%
FREE DIVING-UNKNOWN	12	0.024%	659	0.024%
HOOKAH DIVING-UNKNOWN	3	0.006%	284	0.010%
UNKNOWN-LAMP FISHING	3	0.006%	49	0.002%
UNKNOWN-FREE DIVING-LAMP FISHING	3	0.006%	228	0.008%
TROLLING	3	0.006%	202	0.007%
LAMP FISHING-FREE DIVING	1	0.002%	53	0.002%
UNKNOWN-FREE DIVING-HOOKAH DIVING	1	0.002%	18	0.001%
TROLLING-DIVING UNSPECIFIED	2	0.004%	146	0.005%
HANDLINING-FREE DIVING-UNKNOWN	2	0.004%	30	0.001%
DIVING UNSPECIFIED-LAMP FISHING	1	0.002%	32	0.001%
HANDLINING-TROLLING	2	0.004%	22	0.001%
HANDLINING-DIVING UNSPECIFIED	1	0.002%	2	0.000%
ROD AND REELING-FREE DIVING	1	0.002%	30	0.001%
UNKNOWN-TROLLING-FREE DIVING	1	0.002%	74	0.003%
FREE DIVING-TROLLING	1	0.002%	13	0.000%
Total	49,135	1	2,724,640	1

The number of recorded days-fished associated with the above TIB catch records (c.f. Table 4-4) varies between 1 and 16 days, though is only one, two or three days for 75.6%, 6.2% and 3.1% of all catch records respectively. The days-fished remains unknown (i.e. not recorded) for 11.4% of these records (but for 26.3% of the total catch). Finally, the number of crew varies between 1 and 14 (c.f. Table 4-5), though is only numbers one or two for 59.1% and 26.9% of records respectively. The number of crew remains unknown for 11.8% of all records (and 28.2% of the total catch).

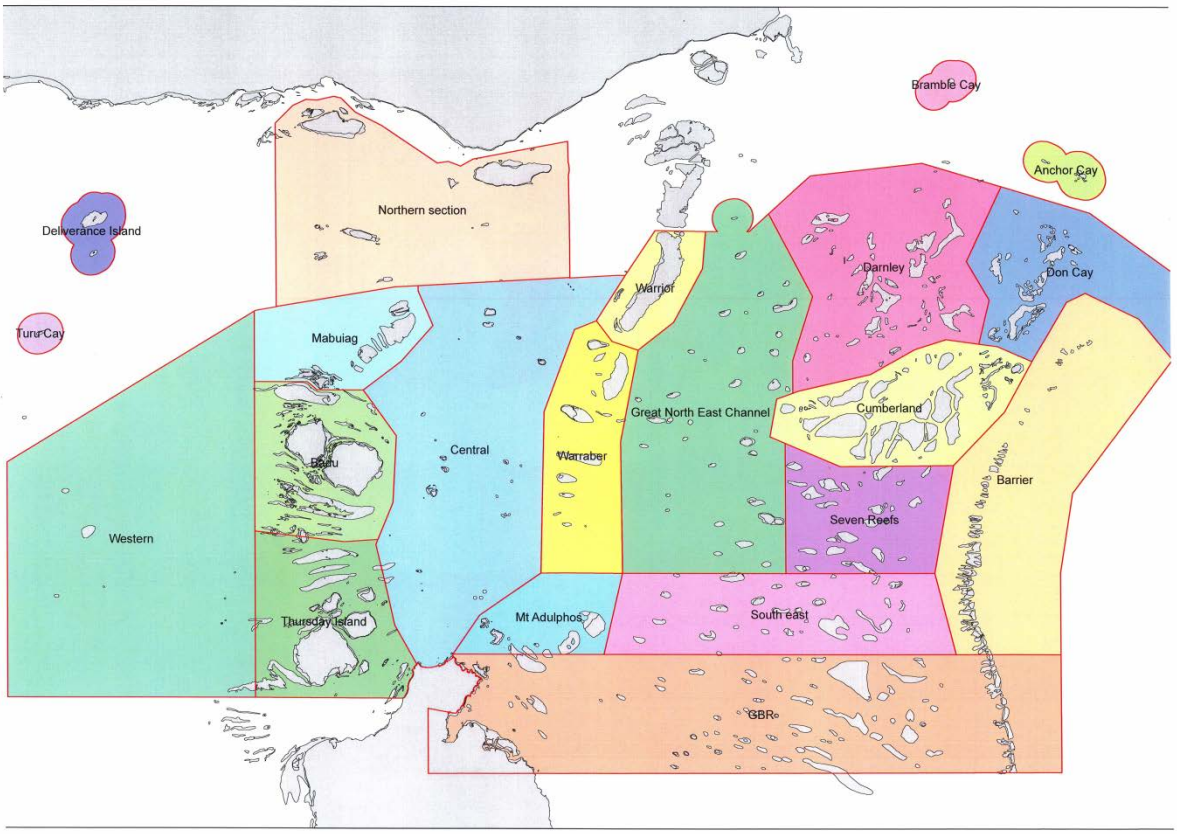


Figure 4-2. Spatial structure of the TIB data.

Table 4-3. Number of TIB records (and associated catch in kilograms) by region.

Area	Area-Name	N-recs	%	Catch	%
9	Thursday Island	20748	42.23%	741,336	27.2%
0	Unknown	3713	7.56%	563,278	20.7%
7	Mabuiag	6053	12.32%	454,694	16.7%
8	Badu	5535	11.27%	272,790	10.0%
12	Warraber	4166	8.48%	192,658	7.07%
11	Warrior	2882	5.87%	159,169	5.84%
14	Great NE Channel	1742	3.55%	96,626	3.55%
13	Mt Adolphus	682	1.39%	53,454	1.96%
17	Cumberland	782	1.59%	42,789	1.57%
16	Darnley	1217	2.5%	42,390	1.6%
10	Central	742	1.51%	38,634	1.42%
3	Northern Section	265	0.54%	27,703	1.02%
1	Turu Cay	230	0.47%	12,999	0.48%
15	South East	117	0.24%	10,897	0.40%
21	GBR	155	0.32%	10,083	0.37%
4	Bramble Cay	18	0.04%	1,470	0.05%
2	Deliverance Island	29	0.1%	1,348	0.0%
6	Western	21	0.04%	1,078	0.04%
18	Seven Reefs	8	0.02%	475	0.02%
20	Barrier	10	0.02%	345	0.01%
5	Anchor Cay	9	0.02%	238	0.01%
19	Don Cay	6	0.01%	189	0.01%
Total		49,130	1	2,724,640	1

Table 4-4. Number of TIB records (and associated catch in kilograms) by the number of days fished as recorded on docket-books.

Days	N-recs	%	Catch	%
1	37,134	75.6%	1,371,597	50.3%
Unknown	5,591	11.4%	717,139	26.3%
2	3,052	6.2%	198,206	7.3%
3	1,502	3.1%	131,186	4.8%
4	695	1.4%	83,703	3.1%
5	553	1.1%	80,554	3.0%
6	186	0.4%	40,574	1.5%
7	174	0.4%	35,239	1.3%
8	95	0.2%	26,789	1.0%
9	69	0.1%	20,920	0.8%
10	32	0.1%	7,306	0.3%
11	20	0.0%	6,792	0.2%
13	8	0.0%	2,086	0.1%
14	6	0.0%	1,062	0.0%
12	8	0.0%	768	0.0%
16	3	0.0%	524	0.0%
15	2	0.0%	192	0.0%
	49,130	100.0%	2,724,640	100.0%

Table 4-5. Number of TIB records (and associated catch in kilograms) by the number of crew as recorded on docket-books.

Crew	N-recs	%	Catch	%
1	29,038	59.1%	1,162,397	42.7%
Unknown	5,807	11.8%	769,655	28.2%
2	13,233	26.9%	731,346	26.8%
3	882	1.8%	46,643	1.7%
4	133	0.3%	6,655	0.2%
6	6	0.0%	3,844	0.1%
5	11	0.0%	2,492	0.1%
8	6	0.0%	1,086	0.0%
7	7	0.0%	285	0.0%
12	2	0.0%	99	0.0%
10	1	0.0%	60	0.0%
14	1	0.0%	37	0.0%
9	2	0.0%	31	0.0%
11	1	0.0%	9	0.0%
	49,130	100.0%	2,724,640	100.0%

The annual percentage of the TIB catch stratified by various levels of (a) fishing method, (b) area fished, (c) days fished and (d) number of crew are shown in Figure 4-3 and Figure 4-4. The annual percent of blank (unknown) levels for each data field are also shown. After 2012 there was a significant increase in the proportion of the annual catch for which the information relating to these four effort variables remains unknown and this percent remains above 60% in 2016. This lack of information impedes the ability to construct indices of resource abundance that represent the distribution of lobsters across the TIB fishery based on the catch and effort data from this fishery. This is largely due to the high proportion of the total catch (>40%) in recent years which is not being recorded in the docket-books but instead is being supplied in aggregate form by processors. However, there is still room for improving the information recorded on docket-books (e.g. the fishing method was not completed for 20% of records in 2016, cf. Table 4-3).

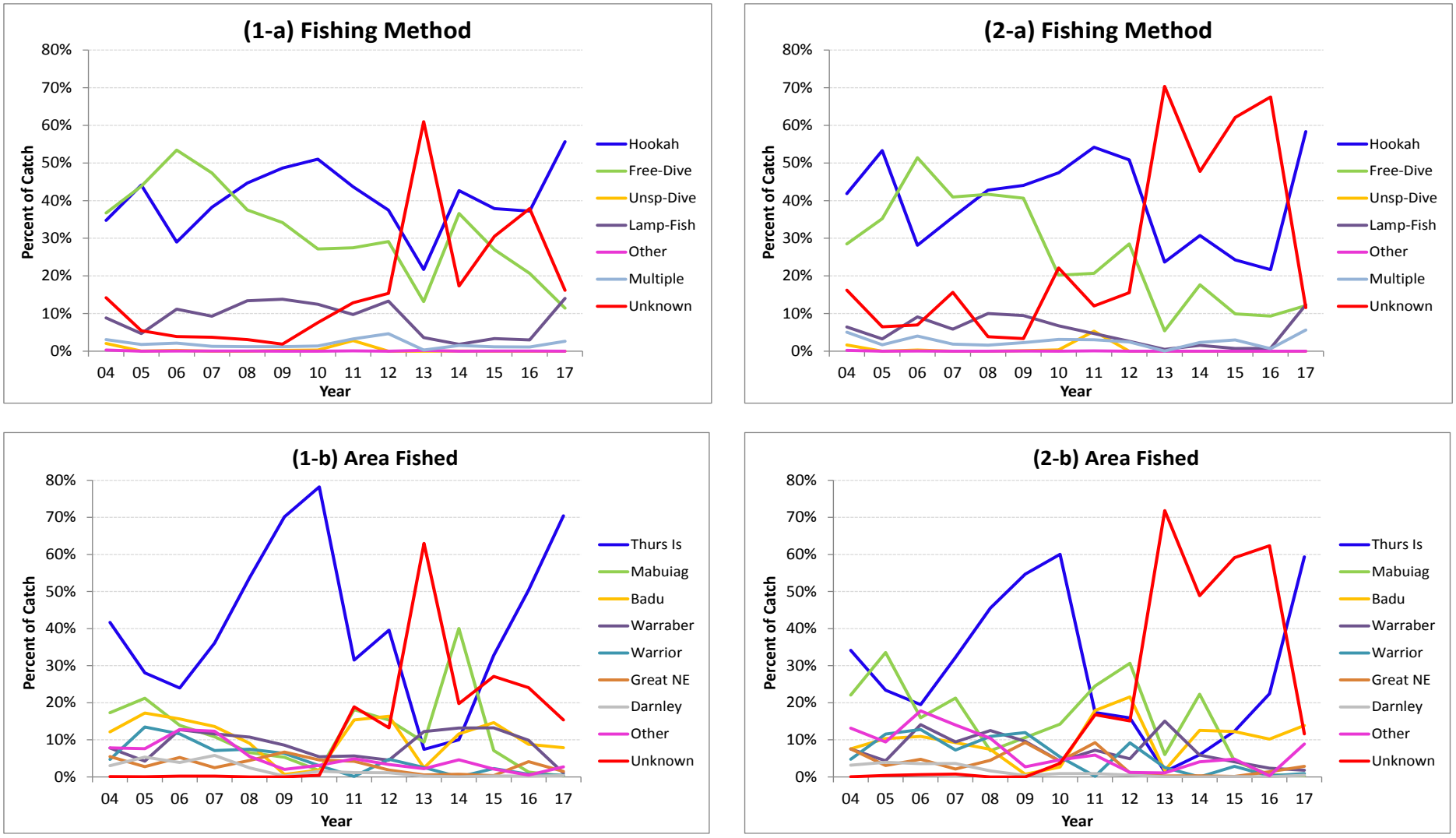
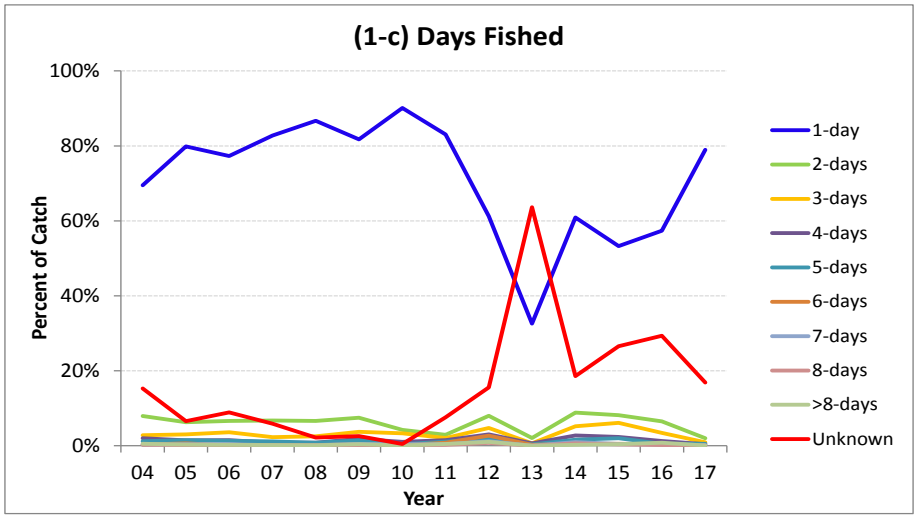
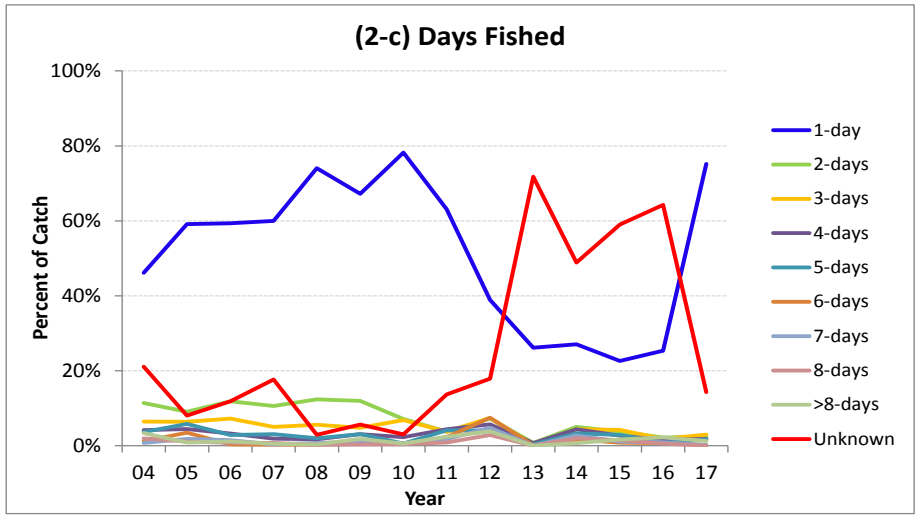
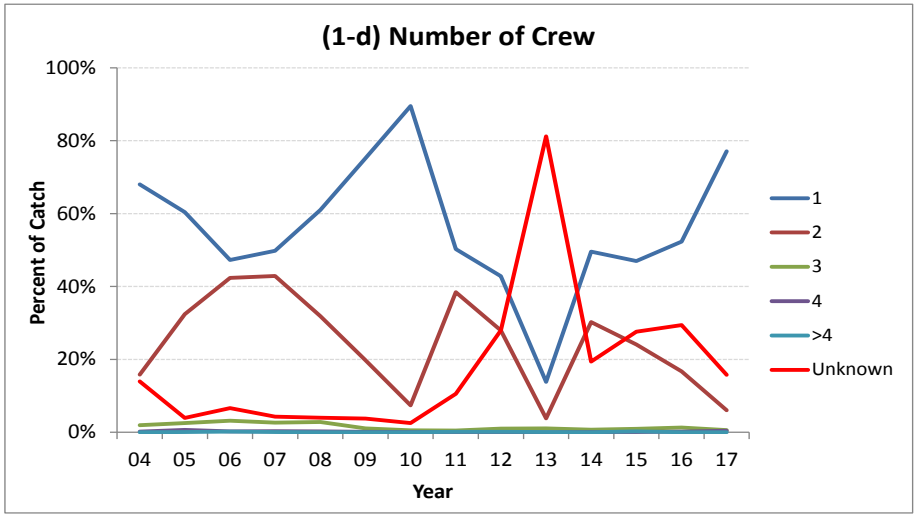


Figure 4-3. Annual percent of (1) number of TIB catch records and (2) total TIB catch for the various levels of: (a) fishing method, (b) area fished in the data. The percent of the annual catch for which each data field was not completed (and therefore remains unknown) is also shown.







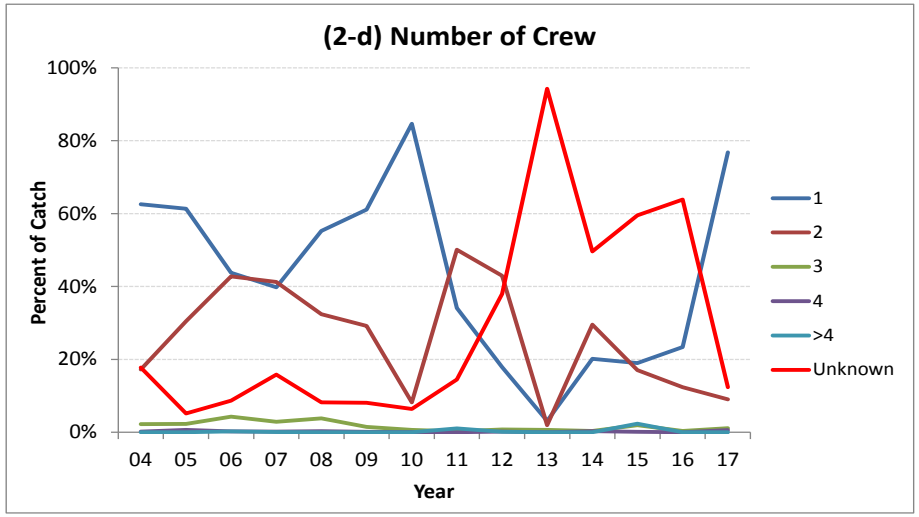


Figure 4-4. Annual percent of (1) number of TIB catch records and (2) total TIB catch for the various levels of: (c) days fished and (d) number of crew. The percent of the annual catch for which each data field was not completed (and therefore remains unknown) is also shown.

4.4 Selection of data used for CPUE analysis

Each catch record in the TIB data is associated with a Record-No, and the structure of the Docket-Book would seem to indicate that there should be a unique Record- Number for each vessel, date and seller-name. However, investigation of the data indicates that there are often multiple Record-Nos associated for a given vessel, date and seller-name. The reason for these multiple records remains unknown. In order to identity an appropriate data structure for analysis, the following procedure was adopted to filter the data:

1. The TIB data was aggregated over vessel-symbol, date and seller-name. Where the vessel-symbol or seller-name was null these fields were set to 'Unknown';
2. Only those records where the first fishing method listed in Table 4-2 was either 'Hookah diving' or 'Free diving' were selected. This resulted in a total of 37,243 aggregate records (hence-forth known as GLM records);
3. Only those GLM records having a unique Record-No were selected for analysis – accounting for 36,123 (97.0%) of the GLM records identified in the previous step. It was assumed that where the vessel or seller were unknown, that selection of only those GLM records having a unique Record-No limited the GLM records chosen to those associated with a single vessel and a single seller;
4. An additional check was made to ensure that the number of days fished, the number of crew on the boat, the fishing method and the area fished was unique for each Record-No. This was done to help eliminate data errors. Five records were eliminated for having two methods each;
5. Finally, GLM records were also deleted where either the number of days fished was not recorded (1718), the area fished was not recorded (641), the record pertained to the TVH logbook data (704) as the structure of the data for these records was different, or the weight of the catch was zero (26) or greater than 1000 kg (12);

Finally, the records for the year 2013 were also deleted due to the small number of records for this year (109) compared to all other years (between 681 and 5,170). The small number for 2013 was due to the fact that many of the fields on the Docket-Book were left blank.

This process resulted in 33,713 GLM records being created and selected.

The number of GLM records, and associated nominal CPUE, within each year, month, quarter and TIB area and the distribution of records per fishing method, days-fished and the percent of the catch which are tailed lobsters are shown in Table 4-6 and Table 4-7 (and for each 2-way combination of the year, quarter and area effects in Appendix D). Due to the small number of records in some TIB areas, these records were combined with the records in an adjacent area so that the minimum number of records in any area was more than 200. This resulted in twelve areas to be used as spatial effects in the GLM analysis. Furthermore, for all records where more than one fishing method was used the fishing method was termed Mixed. Consequently, only three types of fishing methods were in the data. There were also 893 distinct seller-names (unknown for only 9 records) and 564 distinct vessels (but unknown for 70.7% of all records).

The substantive decline in the number of Records-Nos since 2010 has been noted earlier, with the average number of catch records per year decreasing from 3,535 between 2004 to 2010 to only

1,386 between 2011 and 2016. However, with the greater use of the Docket-Book after 2016 this situation improved substantially during 2017 when the number of records selected for the GLM analysis again exceeded 2000.

Table 4-6. Number of GLM records within each year, month and quarter and associated nominal catch rate.

Year	N-Recs	CPUE
2004	3,059	33.3
2005	5,170	40.3
2006	3,017	26.6
2007	4,763	32.4
2008	3,711	31.9
2009	2,777	27.8
2010	2,247	33.4
2011	1,685	51.9
2012	681	46.9
2014	1,665	30.3
2015	1,454	25.2
2016	1,444	32.0
2017	2,040	28.0
Total	33,713	

Month	N-Recs	CPUE
1	2,179	31.6
2	4,511	38.3
3	5,502	38.2
4	4,012	37.2
5	4,034	34.9
6	3,593	34.2
7	3,421	31.8
8	2,575	30.8
9	1,789	27.5
10	37	23.8
11	6	23.7
12	2,054	27.0
Total	33,713	

Qtr	N-Recs	CPUE
1	11,639	35.5
2	7,785	30.5
3	2,097	26.9
4	12,192	37.1
Total	33,713	

Table 4-7. Number of GLM records within each TIB area and distribution across each recorded fishing method and days-fished and the associated nominal catch rate.

TIB-Area	GLM-Area	N-Recs
1	6	74
2	6	20
3	6	190
4	16	14
5	16	3
6	6	15
7	7	4,667
8	8	4,733
9	9	15,074
10	10	373
11	11	2,172
12	12	2,707
13	13	475
14	14	1,343
15	15	102
16	16	912
17	17	698
18	15	8
19	16	3
20	15	10
21	15	120
Total		33,713

GLM-Area	N-Recs	CPUE
6	299	47.6
7	4,667	41.5
8	4,733	30.9
9	15,074	32.9
10	373	38.4
11	2,172	42.0
12	2,707	24.2
13	475	51.3
14	1,343	34.5
15	240	45.4
16	932	31.2
17	698	37.3
Total	33,713	

%-Tails	N-Recs	CPUE
<20%	7,149	23.7
20-40%	2,705	35.2
40-60%	2,285	35.9
60-80%	2,085	38.7
>80%	19,489	37.5
Total	33,713	

Method	N-Recs	CPUE
FREE	15291	31.6
HOOKAH	17830	36.7
MIXED	592	37.5
Total	33,713	

Days	N-Recs	CPUE
1	28,508	34.9
2	2,422	33.3
3	1,198	29.5
4	581	30.7
5	482	30.3
6	164	36.9
7	150	28.6
8	80	36.9
9	62	33.0
10	28	22.6
11	18	27.5
12	6	10.5
13	7	18.5
14	3	8.0
15	1	5.8
16	3	10.9
Total	33,713	

Unlike the TVH data where the measure of effort is hours-fished, the measure of effort for the TIB data is coarser, being days-fished. Furthermore, and as noted above, it has been assumed that each selected GLM record pertains to the catch and effort of a single fisher (or seller) during a given trip, i.e. it is assumed that the measure of effort (i.e. days fished) associated with each GLM record also pertains to the actual effort expended by that seller in obtaining the recorded catch. While the number of days fished for each Record-No in the GLM data is unique, there are instances nevertheless where for the same vessel, date and seller there are multiple Record-Nos where the number of days fished is different. Investigation of this issue undertaken with the AFMA

data section indicated that the dates associated with these docket-book forms were most likely not correct (Campbell 2016a).

4.5 General Linear Model Analysis

As with the analysis of the TVH data in previous years, General Linear Models (GLM) were fitted to the TIB data selected in the previous section in order to standardise the CPUE to account for changes in the distribution of records across a number of effects (Year, Month, Quarter, Area and Fishing-Method). As mentioned previously, the measure of effort for the TIB data is days-fished. The catch rate associated with each GLM record was then defined to be the mean weight of lobsters caught per day-fished, i.e.

$$CPUE = \frac{Whole\ \ Weight\ of\ landed\ lobsters}{Number\ of\ days\ fished}$$

In order to investigate the influence of the various effects on the catch rate associated with each GLM data record, the following two models were fitted to the data records described in the previous section. All GLMs were weighted as described in Campbell (2016c).

GLM-1: Main Effects only

CPUE = Intercept + Year +Quarter + Area +Method + Proportion-Tails + SOI

/ distribution = gamma, link = log

GLM-2: Main Effects + Quarter*Area Interaction

*CPUE = Intercept + Year + Quarter *Area +Method+ Proportion-Tails + SOI*

/ distribution = gamma, link = log

where:

a) *Year* has 12 levels: 2004-2012, 2014-2016 (see below)

b) *Quarter* has 4 levels: (1) Jan-Mar, (2) Apr-Jun, (3) Jul-Sep, and (4) Oct-Dec.

c) *Area* has the 12 levels as shown in Table 6b.

d) *Fishing-Method* has 3 levels: (1) Hookah, (2) Free Diving, and (3) Mixed methods

e) *Proportion*-Tails has 5 levels: (1) <20%, (2) 20-40%, (3) 40-60%, (4) 60-80%, and (5) ≥80%

f) *SOI* is the monthly value of the Southern Oscillation Index

All effects were fitted as categorical effects except for SOI which was fitted as a continuous variable.

The above models were fitted to the TIB described in the previous section with the following filters: a) the 66 data records where the number of days fished was greater than 9 were excluded as the mean catch rates for these records was substantially below those where the number of days fished was between 1 and 9 days, and b) the 319 records where the catch was less than 1.0kg or greater than 300 kilograms as these could also be outliers. This left a total of 33,348 records.

Using the results from each GLM an annual abundance index was constructed based on the standardised CPUE calculated for each of the (Year, Quarter, Area) strata. As the standardised -

CPUE is taken as an index of the density of fish within each strata, an index of the abundance of lobsters across the fishery in each year and quarter is given by:

$$Index(year = y, quarter, q) = \frac{1}{\sum_{a=1}^{NA} Area_a} \sum_{a=1}^{NA} Area_a .stdCPUE(y, q, a)$$

where $Area_a$ is the spatial size of each of the *NA Area* effects included in the GLM. Finally, an index of abundance for each year can be obtained by taking the average of the *NQ* quarter indices in each year.

$$Index(year = y) = \frac{1}{NQ} \sum_{q=1}^{NQ} \left[\frac{1}{\sum_{a=1}^{NA} Area_a} \sum_{a=1}^{NA} Area_a .stdCPUE(y, q, a) \right]$$

Finally, a relative annual abundance index, B_y, was calculated such that the mean index over all years equals 1, i.e.:

$$B_y = \frac{Index(year = y)}{\frac{1}{NY} \sum_{i=1}^{NY} Index(year = i)}$$

For those models which do not included an interaction with the Year effect (i.e. models GLM-1 and GLM-2), the relative abundance index, B_y, reduces to the simpler form:

$$B_y = \frac{\exp(Y_Y)}{\frac{1}{NY} \sum_{i=1}^{NY} \exp(Y_i)}$$

where Yi , i=1, NY are the parameters estimates relating to NY Year effects included in the model. In these situations the abundance is independent of the relative size of each Area effect included in the GLM.

No models including an interaction with the Year*Area interaction effect were fitted as there were a number of Year*Area strata having no data records (c.f. Appendix D) and construction of an abundance index from a model including a Year*Area interaction would entail the need to impute catch rates for those strata for which the number of records is zero or small (and, hence, maybe unrepresentative). While there was only one Year*Quarter strata having no data records (c.f. Appendix D), unlike previous years no models including an interaction with the Year*Quarter interaction effect were fitted due to the need to know the spatial extent occupied by lobsters within each TIB fishing region (required to construct the abundance index – see Campbell 2016c) and the related uncertainty noted in previous reports about the spatial size of each GLM-area.

As a sensitivity analysis several alternative model runs were conducted. First, the Seller-Name was fitted as an additional effect to the above two models. To ensure that there was sufficient data for parameter estimation of each Seller effect only those sellers which had fished for three or more years and for which there were 30 or more data records where included in the analyses. Second, as seen from Table B(i) in Appendix D the data coverage for many of the GLM-areas has been poor since 2012 with only four areas (GLM-areas 7, 8, 9 and 12) having a reasonable data coverage in recent years. As this poor data coverage will influence our ability to estimate representative Area

effects for many areas, the analysis was repeated where the above models were fitted only to the data for GLM-areas 7 (Mabuiag), 8 (Badu), 9 (Thursday Island) and 12 (Warraber). A summary of the number of records fitted to each model is shown in Table 4-8.

Table 4-8. Summary of models fitted to the TIB data.

(a) All Areas

Model		# Fitted Parameters	# Sellers Parameters	Records	AIC
1	Main Effects	33	0	33,348	301,262
2	Main Effects + Q.A	66	0	33,348	299,606
3	Model 1 + Seller-Name	275	242	27,828	244,847
4	Model 2 + Seller-Name	308	242	27,828	244,308

(b) Four Areas Only

Model		# Fitted Parameters	# Sellers Parameters	Records	AIC
1	Main Effects	25	0	26,896	236,191
2	Main Effects + Q.A	34	0	26,896	235,932
3	Model 1 + Seller-Name	205	180	22,344	186,547
4	Model 2 + Seller-Name	214	180	22,344	186,388

4.6 Results and Abundance Indices

Standardising Effects

Statistics for the Type 3 contrasts computed for each fitted effect indicated that each effect was highly significant. A comparison of relative influence of each level of the *Quarter*, *Area*, *Method* and *Proportion-Tails* effects for each GLM model is shown in Figure 4-5. For each effect the values have been scaled so that the influence of each effect is relative to that of the last level of each effect (i.e., Qtr=1, Area=T.I., Method= Hookah and %-Tail >80%). For those models which included the *Quarter*Area* interaction the *Quarter* and *Area* effects were determined by calculating the mean effect across all areas and quarters respectively.

Relative CPUE is similar across the four quarters of the year, though taking the average effect across the individual results for the eight models for each quarter indicates that CPUE is highest during the first and second quarters and lowest in the fourth quarter. However, this result is influenced by the variation shown between the results for those models with all 12 areas included and those limited to only four areas. For example, the second quarter has the highest relative CPUE when averaged across models with all areas included, but for those models limited to only four areas the CPUE for this quarter is 10% lower (and the first quarter has the highest relative CPUE).

Relative CPUE varies considerably between the various areas included in the GLM. There is also considerable variation in the relative effect for a particular area between the different models. For example, for the two models with all areas and no *Seller* effect the relative CPUE's vary between

188% (for South East) to 93% (for Warraber), while for the two models which include the *Seller*-effect, the relative CPUE's varies between 134% (for Mabuiag) to 94% (for Cumberland). For the four models limited to the four area effects, the relative CPUE is higher in Mabuiag for the two sets of models with and without the *Seller* effect, while there is some variation in relative CPUE for both Badu and Warraber across these models.

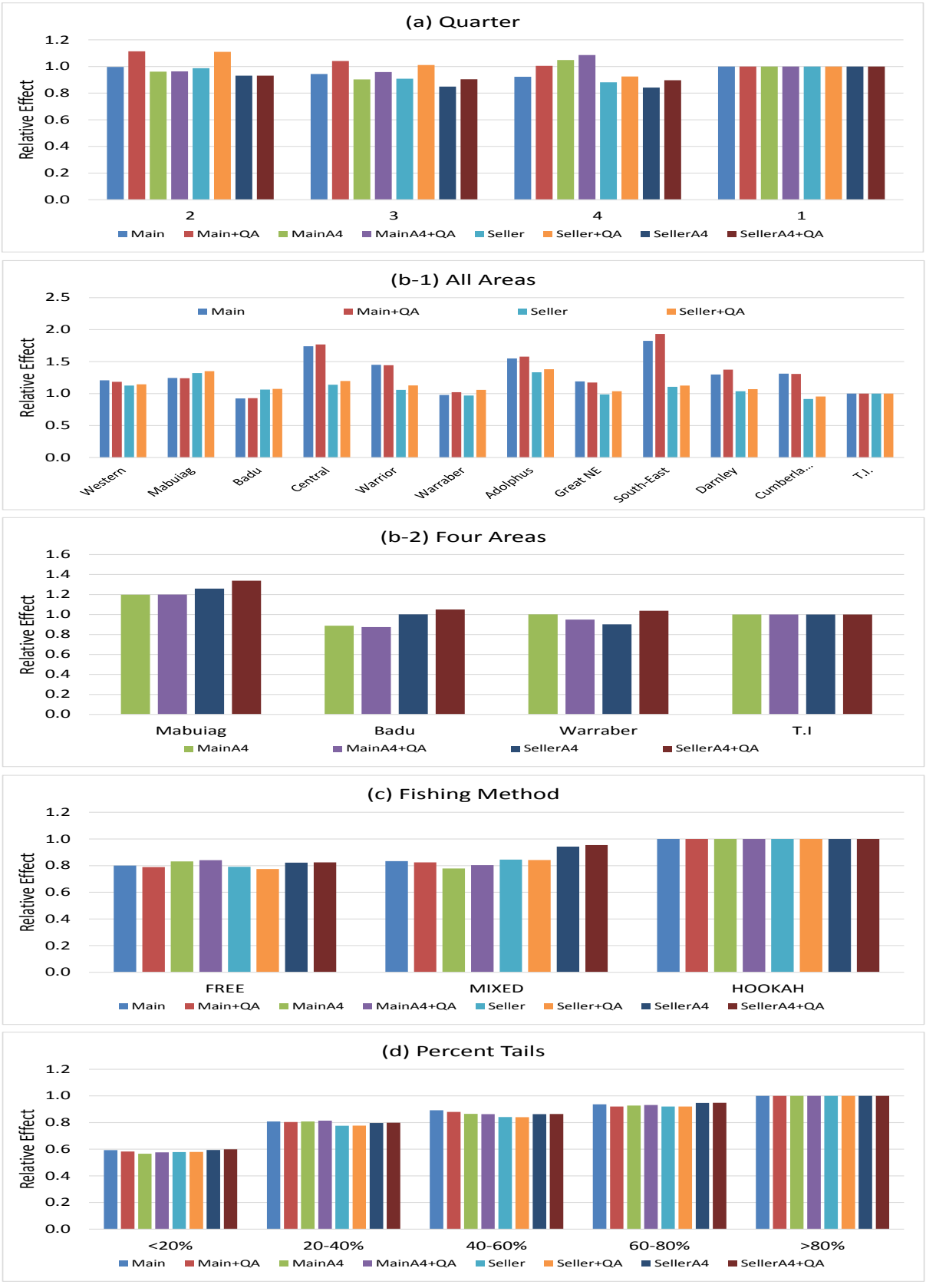


Figure 4-5. Comparison of relative influence of each level of the Quarter, Area, Method and Percent-Tails effects for each fitted model. Results are shown for both model runs. Note, for each effect the values have been scaled so that the influence of each effect is relative to that of the last level of each effect (i.e, Qtr=1, Area=T.I., Method= Hookah and %-Tails= '>80%').

Apart from the four area only models including a Seller effect for mixed fishing, the relative CPUE of each fishing method is similar across all models. On average the CPUE for hookah fishing is found to be around 24% higher than for free diving and 17% higher than for mixed fishing. This latter result is to be expected if mixed fishing is a combination of the two other fishing methods.

Finally, the relative CPUE across all models is similar for each category of the proportion of the catch which is tails with the relative CPUE increasing as the Proportion-Tails increases in the catch. Across all models, the relative CPUE within each %-tails category is 0.58, 0.80, 0.86, 0.93 and 1.00 respectively.

Annual Abundance Indices

The relative abundance indices based on each of the eight GLM models listed in the previous section are listed and displayed and in Table 4-9 and Figure 4-6 and Figure 4-7 respectively. Relative to the nominal index, each of the standardised indices displays a number of substantive shifts, being lower than the nominal index at the start of the time-series and for 2011 and 2012 and higher than the nominal index for 2009 and 2010 and since 2014. These changes are likely due to shifts in the percentage of the catch which are processed as tailed or whole lobsters (c.f. Figure 4-8). There are some small differences, especially for the last year, in the relative indices between the all areas, no *Seller*-effect model with and without the *Quarter*Area* interaction included (c.f. Figure 4-6a) but these differences are negligible for the other models (c.f. Figure 4-6b-d). There are also some differences between the models which include all 12 GLM-areas and those which only include the four selected GLM-areas, with these differences being similar across the two sets of models with and without the *Quarter*Area* interaction included (c.f. Figure 4-7).

Using the Akaike Information Criteria (AIC) as a measure to select the relative quality of the different statistical models fitted to a given set of data (where a lower value is better), then based on the results shown in Table 4-8 the models with the *Quarter*Area* interaction included are found to provide a better fit to the data for all the four sets of models. Although not shown in Table 4-8, the AIC measure also indicates that between the two models with and without the *Seller*-effect included and fitted to the same set of data as Models 3 and 4 (i.e. 27,828 records) that the model including the *Seller*-effect provides the better fit. Based on these observations, Model 4 is therefore seen as the preferred model. Of the two sets of models fitted to the data

Table 4-9. Relative abundance indices based on standardised CPUE data for the TIB fishery. Note, each index is scaled so that the mean of the index over the all years is equal to 1.

Year	Nominal	Main	Main+QA	Main.A4	Main.A4+QA	Seller	Seller+QA	Seller.A4	Seller.A4+QA
04	0.97	0.89	0.89	0.91	0.90	0.88	0.87	0.90	0.90
05	1.17	0.92	0.94	0.95	0.97	1.03	1.03	1.04	1.05
06	0.82	0.71	0.73	0.68	0.69	0.76	0.76	0.72	0.72
07	0.99	0.83	0.84	0.86	0.86	0.86	0.86	0.89	0.89
08	0.98	0.96	0.93	0.97	0.95	0.90	0.89	0.92	0.91
09	0.87	0.90	0.90	0.89	0.88	0.88	0.87	0.84	0.84
10	1.01	1.05	1.04	1.10	1.07	1.06	1.06	1.05	1.05
11	1.48	1.32	1.32	1.29	1.29	1.40	1.37	1.24	1.22
12	1.31	1.19	1.22	1.24	1.26	1.26	1.26	1.26	1.25
14	0.88	0.85	0.89	0.85	0.87	0.90	0.93	0.92	0.95
15	0.72	0.91	0.93	0.90	0.90	0.90	0.92	0.93	0.94
16	0.96	1.24	1.24	1.31	1.30	1.27	1.28	1.34	1.34
17	0.84	1.24	1.14	1.06	1.05	0.90	0.90	0.93	0.93
Mean	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

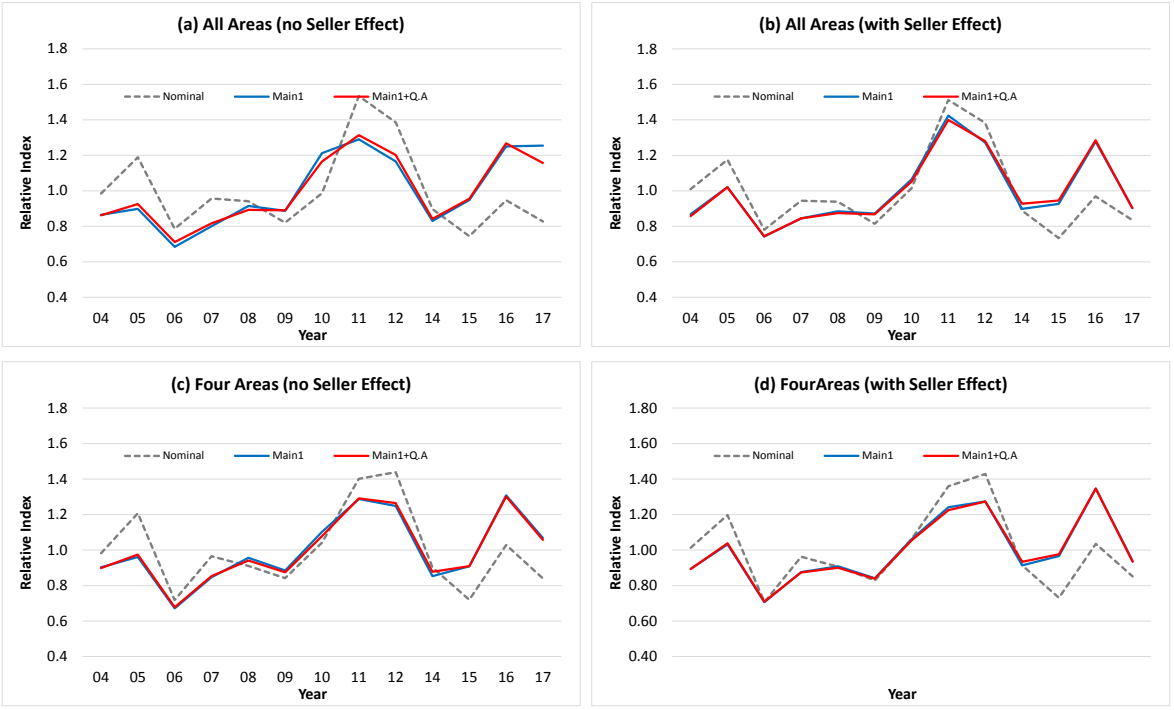


Figure 4-6. Relative indices of resource availability based on each the models fitted to the catch and effort data for the TIB fishery.

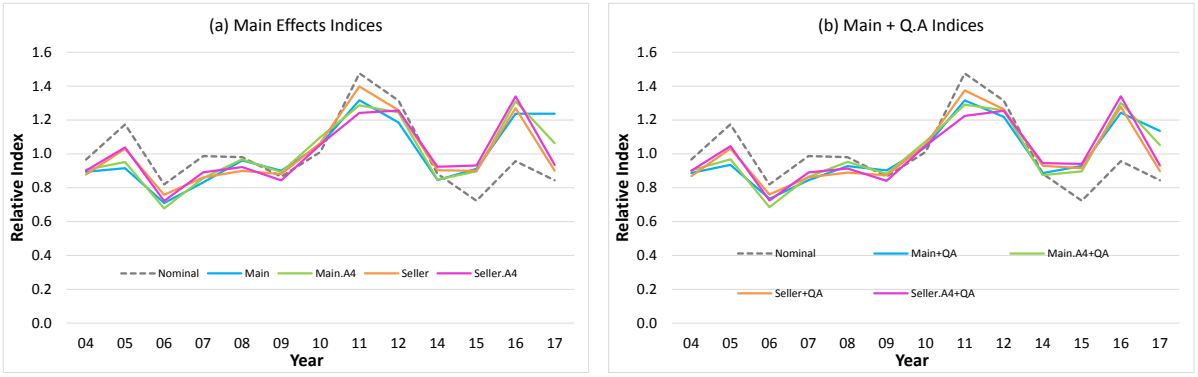


Figure 4-7. Comparison of the relative indices of resource availability based on (a) Main-Effects only and the (b) Main Effects + Quarter*Area interaction models fitted to the catch and effort data for the TIB fishery.

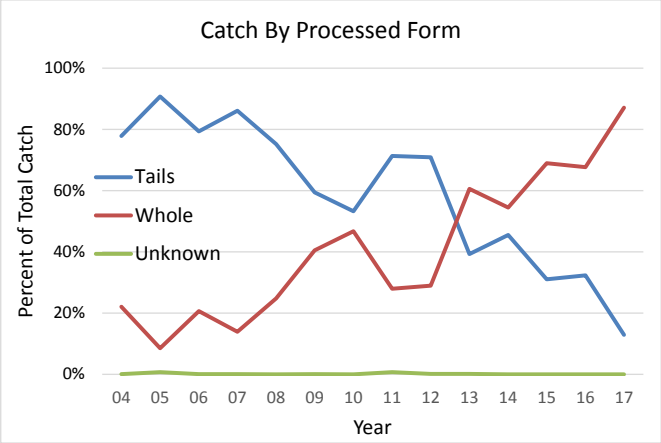


Figure 4-8. Percent of total annual catch (whole weight) by processed form.

for all 12 GLM-areas or just the four selected GLM-areas it can be argued that as the *Area*-effect are assumed to the same across all years, and despite the poor data coverage in some areas in more recent years, that the latter model only provides an index across the smaller region comprising the selected four areas while the former model should provide a better index across the entire fishery.

4.7 Comparison with other indices

A comparison of the TIB abundance indices with two of the preferred indices based on the standardised CPUE from the TVH fishery is shown in Figure 4-9 while the Pearson correlation, ρ, between each of these indices is shown in Table 4-10. A number of differences are seen between each set of indices. In particular, the standardised TIB indices each display a considerably flatter trend over time than the TVH indices. Despite this, the peaks and troughs in each of the TIB and TVH indices generally coincide. For example, local maximum occur for the years 2005, 2011 and 2016 while local minimum occur for 2006, 2009, 2015 and 2017. This similarity is also reflected in the relatively high correlation (ρ =0.76) between the TIB index (*seller+Q.A*) and the two TVH indices. As both the TIB and TVH fisheries are fishing the same resource, this result is not unexpected. The reasons for the flatter trend in the TIB indices remain uncertain and warrants further investigation but may be due to the more limited data collected from this fishery, in particular the courser scale measure of effort collected from the TIB fishery (day) in comparison to that collected in the TVH fishery (hours). There is also a problem with the decline in the amount of data available for analysis from the TIB fisher in more recent years, and its more limited spatial extent, due to the fact that some of the data fields in the docket-book were not completed and that a large proportion (>40%) of the data was not recorded on the docket-book.

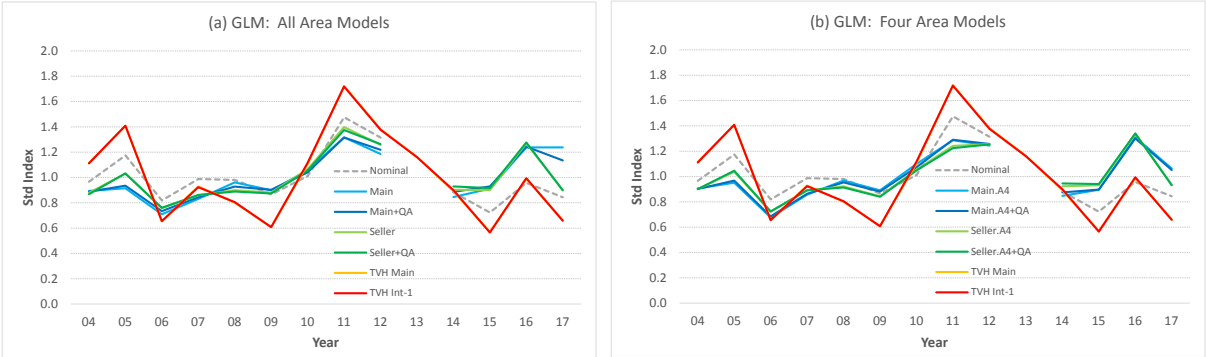


Figure 4-9. Comparison of the selected TIB and TVH resource indices.

Table 4-10. Pearson correlation between the various TIB and TVH-based indices.

	All Areas		Four Areas	
Model	TVH-Main	TVH-Int1	TVH-Main	TVH-Int1
Main	0.49	0.49	0.61	0.61
Main+QA	0.57	0.57	0.64	0.64
Seller	0.78	0.78	0.68	0.69
Seller+QA	0.76	0.76	0.68	0.68

4.8 Concluding Remarks

For the Torres Strait rock lobster fishery there are currently two sources of catch and effort data, those for the TVH and TIB sectors. The TRL04 Logbook data from the TVH sector is believed to provide a relatively complete and good source of catch and effort data for this sector (e.g. Campbell eta al, 2017). Improvements in compliance to ensure that all fields in the Logbook are completed (e.g. area fished and hours fished) would improve the utility of these data. Also, a better recording of the locations of the fishing effort (i.e. at the tender level) would also improve the accuracy of the data for standardising catch rates. On the other hand, the data for the TIB sector is less complete and the measure of effort (days fished) is less accurate and incomplete in many instances. However, given the potential for this sector to grow in importance in future years there is a need to assess the utility of these data to provide a useful index of resource abundance.

The results presented above indicate that while the TIB-based indices have the potential to capture the major trends stock abundance, they likely lack the detail required to track finer inter-annual trends in abundance. There are several reasons for this outcome. In particular, the measures of catch and effort in the TIB data are coarser (trip-based) compared to the tender-hours based data for the TVH data. Indeed, for the TIB data it remains unknown how many hours per trip fishing actually occurred and whether there are differences between the different sellers and trends over the years.

Finally, it has been noted that either the Docket-Book or many of the fields in the Docket-Book were not completed in recent years, though there were improvements in 2017. With the introduction of the new Torres Strait Catch Disposal Record (TDB02, shown in Appendix D) it is hoped that the improvements seen in data recording will continue. While the recording of several data fields (e.g. Fisher Name, Fisher Type, Boat Symbol, and catch details) will be mandatory in the new form, it is also essential that the other fields in the voluntary sector of the form (e.g. detailing fishing effort and methods) are completed if the required information is to be available for standardising the TIB catch and effort data. As with the TVH data, continued effort needs to be placed on ensuring the completeness and accuracy of these data if they are to be used on a continuing basis.

Chapter 5 Pre-season Survey 2017

5.1 Introduction

The 2017 pre-season (November) survey of the Torres Strait lobster population was conducted during 1 -12 November 2017 by four CSIRO staff, using the mothership *M.V. Kerra Lyn* (Frontier Fishing Pty Ltd) and a CSIRO dive tender (Figure 5-1). A total of 77 sites (Figure 5-2) were surveyed by divers and each site was re-located accurately using portable GPS. Measured belt transects (500 m by 4 m) were employed as the primary sampling unit, as they were found to give the greatest precision (p=SE/Mean) of lobster abundance. Transect distance was measured, to the nearest metre using a Chainman® device. At the completion of each transect divers recorded: the number of lobsters caught, the number and age-class of those observed but not caught, depth, visibility, distance swum, numbers of pearl oyster (*Pinctada maxima*), crown of thorns starfish and holothurian species observed, and percent covers of standard substratum and biota (including seagrass and algae species) categories. The sampled lobsters were measured (tail width in mm), sexed and moult staged to provide fishery-independent size-frequency data.

Figure 5-1. Vessels used for 2017 pre-season survey: mothership M.V. Kerra Lyn and a 5m CSIRO naiad

The weather and underwater conditions for the survey were generally good. Winds for the majority of the trip were 10-15 knots but increased to 20-25 knots for the final few days of the survey. Diving was conducted around the neap tides so currents were reasonable and visibility good (average 4m but not less than 2m).

As in 2016, the survey was limited by a Marine Park Permit to take only 5 lobsters per site from 6 sites located within the Great Barrier Marine Park Zone in the SE region of the fishery. Restrictions included: collection of no more than 30 juvenile lobster (< 90mm carapace length) from the 6 sites per year and no more than 5 collected per site per year. These restrictions did not affect our sample collection as lobster densities were below the permit limitations for five sites and equalling our limit at one site.

We repeated the photo-transects that were initially conducted at eight reef-edge sites during the 2015 pre-season survey to monitor coral cover given the coral bleaching event in April/May 2015 (Figure 5-2) to monitor coral cover given the coral bleaching event in April/May 2015. This involved photographing the reef-edge habitat in three 50 m transects following the completion of the lobster census. In addition, the percent bleached coral and live coral was recorded as a

component of the ongoing habitat monitoring initiated in 1994. The likely short-term and longer-term impacts of the 2015 bleaching event on the TRL fishery are discussed below.

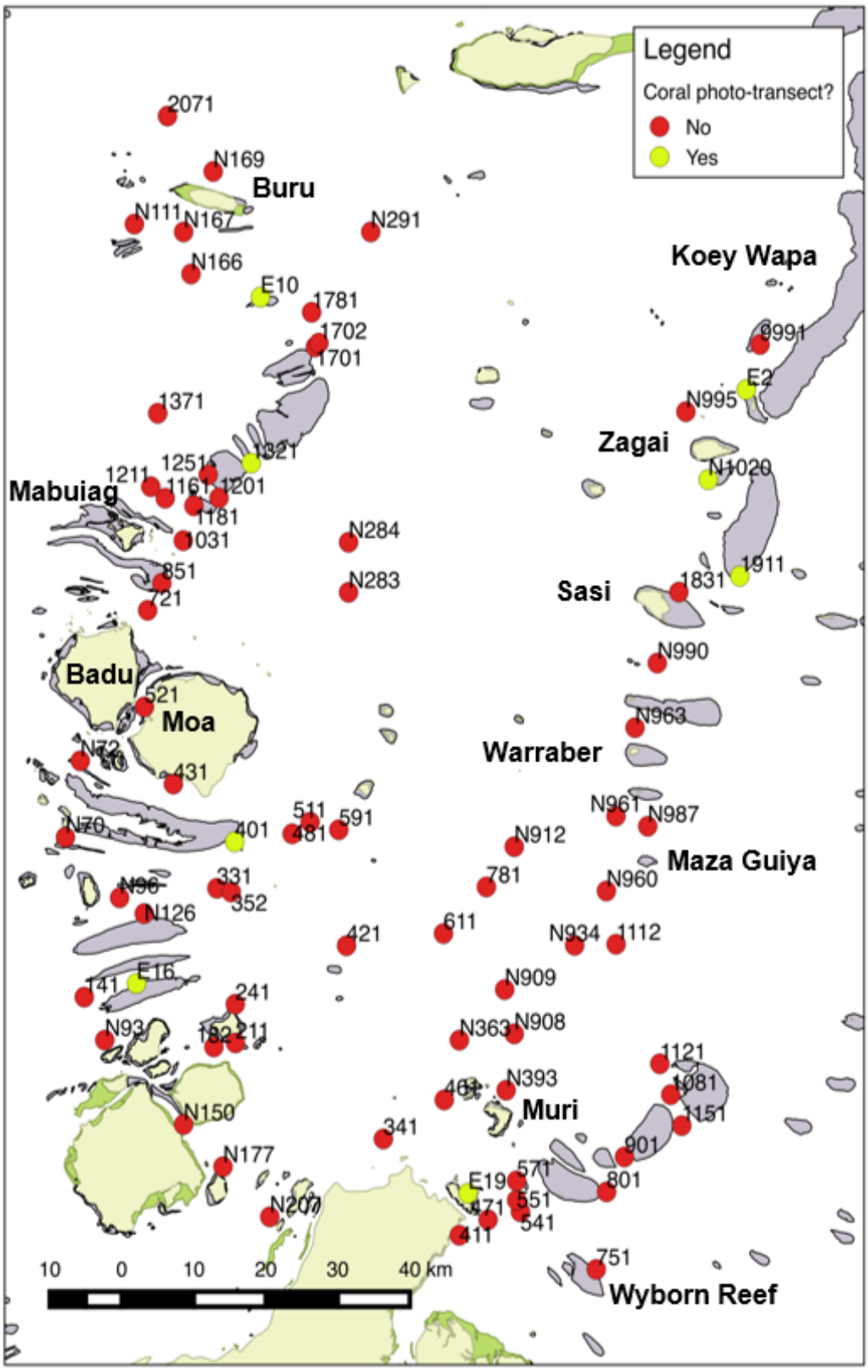


Figure 5-2. Map of western Torres Strait showing sites surveyed during the 2017 TRL pre-season population survey. Sites where coral monitoring photo-transects were conducted in 2015, 2016 and 2017 are marked pale green.

5.2 Results

TRL distribution and abundance

The distributions of recently-settled (0+) lobster was similar to previous pre-season surveys however abundance was low across all stratum except for the South East which had average abundance. Of particular interest were the very low abundances observed at the Mabuiag and TI Bridge stratums which traditionally are areas of good (0+) settlement (Figure 5-3). A comparison of recently-settled lobster densities between 2016 and 2017 pre-season surveys is represented in Figure 5-4, top pane.

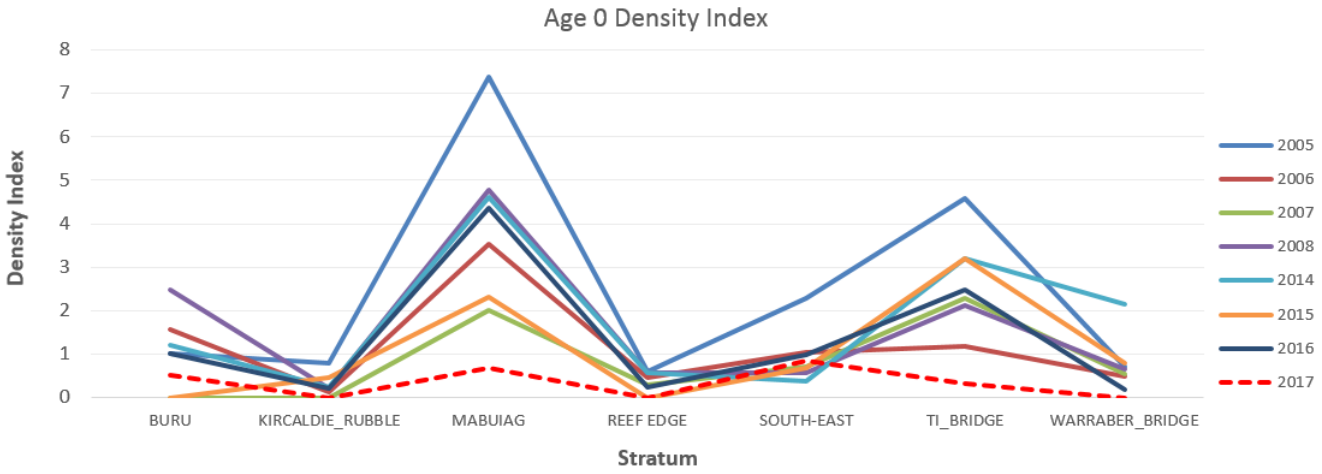


Figure 5-3. Comparative indices of abundance of recruiting (0+) ornate rock lobsters (*Panulirus ornatus*) recorded in each sampling stratum during pre-season surveys in Torres Strait between 2005 and 2017 (note surveys were not done during 2009-2013).

The distribution of recruiting (1+) lobsters was also similar to previous pre-season surveys, however like the recently-settled lobster they were less abundant throughout most sampling stratums with four of the seven stratum recording their lowest pre-season index (Figure 5-5). Western survey stratums such as TI Bridge, Mabuiag and Buru all had very low abundances. The stratums that showed average levels of (1+) recruitment were the South-East, Kircaldie Rubble and Reef Edge. The indices for the South East and Reef Edge stratums were relatively high compared to previous surveys and were very similar to the 2006 pre-season survey abundances for these strata (Figure 5-5). A comparison of recruiting lobster densities between 2016 and 2017 pre-season surveys is represented in Figure 5-4, bottom pane.

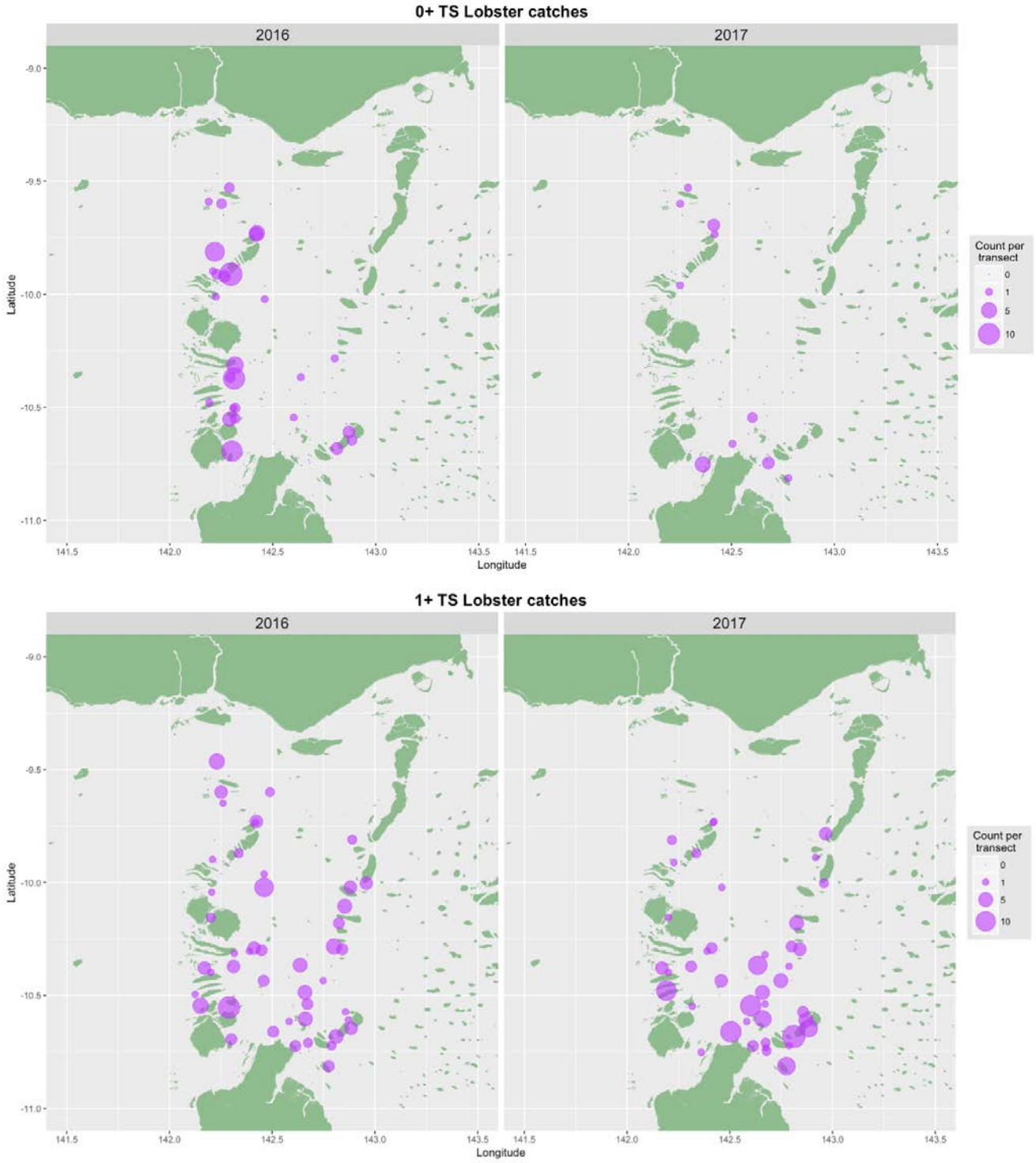


Figure 5-4. Density of recently-settled (0+) lobsters (*Panulirus ornatus*) recorded during the 2016 and 2017 pre-season surveys in western Torres Straits (top pane); density of recruiting (1+) lobsters for the same surveys (bottom pane)

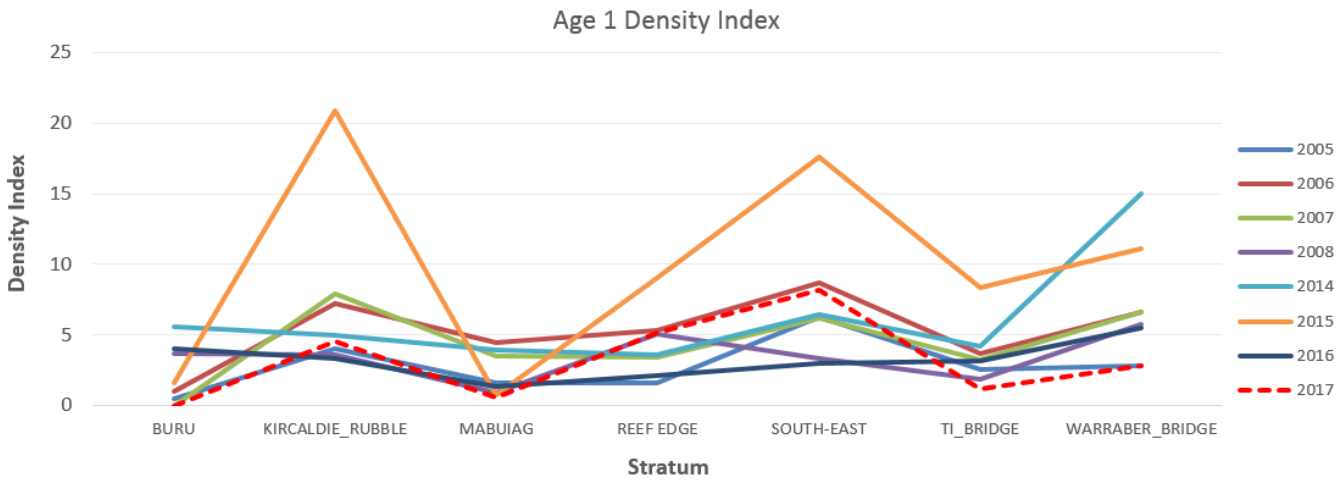


Figure 5-5. Comparative indices of abundance of recruiting (1+) ornate rock lobsters (*Panulirus ornatus*) recorded in each sampling stratum during pre-season surveys in Torres Strait between 2005 and 2017 (note surveys were not done during 2009-2013).

As expected fished (2+) lobsters were rarely observed, as the vast majority of fished lobsters would have emigrated from Torres Strait during August/September to undertake the breeding migration. Only a few (2+) male lobsters were observed in the Warraber Bridge and TI Bridge stratums in 2017 (Figure 5-6). These larger males are usually caught by lamp fishing and free diving on reef tops and edges during December and February. Unusually no (2+) lobster were observed in the Reef Edge stratum during the 2017 survey. The lack of (2+) lobster and the reasonably high abundance of (1+) lobster at reef edge sites may indicate that the recruiting lobster have moved into spaces normally occupied by the larger lobster. Inversely, the 2016 (2+) indices were very high and (1+) indices very low in the Reef Edge stratum (Figure 5-5, Figure 5-6).

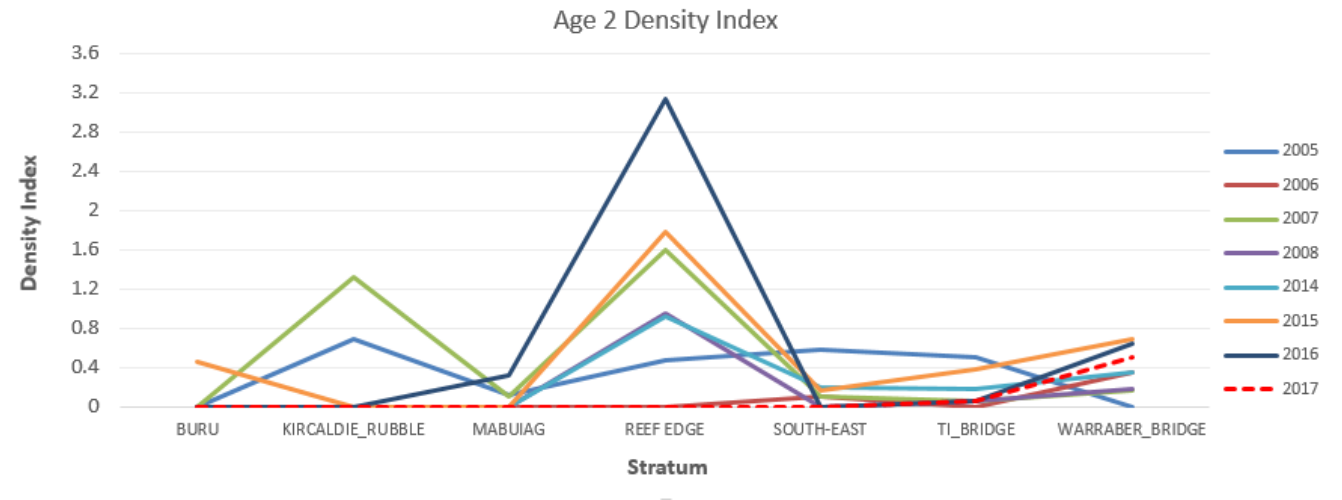


Figure 5-6. Comparative indices of abundance of recruiting (2+) ornate rock lobsters (*Panulirus ornatus*) recorded in each sampling stratum during pre-season surveys in Torres Strait between 2005 and 2017 (note pre-season surveys were not conducted during 2009-2013).

Annual indices of abundance for 0+ and 1+ lobster

As the 2015, 2016 and 2017 pre-season surveys involved a reduced number of transects (77) from previous surveys (>130) (Figure 5-7), four alternative methods were used to calculate annual indices of abundance between 2005 and 2017. This enabled an assessment of the likely impact of the reduced sampling on accuracy and precision of the indices. The four options are described in Table 5-1. As previously, the 1+ relative index of abundance was computed after applying an area weighting factor, and the same approach was used for the 0+ index. The latter is an improvement on the non-standardised average value used previously.

The resulting indices for (0+) lobsters (Figure 5-8) and (1+) lobsters (Figure 5-10), highlights that the long-term trends using data from the mid-year only (74) transects are generally consistent with trends using data from all sites and sub-sets of sites. As discussed previously, this strongly indicates that transitioning to smaller scale pre-season surveys will not interrupt the time series collected to date. Nevertheless, as discussed at the TRL RAG meetings, additional industry-run surveys would increase precision of the estimates and provide even greater confidence in the annual recruitment and recently–settled lobster indices. This is highlighted by the increased precision of the abundance indices generated using all sites in comparison to the mid-year only indices (Figure 5-9, Figure 5-11).

The 2017 abundance indices for recently-settled (0+) and recruiting (1+) lobsters are significantly lower than all other pre-season surveys (Figure 5-8, Figure 5-10). Between 2014 and 2016 the densities of (0+) lobster had been consistent and above average however the 2017 (0+) index is approximately 80 percent down from 2016 (Figure 5-8). The (1+) index has declined over the past two years and at its current level is down approximately 75 percent from 2015 and 35 percent from 2016 (Figure 5-10).

Table 5-1. Description of the four options used to estimate ornate rock lobster (*Panulirus ornatus*) abundance indices from pre-season population surveys conducted in Torres Strait between 2005 and 2017.

Pre-season Index Option	Number of Strata	Description
1a. ALL SITES	7	All transects for all years utilised
1b. ALL SITES excluding Buru	6	All transects for all years utilised, excluding those from the Buru stratum
2a. MID_YEAR ONLY SITES	7	All mid-year transects (74) utilised
2b. MID_YEAR ONLY SITES- common across all years	6	All common transects utilised; equal number in each year

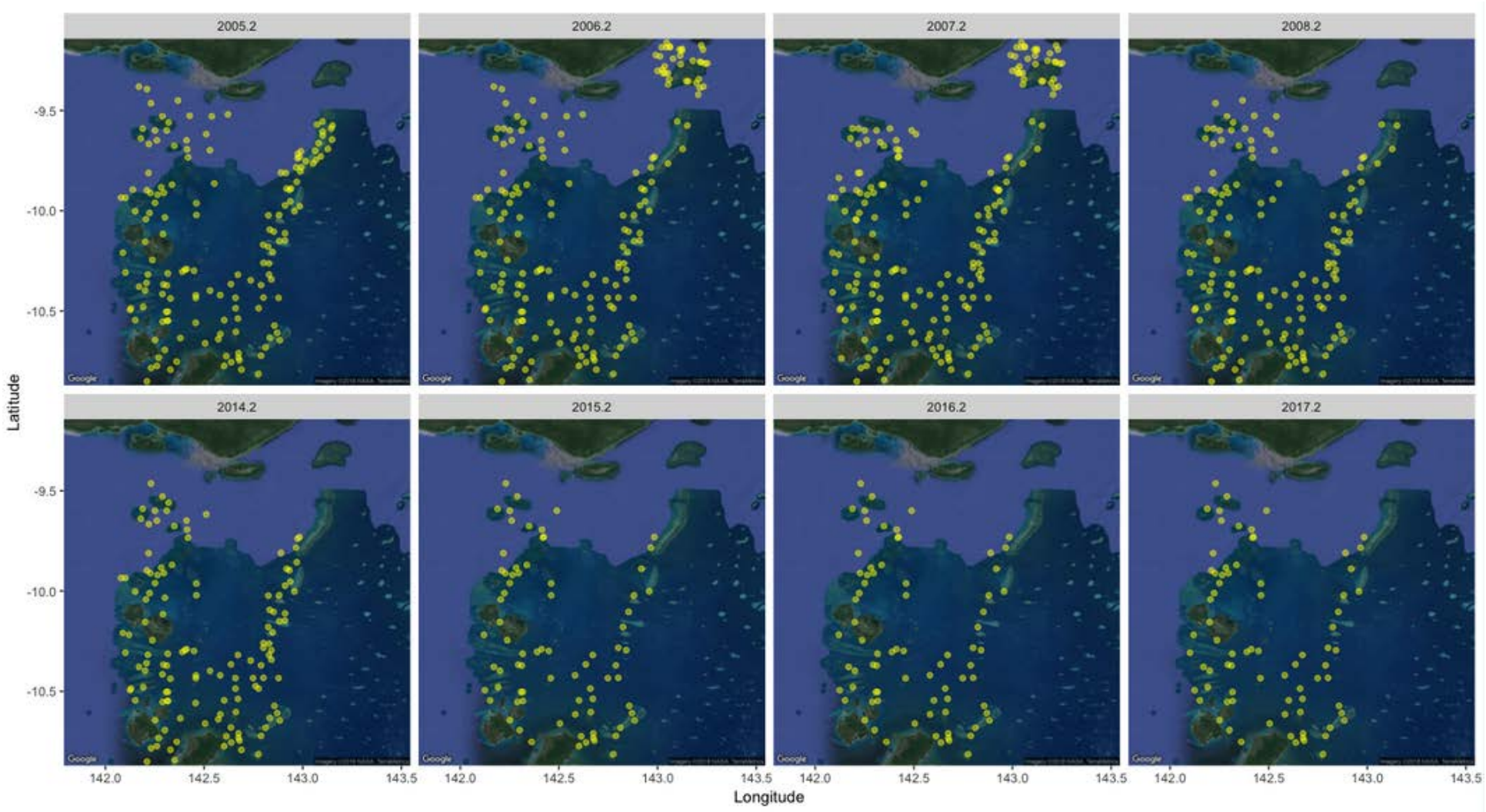


Figure 5-7. Pre-season survey sites between 2005 and 2017. Number of sites pre-season survey sites reduced from >130 (2005-2014) to <80 (2015-2017). Note that pre-season surveys were not conducted during 2009-2013.

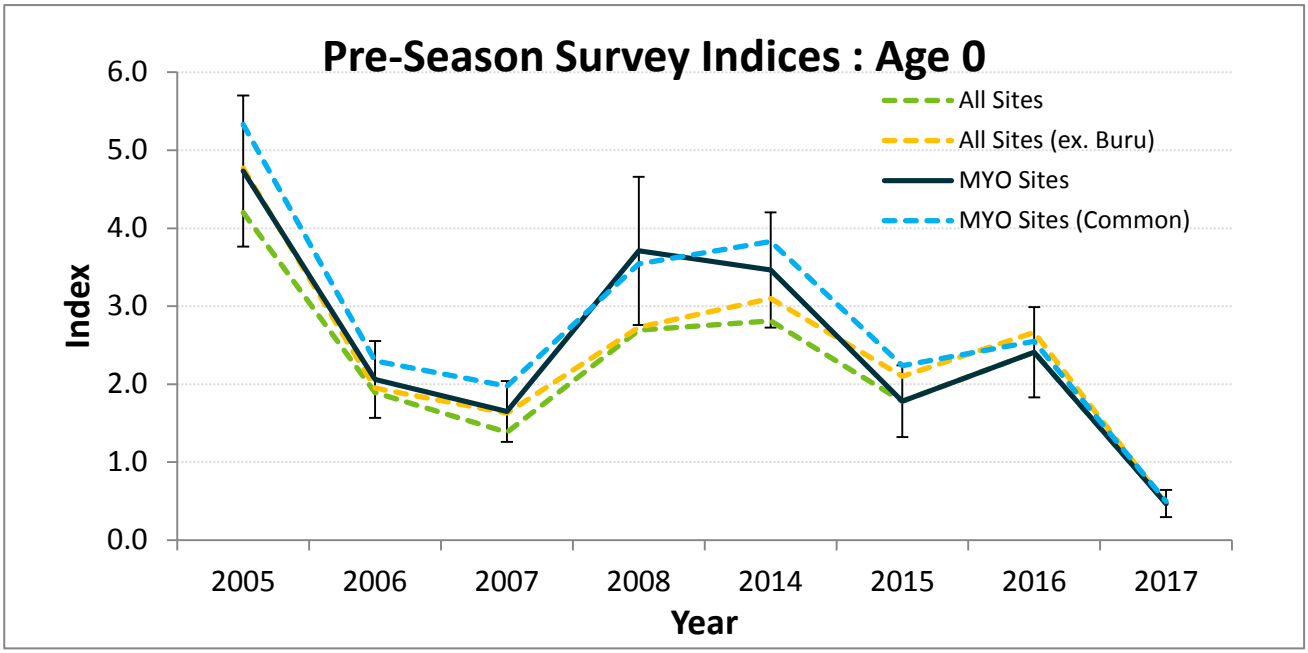


Figure 5-8. Four comparative indices of abundance of recruiting (0+) ornate rock lobsters (*Panulirus ornatus*) recorded during pre-season surveys in Torres Strait between 2005 and 2017 (note pre-season surveys were not conducted during 2009-2013). Error bars of MYO indices represent standard errors.

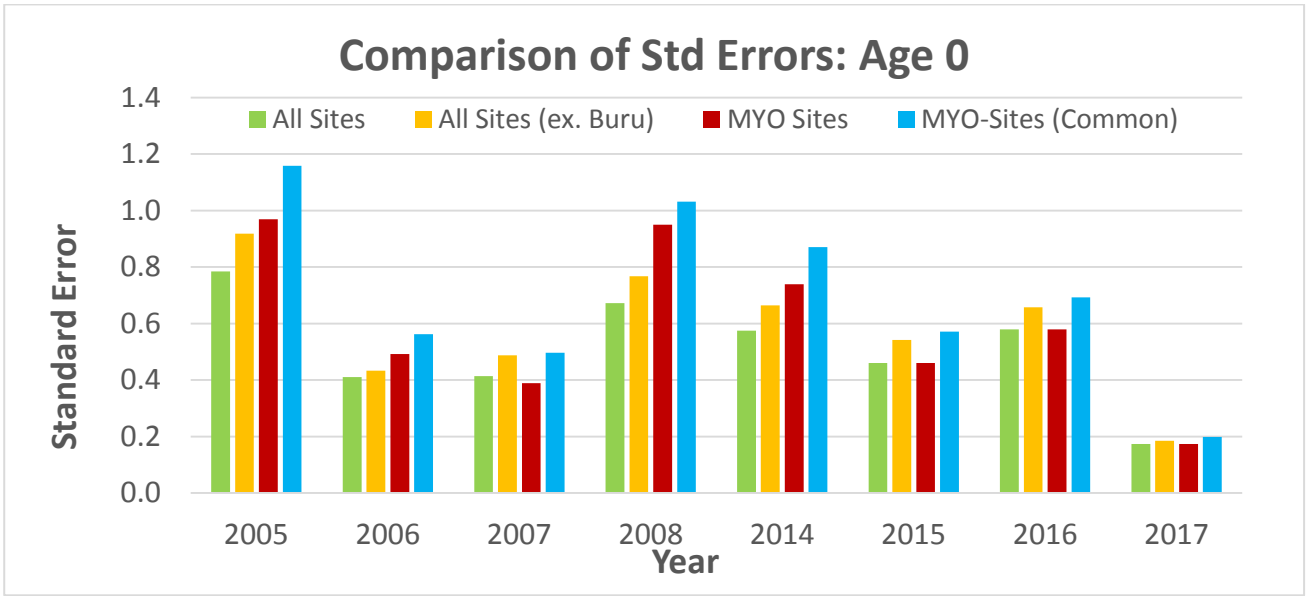


Figure 5-9. Comparative standard errors for four indices of abundance of recruiting (0+) ornate rock lobsters (*Panulirus ornatus*) recorded during pre-season surveys in Torres Strait between 2005 and 2017 (note pre-season surveys were not conducted during 2009-2013).

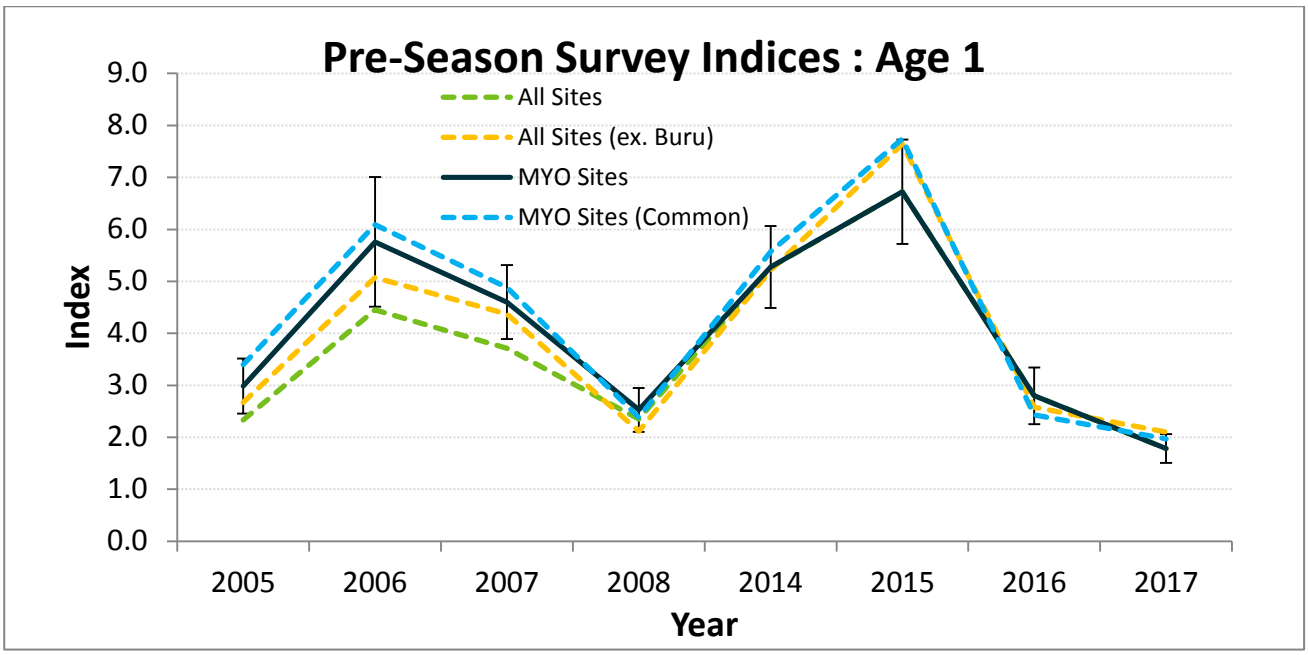


Figure 5-10. Four comparative indices of abundance of recruiting (1+) ornate rock lobsters (*Panulirus ornatus*) recorded during pre-season surveys in Torres Strait between 2005 and 2017 (note pre-season surveys were not conducted during 2009-2013). Error bars of MYO indices represent standard errors.

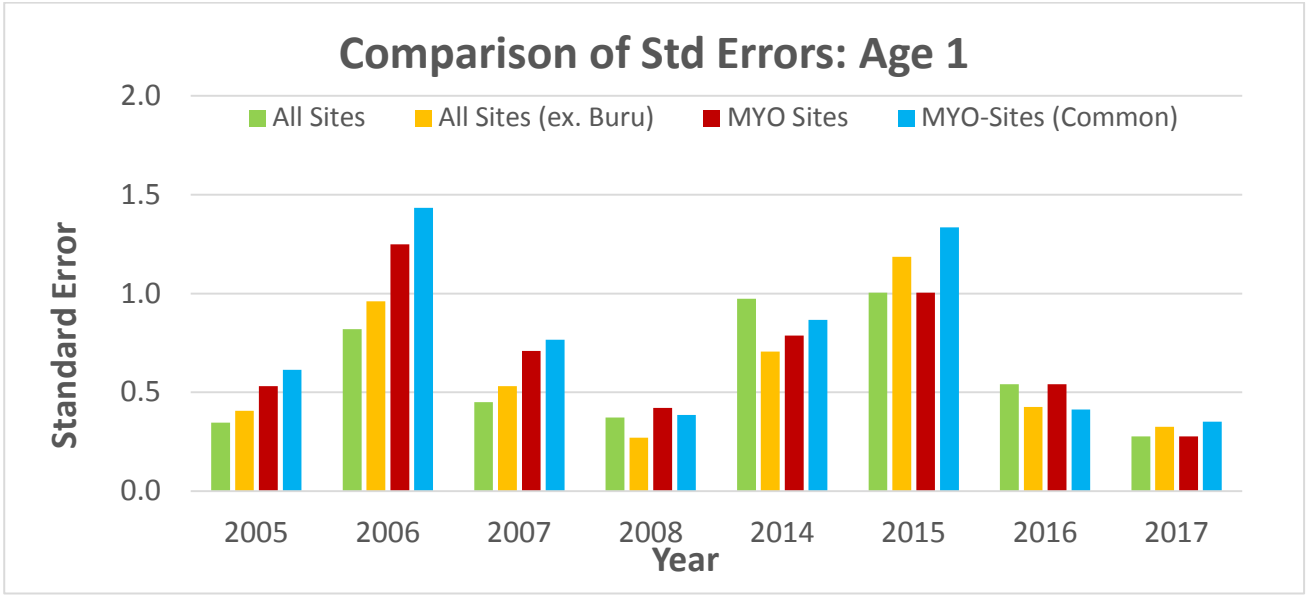


Figure 5-11. Comparative standard errors for four indices of abundance of recruiting (0+) ornate rock lobsters (*Panulirus ornatus*) recorded during pre-season surveys in Torres Strait between 2005 and 2017 (note pre-season surveys were not conducted during 2009-2013).

Size/Age Distribution of Sampled Lobsters

The size distribution of lobsters sampled during the 2017 pre-season survey was similar to previous surveys in that it was comprised mostly of (1+) lobsters, however significantly less recently-settled (0+) lobster were observed (Figure 5-12). Only 19 recently-settled lobster were observed in 2017 compared to 82 (2015) and 89 (2016). Of the 19 observed only 5 were captured and measured therefore the size frequency distribution for this age class is underrepresented compared to previous years. Although all (0+) lobsters observed during the pre-season surveys are recorded, it is not known how many are missed due to their small size and cryptic behaviour. Nevertheless, if the percentage of lobsters observed has remained constant throughout the study period, the density indices should be an indicator of relative recruitment strength one year in advance. Since 2014 there have been very few legal size (2+) lobsters in the sampled population. Further, the modal size of recruiting (1+) lobsters recorded since 2014 has been generally decreasing, although a comparable mean size was recorded in 2007.

The reason/s for the reduced size of lobsters in recent surveys are difficult to determine as both settlement timing and growth influence size distribution of the population. Climate change impacts have been implicated for other Australian lobster fishery impacts, both positive and negative, as well as for TRL (Plaganyi et al. 2017b). For TRL the recent high water temperatures may have impacted growth negatively, and habitat changes may have affected lobster prey items (e.g. demersal shell beds) and indirectly affected growth.

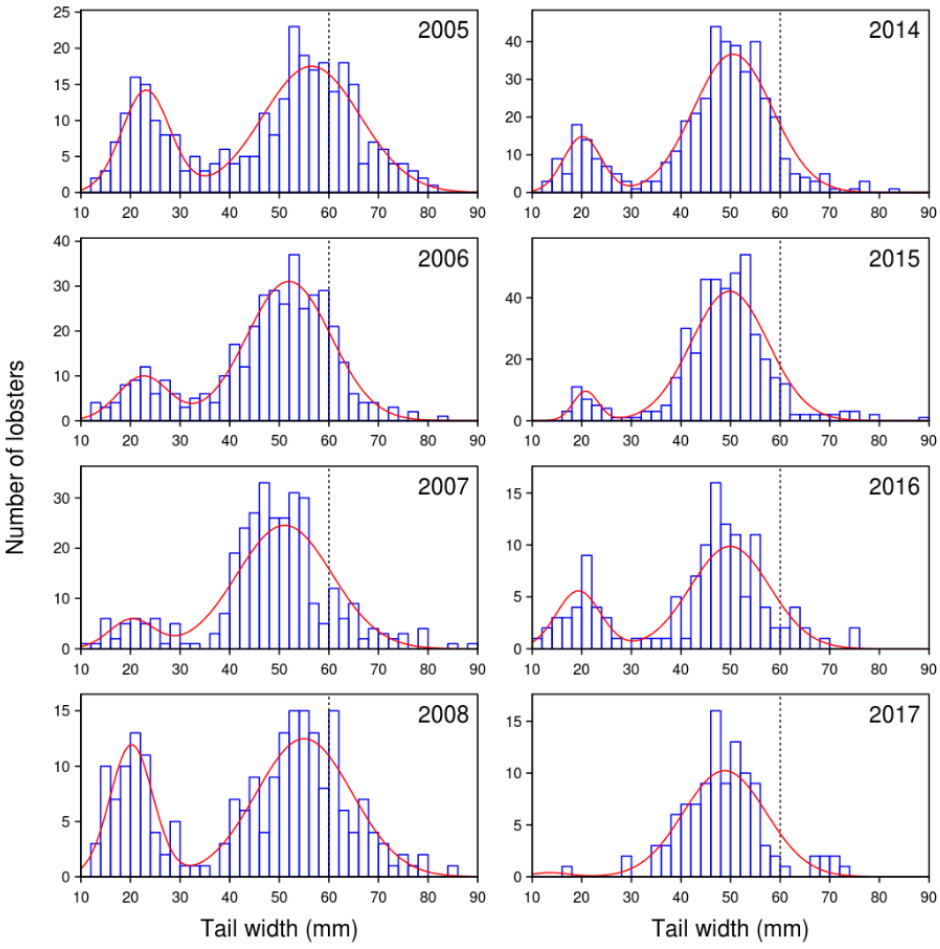


Figure 5-12. Length frequency distributions of lobsters (*Panulirus ornatus*) sampled during pre-season population surveys in Torres Strait in 2005-2008, 2014-2017. The dotted line represents the minimum legal size (90 mm CL ≈ 60 mm tail width).

Long-term Torres Strait Seabed Habitat Monitoring

The seabed habitat monitoring recorded during the previous mid-year surveys provided the longest time series of habitat trends. The trends in percent cover of seabed substrates recorded during mid-year population surveys between 1994 and 2014 showed a relatively consistent composition of sand/mud (Mean 56 %), declining composition of rubble (Mean 13%) and an increasing composition of hard substrate which includes consolidated rubble and limestone pavement (Mean 29 %) (Figure 5-13). Seagrass cover increased steadily during 2000 to 2010, and remained above the long-term average. Interestingly algal cover showed a steady decline throughout the period studied from approximately 20% to 10% (Figure 5-13). Overall the distribution of seabed habitats remained remarkably consistent throughout the study period, and apart from seagrass and algae, most habitats showed no declining or increasing trends indicative of longer term regional changes that might affect lobster abundance.

The consistency of seabed habitat distributions recorded during the benchmark 1989 and 2002 surveys further illustrated the consistency in habitat distribution in the medium term. However, recent bleaching events and high water temperature events suggest that this consistency may not continue and lobsters will be required to adapt to changing environmental conditions.

Although sand incursions were recorded at a number of transects during the 2015 pre-season population survey, particularly the southern survey stratum, the overall cover of sand at repeated sites in that year was the lowest recorded (Figure 5-14). The overall percent cover of sand returned to an average level in 2016 and remained at similar levels in 2017 (Figure 5-14) while regional differences for these years also seemed similar (Figure 5-15). Nevertheless, sand wave movements in Torres Strait have been rapid and continual to date and seabed communities are relatively well adapted to these incursions.

Overall seagrass and algal cover estimates between 2015 and 2017 were above the long-term average suggesting any sand incursions had not impacted the floral communities at the surveyed transects (Figure 5-14). Regionally there is evidence that there's more seagrass in 2017 compared to 2016 in TI Bridge and Mabuiag stratums (Figure 5-16).

Seabed habitat composition across the study area in 2017 appeared to be relatively consistent with that of previous years and there were no indicators to account for the low abundance of (0+) and (1+) lobsters. Further at a regional level seabed habitat in 2017 also appeared comparable to previous years. However, seabed habitats are dynamic in Torres Strait and localised changes reported by fishers could have occurred since the pre-season sampling. For example, fishers have reported good catches of (2+) lobster at the beginning of the 2018 season in reef passages north of Mabuaig and south of Turnagain (Buru) where they believe that sand has moved and exposed suitable lobster habitat. Nevertheless these recent changes would not account for the low 2017 pre-season abundance index.

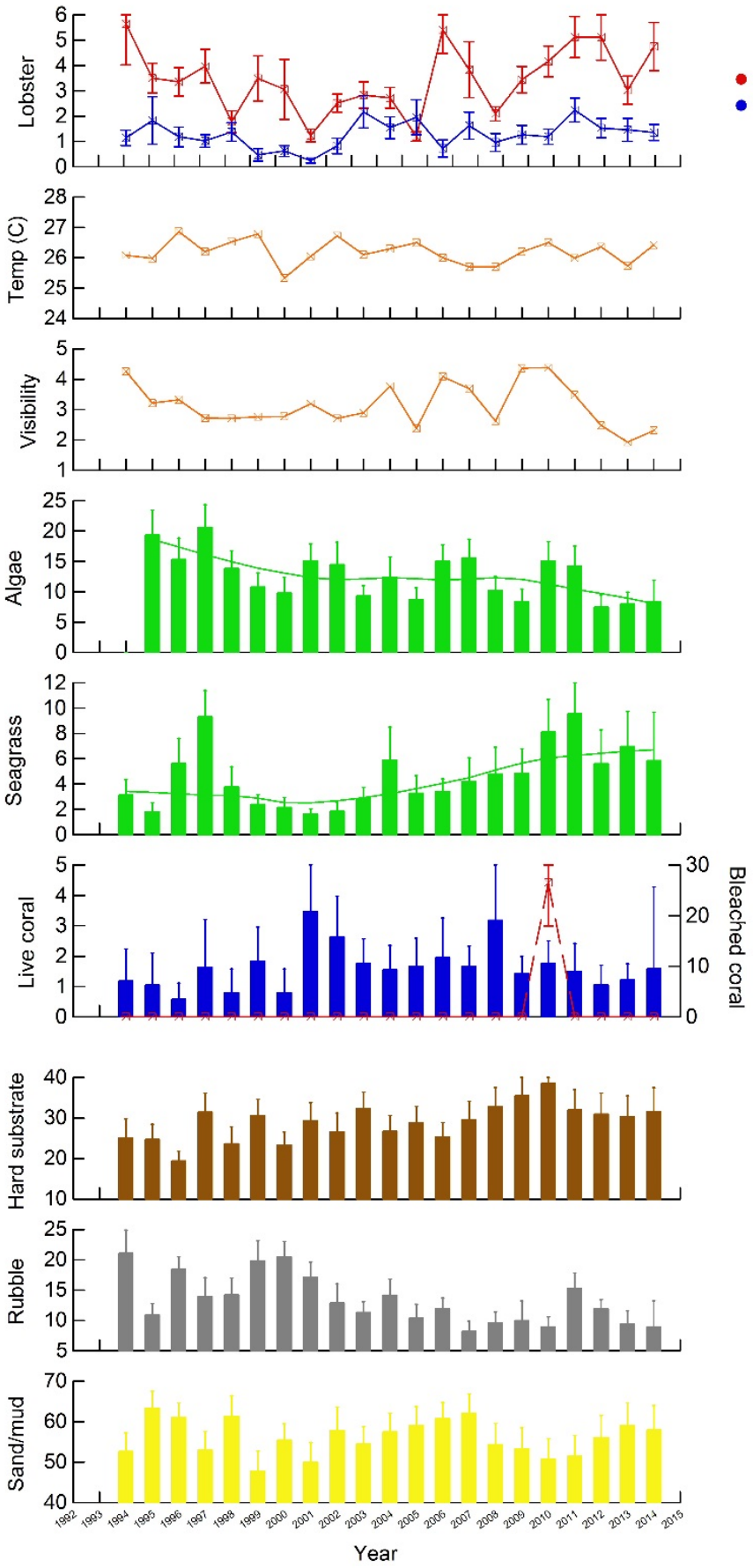


Figure 5-13. Mean percent covers of abiotic and biotic categories and lobster (*Panulirus ornatus*) indices recorded during mid-year population surveys in Torres Strait during 1994 to 2014. Error bars represent standard errors.

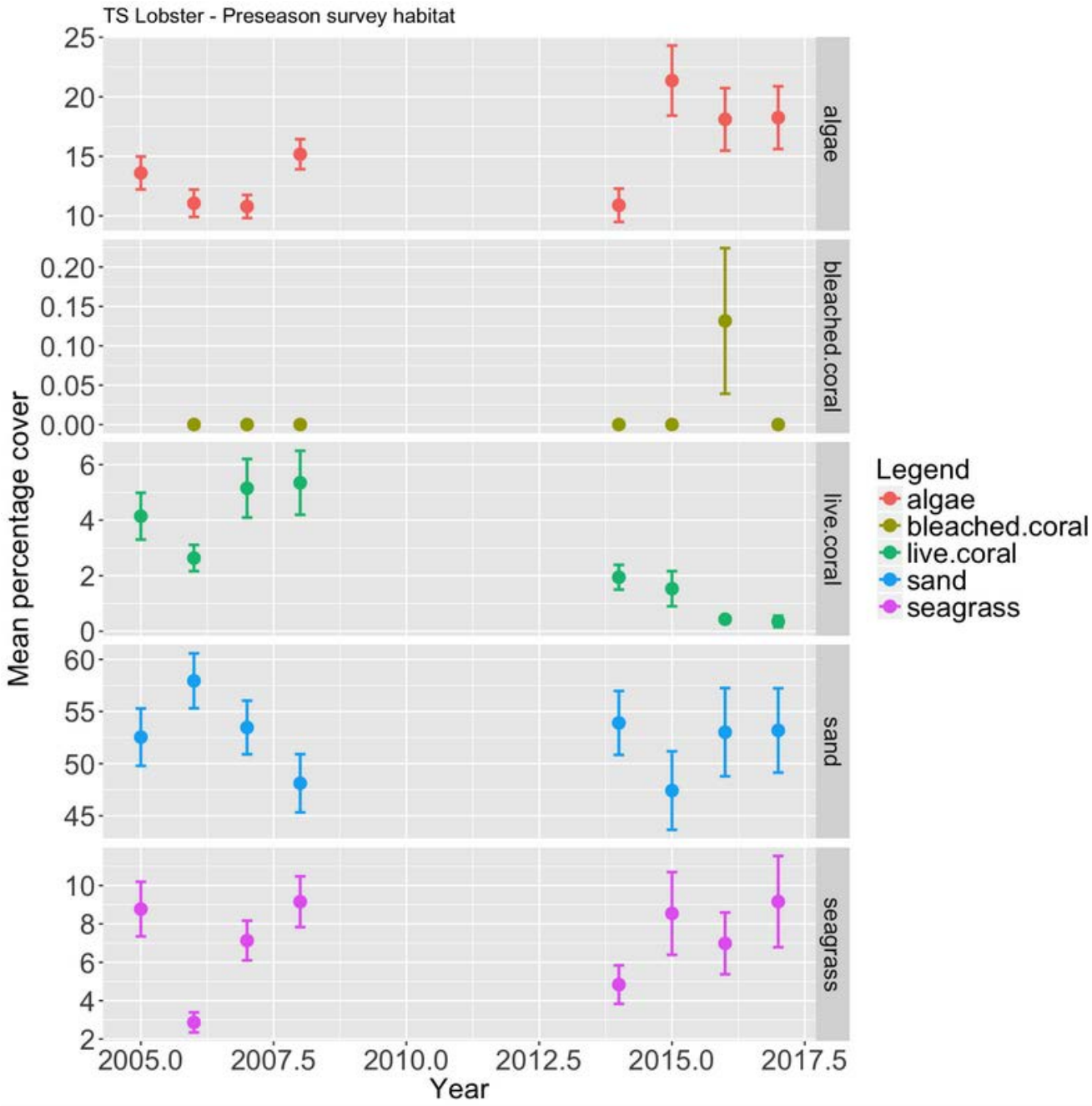


Figure 5-14. Mean percent covers of abiotic and biotic categories recorded during pre-season surveys in Torres Strait during 2005-2008; 2014-2017. Error bars represent standard errors.

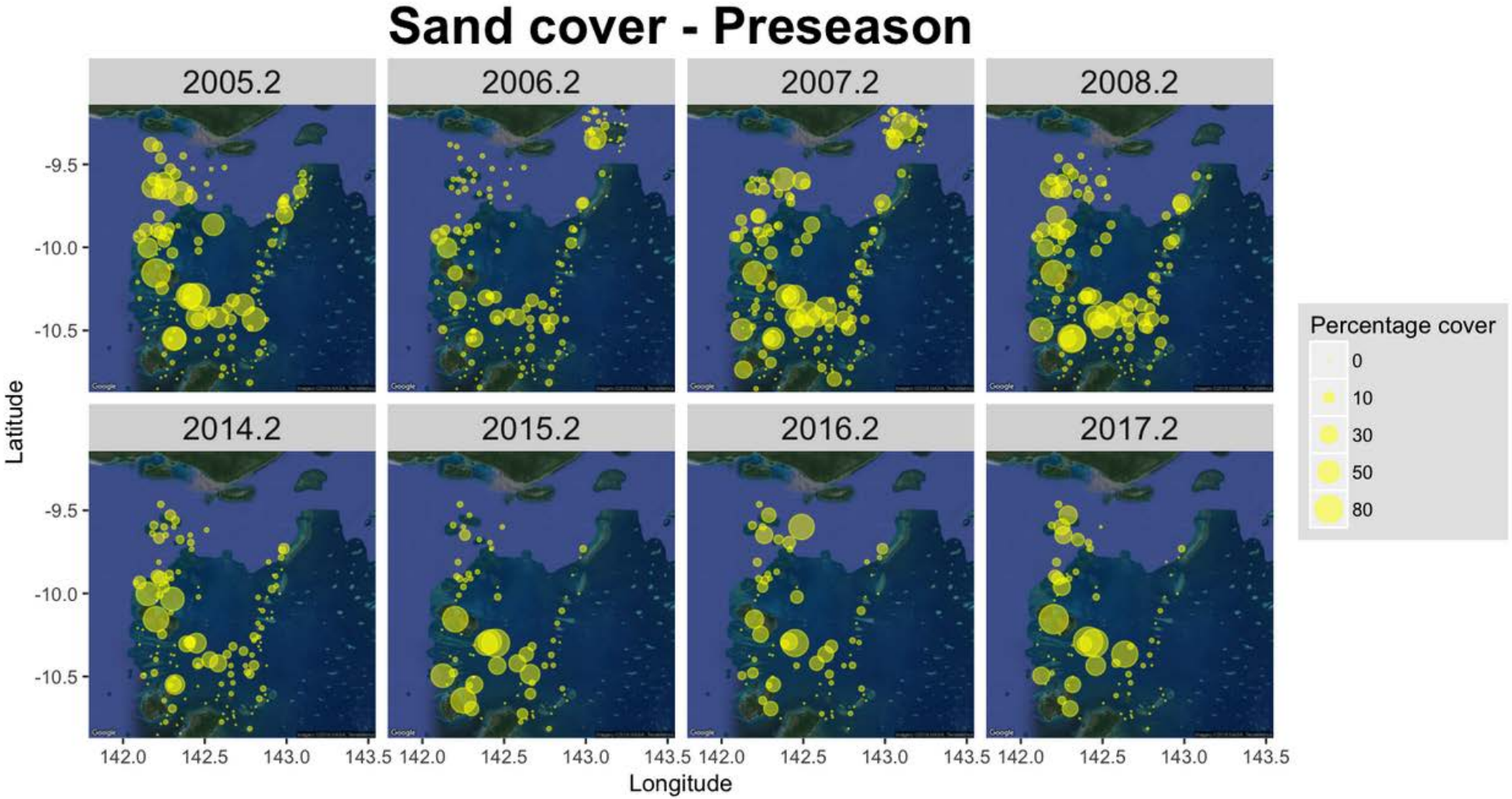


Figure 5-15. Percent cover of sand recorded during pre-season surveys in Torres Strait during 2005-2008; 2014-2017.

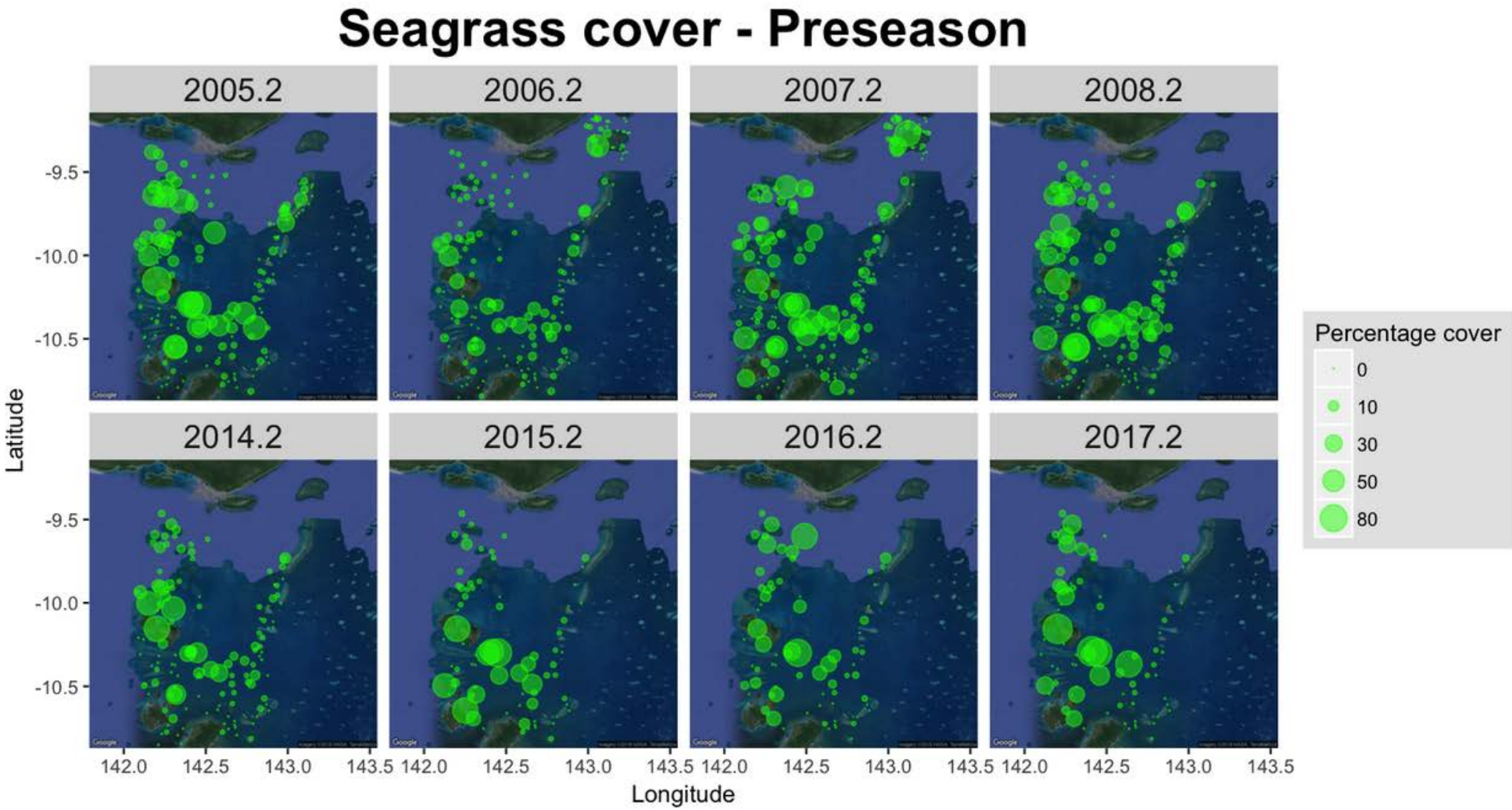


Figure 5-16. Percent cover of seagrass recorded during pre-season surveys in Torres Strait during 2005-2008; 2014-2017

5.3 Discussion

The 2017 pre-season survey was completed successfully within the expected timeframe despite some inclement weather towards the end of the survey. The results from this survey were presented at the TRL RAG meeting in Cairns on 12 December 2017, to provide stakeholders with the updated stock assessment and the revised recommended biological catch for 2018. The survey results indicated that the recruiting (1+) lobster abundance indices had fallen for a second consecutive year and was the lowest of the eight pre-season surveys conducted since 2005. Further, the modal size of recruiting lobster has been reduced since 2014. The recently-settled (0+) lobster index was also the lowest recorded by some margin. The reduced survey abundance indices and low estimated spawning biomass resulted in a low RBC for the 2018 season causing concern amongst TRL stakeholders. The habitat data collected during the surveys has remained reasonably constant over time and does not appear to explain the low recruiting lobster index. Other environmental factors such as high temperatures in 2015 coupled with fishing of migrating lobster may have affected spawning numbers, larval survival and recruitment over the last few years.

The 2017 stock-recruit residual is again seen to be lower than the average value, and is lower than that estimated for at least the past decade. Applying the reference case model straightforwardly with the updates as described, suggests a RBC (2018) of 299t [90% CI 196-401t]. The stock is currently estimated to be at 76% of the pristine (1973) spawning biomass level but is expected to fluctuate widely about the average target spawning biomass level, and to decline further in 2018 (down to 59%).

Phasing out of the mid-year surveys has placed greater reliance on TVH and TiB sector CPUE in providing relative abundance data for the fished (2+) year classes. The recent research to standardise these data has improved the reliability and accuracy of the CPUE indices and the strong correlation obtained in previous work between the TVH and TiB CPUE estimates and the (2+) year class indices from the mid-year surveys suggests that CPUE data are a viable alternative for indexing the spawning biomass. However, the pre-season survey does not allow cross-checking of spawning biomass trends (as large animals have mostly migrated out the area at that time) and hence a mid-year survey could be considered at times to independently validate the CPUE trends and increase understanding of stock dynamics.

Chapter 6 Updated Assessment of the Tropical Rock Lobster (*Panulirus ornatus*) Fishery in Torres Straits following November 2017 Preseason survey

6.1 Summary

This document summarises the post-Nov 2017 preseason survey update of the integrated stock assessment model presented at the December 2017 TRLRAG. The TRLRAG agreed that if the fishery transitions to using an empirical Harvest Control Rule (eHCR) to inform the Recommended Biological Catch (RBC), then the stock assessment would only need to be conducted every three years. However until such time as this is formally adopted, the stock assessment model is being used to inform the RBC for the tropical rock lobster *Panulirus ornatus*.

The data updates include the latest (Nov 2017) pre-season survey results (Chapter 5), the catch total for 2017 (Chapter 1) and revisions and updates to the commercial CPUE (TVH & TIB) data series (Chapters 2-4). The full details of the stock assessment model are provided in this report.

The model predictions for 2018 are not optimistic because they are based mostly on the preseason survey 1+ index, which is the lowest of the 8 values recorded thus far. Note that the model results presented here are fitted to the preseason survey index based on midyear sites only.

The model fits the 1+ Preseason survey data reasonably well, but overestimates the 0+ index for 2017. The model reasonably fits the recent CPUE series for both sectors, but is unable to satisfactorily fit the 2015 CPUE data for TVH in particular. The potential reasons for this are discussed in more detail in Plagányi et al. (2015a,b). Anomalous environmental changes almost certainly caused a change in catchability in 2015, but there is also likely to have been an impact of changes in lobster habitat on their survival and productivity, but there are no data available to assist in separating the effect of changes in catchability and survival on the overall catches for 2015 (noting that the total catch was higher than initially expected due to trawling catches). The model assumes constant annual natural mortality, and hence cannot straightforwardly model the change in catchability and/or survival without additional information, and hence the Reference Case model has not included any *ad hoc* adjustments, but these could be further investigated via sensitivity analyses.

The Reference case model presented here is fitted to the TVH CPUE Main Effects Int1 option and the standardised Seller+QA CPUE TIB series. There isn't much difference between the alternative CPUE standardisations.

The 2017 stock-recruit residual is again seen to be lower than the average value, and is lower than that estimated for at least the past decade. Applying the reference case model straightforwardly with the updates as described, suggests a RBC (2018) of 299t [90% CI 196-401t]. The stock is currently estimated to be at 76% of the pristine (1973) spawning biomass level but is expected to

fluctuate widely about the average target spawning biomass level, and to decline further in 2018 (down to 59%).

The previous assessment suggested that there are indications that 2018 will be a below-average year with a consequent low RBC value recommended by the TRLRAG.

6.2 Introduction

A new stock assessment model (termed the "Integrated Model") (Plagányi *et al.* 2009) was developed in 2009 for the following reasons:

- the new model facilitates the move to a quota management system, in that it integrates all available information into a single framework to output a RBC;
- the new model addresses all of the concerns highlighted in a review of the previous stock assessment approach (Bentley 2006, Ye et al. 2006, 2007);
- the new model incorporates the Pre-Season survey data as well as CPUE data available from the TVH sector;
- the growth relationships used in the model were revised;
- the new model is of a form that could be used as an Operating Model in a Management Strategy Evaluation (MSE) framework, given that the need for a MSE to support the management of the TRL fishery was identified by the TRL RAG.

The model outputs a single RBC (with Confidence Interval) for each year, which is an integrated estimate that takes into account all available sources of information. The Integrated Model is a widely used approach for providing TAC advice with associated uncertainties. More formally, it is a Statistical Catch-at-Age Analysis (SCAA) (e.g. Fournier and Archibald 1982). This paper summarises the revised 2016 model assessment using the 2016 pre-season survey data.

The revised Reference Case includes the following specifications (see Plagányi et al. 2010):

- fitting to the CPUE data assuming a hyperstable relationship (with hyperstability parameter 0.75), and setting a lower bound of 0.15 (value selected by TRLRAG in 2013) to the variance associated with the CPUE data because it is less reliable than the survey data;
- increasing the stock recruit variance parameter from 0.3 to 0.5 to capture larger fluctuations in recruitment;
- estimating a different selectivity for the 1973-1988 period;
- using as the new Reference spawning biomass level the annual biomass of mature lobsters on 1 November each year i.e. at the start of the annual migration period;
- estimating the 2017 recruitment residual;
- the use of historic information to permit estimation of a large recruitment event that is known to have occurred in 1988, the year before the long-term surveys commenced. This is an important development as if this good recruitment is not accounted for in the model, the model tries to reconcile the subsequent dynamics by over-estimating the pristine stock size.

In addition, in response to review comments in 2012, the following changes are also implemented:

- there is no lower limit on the sigma parameter associated with fitting to the catch at age information;
- the fitting to the commercial catch-at-age information ignores the years when there are no true data;
- given there are catch-at-age data for the pre-1989 period, recruitment residuals are estimated for all years from 1985.

More recently, the following changes have been made:

- the model is fitted to the new standardised TIB CPUE series, in an analogous manner to the method to fit the TVH CPUE data, and hence assuming a hyperstable relationship (with hyperstability parameter 0.5) and setting a lower bound of 0.15.
- the historic catch estimates have been reanalysed resulting in some changes which are incorporated in the revised model;
- the model fits to the historical midyear survey series for the two age classes separately rather than as a combined series (and including fitting to the age proportions).

Finally, the TRLRAG agreed to use as the Reference Case model a version with the main effects interaction 1 TVH CPUE data and the standardised Seller&QA scenario TIB CPUE data.

6.3 Objectives

This document describes an update of the TRL stock assessment model using the results of the preseason survey conducted in November 2017.

6.4 Methods

The model details are given in Appendix E of this document. A summary of the input catch data is shown in Table 6-1. The footnote also describes catch estimates used in an alternative sensitivity analysis. The latest November 2017 Pre-season survey (Chapter 5) is included in the model. The historical mid-year survey data are shown in Table 6-2. The commercial catch-at-age data have been updated and the revised series is shown in Table 6-3.

The model uses the latest revised historical catch estimates. As previously, the trawl catch has been separated from the other catches because of differences in the selectivity / targeting of the trawling sector which was focused predominantly on migrating 2+ lobsters. This is important because in the early years the trawling catch comprised 35 – 90% of the total TRL catch (Table 6-1). If recent trawling catches continue, then the model will need to similarly account for these separately to the total catch.

The TVH CPUE data input series have been revised and updated for the period 1989-2017 and TIB for 2004-2017 (Chapters 2-4, Campbell *et al.* 2017a,b).

The model is fitted to additional historical information as described in Plagányi et al. (2010). An adjustment has been made to the model to allow use of a separate selectivity function to be applied to the period 1973 to 1988, prior to the introduction of a MLS of 100mm TL in July 1988.

The model already accounts for the subsequent size limit change to 115mm in 2002. Background information on the above specifications is given in Plagányi et al. (2010) and this document.

The relationship between stock abundance and CPUE was explored, and found to be better represented by a hyperstable relationship, than the assumption that CPUE is proportional to stock abundance (see e.g. Harley *et al.* 2001). Based on additional sensitivity tests that were conducted, the Reference case model therefore uses a power curve with a hyperstability shape parameter of 0.75. This suggests that CPUE remains high while stock abundance declines. This is consistent also with results from considering an ecometric production function approach (Pascoe et al. 2013). In addition, the MSE and production function analyses (Pascoe et al. 2013, Plagányi et al. 2012, 2013) suggested that the TIB CPUE relationship was characterized by a greater degree of hyperstability, and hence the Reference case model uses a power curve with a hyperstability shape parameter of 0.5, and sensitivity to alternative choices of this value were tested but don't have a large effect on model outputs.

Table 6-1. Lobster catches (tonnes whole weight) landed in different jurisdictions from 1973 to 2017. Catches comprised of both whole animals and tails have been converted into units of whole mass using the conversion ratio of 1kg tail=2.677 kg live.

YEAR	TIB	TVH	AUS_DIVERS	AUS_TRAWL	PNG_DIVERS	YULE_DIVERS	PNG_TRAWL	TS_TOTAL
1973			0	0	54	19	562.2	635.2
1974			0	0	75	83	107.1	265.1
1975			0	0	62	13	214.2	289.2
1976			0	0	48	0	262.3	310.3
1977			0	0	72	35	131.2	238.2
1978			296.1	0	43	3	187.4	529.5
1979			308.5	0	56	13	0	377.5
1980			328.4	21	94	3	588.9	1035.3
1981			495.1	131	96	3	262.3	987.4
1982			669.2	201	102	3	398.9	1374.1
1983			432.9	139	86	0	112.4	770.3
1984			330.9	8	86	0	29.4	454.3
1985			537.4	24	187	16	0	764.4
1986			890.6	21	198	62	0	1171.6
1987			622	0	128	54	0	804
1988			537.4	0	150	5	0	692.4
1989			651	0	211	24	0	886
1990			490.1	0	158	0	0	648.1
1991			444.1	0	168	0	0	612.1
1992			423.2	0	134	0	0	557.2
1993			505.7	0	166	0	0	671.7
1994		123	577.8	0	247	0	0	824.8
1995		101	556.9	0	257	0	0	813.9
1996		226.9	584.1	0	228	0	0	812.1
1997		275	653.1	0	241	0	0	894.1
1998		329.6	661.4	0	201	0	0	862.4
1999		95.1	409.6	0	163	0	0	572.6
2000		128.9	418	0	235	0	0	653
2001	52	69.1	121.1	0	173	0	5.4	299.5
2002	68	147.7	215.7	0	327	0	42.8	585.5
2003	123	361.4	484.4	0	211	0	5.4	700.8
2004	232	481.1	713.1	0	182	0	0	895.1
2005	358.5	545	903.5	0	228	0	0	1131.5
2006	146.9	135.4	282.3	0	142	0	0	424.3
2007	260.1	268.6	528.7	0	228	0	0	756.7
2008	184.9	100.4	285.3	0	221	0	0	506.3
2009	143.9	91.1	235	0	161.4	0	0	396.4
2010	141.2	282.6	423.8	0	292.8	0	0	716.6
2011	201.2	503.5	704.7	0	165	0	0	869.7
2012	136.4	370.5	506.9	0	173.7	0	0	680.6
2013	146.1	361.7	507.8	0	108.3	0	0	616.1
2014	204.6	273.2	477.8	0	151.4	0	109.8	739
2015	196.3	152.7	349	0	235.7	0	0	584.7
2016	266.1	243.7	509.8	0	248	0	0	757.8
2017	106.4	149	255.4	0	113	0	0	368.4

*Sensitivity analysis uses alternative estimates for PNG for 2015 and 2016, of 157.4 and 131.3 t respectively, yielding totals for these years of 506.4t and 641,1t

Table 6-2. Mid-year survey data summary for the period 1989-2014. Indices reflect abundance.

	Age 1+	S.E.	Age 2+	S.E.
1989	0.059	0.243	0.093	0.305
1990	0.619	0.787	0.077	0.277
1991	0.294	0.542	0.118	0.344
1992	0.585	0.765	0.449	0.670
1993	0.238	0.488	0.108	0.329
1994	2.637	1.624	0.092	0.303
1995	0.349	0.591	0.891	0.944
1996	0.314	0.560	0.15	0.387
1997	0.453	0.673	0.062	0.249
1998	0.186	0.431	0.129	0.359
1999	0.799	0.894	0.059	0.243
2000	1.411	1.188	0.05	0.224
2001	0.061	0.247	0.009	0.095
2002	0.124	0.352	0.096	0.310
2003	0.271	0.521	0.41	0.640
2004	0.169	0.411	0.184	0.429
2005	0.033	0.182	0.471	0.686
2006	0.87	0.933	0.113	0.336
2007	1.21	1.100	0.287	0.536
2008	0.079	0.281	0.125	0.354
2009	0.274	0.523	0.139	0.373
2010	0.372	0.610	0.09	0.300
2011	0.659	0.812	0.217	0.466
2012	0.823	0.907	0.143	0.378
2013	0.309	0.556	0.206	0.454
2014	0.903	0.950	0.102	0.319

Table 6-3. Summary of commercial catch at age information from 1989 to 2017.

Year	Proportion 1+	Prop age 2
1989	5.87	94.13
1990	11.13	88.87
1991	24.84	75.16
1992	24.57	75.43
1993	20.83	79.17
1994	25.99	74.01
1995	21.62	78.38
1996	25.28	74.72
1997	28.4	71.6
1998	16.87	83.13
1999	30.94	69.06
2000	-	-
2001	-	-
2002	-	-
2003	-	-
2004	2.5	97.5
2005	1.2	98.8
2006	6.72	93.28
2007	1.49	98.51
2008	5.38	94.62
2009	0.71	99.29
2010	6.74	93.26
2011	0.89	99.11
2012	7.24	92.76
2013	5.82	94.18
2014	1.96	98.04
2015	1.76	98.24
2016	1.5	98.5
2017	1.33	98.67

6.5 Results

Model fits

The fits of the Model to all available data sources are shown in Figure 6-1 to Figure 6-9. The results are shown primarily for the TRLRAG Reference Case. The starting number of lobsters is estimated and Figure 6-1 compares the benchmark survey (Ye et al. 2004) observed total lobster abundances in 1989 and 2002 with the corresponding model estimates. The Integrated model is fitted to the survey midyear index of abundance (in terms of total numbers of 1+ and 2+ lobsters) (Figure 6-2). The deterioration in the fit for the last year (2014) of the series was because of a conflict with the more reliable and lower estimate that same year based on the Preseason survey. The observed and model-predicted proportions in each age class are compared in Figure 6-3.

The model fits to the catch at age data are adequate (Figure 6-4). The variability in the lobster age groups is well captured and the model reflects the post-2001 (increased size limit) decrease in the relative proportion of 1+ lobsters that are caught.

There were eight data points available from the Pre-season survey for the TRLRAG Reference Case, and the model was fitted to data on both 0+ and 1+ abundance, with a close fit evident for the 1+ (Figure 6-5). The fit is better for the 1+ age group than the 0+ age group, but incorporation of the latter assists in strengthening prediction of future lobster abundance, even given the fairly large uncertainty associated with these estimates. The model doesn't fit the 2017 0+ index as the variability associated with this value is high and the model likelihood contribution is weighted by the inverse of the variance (see Appendix E). The model estimate of 0+ in 2017 is therefore higher than the survey observation, suggesting the model forecast of 1+ numbers for 2018 will be similarly unreliable, and possibly positively biased.

Comparisons between CPUE data from the TVH sector (in kg per tender-day from 1994 to 2017) (standardised as described in Chapter 3) and corresponding model-predicted estimates are shown in Figure 6-6a (when fixing the lower bound of sigma at 0.15). Similarly, Figure 6-6b shows the fit to the standardised CPUE TIB data as described in Chapter 4. The Reference Case assumes a hyperstable relationship between biomass and CPUE (TVH) as follows (Figure 6-6c):

$$\left(\frac{C}{E}\right)_y^{TVH} = q_{TVH}\left(B_y^{ex}\right)^{0.75}$$

And similarly for the TIB CPUE data:

$$\left(\frac{C}{E}\right)_y^{TIB} = q_{TIB}\left(B_y^{ex}\right)^{0.5}$$

Comparison between historic data and model estimates of the proportions of 1+ and 2+ lobsters in the catch is shown in Figure 6-7. The fit in the early years is reasonably good, with the later deviations in the fit partly a result of a slight conflict between these data and the catch at age data.

The fitted stock-recruit relationship from the Reference-case model version is shown in Figure 6-8, which also highlights the spawning stock biomass estimates in recent years. The stock-recruit residuals are shown in Figure 6-9, from which it is clear that recruitment has been high over the recent period but has declined substantially during the past two years. There is considerable variation about the stock-recruit curve (as is expected), but nonetheless there is some support for an underlying stock-recruit relationship.

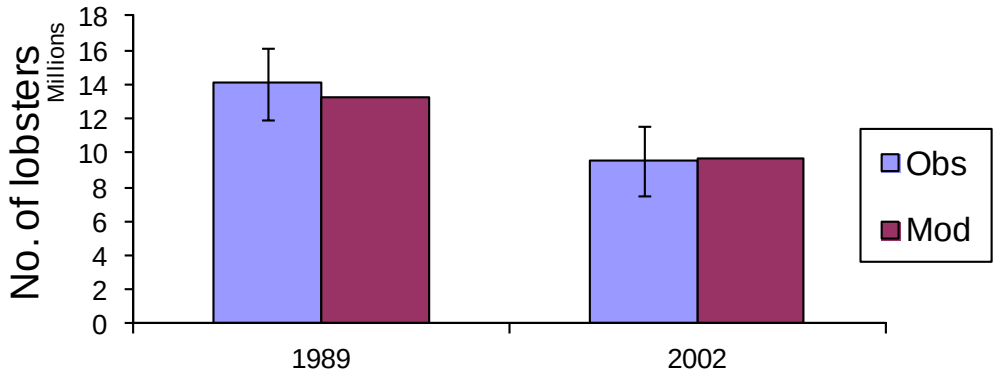
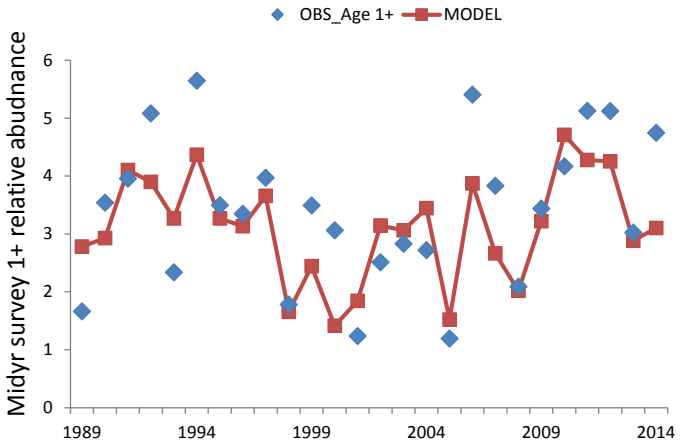
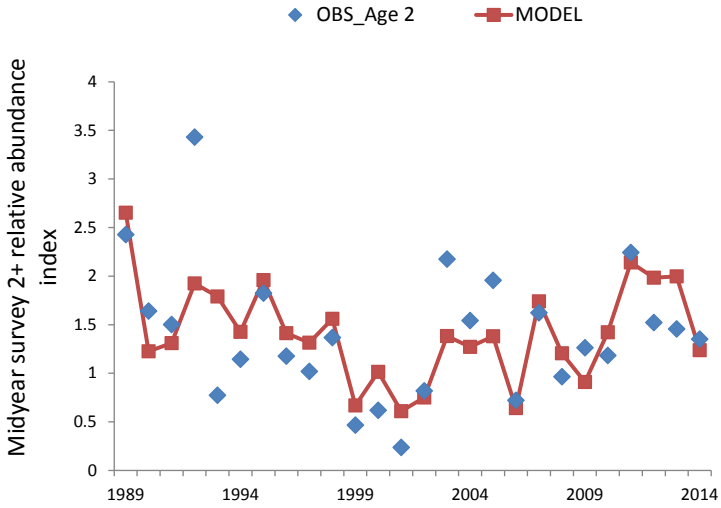


Figure 6-1. Comparison of benchmark survey observed lobster total abundance (with standard errors) and corresponding Reference Case model-estimates of abundance.





Fit shown when combining total numbers from survey

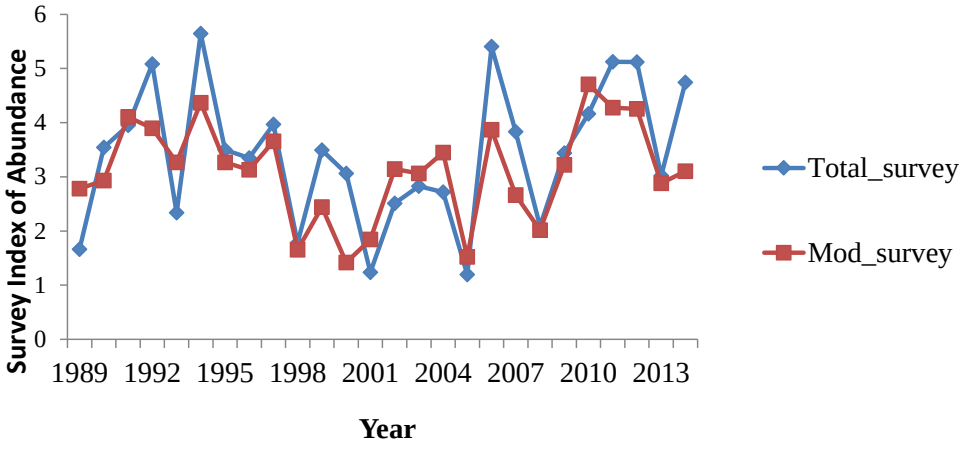


Figure 6-2. Comparison between survey midyear index of abundance (in terms of total numbers of 1+ and 2+ lobsters) compared with the corresponding model-estimated values for TRLRAG Reference Case.

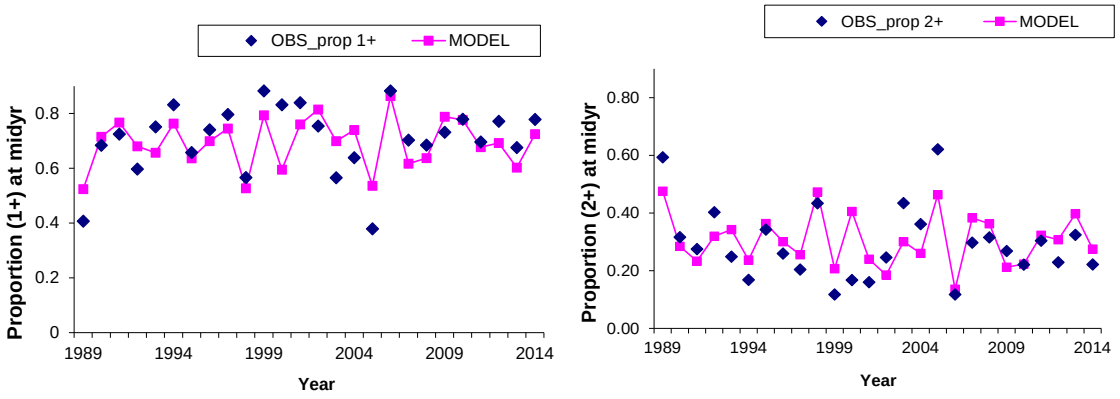


Figure 6-3. Comparison between observed and model-predicted proportions of 1+ and 2+ lobsters in the midyear survey.

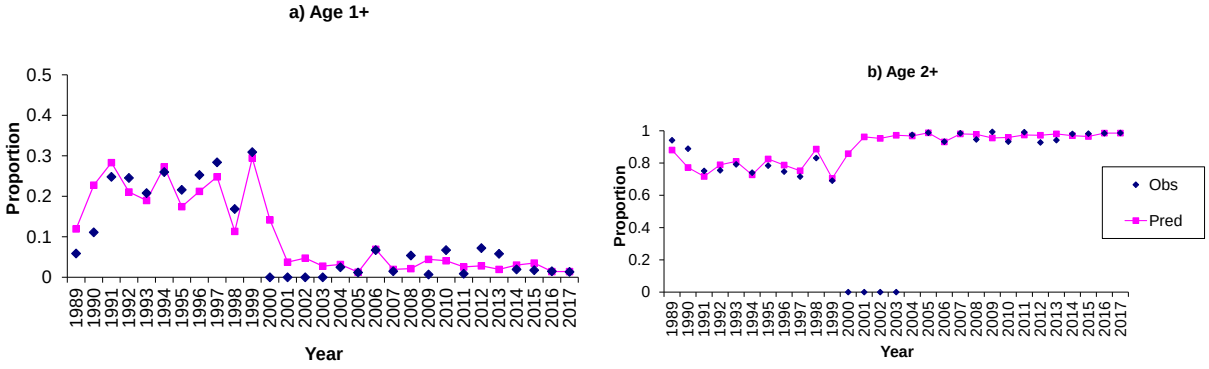
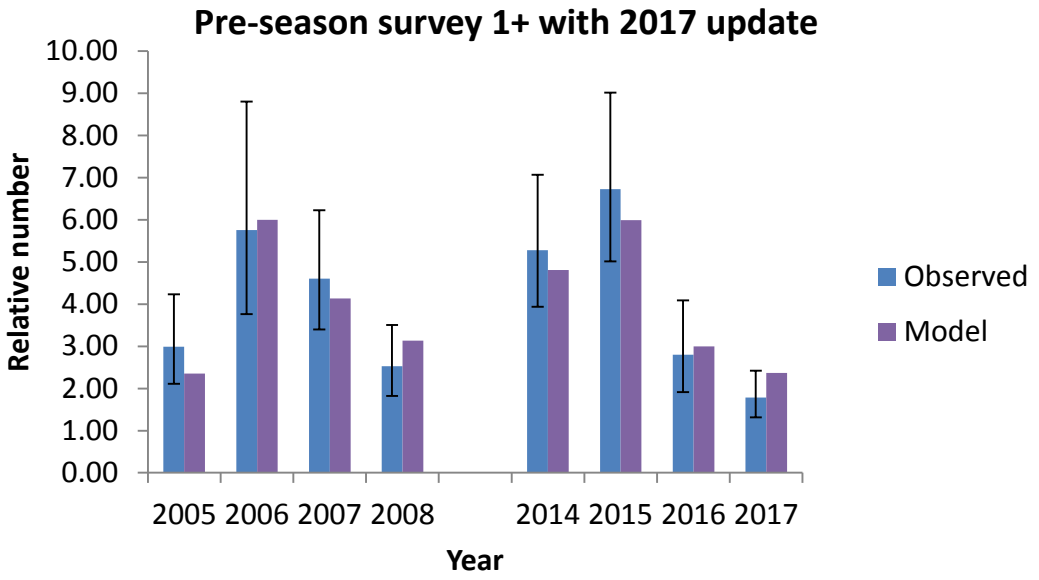


Figure 6-4. Comparison between available commercial catch-at-age data and corresponding model-predicted estimates.

(A)



(B)

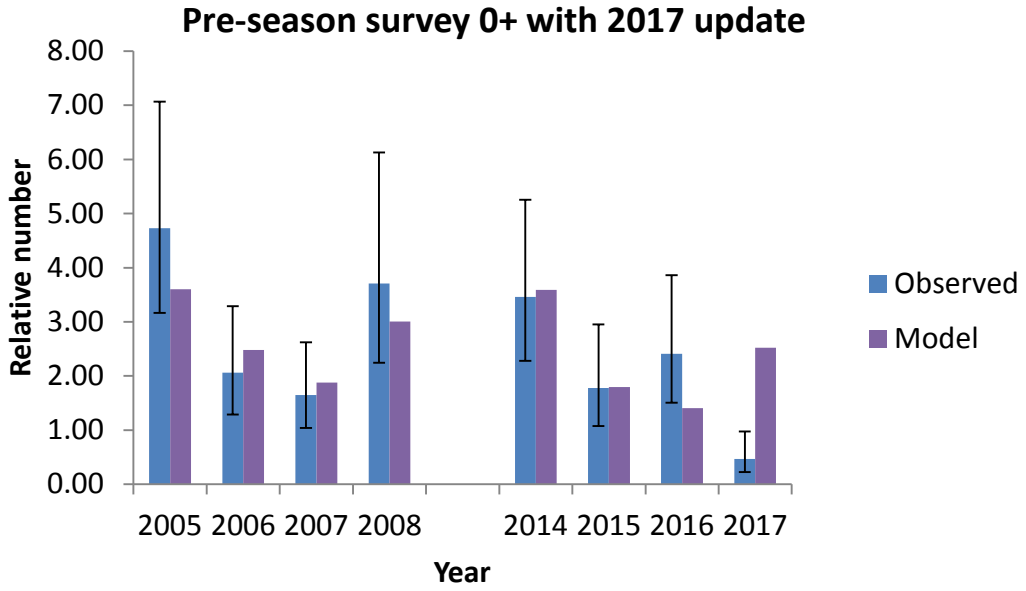
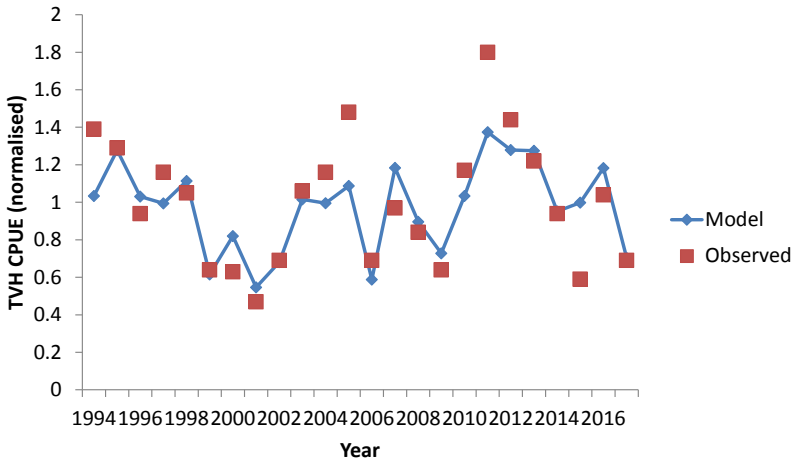
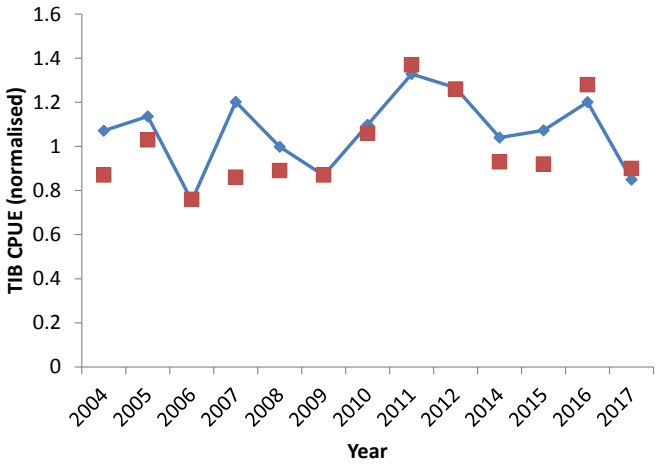


Figure 6-5. Comparison between observed Pre-season survey data (expressed in terms of number * 104) and corresponding (A) 1+ and (B) 0+ model-predicted estimates for TRLRAG Reference Case.

a) FIT TO TVH CPUE (sigma lower bound = 0.15); MAIN EFFECTS Int1 MODEL



b) FIT TO TIB CPUE (sigma lower bound = 0.15); TIB Seller&QA



c) HYPERSTABLE RELATIONSHIP

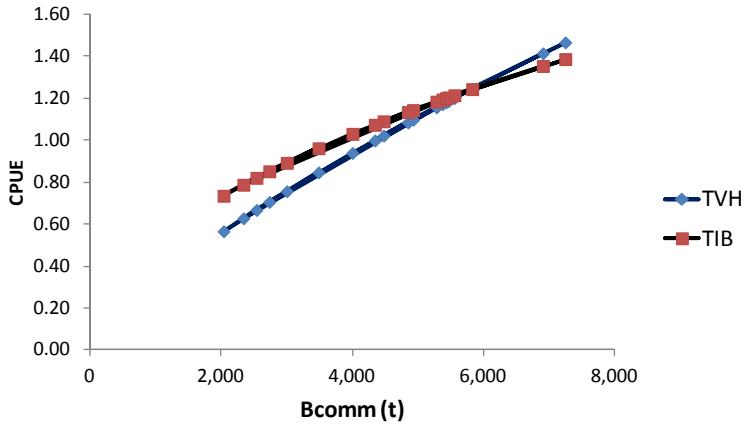


Figure 6-6. Comparison between CPUE data and corresponding model-predicted estimates. The plots are respectively a) Reference-Case fit to CPUE standardised estimates from the TVH sector with lower bound for sigma set at 0.15, b) fit to TIB CPUE standardized estimates available from 2004-2017; and c) plot of the hyperstable relationship (with power shape parameter 0.75 and 0.5 respectively) between CPUE and exploitable biomass for the TVH and TIB sectors.

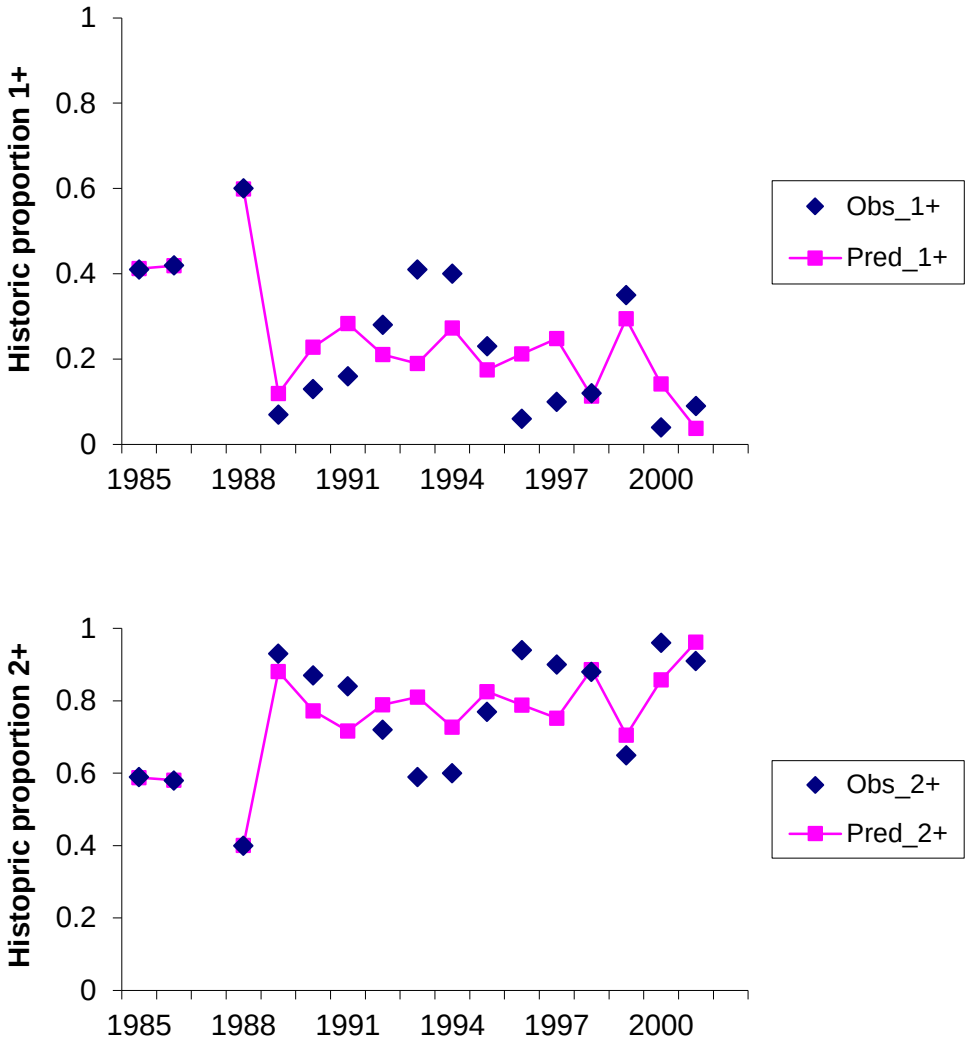


Figure 6-7. Comparison between historic data and model estimates of the proportions of 1+ and 2+ lobsters in the catch.

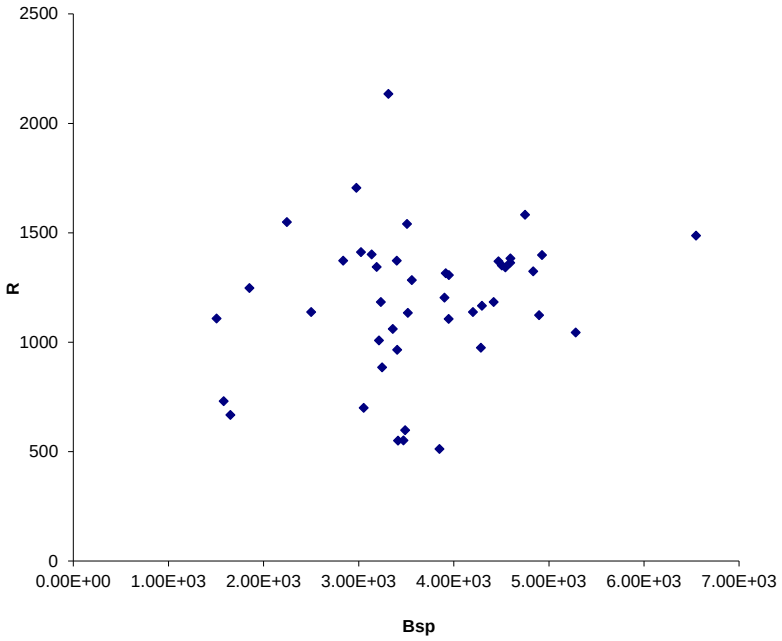


Figure 6-8. Integrated model stock recruitment relationship showing relative number of recruits R as a function of the spawning biomass Bsp.

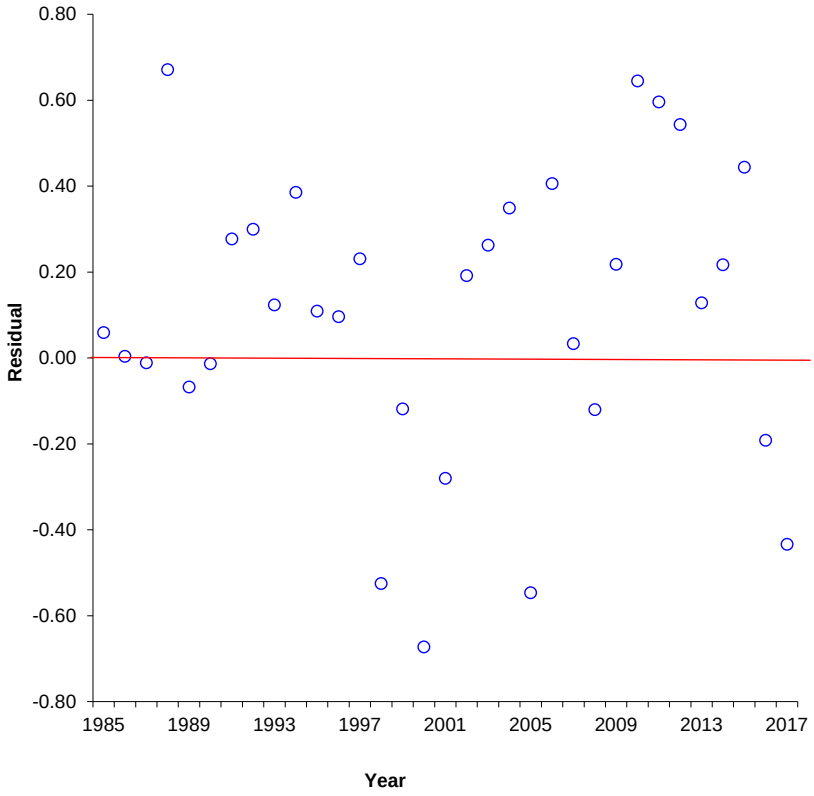


Figure 6-9. Plot of stock-recruit residuals. Note the low 2016 and 2017 residuals

Estimates of model parameters

A full set of model parameter estimates, depletion statistics and likelihood contributions for the TRLRAG Reference Case including 2017 Pre-season survey and a sensitivity using the alternative catch inputs for 2015-16 is shown Table 6-4. In all cases the 90% Hessian-based Confidence Intervals (CI) are given alongside. The new Integrated model estimates a total of 38 parameters, namely the starting biomass $B(1973)^{sp}$, natural mortality *M*, 1+ selectivity for the 1973-1988, 1989-2001 and post-2002 periods, and 33 stock-recruit residuals. The steepness parameter *h* could not be precisely estimated as the confidence interval associated with the previous estimate is very wide hence steepness *h* is fixed in the Reference Case at 0.7, based on the median of a fisheries database (Myers et al. 1995). However sensitivities to this are also tested given previous assessments suggesting *h* may be lower. The natural mortality estimate of 0.69 [90% C.I. 0.57 – 0.82] year^{-1} is reasonably estimated.

Full selectivity of the 2+ age class is assumed given they are the target of the fishery and are assumed caught before the end of September, before they migrate out the Torres Straits. Selectivity of 1+ lobsters is substantially less because they are usually only susceptible to fishing after September and not all individuals will have attained the minimum legal size by that time. The selectivity coefficient for age 1+ lobsters was 0.43 for 1973-1988, 0.16 for the period of 1989-2001 and 0.02 for the remaining years. As expected, the decrease in selectivity during the recent time period is a consequence of a change in management measures having been introduced in 2002, which included an increase in the minimum legal size (to 115 mm tail length), a 4-month extension of the hookah ban (October to January) and a 2-month fishing closure (October-November) (Ye et al. 2006).

Following from the above, the level of fishing mortality on age 1+ lobsters is expected to be substantially less than that on age 2+ lobsters (Figure 6-10), with a decreasing trend evident following the implementation of the new management measures in 2002. The fishing mortality rate for age 2+ lobsters ranged from 0.09 year^{-1} to 0.27 year^{-1} (Figure 6-10), with a historic average (from 1989) of 0.15 year^{-1}. The target fishing mortality rate is 0.15 year^{-1}. The 2017 catch of 368t was assessed to have been only slightly below the target fishing mortality rate (0.14) whereas the 2014 catch (that included trawling) was substantially greater than the target rate (0.20).

The fishing mortality estimates above refer to the combined estimate when lumping all TRL catches in the Torres Straits, except the trawling sector (Australian and PNG combined) catches. The latter are assumed to target 2+ lobsters only and were substantial in the early years (1973 – 1984) Figure 6-11, with small catches taken during the period (2001-2003) and zero values for all other years, except for some recent reports that are under discussion by the TRLRAG.

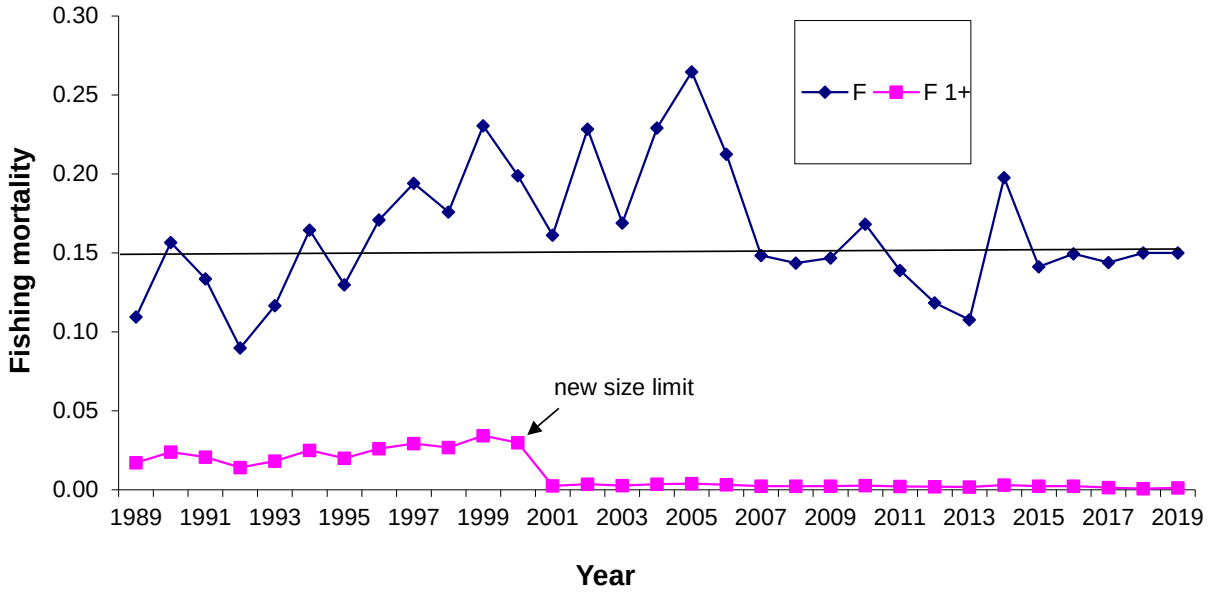


Figure 6-10. Model-estimated fishing mortality trends for 1+ (F 1+star) and 2+ (F 2+ star) lobsters. The 2002 change in size limit is highlighted and the 2018 fishing mortality set equal to the target value of 0.15.

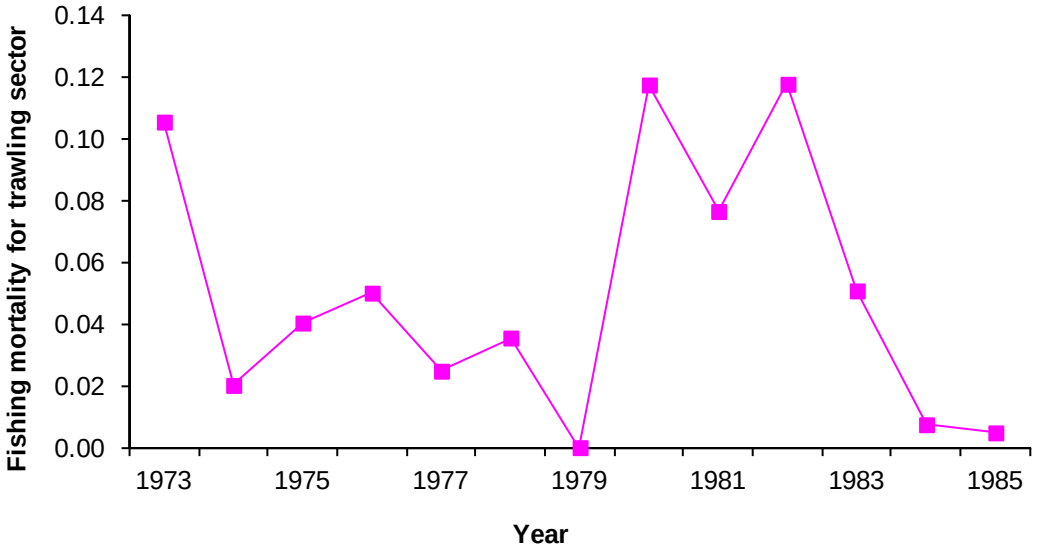


Figure 6-11. Model-estimated trawling sector fishing mortality trends for the early period of the fishery from 1973 - 1985.

Table 6-4. Summary of model parameter estimates for the RAG Reference Case and low and high catch sensitivities (see text for details).

	(a) Reference Case			(b) Low catch sensitivity			(c) 33% higher catch sensitivity (2014-17)		
Parameter	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**
B(1973)^{sp} (tons)	3402	2428	4377	3404	2429	4378	3417	2442	4391
M	0.69	0.57	0.82	0.69	0.57	0.82	0.69	0.57	0.82
h	fixed 0.7			fixed 0.7			fixed 0.7		
Sel (age 1+) 1973-1988	0.43	0.24	0.63	0.43	0.24	0.63	0.43	0.24	0.63
Sel (age 1+) 1989-2001	0.16	0.14	0.19	0.16	0.14	0.19	0.16	0.14	0.19
Sel (age 1+) post2002	0.02	0.00	0.03	0.02	0.00	0.03	0.02	0.00	0.03
Recruitment residuals (1985-2017)		33 parameters			**33 parameters**			33 parameters	
Model estimates and depletion statistics									
B(2017)^{sp} (tons)	2421	1541	3301	2424	1544	3304	2401	1522	3281
RBCprelim(2018) model	299	196	401	299	197	401	299	196	401
RBCforecast(2019) model	531	383	678	532	384	680	530	382	677
Current Depletion (Nov)									
B(2017)^{sp} / B(1973)sp	0.76	0.54	0.98	0.76	0.54	0.98	0.75	0.53	0.97
Bexp(2017) (tons)	2746	1893	3599	2749	1895	3603	2747	1894	3600
No. parameters estimated	38			38			38		
'-lnL:overall	**-173.984**			-173.954			-174.031		
AIC	**-271.968**			-271.908			-272.062		
Likelihood contributions		**Sigma**	**q**		Sigma	q		Sigma	q
'-lnL:CAA	-63.66	0.04		-63.66	0.04		-63.67	0.04	
'-lnL:CAAsurv	-19.46	input from data		-19.46	input from data		-19.57	input from data	
-lnL:CAA historic	-21.95	0.13		-21.95	0.13		-21.95	0.13	
-lnL:Survey Index 1+	-18.00	input from data	0.000E+00	-18.02	input from data	0.000E+00	-18.03	input from data	0.000E+00
-lnL:Survey Index 2+	-13.96	input from data	0.000E+00	-13.96	input from data	0.000E+00	-13.86	input from data	0.000E+00
-lnL:Survey benchmark	-3.12	input from data		-3.12	input from data		-3.12	input from data	
'-lnL:PRESEASON	-10.15	input from data	0.000E+00	-10.15	input from data	0.000E+00	-10.14	input from data	0.000E+00
-lnL:PRESEASON 0+	3.92	input from data	0.000E+00	3.94	input from data	0.000E+00	3.89	input from data	0.000E+00
-lnL:CPUE (TVH)	-19.96	0.26	0.0019	-19.95	0.26	0.0019	-19.99	0.26	0.0019
-lnL:CPUE (TIB)	-15.64	0.19	0.0163	-15.64	0.19	0.0163	-15.56	0.19	0.0163
'-lnL:RecRes	7.98	0.50	(input sigma 0.5)	7.99	0.50	(input sigma 0.5)	7.96	0.50	(input sigma 0.5)

Table 6-5. Summary of TRLRAG Reference Case RBC.

TAC/Catch (t)	2013	2014	2015	2016	2017	2018
Forecast TAC (90% CI)	769 (485-1053)	767 (518-1016)	751 (556-945)	719 (515-923)	677 (489-866)	531 (383-678)
Preliminary TAC (90% CI)	871 (445-1298)	616 (294-938)	894 (571-1217) TIB: 328 t TVH: 251 t PNG: 285 t	704 (510-897) Aug 2015 Dec 2015 update	495 (315-676) TIB: 188 t TVH: 144 t PNG: 163 t	299 (196-401) TIB: 136 t TVH: 64 t PNG: 99 t
Preliminary TAC allocation* **(lower 75th percentile)**	573	391	668 TIB: 254 t TVH: 194 t PNG: 220 t	568t TIB: 216 t TVH: 165 t PNG: 187 t	495t	
Final TAC	871	616	Mar 2015 (revision with preseason survey = 769t)	796	495t	
Catch	604t	682t	562t	572t	368t	-

Model trajectories

The model-predicted numbers of 1+ and 2+ lobsters for the entire model period are shown in Figure 6-12. There is considerable inter-annual variability in stock size, with the extent of the variability consistent with that observed from field studies.

The lobster spawning biomass (t) trajectory is given in Figure 6-13. The stock is currently estimated to be at 76% of the pristine (1973) spawning biomass level but is expected to fluctuate widely about the average target spawning biomass level, and to decline further in 2018 (down to 59%).

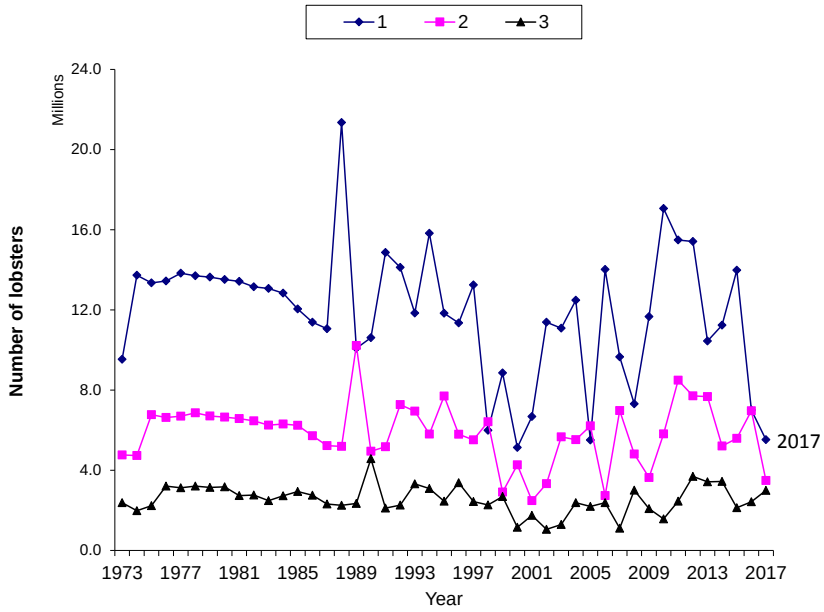


Figure 6-12. Model trajectories of the annual numbers of lobsters in each age class at the start of each of years 1973 to 2016. The increased variability from 1985 onwards is because the model estimates stock recruit residuals for years from 1985 to 2016.

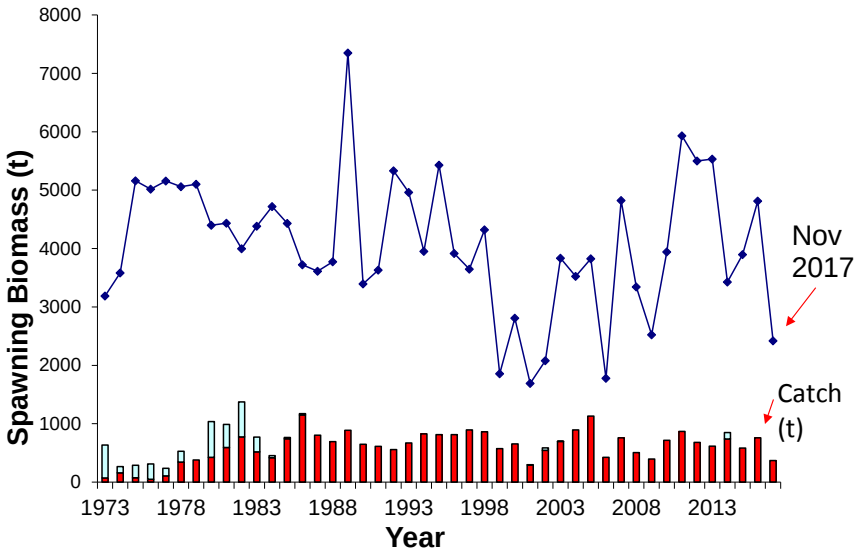


Figure 6-13. Model trajectories of the lobster spawning biomass (t) over the model period shown together with annual catches by the trawling and other sectors combined.

The model-predicted spawning biomass trajectory is shown in Figure 6-14. The November 2017 spawning biomass for the TRLRAG Reference Case is estimated to be 2421 t [1541; 3301] (Table 6-4). Figure 6-15 shows the model-predicted commercially available (also termed exploitable) lobster biomass, computed as the sum of all 1+ and 2+ lobsters which are "available" to be caught each year. The current 2017 estimate is 2746t [1893; 3599], but this is predicted to decline substantially in 2018 (Figure 6-15).

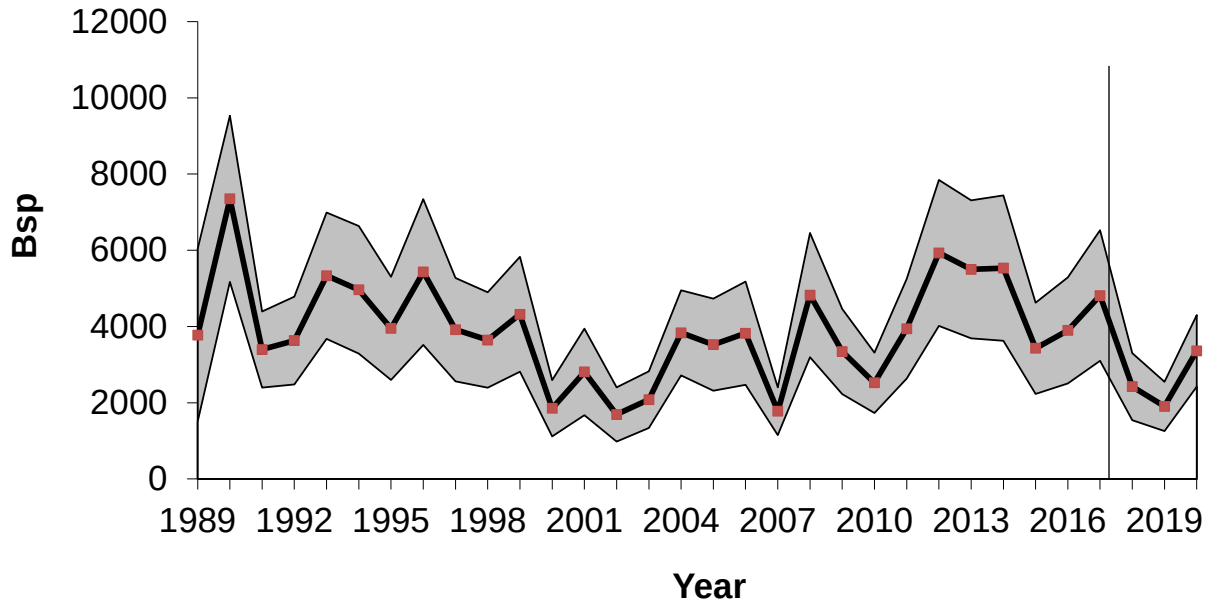


Figure 6-14. Model-predicted lobster November spawning biomass trajectory shown together with Hessian-based 90% confidence intervals. The vertical line indicates the separation between historic and predicted estimates.

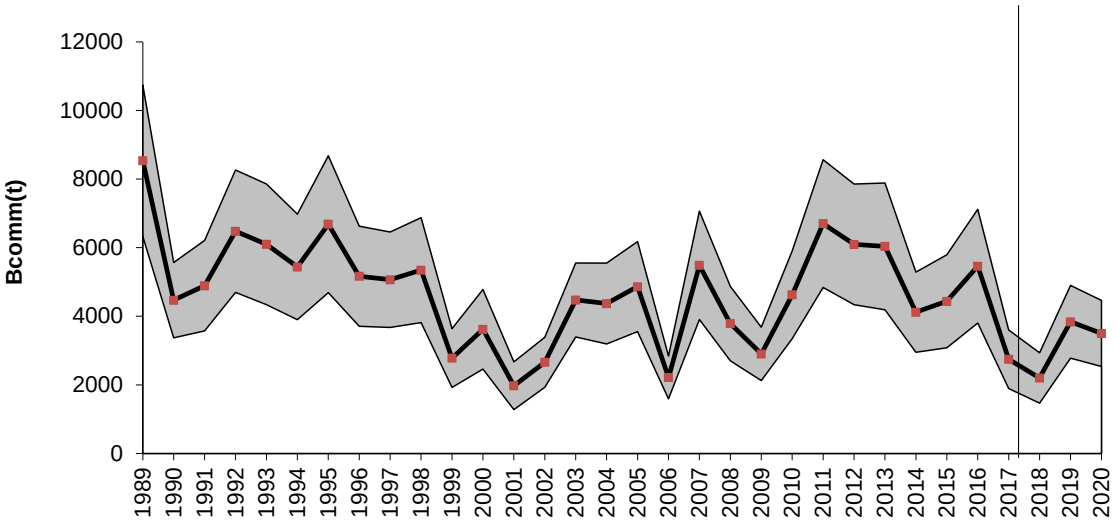


Figure 6-15. Model-predicted commercially available (also termed exploitable) lobster biomass (Bcomm), which is the sum of all 1+ and 2+ lobsters which are "available" to be caught each year. The shaded area shows the Hessian-based 90% confidence intervals. The vertical line indicates the separation between historic and predicted estimates.

Sensitivity Tests

The robustness of model results were tested across a number of important sensitivity tests, including the following which were presented at the TRLRAG December 2017 meeting:

- A) Reference Case
- B) Lower catches
- C) Higher catches
- D) Alternative CPUE TVH & TIB standardisation series (Main effects & nominal series)
- E) Estimate Additional mortality proportion for years 2014-2016
- F) Combined (D) & (E)
- G) Estimate Additional mortality & steepness parameter h
- H) Sigma (recruitment variability) = 0.6 (vs Ref case 0.5)
- I) Hyperstability = 1 for both sectors (vs Ref case 0.75(TVH CPUE) & 0.5 (TIB (CPUE))

The results are summarised in Table 6-6. A range of CPUE_TVH and CPUE_TIB alternative standardisations from Campbell et al. (2017 a, b) (Chapters 3-4), as well as the nominal CPUE_TIB series, were used but made very little difference to the results. This was largely because the series themselves were all very similar.

Changing the assumed hyperstability parameter for the TIB CPUE series also had only a small effect on model results, with the largest difference being attributed to a change in the catchability parameter estimate for the fit to the TIB CPUE series.

The sensitivity analysis to estimate an additional mortality proportion for lobsters in recent years 2014-2016 based on environmental anomalies as outlined in Plagányi et al. (2015b, 2018) resulted in a lower *M* estimate and improved the overall model fit and is being investigated further in ongoing work.

Decreasing the stock-recruitment steepness parameter *h* from 0.7 to 0.6 resulted in a small improvement in the likelihood and AIC values, and there was some support for a lower steepness value, which is being investigated further in ongoing work.

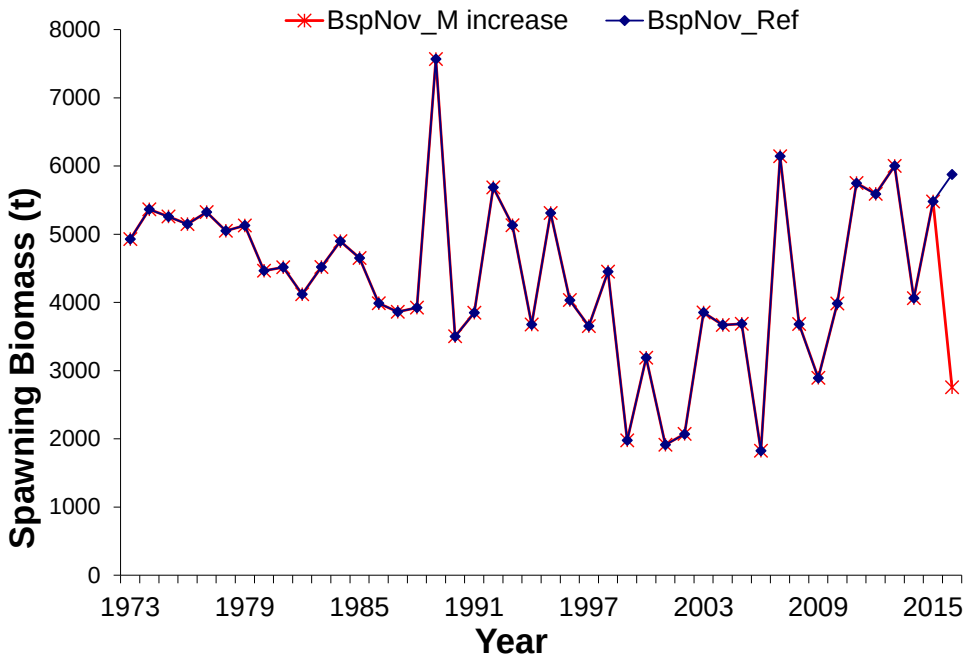


Figure 6-16. Model sensitivity test with increased mortality of 2+ lobsters assumed in 2015, compared with spawning biomass trajectory from Reference Case model.

6.6 Discussion

The revised and updated model adequately fits the available data and integrates all available information to output a RBC value as required for management. The use of a single model facilitates understanding of the way in which data inputs translate into an assessment of the status and productivity of the resource and hence an associated RBC estimate. Moreover, parameter estimates and resource trajectories are presented together with confidence intervals to illustrate the extent of uncertainty associated with model predictions.

An important assumption of the current and previous assessments is that the Torres Straits rock lobster resource is a closed population, but this is clearly not the case given they migrate eastwards out the Torres Straits (Moore and MacFarlane 1984, Skewes et al. 1994). It is not known to what extent mixing occurs with the eastern component of the stock, and hence whether these two stock components should rather be treated as a single stock in computing a spawning stock biomass. This aspect has been investigated during a related MSE project as well as in ongoing work.

Overall the resource is assessed to be in good condition. The 2016 assessment that was agreed by the TRLRAG recommended a preliminary TAC of 495t (90%CI, 315-676t) for the 2017 season (Table 6-5). The forecast TAC for 2018 was recommended to be 677t (90%CI; 489-866t) (Table 6-5), to be reassessed at the TRLRAG meeting in November/December 2017.

The inherent variability of environmental influences in relatively short-lived highly variable stocks such as TRL confounds both the accuracy and precision of optimal sustainable yield estimates for the following year. As more and better surveys are added (e.g. the pre-season survey which is closer to the opening of the fishing season), it becomes possible to set less conservative TACs.

The TRLRAG is currently considering adopting a pre-tested harvest control rule that is based on the results of the pre-season survey and other data inputs to set the RBC, rather than annually running the stock assessment. The advantage of the latter approach is that it can be simulation tested and the harvest control rules agreed beforehand by all stakeholders, so that the TAC updating process is quick and efficient as is necessary given the short time between the pre-season survey completion (plus time for analysis of the data), and the opening of the fishing season.

Table 6-6. Summary of results of sensitivity analyses

	(a) Reference Case			(d) CPUE (TVH main; TIB nominal)			(e) Estimate M			(f) Estimate M & use CPUE from (d)		
Parameter	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**
B(1973)^{sp} (tons)	3402	2428	4377	3328	2373	4283	3596	2561	4631	3612	2666	4559
M	0.69	0.57	0.82	0.70	0.57	0.82	0.68	0.56	0.81	0.68	0.56	0.81
M addiitonal mortality							**0.47**	**0.18**	**0.76**	**0.65**	**0.42**	**0.87**
h	fixed 0.7			fixed 0.7			fixed 0.7			fixed 0.7		
Sel (age 1+) 1973-1988	0.43	0.24	0.63	0.43	0.24	0.62	0.48	0.26	0.70	0.49	0.27	0.71
Sel (age 1+) 1989-2001	0.16	0.14	0.19	0.16	0.14	0.19	0.18	0.15	0.21	0.18	0.16	0.21
Sel (age 1+) post2002	0.02	0.00	0.03	0.02	0.00	0.03	0.02	0.00	0.03	0.02	0.00	0.03
Recruitment residuals (1985-2017)		33 parameters			33 parameters			34 parameters			34 parameters	
Model estimates and depletion statistics												
B(2017)^{sp} (tons)	2421	1541	3301	2271	1444	3097	1795	1060	2530	1586	996	2176
RBCprelim(2018) model	299	196	401	**287**	188	385	**225**	140	311	**195**	124	265
RBCforecast(2019) model	531	383	678	514	370	658	326	195	458	263	165	361
Current Depletion (Nov)												
B(2017)^{sp} / B(1973)sp	0.76	0.54	0.98	0.73	0.52	0.94	0.53	0.33	0.73	0.46	0.33	0.60
Bexp(2017) (tons)	2746	1893	3599	2591	1788	3393	2274	1528	3020	2092	1459	2725
No. parameters estimated	38			38			39			39		
'-lnL:overall	**-173.984**			-173.123			**-177.838**			**-181.307**		
AIC	**-271.968**			-270.246			**-277.676**			**-284.614**		
Likelihood contributions		**Sigma**	**q**		Sigma	q		Sigma	q		Sigma	q
'-lnL:CAA	-63.66	0.04		-63.62	0.04		-63.31	0.05		-63.04	0.05	
'-lnL:CAAsurv	-19.46	input from data		-19.35	input from data		-19.88	input from data		-19.97	input from data	
-lnL:CAA historic	-21.95	0.13		-21.91	0.13		-21.84	0.13		-21.79	0.13	
-lnL:Survey Index 1+	-18.00	input from data	3.907E-07	-15.72	input from data		-18.60	input from	3.940E-07	-16.12	input from	3.986E-07
-lnL:Survey Index 2+	-13.96	input from data	4.098E-07	-14.56	input from data		-14.68	input from	4.138E-07	-14.94	input from	4.199E-07
-lnL:Survey benchmark	-3.12	input from data		-3.12	input from data		-3.12	input from data		-3.11	input from data	
'-lnL:PRESEASON	-10.15	input from data	8.120E-07	-9.62	input from data		-10.69	input from	8.356E-07	-10.07	input from	8.871E-07
-lnL:PRESEASON 0+	3.92	input from data	2.424E-07	3.91	input from data		3.54	input from	2.190E-07	3.84	input from	2.191E-07
-lnL:CPUE (TVH)	-19.96	0.26	0.0019	-22.54	0.24	0.0019	-22.84	0.23	0.0019	-25.82	0.21	0.0020
-lnL:CPUE (TIB)	-15.64	0.19	0.0163	-14.83	0.20	0.0164	-14.69	0.20	0.0165	-18.66	0.15	0.0165
'-lnL:RecRes	7.98	0.50	(input sigma 0.5)	8.21	0.50	(input sigma 0	8.28	0.50	(input sigma 0.5	8.35	0.50	(input sigma 0.5

	(a) Reference Case			(g) Estimate M & h			(h) Sigma=0.6			(i) Hyperstability = 1		
Parameter	**Parameter**	**Value**	**90% CI**	**Paramete**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**
B(1973) ^{sp} (tons)	3402	2428	4377	3886	2648	5125	3424	2382	4467	3352	2399	4305
M	0.69	0.57	0.82	0.68	0.56	0.81	0.69	0.57	0.82	0.69	0.57	0.82
M addiitonal mortality				**0.57**	**0.27**	**0.86**	-0.40	-0.68	-0.12			
h	fixed 0.7			**0.40**	**0.38**	**0.43**	fixed 0.7			fixed 0.7		
Sel (age 1+) 1973-1988	0.43	0.24	0.63	0.50	0.28	0.73	0.44	0.22	0.65	0.43	0.24	0.63
Sel (age 1+) 1989-2001	0.16	0.14	0.19	0.18	0.15	0.21	0.16	0.14	0.19	0.16	0.14	0.19
Sel (age 1+) post2002	0.02	0.00	0.03	0.02	0.00	0.03	0.02	0.01	0.03	0.02	0.01	0.03
Recruitment residuals (1985-2017)		33 parameters			34 parameters			34 parameters			34 parameters	
Model estimates and depletion statistics												
B(2017) ^{sp} (tons)	2421	1541	3301	1668	966	2369	2394	1519	3270	2547	1678	3415
RBCprelim(2018) model	299	196	401	210	129	291	294	192	395	295	195	394
RBCforecast(2019) model	531	383	678	270	139	401	534	377	691	519	376	663
Current Depletion (Nov)												
B(2017) ^{sp} / B(1973)sp	0.76	0.54	0.98	0.45	0.25	0.65	0.75	0.51	0.98	0.81	0.59	1.04
Bexp(2017) (tons)	2746	1893	3599	2158	1431	2885	2720	1871	3568	2868	2026	3710
No. parameters estimated	38			40			38			38		
'-lnL:overall	**-173.984**			-178.506			-175.827			-166.130		
AIC	**-271.968**			-277.012			-275.654			-256.260		
Likelihood contributions		**Sigma**	**q**		Sigma	q		Sigma	q		Sigma	q
'-lnL:CAA	-63.66	0.04		-63.26	0.05		-63.58	0.04		-64.10	0.04	
'-lnL:CAAsurv	-19.46	input from data		-19.97	input from data		-19.44	input from data		-19.45	input from data	
-lnL:CAA historic	-21.95	0.13		-21.79	0.13		-21.97	0.13		-21.75	0.13	
-lnL:Survey Index 1+	-18.00	input from data	3.907E-07	-19.09	input from	3.931E-07	-17.93	input from da	3.909E-07	-14.92	input from d	3.975E-07
-lnL:Survey Index 2+	-13.96	input from data	4.098E-07	-14.57	input from	4.117E-07	-14.15	input from da	4.097E-07	-13.82	input from d	4.185E-07
-lnL:Survey benchmark	-3.12	input from data		-3.13	input from data		-3.12	input from data		-3.11	input from data	
'-lnL:PRESEASON	-10.15	input from data	8.120E-07	-10.64	input from	8.477E-07	-10.29	input from da	8.169E-07	-9.72	input from d	8.269E-07
-lnL:PRESEASON 0+	3.92	input from data	2.424E-07	**2.40**	input from	2.178E-07	4.12	input from da	2.435E-07	4.23	input from d	2.485E-07
-lnL:CPUE (TVH)	-19.96	0.26	0.0019	-22.60	0.24	0.0019	-20.23	0.26	0.0019	-21.25	0.25	0.0002
-lnL:CPUE (TIB)	-15.64	0.19	0.0163	-14.08	0.21	0.0165	-15.52	0.19	0.0164	-9.09	0.31	0.0003
'-lnL:RecRes	7.98	0.50	(input sigma 0.5)	8.20	0.50	(input sigma 0	6.28	0.50	(input sigma	6.84	0.50	(input sigma

Appendix A Separating TIB, TVH and Processor catch records from Docket-Book Data

The recommended data rules for using TRL catch data reported in the Torres Strait Buyers and Processors Docket Book (TDB01)

1. Where Seller-Type is identified as a processor then the corresponding catch record should be interpreted as a duplicate associated with a Processor-to-Processor trade and as such should not be included in the catch for the TIB sector. The DATA_TYPE associated with these records is therefore set to 'PROCESSOR'.
    a. An exception is made for the records associated with Joseph Dai where DATA_TYPE='TIB'.

2. Where Seller-Type is identified as processor but the Seller-Name is a business name then the corresponding catch record should be identified with the fishery sector (TIB or TVH). The DATA-TYPE is listed as 'TVH-TradeName' or 'TIB-TradeName' respectively.

3. Where Vessel-Type is identified as a TVH-vessel then the corresponding catch record should be interpreted as a duplicate associated with the TVH sector and as such should not be included in the catch for the TIB sector. The DATA-TYPE is listed as TVH.
    a. Note, whether or not the corresponding catch is contained in the TVH database needs to be checked.

4. Where Vessel-Type identifies the distinguishing symbol as an 'F-symbol' then the corresponding catch record should be included in the catch for the TIB sector and the DATA-TYPE is listed as 'TIB'.
    a. An exception is made for the two vessels with the symbol FXYC or FWED which are TVH vessels and for these records the DATA-TYPE is listed as 'TVH'.

5. Where Related-Log is blank then the corresponding catch record should be identified as a catch for the TIB sector and the DATA-TYPE is listed as 'TIB'

6. All other records should be attributed to the TIB sector and the DATA-TYPE listed as 'TIB'.
    a. After fitting the five rules above, only 1055 records (of the 77,358 in total) remained un-assigned. Note: all but 3 of the 1055 (22 of the 25 vessels-symbols) occur in the Docket-Book database where the DATA-TYPE has already been assigned to the TIB sector

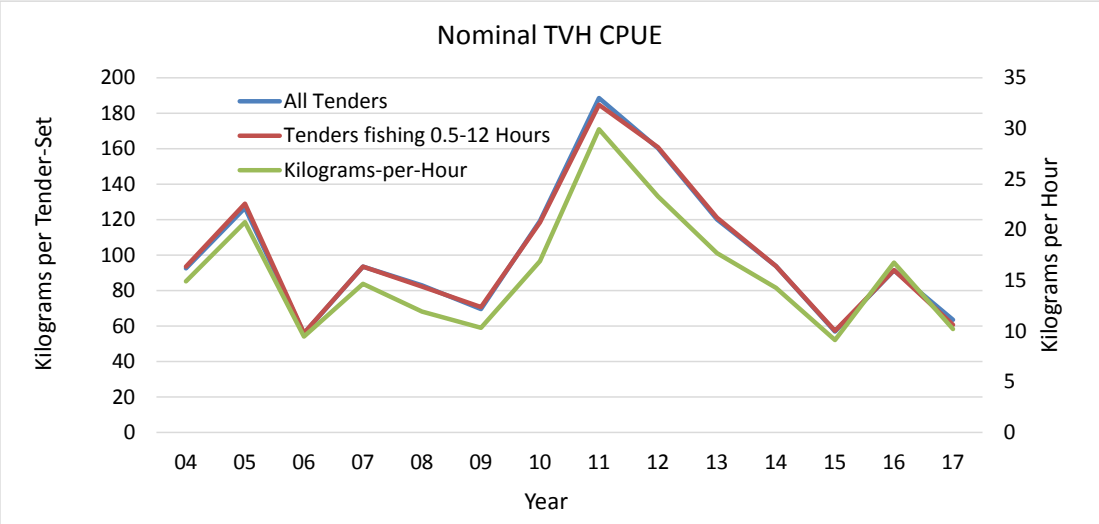
Appendix B Annual Catch-Per-Unit-Effort

B.1 TVH Sector

Effort in the TVH-sector is recorded as hours fished by a tender during each set. As indicated in Apx Table B-2 the hours fished for the majority of tender sets (93.2%) are between 0.5 and 12 hours, while the hours fished is not recorded for 6.8% of tender sets. The effort recorded for the remainder of tender sets (<0.5 or >12 hours) is considered not reliable. The annual total number of tender sets, associated catch and corresponding catch-per-unit-effort (CPUE) for (a) all tender-sets and (b) those where effort is between 0.5 and 12 hours is listed in Apx Table B-1 while the CPUE for each of the data sets is displayed in Apx Figure B-1.

Apx Table B-1. (a) Annual total number of tender-sets, associated catch (kilograms) and corresponding CPUE (kilograms per tender-set) for all TVH tender sets, and (b) annual total number of tender-sets, associated hours fished and catch (kilograms) and corresponding CPUE (kilograms per tender-set) and kilograms per hour fished for TVH tender sets where effort is between 0.5 and 12 hours.

	(a) All Sets			(b) Sets fishing 0.5-12 Hours				
Year	N-sets	Catch	CPUE	N-sets	Hours	Catch	CPUE	Kg/hour
04	5,200	481,118	92.5	4,880	30,627	456,700	93.6	14.9
05	4,302	544,977	126.7	3,671	22,829	473,774	129.1	20.8
06	2,428	135,448	55.8	2,329	13,775	130,533	56.0	9.5
07	2,869	268,596	93.6	2,731	17,403	255,468	93.5	14.7
08	1,211	100,438	82.9	1,159	7,996	95,452	82.4	11.9
09	1,308	91,061	69.6	1,240	8,484	87,696	70.7	10.3
10	2,368	282,614	119.3	1,933	13,547	229,162	118.6	16.9
11	2,670	503,533	188.6	2,465	15,216	455,579	184.8	29.9
12	2,311	370,482	160.3	2,131	14,721	342,986	161.0	23.3
13	3,008	361,661	120.2	2,920	19,994	353,786	121.2	17.7
14	2,910	273,186	93.9	2,781	18,296	261,091	93.9	14.3
15	2,683	152,709	56.9	2,615	16,464	150,147	57.4	9.1
16	2,663	243,700	91.5	2,630	14,359	240,919	91.6	16.8
17	2,343	149,048	63.6	2,049	12,190	124,453	60.7	10.2



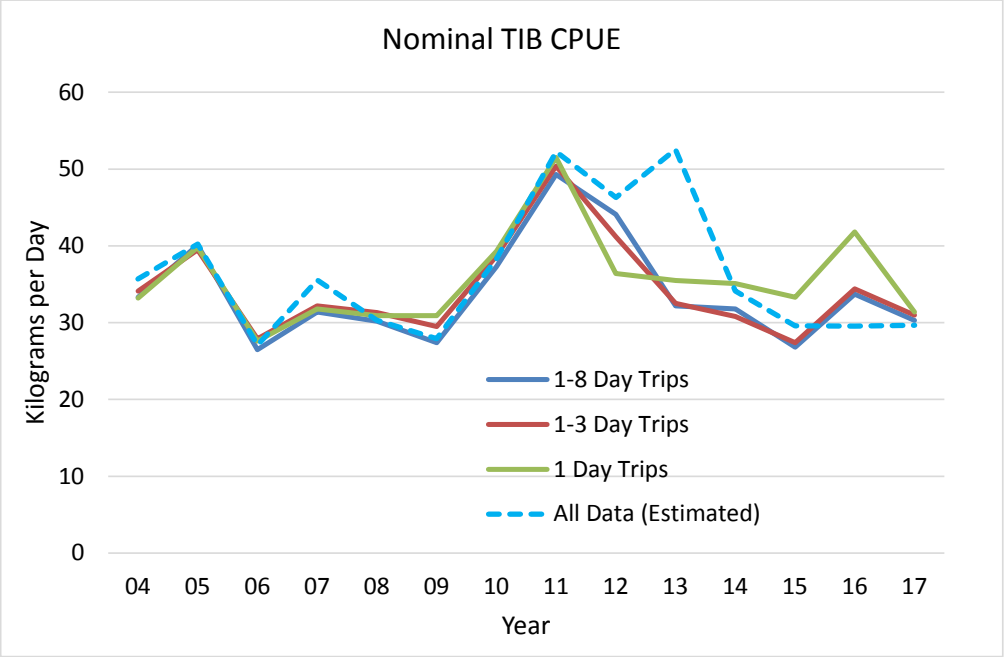
Apx Figure B-1. Annual CPUE (kilograms per tender-set and kilograms per hour) for (a) all TVH tender sets and (b) tender sets where effort is between 0.5 and 12 hours.

B.2 TIB Sector

Effort in the TIB-sector is recorded as the length of each fishing trip in days fished. As indicated in Table 2-4 fishing trips of up to 16 days have been recorded in the TIB docket-book, though the majority of trips (75.3%) are recorded as having a length of only one day. Whether or not the effort for trips having a long duration is recorded correctly remains unknown. The annual total number of days fished, associated catch and corresponding catch-per-unit-effort (CPUE) for trips having a duration of (a) 1-8 days, (b) 1-3 days and (c) 1 day only is listed in Apx Table B-2 while the CPUE (kilograms per day) for each of the data sets is displayed in Apx Figure B-2. For comparison, the CPUE associated with the Total Catch and estimated Total Days-Adj2 calculated for all TIB records in Table 2-4b is also displayed.

Apx Table B-2. Annual total number of days fished, associated catch (kilograms) and corresponding catch-per-unit-effort (kilograms per day) for TIB trips having a duration of (a) 1-8 days, (b) 1-3 days and (c) 1 day only. The CPUE in the column All Data relates to that associated with the Total Catch and estimated Total Days-Adj2 calculated for all TIB records in Table 2-4b.

		Trips 1 to 8 days			Trips 1 to 3 days			Trips 1 day only			All Data
Year	Year	Days	Catch	CPUE	Days	Catch	CPUE	Days	Catch	CPUE	CPUE
04	2004	5,262	175,421	33.3	4,353	148,401	34.1	3,227	107,050	33.2	35.7
05	2005	8,143	326,697	40.1	6,761	267,151	39.5	5,321	211,921	39.8	40.2
06	2006	4,828	127,871	26.5	4,129	115,234	27.9	3,156	87,207	27.6	27.1
07	2007	6,775	212,975	31.4	6,112	196,568	32.2	4,914	156,029	31.8	35.5
08	2008	5,594	168,762	30.2	5,110	159,778	31.3	4,107	126,709	30.9	30.3
09	2009	4,577	125,212	27.4	3,820	112,873	29.5	2,876	88,752	30.9	27.9
10	2010	3,500	130,459	37.3	3,214	124,419	38.7	2,663	104,727	39.3	38.3
11	2011	3,407	167,874	49.3	2,800	141,000	50.4	2,445	125,941	51.5	52.3
12	2012	1,766	77,810	44.1	1,069	44,020	41.2	661	24,063	36.4	46.3
13	2013	238	7,670	32.2	187	6,071	32.5	131	4,656	35.5	52.6
14	2014	3,172	100,773	31.8	2,340	72,013	30.8	1,503	52,826	35.1	34.1
15	2015	2,832	75,914	26.8	2,142	58,596	27.4	1,290	43,011	33.3	29.6
16	2016	2647	89312	33.7	2261	77859	34.4	1612	67427	41.8	29.5
17	2017	2,963	89,818	30.3	2,767	85,723	31.0	2,549	79,995	31.4	29.7



Apx Figure B-2. Annual CPUE (kilograms per day) for TIB trips having a duration of (a) 1-8 days, (b) 1-3 days and (c) 1 day only, together with the estimated CPUE for All Data records.

Appendix C Summary of Data fitted to GLM

The following three spatial-temporal effects were included in the GLM used to standardise the CPUE for lobsters caught in the Torres Strait:

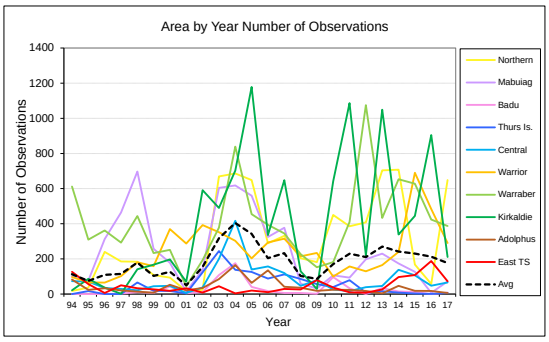
1. Year (all 24 years between 1994 and 2017)
2. Month (all 8 months between February and September)
3. MSE-Area (10 areas)

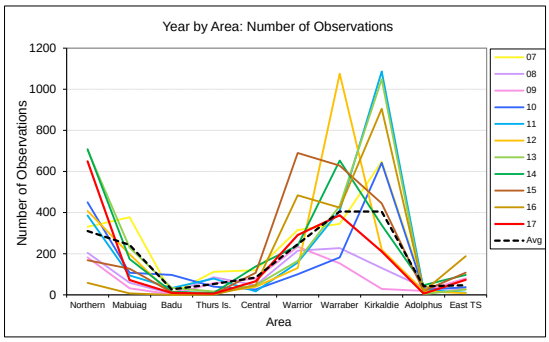
For each 2-way combination of these effects, the following figures provide:

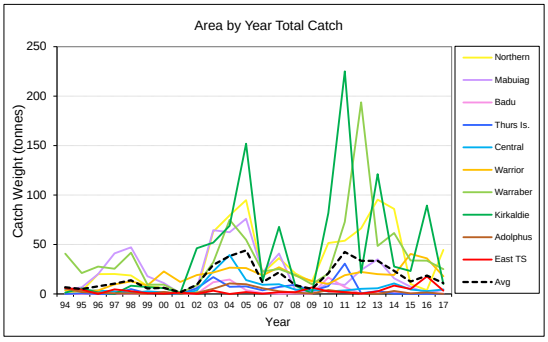
4. Number of data observations
5. Total catch (kilograms of lobsters)
6. Nominal CPUE (kilograms per hour fished)

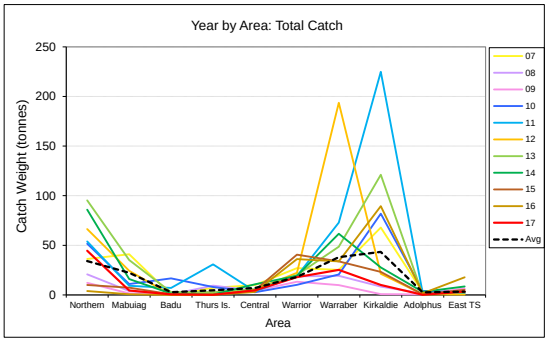
A histogram of the number of observations within each stratum is also shown for each of the above 2-way combination of these effects.

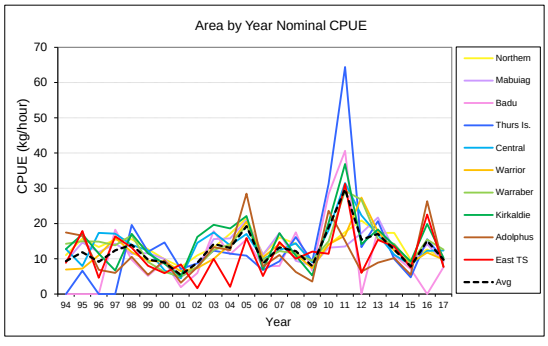
a) Year*Area

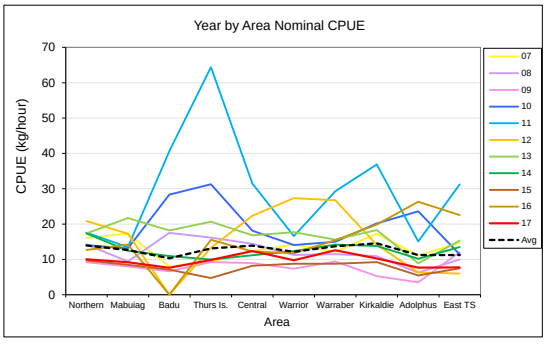




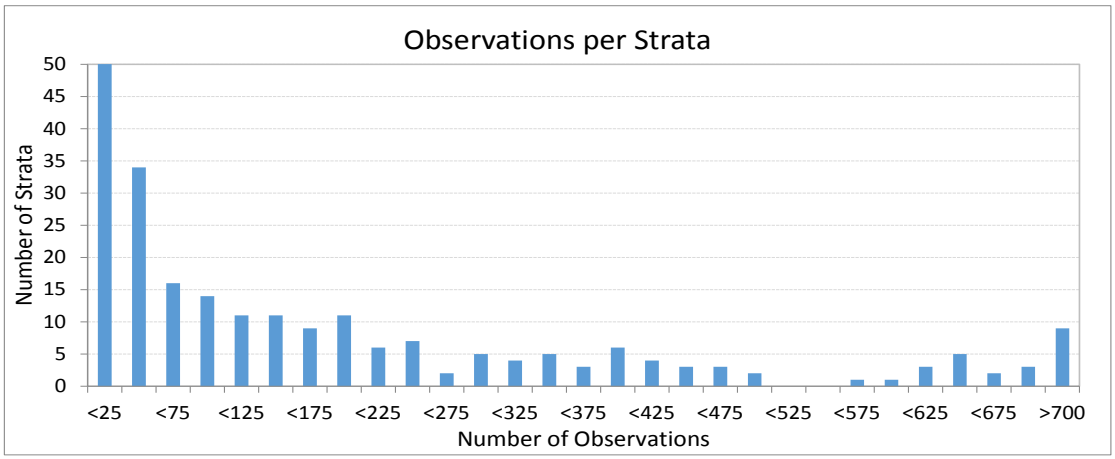




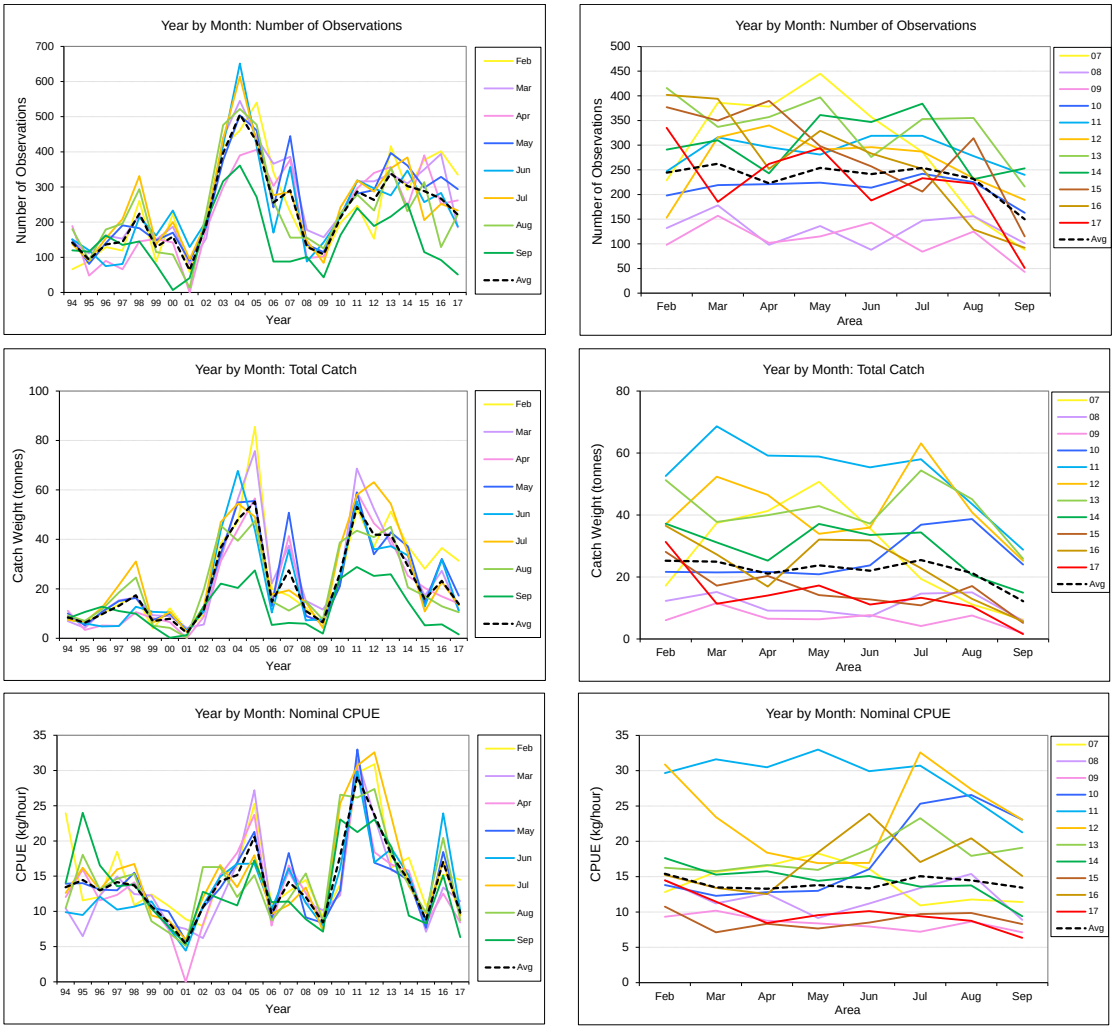




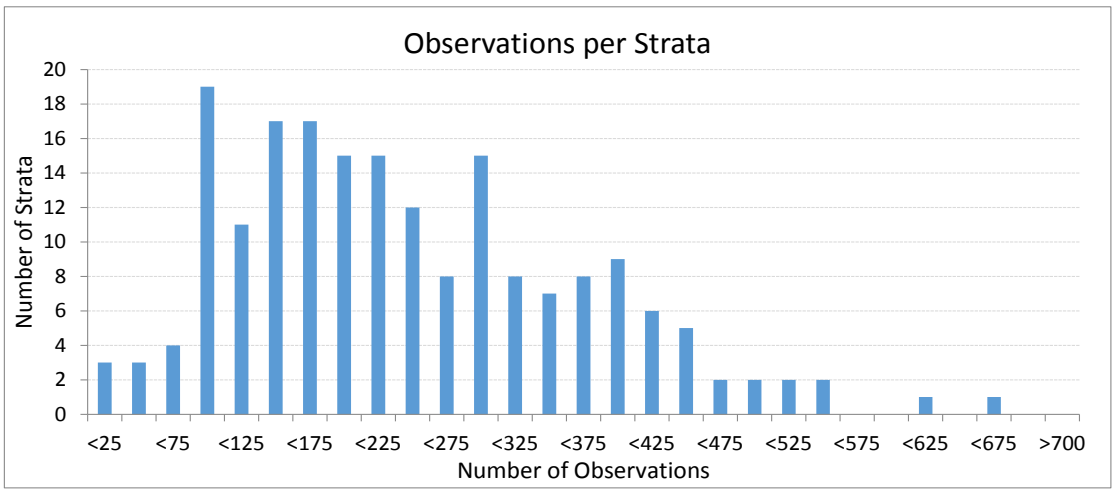
Of the 240 Year*Area strata (24 years x 10 areas) the number of observations is zero for 8 strata: There are a further 8 strata where the number of observations was between 1 and 4 and 15 strata where the number of observations was between 5 and 9. The number of observations for all other strata was between 10 and 1,178.



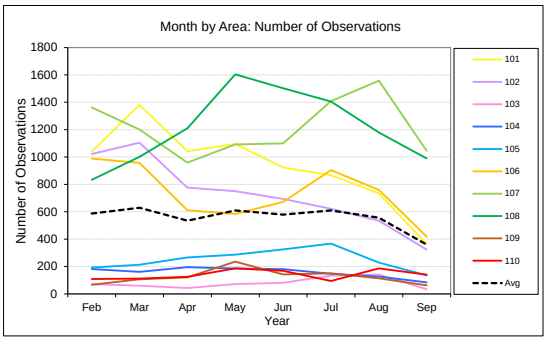
b) Year*Month

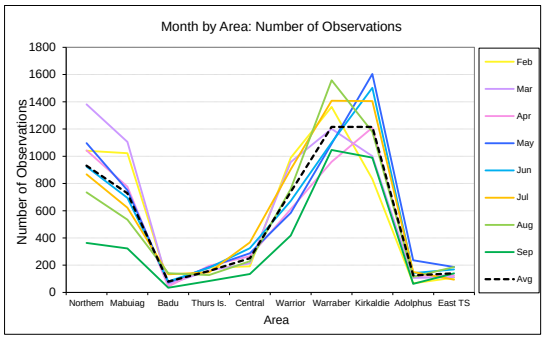


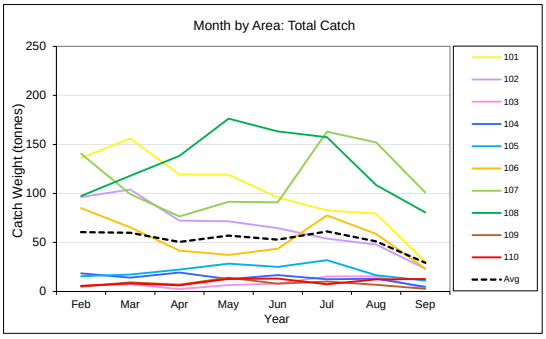
Of the 192 Year*Month strata (24 years x 8 months) there was zero observations in one strata (2001, April) and one other strata where the number of observations was less than ten. For the remaining 190 strata the number of observations was between 10 and 651.

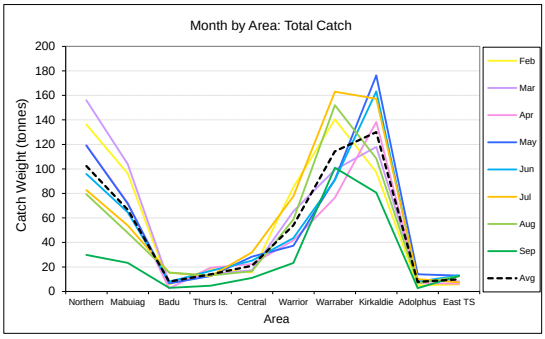


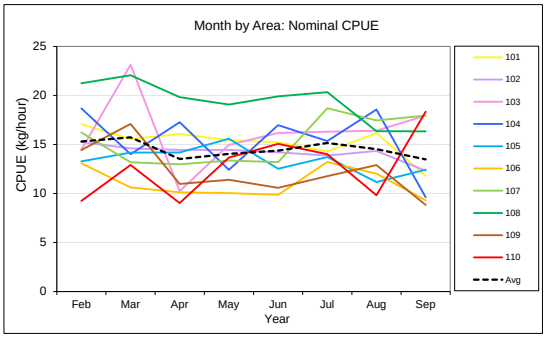
c) Month*Area

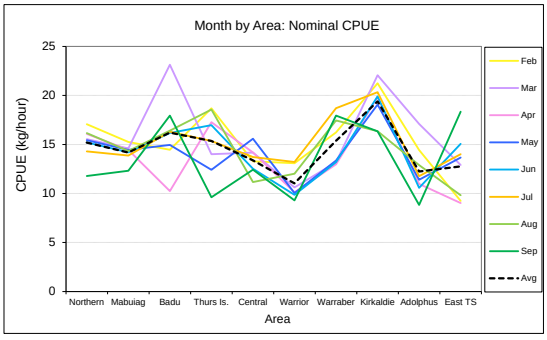




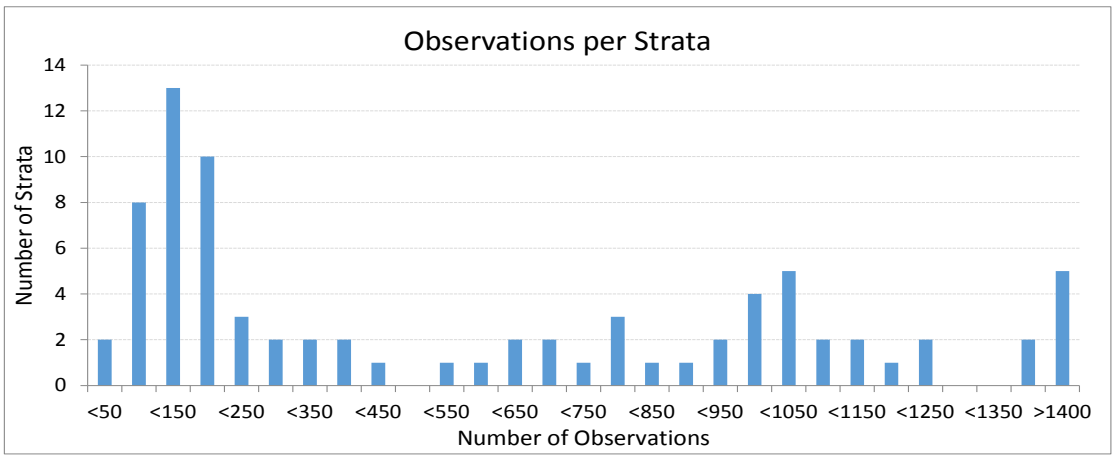








Of the 80 Month*Area strata (8 months x 10 areas) the number of observations for all strata was between 34 and 1,604.


Observations per Strata
Number of Strata
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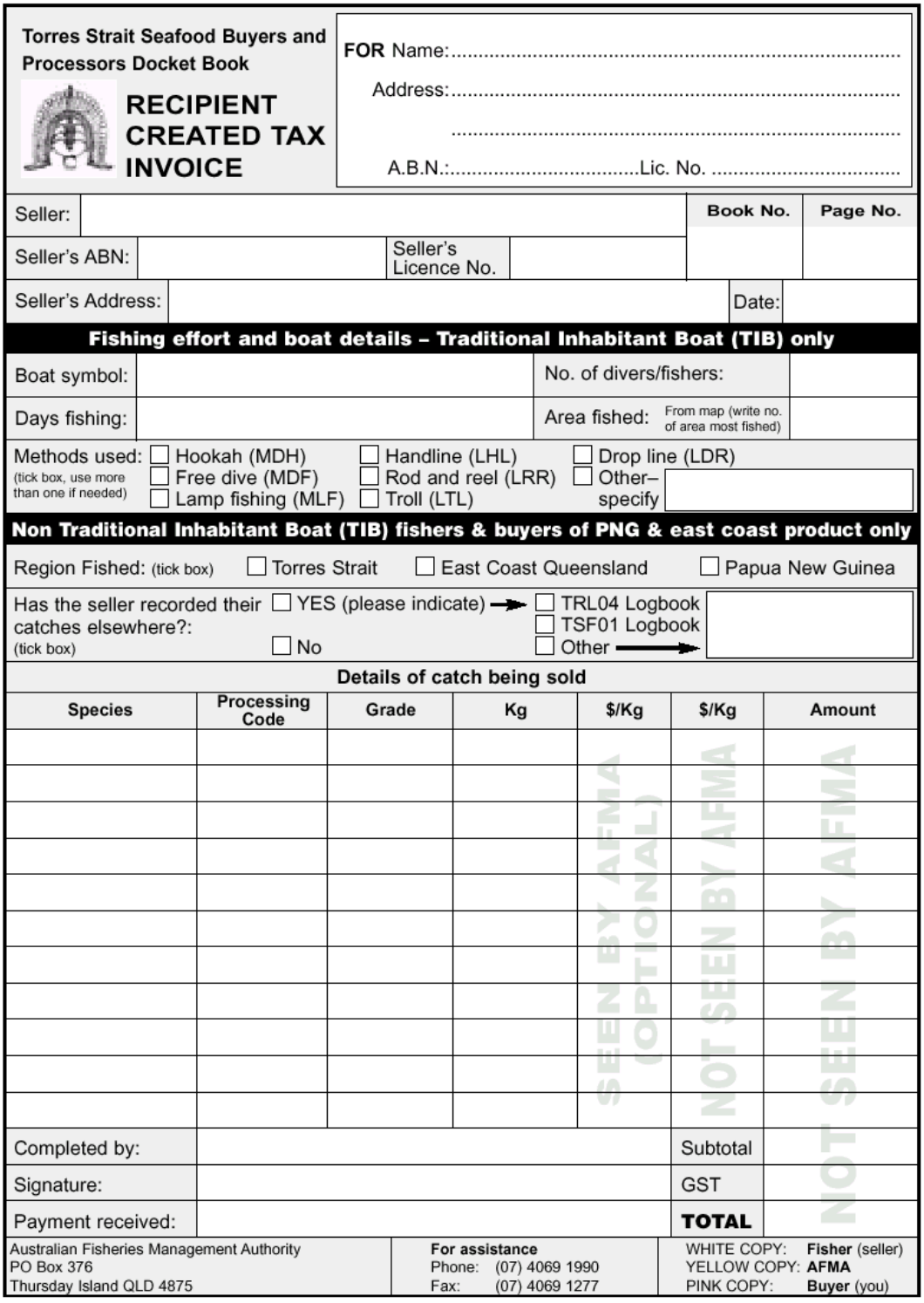
12
10
8
6
4
2
0
<50
<150
<250
<350
<450
<550
<650
<750
<850
<950
<1050
<1150
<1250
<1350
>1400
Number of Observations

Appendix D Docket-Book Copy

D.1



Torres Strait Seafood Buyers and Processors Docket Book

RECIPIENT CREATED TAX INVOICE

FOR Name:.....

Address:.....

.....

A.B.N.:.....Lic. No. .....

Seller:		**Book No.**	**Page No.**
Seller's ABN:	Seller's Licence No.		
Seller's Address:	Date:		

Fishing effort and boat details – Traditional Inhabitant Boat (TIB) only

Boat symbol:		No. of divers/fishers:	
Days fishing:		Area fished: From map (write no. of area most fished)	

Methods used: (tick box, use more than one if needed)
☐ Hookah (MDH) ☐ Handline (LHL) ☐ Drop line (LDR)
☐ Free dive (MDF) ☐ Rod and reel (LRR) ☐ Other–specify
☐ Lamp fishing (MLF) ☐ Troll (LTL)

Non Traditional Inhabitant Boat (TIB) fishers & buyers of PNG & east coast product only

Region Fished: (tick box) ☐ Torres Strait ☐ East Coast Queensland ☐ Papua New Guinea

Has the seller recorded their catches elsewhere?: (tick box) ☐ YES (please indicate) → ☐ TRL04 Logbook ☐ TSF01 Logbook ☐ Other →

☐ No

Details of catch being sold

Species	Processing Code	Grade	Kg	$/Kg	$/Kg	Amount
Completed by:					Subtotal	
Signature:					GST	
Payment received:					**TOTAL**	

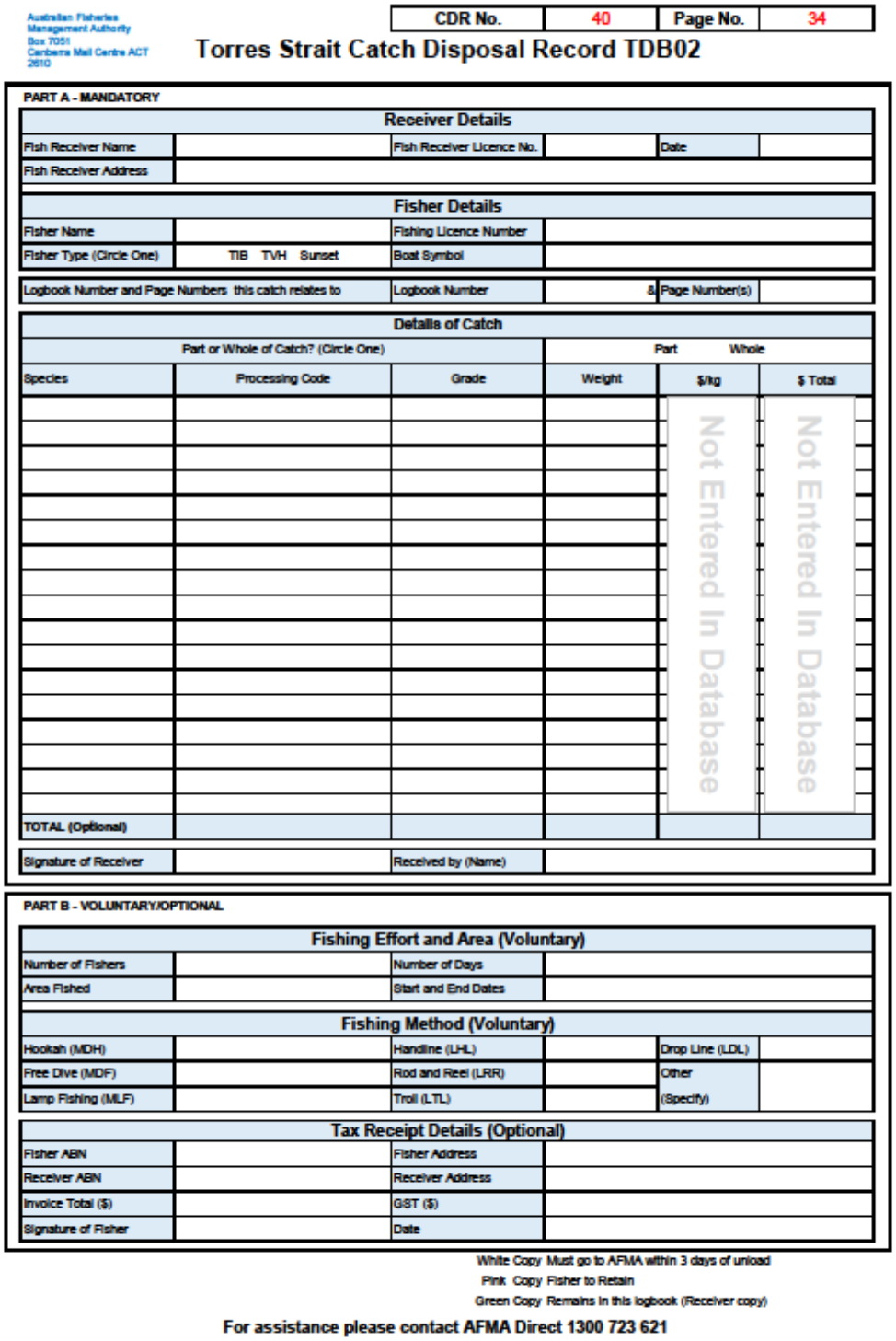
SEEN BY AFMA (OPTIONAL) NOT SEEN BY AFMA NOT SEEN BY AFMA

Australian Fisheries Management Authority
PO Box 376
Thursday Island QLD 4875

For assistance
Phone: (07) 4069 1990
Fax: (07) 4069 1277

WHITE COPY: **Fisher** (seller)
YELLOW COPY: **AFMA**
PINK COPY: **Buyer** (you)

Apx Figure D-1. The old Buyers and Processors Docket Book (TDB01) used in the TIB sector of the Torres Strait rock lobster fishery.



Australian Fisheries Management Authority
Box 7051
Canberra Mail Centre ACT 2610

CDR No.	40	Page No.	34

Torres Strait Catch Disposal Record TDB02

PART A - MANDATORY

Receiver Details

Fish Receiver Name		Fish Receiver Licence No.		Date	
Fish Receiver Address					

Fisher Details

Fisher Name		Fishing Licence Number	
Fisher Type (Circle One)	TIB TVH Sunset	Boat Symbol	

Logbook Number and Page Numbers this catch relates to	Logbook Number	&	Page Number(s)	

Details of Catch

Part or Whole of Catch? (Circle One)			Part	Whole	
Species	Processing Code	Grade	Weight	$/kg	$ Total
				Not Entered In Database	Not Entered In Database
TOTAL (Optional)					

Signature of Receiver		Received by (Name)	

PART B - VOLUNTARY/OPTIONAL

Fishing Effort and Area (Voluntary)

Number of Fishers		Number of Days	
Area Fished		Start and End Dates	

Fishing Method (Voluntary)

Hookah (MDH)		Handline (LHL)		Drop Line (LDL)	
Free Dive (MDF)		Rod and Reel (LRR)		Other (Specify)	
Lamp Fishing (MLF)		Troll (LTL)			

Tax Receipt Details (Optional)

Fisher ABN		Fisher Address	
Receiver ABN		Receiver Address	
Invoice Total ($)		GST ($)	
Signature of Fisher		Date	

White Copy Must go to AFMA within 3 days of unload
Pink Copy Fisher to Retain
Green Copy Remains in this logbook (Receiver copy)

For assistance please contact AFMA Direct 1300 723 621

Apx Figure D-2. The new Torres Strait Catch Disposal Record (TDB02) to be used in the TIB sector of the Torres Strait rock lobster fishery.

D.2

(a) Number of TIB RECORDS

	Year														
Area	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
6	39	33	63	47	7	6	4	12	5	0	57	20	1	5	299
7	637	1104	424	463	260	110	16	428	169	43	869	158	22	7	4710
8	440	986	569	710	389	23	50	362	191	18	277	350	218	168	4751
9	1338	1413	619	1683	2031	1991	1841	592	271	30	131	562	862	1740	15104
10	38	107	46	67	10	8	10	14	3	0	26	11	2	31	373
11	76	737	383	401	305	174	12	3	0	0	0	52	17	12	2172
12	137	165	338	525	281	213	124	92	19	15	284	283	226	20	2722
13	76	64	99	93	18	11	42	55	2	1	2	5	3	5	476
14	145	139	181	119	181	212	104	94	14	1	18	7	88	41	1344
15	14	38	26	90	40	26	2	1	0	0	0	2	1	0	240
16	93	254	120	287	78	3	41	32	7	1	0	4	3	10	933
17	26	130	149	278	111	0	1	0	0	0	1	0	1	1	698
Total	3059	5170	3017	4763	3711	2777	2247	1685	681	109	1665	1454	1444	2040	33822

(b) Total Number of DAYS_FISHED

AREA	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
6	99	39	84	78	10	7	6	14	6	0	110	52	1	11	517
7	828	2014	732	663	308	423	44	658	594	43	1100	223	24	27	7681
8	478	1018	601	757	451	28	66	631	617	42	834	966	700	278	7467
9	1486	1540	662	1928	2118	2044	1969	602	282	30	132	570	870	1758	15991
10	99	138	56	71	10	8	15	14	3	0	53	33	3	48	551
11	102	767	423	498	384	233	12	5	0	0	0	111	19	35	2589
12	394	410	646	714	474	404	244	103	20	43	556	546	423	27	5004
13	167	125	147	148	44	18	98	64	2	1	2	6	3	9	834
14	401	296	241	151	253	687	198	117	18	1	22	12	199	73	2669
15	65	67	46	128	75	30	4	1	0	0	0	5	1	0	422
16	123	318	129	290	79	3	45	33	11	1	0	5	3	11	1051
17	41	200	217	393	188	0	1	0	0	0	1	0	1	1	1043
Total	4283	6932	3984	5819	4394	3885	2702	2242	1553	161	2810	2529	2247	2278	45819

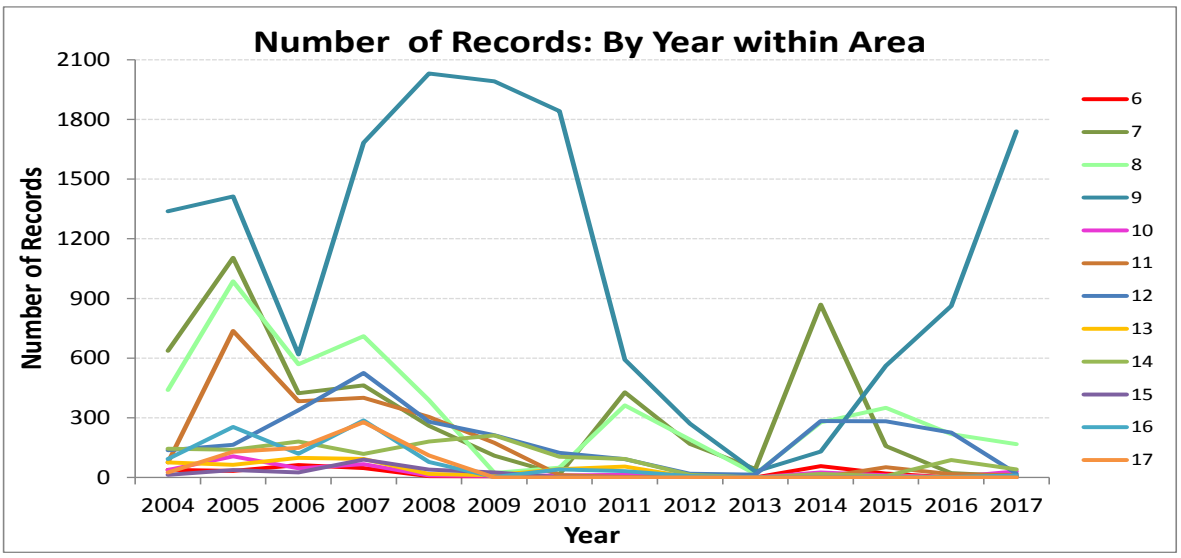
(c) Total CATCH_WEIGHT

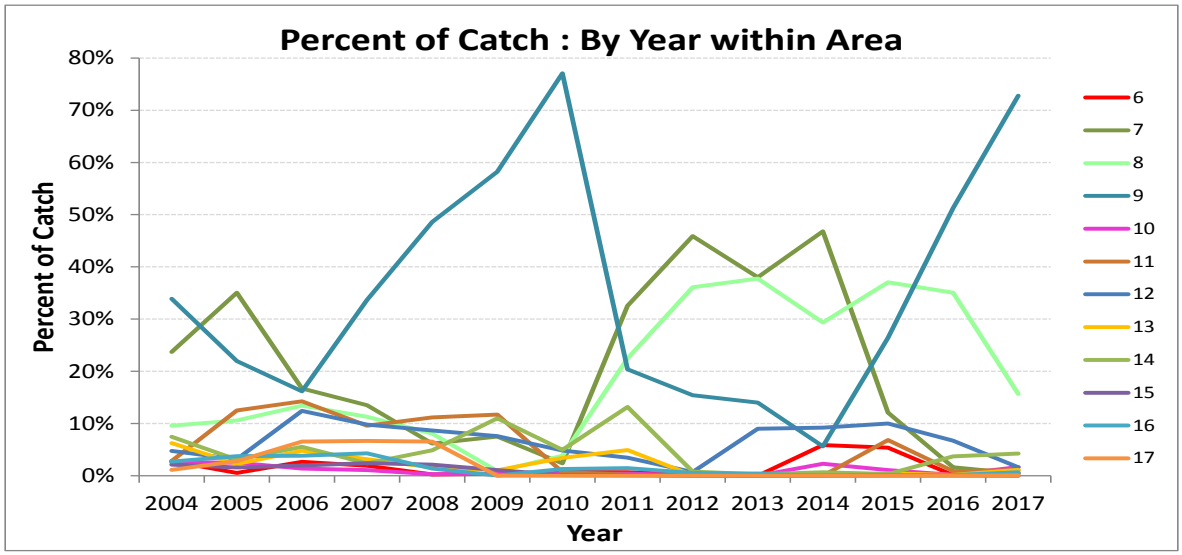
AREA	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
6	4043	1545	2863	3658	386	429	676	808	181	0	5016	3445	99	321	23469
7	33864	97824	17737	25445	8656	8118	2144	37908	33448	2205	39934	7709	1175	267	316433
8	13713	29529	14260	21289	11355	970	3485	26147	26308	2190	25039	23625	25227	9997	233134
9	48407	61355	17163	63511	68070	62857	69541	23735	11244	813	4805	16842	36914	46393	531651
10	3701	7067	1483	2065	462	411	420	529	62	0	1976	696	119	1067	20057
11	4097	34985	15125	18093	15660	12663	671	285	0	0	0	4371	652	708	107310
12	6806	8930	13181	18527	12170	8212	4374	4049	535	522	7866	6376	4836	1042	97427
13	8951	6365	5118	6017	2246	1159	3098	5756	70	27	31	316	126	722	40002
14	10651	8680	5915	4501	6865	11887	4479	15347	602	19	595	237	2683	2734	75193
15	3086	4447	2092	4577	2998	1196	143	135	0	0	0	27	54	0	18755
16	3877	10516	4103	8130	1969	66	1182	1723	405	22	0	89	89	428	32603
17	1641	7816	6970	12636	9166	0	31	0	0	0	20	0	15	62	38358
Total	142837	279059	106010	188449	140003	107968	90244	116422	72855	5798	85282	63733	71989	63741	1534392

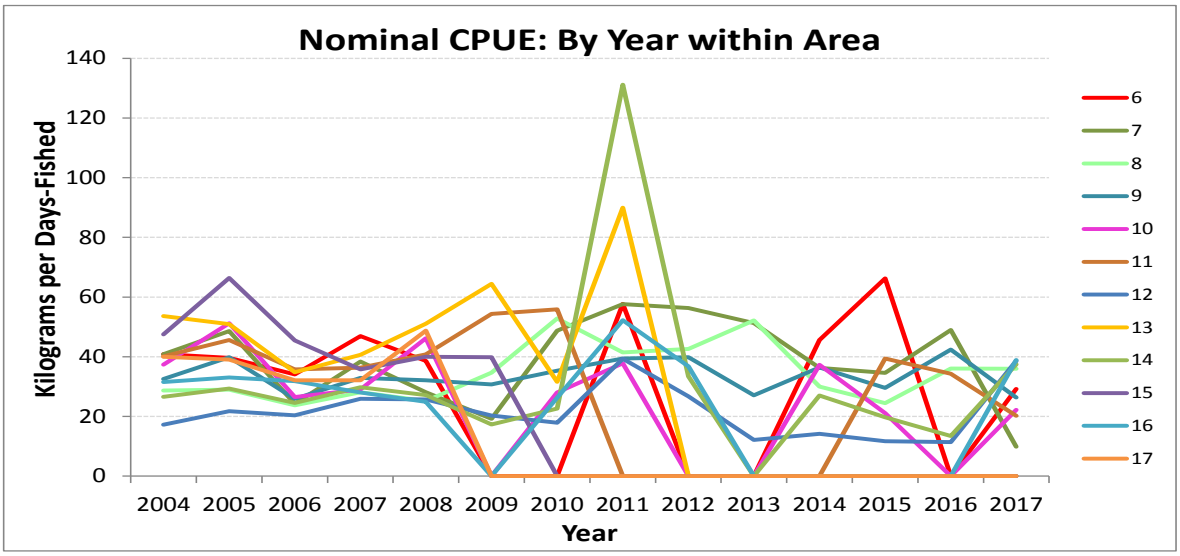
(d) Nominal CPUE

AREA	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
6	40.8	39.6	34.1	46.9	38.6			57.7			45.6	66.3		29.2	45.4
7	40.9	48.6	24.2	38.4	28.1	19.2	48.7	57.6	56.3	51.3	36.3	34.6	49.0	9.9	41.2
8	28.7	29.0	23.7	28.1	25.2	34.6	52.8	41.4	42.6	52.1	30.0	24.5	36.0	36.0	31.2
9	32.6	39.8	25.9	32.9	32.1	30.8	35.3	39.4	39.9	27.1	36.4	29.5	42.4	26.4	33.2
10	37.4	51.2	26.5	29.1	46.2		28.0	37.8			37.3	21.1		22.2	36.4
11	40.2	45.6	35.8	36.3	40.8	54.3	55.9					39.4	34.3	20.2	41.4
12	17.3	21.8	20.4	25.9	25.7	20.3	17.9	39.3	26.8	12.1	14.1	11.7	11.4	38.6	19.5
13	53.6	50.9	34.8	40.7	51.0	64.4	31.6	89.9							48.0
14	26.6	29.3	24.5	29.8	27.1	17.3	22.6	131.2	33.4		27.0	19.8	13.5	37.5	28.2
15	47.5	66.4	45.5	35.8	40.0	39.9									44.4
16	31.5	33.1	31.8	28.0	24.9		26.3	52.2	36.8					38.9	31.0
17	40.0	39.1	32.1	32.2	48.8										36.8
SUM	33.3	40.3	26.6	32.4	31.9	27.8	33.4	51.9	46.9	36.0	30.3	25.2	32.0	28.0	33.5

Apx Figure D-3. Number of GLM data records, total number of days fished, total catch weight, and associated CPUE in each Year*Area strata. Note, strata with less than 10 records are shaded (dark shading where number is zero) and nominal CPUE is only shown for strata where the number of the days fished is 10 or greater.







Apx Figure D-4. Number of GLM data records, percent of catch, and associated CPUE in each Year*Area strata. Note, nominal CPUE is only shown for strata where the number of the days fished is 10 or greater.

(a) Number of TIB RECORDS

	Year														
Qtr	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	913	1434	1264	1833	1597	971	855	820	359	6	449	554	517	626	12198
2	921	2155	1014	1730	1220	1005	793	446	222	13	427	494	452	760	11652
3	835	1353	383	961	763	639	519	296	93	17	523	325	446	649	7802
4	390	228	356	239	131	162	80	123	7	73	266	81	29	5	2170
Total	3059	5170	3017	4763	3711	2777	2247	1685	681	109	1665	1454	1444	2040	33822

(b) Total Number of DAYS_FISHED

Qtr	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	1050	1876	1538	2226	1707	1269	941	847	781	6	860	923	917	723	15664
2	1482	2919	1440	2126	1450	1359	925	801	619	14	860	879	725	824	16423
3	1287	1844	573	1186	1079	1035	740	461	146	17	706	579	573	726	10952
4	464	293	433	281	158	222	96	133	7	124	384	148	32	5	2780
Total	4283	6932	3984	5819	4394	3885	2702	2242	1553	161	2810	2529	2247	2278	45819

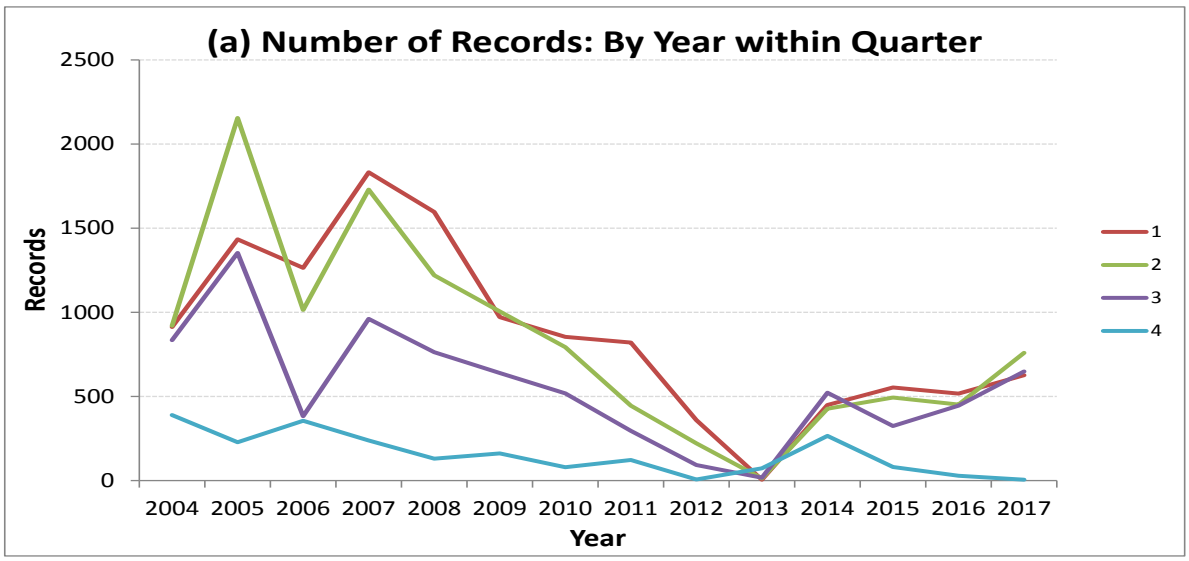
(c) Total CATCH_WEIGHT

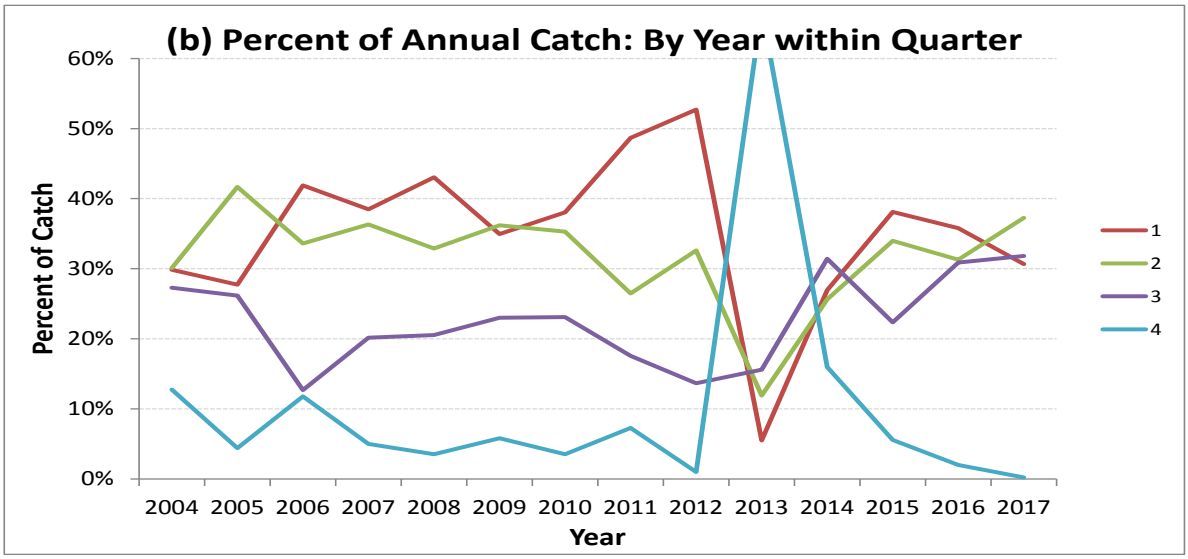
Qtr	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	41607	80138	43333	75577	58120	41536	32806	52929	38072	104	30268	23573	28812	21215	568090
2	52472	127796	35584	70084	46316	42089	31993	40209	28419	514	27509	22870	25455	22541	573851
3	35581	63063	14632	34454	30685	20173	22365	19466	6271	436	20397	13942	16956	19861	318281
4	13178	8064	12461	8336	4881	4170	3079	3817	92	4744	7109	3348	765	124	74169
Total	142838	279061	106010	188451	140002	107968	90243	116421	72854	5798	85283	63733	71988	63741	1534391

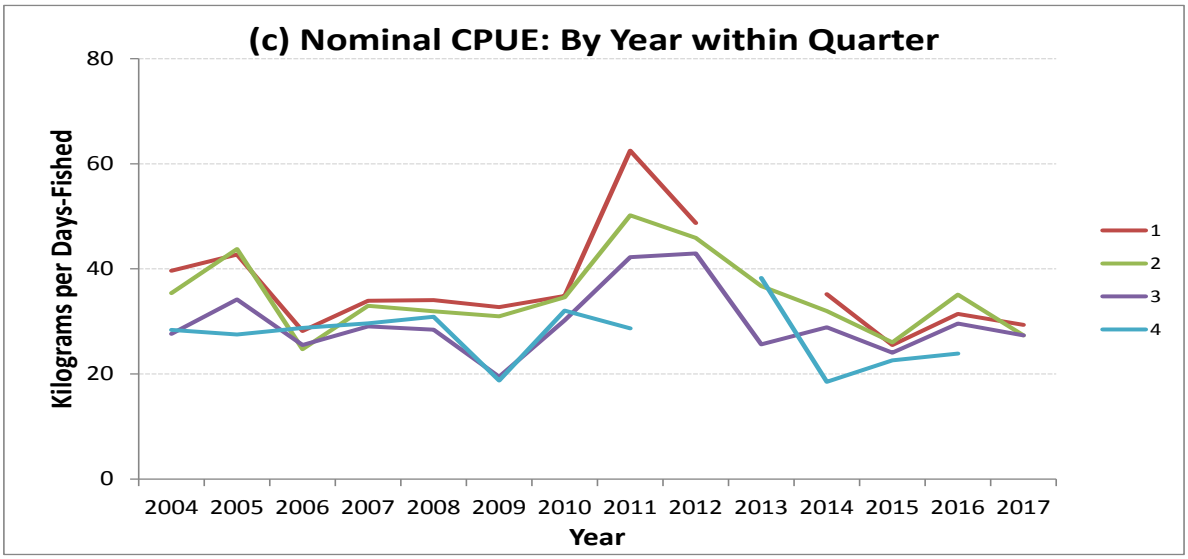
(d) Nominal CPUE

Qtr	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	39.6	42.7	28.2	34.0	34.0	32.7	34.9	62.5	48.7		35.2	25.5	31.4	29.3	36.3
2	35.4	43.8	24.7	33.0	31.9	31.0	34.6	50.2	45.9	36.7	32.0	26.0	35.1	27.4	34.9
3	27.6	34.2	25.5	29.1	28.4	19.5	30.2	42.2	43.0	25.6	28.9	24.1	29.6	27.4	29.1
4	28.4	27.5	28.8	29.7	30.9	18.8	32.1	28.7		38.3	18.5	22.6	23.9		26.7
Total	33.3	40.3	26.6	32.4	31.9	27.8	33.4	51.9	46.9	36.0	30.3	25.2	32.0	28.0	33.5

Apx Figure D-5. Number of GLM data records, total number of days fished, total catch weight, and associated CPUE in each Year*Quarter strata. Note, strata with less than 10 records are shaded (dark shading where number is zero) and nominal CPUE is only shown for strata where the number of the days fished is 10 or greater.







Apx Figure D-6. Number of GLM data records, percent of catch, and associated nominal CPUE in each Year*Quarter strata. Note, nominal CPUE is only shown for strata where the number of the days fished is 10 or greater.

(a) Number of TIB RECORDS

AREA	Q-1	Q-2	Q-3	Q-4	Total
6	108	110	68	13	299
7	2068	1254	1016	372	4710
8	2052	1593	822	284	4751
9	5084	5587	3761	672	15104
10	146	116	79	32	373
11	834	640	408	290	2172
12	789	983	679	271	2722
13	113	213	132	18	476
14	354	524	403	63	1344
15	85	90	56	9	240
16	353	276	198	106	933
17	212	266	180	40	698
Total	12198	11652	7802	2170	33822

(b) Total Number of DAYS_FISHED

AREA	Q-1	Q-2	Q-3	Q-4	Total
6	218	167	110	22	517
7	3077	2453	1707	444	7681
8	3007	2698	1334	428	7467
9	5284	5963	4023	721	15991
10	180	198	131	42	551
11	991	753	478	367	2589
12	1275	1937	1382	410	5004
13	155	372	268	39	834
14	673	991	881	124	2669
15	126	170	114	12	422
16	383	325	223	120	1051
17	295	396	301	51	1043
Total	15664	16423	10952	2780	45819

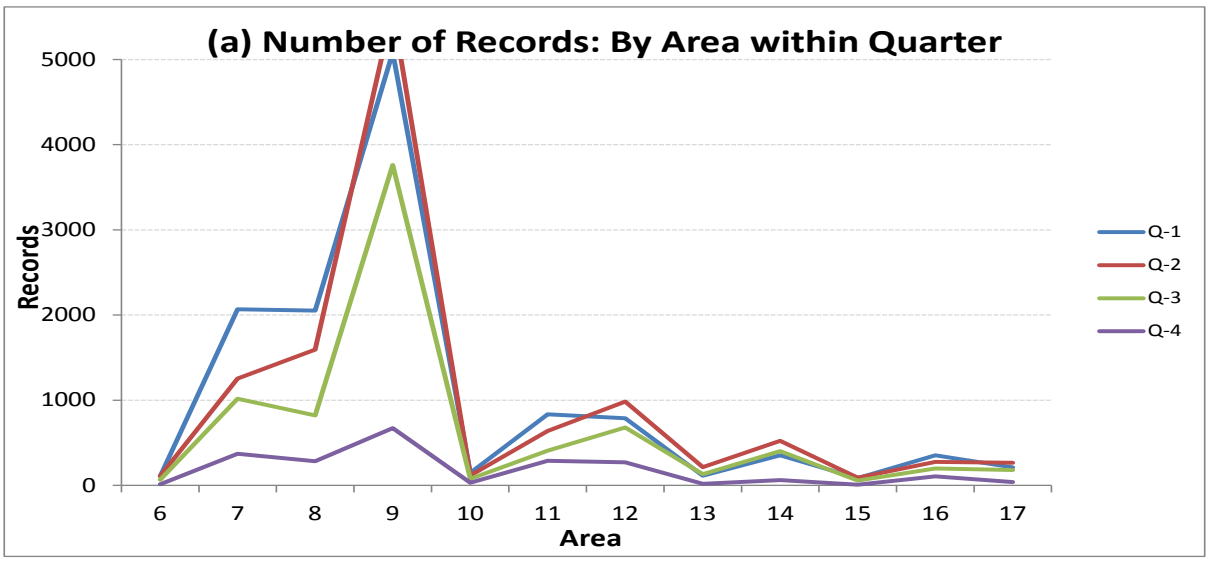
(c) Total CATCH_WEIGHT

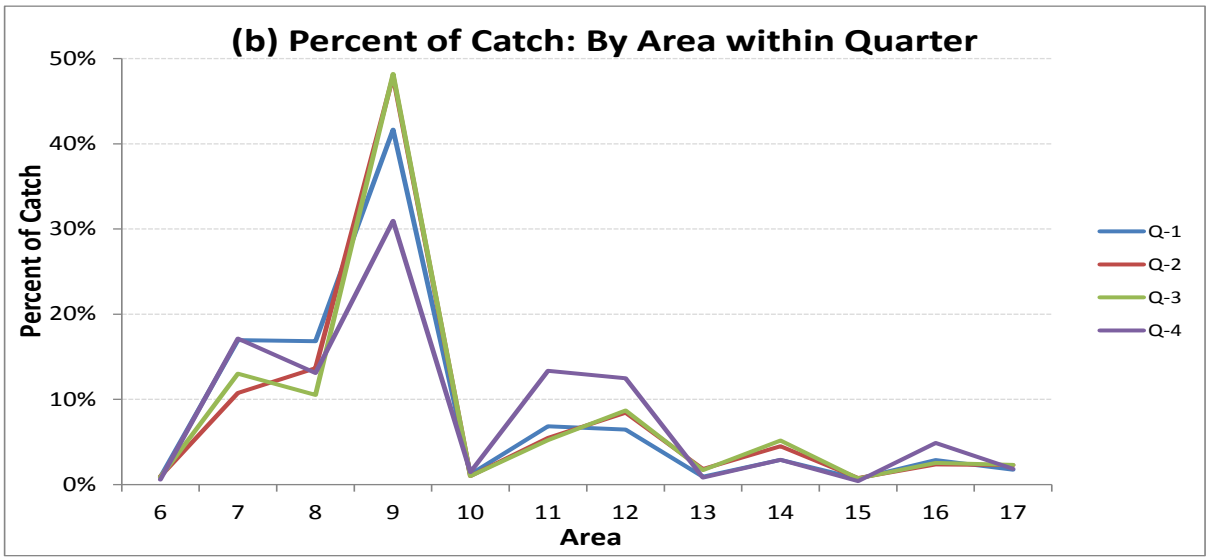
AREA	Q-1	Q-2	Q-3	Q-4	Total
6	10998	8589	3278	604	23469
7	139312	109367	53933	13820	316433
8	98373	85424	37781	11556	233134
9	194498	203631	117003	16518	531651
10	6304	8207	3975	1570	20057
11	37419	36412	20904	12574	107310
12	26230	37408	26484	7305	97427
13	6576	21126	11263	1037	40002
14	23532	28709	20136	2816	75193
15	5612	8313	4358	472	18755
16	11193	10374	7033	4003	32603
17	8043	16289	12133	1892	38358
Total	568090	573849	318281	74167	1534392

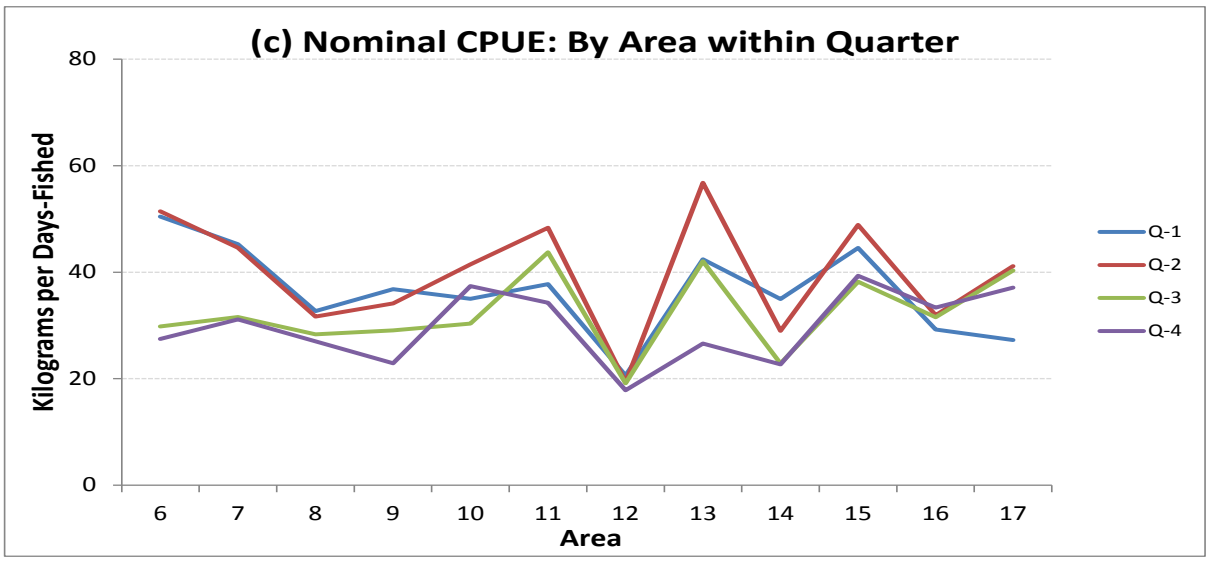
(d) Nominal CPUE

AREA	Q-1	Q-2	Q-3	Q-4	Total
6	50.4	51.4	29.8	27.5	45.4
7	45.3	44.6	31.6	31.1	41.2
8	32.7	31.7	28.3	27.0	31.2
9	36.8	34.1	29.1	22.9	33.2
10	35.0	41.4	30.3	37.4	36.4
11	37.8	48.4	43.7	34.3	41.4
12	20.6	19.3	19.2	17.8	19.5
13	42.4	56.8	42.0	26.6	48.0
14	35.0	29.0	22.9	22.7	28.2
15	44.5	48.9	38.2	39.3	44.4
16	29.2	31.9	31.5	33.4	31.0
17	27.3	41.1	40.3	37.1	36.8
Total	36.3	34.9	29.1	26.7	33.5

Apx Figure D-7. Number of GLM data records, total number of days fished, total catch weight, and associated CPUE in each Area*Quarter strata. Note, strata with less than 10 records are shaded (dark shading where number is zero) and nominal CPUE is only shown for strata where the number of the days fished is 10 or greater.







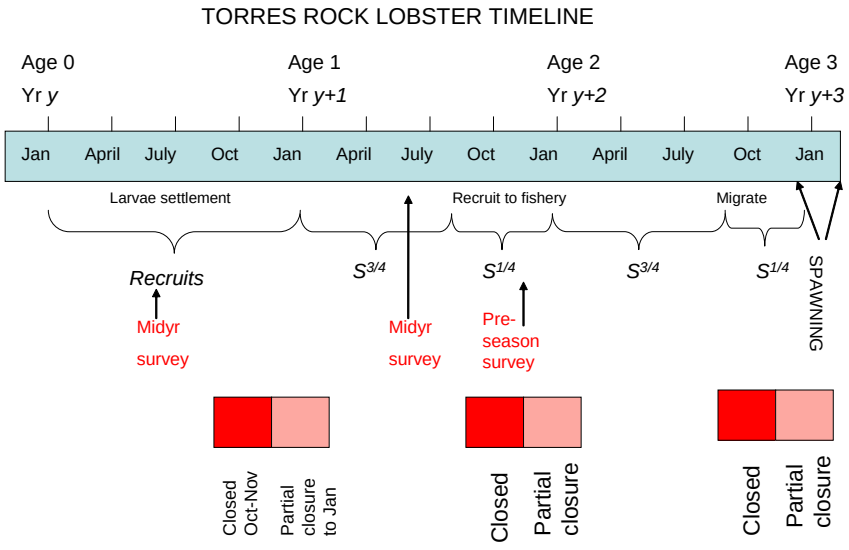
Apx Figure D-8. Number of GLM data records, percent of catch, and associated CPUE in each Area*Quarter strata. Note, nominal CPUE is only shown for strata where the number of the days fished is 10 or greater.

Appendix E Stock Assessment Model Equations

E.1 Stock Assessment Equations

Introduction

Torres Strait rock lobsters emigrate in spring and breed during the subsequent summer (November-February) (Moore and MacFarlane, 1984; MacFarlane and Moore, 1986). Therefore, the number of age 2+ lobsters at the middle of the breeding season (December) should represent the size of the spawning stock (Apx Figure E-1). A schematic summary timeline underlying the new Integrated model is presented in Apx Figure E-1. To simplify computations, the new model assumes catches, migration and spawning occur at discrete times, with quarterly updates to the dynamics of each age class. Catches of 2+ individuals are assumed taken as a pulse at midyear, with individuals migrating out of the Torres Straits at the end of the third quarter, and a spawning biomass being computed at the end of the year. Catches of 1+ lobsters are assumed taken at the end of the third quarter, when a proportion of this age class have grown large enough to be available to fishers.



Apx Figure E-1. Summary timeline for Torres Strait Rock Lobster model.

P. ornatus is an unusually fast growing lobster and hence analyses are expected to be sensitive to changes in assumption regarding growth rate (length vs age) and mass-at-length. Previous modelling studies used the Trendall et al. (1988) relationship:

$$CL_m = 177\left(1 - e^{-0.386(m/12 - 0.411)}\right)$$

where *CL* is carapace length (mm) and *m* is age in months for aspects of the computations. However, after converting length to mass using the morphometric relationship:

TOTWT=0.00258*(CL^2.76014)

the Trendall et al (1988) relationship translates into average individual masses that are less than the observed average mass of lobsters caught in the fishery. The Integrated model thus uses the Phillips et al. (1992) male growth relationship:

$$CL = L_{\infty}\left(1 - e^{-kt}\right)$$

where $L_{\infty} = 165.957 \quad mm$;

$\kappa = -0.0012$; and

t is age in DAYS.

The integrated model

An age-structured model of the Torres Rock Lobster population dynamics is developed and fitted to the available abundance indices by maximising the likelihood function. The model equations and the general specifications of the model are described below, followed by details of the contributions to the log-likelihood function from the different sources of data available. Quasi-Newton minimization is used to minimize the total negative log-likelihood function (the package AD Model BuilderTM (Fournier et al. 2012) is used for this purpose.

Lobster population dynamics

Numbers-at-age

The resource dynamics are modelled by the following set of population dynamics equations:

$$N_{y+1,1} = R_{y+1} \qquad 1$$

$$N_{y+1,a+1} = \left(N_{y,a}\, e^{-3M_a/4} - C_{y,a}\right) e^{-M_a/4} \quad \text{for a=1} \qquad 2$$

$$N_{y+1,a+1} = \left(N_{y,a}\, e^{-M_a/2} - C_{y,a}\right) e^{-M_a/2} \quad \text{for a=2} \qquad 3$$

where

$N_{y,a}$ is the number of lobsters of age a at the start of year y (which refers to a calendar year),

R_y is the recruitment (number of 1-year-old lobsters) at the start of year y,

M_a denotes the natural mortality rate on lobsters of age a, and

$C_{y,a}$ is the predicted number of lobsters of age a caught in year y

These equations simply state that for a closed population, with no immigration and emigration, the only sources of loss are natural mortality (predation, disease, etc.) and fishing mortality (catch). They reflect Pope's form of the catch equation (Pope, 1972) (the catches are assumed to be taken as a pulse at midyear for the 2+ class and at the start of the third quarter for the 1+ class) rather than the more customary Baranov form (Baranov, 1918) (for which catches are incorporated under the assumption of steady continuous fishing mortality). Pope's form has been used in order to simplify computations.

Recruitment

The number of recruits (i.e. new 1-year old lobsters – it is simpler to work with 1- rather than 0-year old lobsters as recruits) at the start of year y is assumed to be related to the spawning stock size (i.e. the biomass of mature lobsters) by a Beverton-Holt stock-recruitment relationship (Beverton and Holt, 1957), allowing for annual fluctuation about the deterministic relationship:

$$R_y = \frac{\alpha B_{y-1}^{sp}}{\beta + \left(B_{y-1}^{sp}\right)^{\gamma}} e^{(\varsigma_y - (\sigma_R)^2/2)} \qquad 4$$

where

α, β and γ are spawning biomass-recruitment relationship parameters (note that cases with γ > 1 lead to recruitment which reaches a maximum at a certain spawning biomass, and thereafter declines towards zero, and thus have the capability of mimicking a Ricker-type relationship),

ς_y reflects fluctuation about the expected recruitment for year y, which is assumed to be normally distributed with standard deviation σ_R (which is input in the applications considered here); these residuals are treated as estimable parameters in the model fitting process. Estimating the stock-recruitment residuals is made possible by the availability of catch-at-age data, which give some indication of the age-structure of the population.

B_y^{sp} is the spawning biomass at the start of year y, computed as:

$$B_y^{sp} = w_3^{st} \cdot N_{y,3} \qquad 5$$

where

w_3^{st} is the mass of lobsters of age 3 (i.e. in December during the spawning season).

In order to work with estimable parameters that are more meaningful biologically, the stock-recruitment relationship is re-parameterised in terms of the pre-exploitation equilibrium spawning biomass, K^{sp}, and the "steepness", h, of the stock-recruitment relationship, which is the proportion of the virgin recruitment that is realized at a spawning biomass level of 20% of the virgin spawning biomass:

$$\beta = \frac{\left(K^{sp}\right)^{\gamma}\left(1 - 5h0.2^{\gamma}\right)}{5h - 1} \qquad 6$$

and

$$\alpha = \frac{\beta + \left(K^{sp}\right)^{\gamma}}{SPR_{virg}} \qquad 7$$

where

$$SPR_{virg} = w_3^{st} N_3^{virg} \qquad 8$$

with

$$N_1^{virg} = 1 \qquad (9)$$

$$N_a^{virg} = N_{a-1}^{virg} e^{-M_{a-1}} \quad \text{for} \quad 2 < a \leq m \qquad (10)$$

where

m is the maximum age considered (taken to be 3).

Total catch and catches-at-age

The catch by mass in year *y* is given by:

$$C_y = w_1^{land} N_{y,1} e^{-3M_a/4} S_{y,1} F_y^{1+} + w_2^{mid} N_{y,2} e^{-M_a/2} S_{y,2} F_y^{2+} \qquad (11)$$

where

w_a^{land} denotes the mass of lobsters of age *a* that are landed at the end of the third quarter,

w_a^{mid} denotes the mid-year mass of lobsters of age *a*,

$S_{y,a}$ is the commercial selectivity (i.e. vulnerability to fishing gear) at age *a* for year *y*; and

F_y is the fished proportion (of the 1+ and 2+ classes) of a fully selected age class.

The model estimate of the exploitable ("available") component of biomass is calculated by converting the numbers-at-age into mass-at-age (using the individual weights of the 1+ lobsters assumed landed at the end of the third quarter, and the 2+ lobsters assumed landed at midyear):

$$B_y^{ex,1+} = w_1^{land} S_{y,1} N_{y,1} e^{-3M_a/4} \qquad (12)$$

$$B_y^{ex,2+} = w_2^{mid} S_{y,2} N_{y,2} e^{-M_a/2} \qquad (13)$$

and hence:

$$B_y^{ex} = B_y^{ex,1+} + B_y^{ex,2+} \qquad (14)$$

The 2010 model version computes the catch by mass separately for the trawling sector, which is assumed to target 2+ lobsters only. The exploitable component of biomass for this sector is thus based on Equation (13) only and assumes full selectivity of the 2+ age group.

The model estimates of the midyear numbers of lobsters are:

$$N_y^{mid} = N_{y,1} e^{-M_1/2} + \left(N_{y,2}\, e^{-M_2/2} - C_{y,2}\right) \qquad (15)$$

i.e.

$$N_{y,1}^{mid} = N_{y,1} e^{-M_1/2} \qquad (16)$$

$$N_{y,2}^{mid} = N_{y,2}\, e^{-M_2/2} - C_{y,2} \qquad (17)$$

Similarly, the model estimate of numbers for comparison with the Pre-Season November survey are as follows:

$$N_{y,1}^{pre} = \left(N_{y,1} e^{-3M_1/4} - C_{y,1}\right) e^{-M_1/6} \qquad (18)$$

$$N^{pre}_{y,2} = N^{mid}_{y,2}\, e^{-5M_2/12} \quad (19)$$

The proportion of the 1+ and 2+ age classes harvested each year (F^{1+}_y) are given respectively by:

$$F^{1+}_y = C^{1+}_y / B^{exp,1+}_y \quad (20)$$

$$F^{2+}_y = C^{2+}_y / B^{exp,2+}_y \quad (21)$$

where C^{1+}_y and C^{2+}_y are the catch by mass in year *y* for age classes 1 and 2, such that:

$$C^{1+}_y = p_{y,1+} C_y \quad (22)$$

and

$$C^{2+}_y = (1 - p_{y,1+}) C_y \quad (23)$$

with $p_{y,1+}$ representing the 1+ proportion of the total catch.

Given different fishing proportions for the two age classes, the numbers-at-age removed each year from each age class can be computed from:

$$C_{y,1} = S_{y,1} F^{1+}_y N_{y,1} e^{-3M_a/4} \quad \text{for } a = 1, \text{ and} \quad (24)$$

$$C_{y,2} = S_{y,2} F^{2+}_y N_{y,2} e^{-M_a/2} \quad \text{for } a = 2 \quad (25)$$

The fully selected fishing proportion (*F*) is related to the annual fishing mortality rate (*F**) as follows:

$$1 - F = e^{-F^*} \quad (26)$$

Initial conditions

Although some exploitation occurred before the first year for which data are available for the lobster stock, this is considered relatively minor and hence the stock is assumed to be at its pre-exploitation biomass level in the starting year and hence the fraction (θ) is fixed at one in the analysis described here:

$$B^{sp}_{y_0} = \theta \cdot K^{sp} \quad (27)$$

with the starting age structure:

$$N_{y_0,a} = R_{start} N_{start,a} \quad \text{for } 1 \le a \le m \quad (28)$$

where

$$N_{start,1} = 1 \quad (29)$$

$$N_{start,a} = N_{start,a-1} e^{-M_{a-1}} \quad \text{for } 2 \le a \le m-1 \quad (30)$$

The (penalised) likelihood function

Model parameters are estimated by fitting to survey abundance indices, commercial and survey catch-at-age data as well as standardised CPUE data in some cases. A penalty function is included

to permit estimation of residuals about the stock-recruitment function. Contributions by each of these to the negative of the log-likelihood ($-\ln L$) are as follows.

Survey abundance data

The same methodology is applied for the midyear and pre-season surveys, except that for the former there are indices for both the total 1+ and 2+ numbers, whereas for the pre-season the fit is only to the 1+ lobsters as most of the older lobsters will have migrated out of the region by November. The likelihood is calculated assuming that the observed midyear (and pre-season) survey abundance index is log-normally distributed about its expected value:

$$I_y^i = \hat{I}_y^i \exp\left(\varepsilon_y^i\right) \quad \text{or} \quad \varepsilon_y^i = \ln\left(I_y^i\right) - \ln\left(\hat{I}_y^i\right) \qquad 31$$

where

I_y^i is the scaled survey abundance index for year *y* and series *i*,

$\hat{I}_y^i = \hat{q}_s \hat{N}_y^{survey}$ is the corresponding model estimate, where $\hat{N}_y^{survey}$ is the model estimate of midyear numbers, given by equation 16 and 17 for the midyear survey, and for the pre-season survey it is given by equation 18.

$\hat{q}_s$ is the constant of proportionality (catchability) for the survey, and

ε_y^i from $N\left(0, \left(\sigma_y^i\right)^2\right)$.

The contribution of the survey data to the negative of the log-likelihood function (after removal of constants) is then given by:

$$-\ln L^{Surv} = \sum_i \sum_y \left[\ln\left(\sigma_y^i\right) + \left(\varepsilon_y^i\right)^2 / 2\left(\sigma_y^i\right)^2\right] \qquad 32$$

where $\left(\sigma_y^s\right)^2 = \ln\left(1 + \left(CV_y\right)^2\right)$ and the coefficient of variation (CV_y) of the resource abundance estimate for year *y* is input.

The survey catchability coefficient $\hat{q}_s$ is estimated by its maximum likelihood value:

$$\ln \hat{q}_s = 1/n_i \sum_y \left(\ln I_y^i - \ln N_y^{ex}\right) \qquad 33$$

Commercial catches-at-age

The contribution of the catch-at-age data to the negative of the log-likelihood function under the assumption of an "adjusted" lognormal error distribution is given by:

$$-\ln L^{CAA} = \sum_y \sum_a \left[\ln\left(\sigma_{com} / \sqrt{p_{y,a}}\right) + p_{y,a}\left(\ln p_{y,a} - \ln \hat{p}_{y,a}\right)^2 / 2\left(\sigma_{com}\right)^2\right] \qquad 34$$

where

$p_{y,a} = C_{y,a} / \sum_{a'} C_{y,a'}$ is the observed proportion of lobsters caught in year y that are of age a,

$\hat{p}_{y,a} = \hat{C}_{y,a} / \sum_{a'} \hat{C}_{y,a'}$ is the model-predicted proportion of lobsters caught in year y that are of age a, where

$$\hat{C}_{y,1} = N_{y,1}\, e^{-3M_a/4}\, S_{y,1}\, F_y^{1+} \qquad 35$$

$$\hat{C}_{y,2} = N_{y,2}\, e^{-M_a/2}\, S_{y,2}\, F_y^{2+} \qquad 36$$

and

σ_{com} is the standard deviation associated with the catch-at-age data, which is estimated in the fitting procedure by:

$$\hat{\sigma}_{com} = \sqrt{\sum_y \sum_a \left(\ln p_{y,a} - \ln \hat{p}_{y,a}\right)^2 / \sum_y \sum_a 1} \qquad 37$$

The same approach is applied when fitting to the historic catch proportion data.

Survey catches-at-age

The survey catches-at-age are incorporated into the negative of the log-likelihood in an analogous manner to the commercial catches-at-age, assuming an adjusted log-normal error distribution (equation 25) where:

$p_{y,a} = C_{y,a}^{surv} / \sum_{a'} C_{y,a'}^{surv}$ is the observed proportion of lobsters of age a in year y,

$\hat{p}_{y,a}$ is the expected proportion of lobsters of age a in year y in the survey, given by:

$$\hat{p}_{y,a} = N_{y,a} \Big/ \sum_{a'=1}^{2} N_{y,a} \qquad 38$$

Benchmark Survey Estimates of Absolute Abundance

The absolute abundance of lobsters is estimated by fitting to data from two benchmark midyear surveys. The total 2002 population estimate, together with 95% confidence interval, was T_{89} = 9.0 (±1.9) million lobsters, and for 1989, T_{89} = 14.0 (±2.9) million lobsters (Pitcher et al. 1992). The 2+ year class was estimated at 1.77 (±0.38) million in 2002, and the 1+ year-class was at 5.2 (±1.5) million.

The approach is similar to that described above for the survey relative abundance index. The contribution of the survey data to the negative of the log-likelihood function (after removal of constants) is then given by:

$$-\ln L^{Bench} = \ln\left(\sigma_{89}\right) + \left(\varepsilon_{89}\right)^2 / 2\left(\sigma_{89}\right)^2 + \ln\left(\sigma_{02}\right) + \left(\varepsilon_{02}\right)^2 / 2\left(\sigma_{02}\right)^2 \qquad 39$$

where $\varepsilon_{89} = \ln\left(T_{89}\right) - \ln\left(\hat{N}_{1989,1}^{mid} + \hat{N}_{1989,2}^{mid}\right)$;

$\varepsilon_{02} = \ln\left(T_{02}\right) - \ln\left(\hat{N}_{2002,1}^{mid} + \hat{N}_{2002,2}^{mid}\right)$; and

$(\sigma_y)^2 = \ln(1+(CV_y)^2)$ and the two coefficients of variation (CV_{89} and CV_{02}) are input.

Stock-recruitment function residuals

The stock-recruitment residuals are assumed to be log-normally distributed. The contribution of the recruitment residuals to the negative of the (now penalised) log-likelihood function is given by:

$$-\ln L^{pen} = \sum_{y=y1+1}^{y2} \frac{(\lambda_y)^2}{2\sigma_R^2} \qquad 40$$

where

$\lambda_y = \varepsilon_y$ is the recruitment residual for year y, which is estimated for year $y1$ to $y2$ (see equation 4),

ε_y from $N(0,(\sigma_R)^2)$,

σ_R is the standard deviation of the log-residuals, which is input.

Model parameters

Natural mortality:

Natural mortality (M_a) is generally taken to be age independent and is estimated in the model fitting process.

In sensitivity tests where age-dependence is admitted, it is taken to have the form:

$$M_a = \mu_1 + \mu_2/a \qquad 41$$

Fishing selectivity-at-age:

The commercial selectivity is taken to differ over the 1973-2002 and 2002+ periods. Full selectivity of the 2+ class is assumed, with a separate selectivity parameter being estimated for each period for the 1+ class.

E.2 2017 Model stock recruitment residual estimates

	Estimate	90% Hessian-based confidence limits	
1985	0.06	-0.37	0.49
1986	0.00	-0.68	0.69
1987	-0.01	-0.54	0.52
1988	0.67	0.44	0.91
1989	-0.07	-0.29	0.16
1990	-0.01	-0.23	0.21
1991	0.28	0.07	0.49
1992	0.30	0.08	0.52
1993	0.12	-0.09	0.34
1994	0.39	0.15	0.62
1995	0.11	-0.11	0.33
1996	0.10	-0.11	0.30
1997	0.23	0.02	0.45
1998	-0.53	-0.76	-0.29
1999	-0.12	-0.36	0.13
2000	-0.67	-0.96	-0.38
2001	-0.28	-0.52	-0.04
2002	0.19	-0.02	0.40
2003	0.26	0.05	0.48
2004	0.35	0.14	0.56
2005	-0.55	-0.75	-0.34
2006	0.41	0.20	0.62
2007	0.03	-0.18	0.24
2008	-0.12	-0.30	0.06
2009	0.22	0.01	0.42
2010	0.64	0.44	0.85
2011	0.60	0.38	0.81
2012	0.54	0.31	0.78
2013	0.13	-0.09	0.35
2014	0.22	-0.02	0.45
2015	0.44	0.21	0.68
2016	-0.19	-0.43	0.05
2017	-0.43	-0.70	-0.17

Glossary

AFMA	Australian Fisheries Management Authority
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific and Industrial Research Agency
eHCR	Empirical Harvest Control Rule
RBC	Recommended Biological Catch
TAC	Total Allowable Catch
TIB	Traditional Inhabitant Boat sector
TRL	Tropical Rock Lobster
TSSAC	Torres Strait Scientific Advisory Committee
TVH	Transferrable Vessel Holder (Licence)
TRL RAG	Tropical Rock Lobster Research Advisory Group
PNG	Papua New Guinea

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