

2016 Updated Assessment of the Tropical Rock Lobster (*Panulirus ornatus*) Fishery in the Torres Straits following November 2016 preseason survey



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SUMMARY

This document summarises the post-Nov 2016 preseason survey update of the integrated stock assessment model. The data updates include the latest (Nov 2016) pre-season survey results, the catch total for 2016 and revision for 2015 (Table 1), and revisions and updates to the commercial CPUE (TVH & TIB) data series (see Campbell et al. 2016a,b). The full details of the stock assessment model are provided in Plagányi et al. (2015a), and a more detailed update will be presented at the next TRLRAG meeting. Reference Case results are summarised in Table 1.

The model predictions for 2017 are not as optimistic as has been the case for the past couple of years because they are based mostly on the preseason survey 1+ index, which is similar to the lowest of the 6 values recorded thus far, namely 2.5 in 2008. Note that the model results presented here are fitted to the preseason survey index based on midyear sites only, as discussed in Campbell et al. (2016).

The model fits the Preseason survey data reasonably well (Fig. 1), and most of the CPUE series, except that the model is unable to satisfactorily fit the 2015 CPUE data for TVH or TIB sectors. The potential reasons for this are discussed in more detail in Plagányi et al. (2015b). 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 will be further investigated via sensitivity analyses.

Summary model results are shown in Figs. 1-6. The Reference case model presented here is fitted to the TVH CPUE Main Effects Int1 option and the standardised Seller+QA CPUE TIB series as described in Campbell *et al.* 2016a,b (Fig. 5). There isn't much difference between the alternative CPUE standardisations, but sensitivity analyses will be done to check for any differences to model predictions.

The 2016 stock-recruit residual is seen to be lower than the average value, but is not as low as has been predicted to be the case for some past years (Fig. 6).

Applying the reference case model straightforwardly with the updates as described, suggests a RBC(2017) of 495t [90% CI 315-676t] [75% CI 369-622t] (Tables 2-3). This value is slightly lower than the RBC of 602t that would be recommended if applying the empirical Harvest Control Rule (eHCR), but note that the latter estimate falls within the 90% confidence interval. The resource spawning biomass is estimated to be currently at approximately the 1973 level (used as a proxy for carrying capacity K although the stock is highly variable and fluctuates around this level), but given the variability, it is predicted that next year's spawning biomass will drop to 63% of this level (Fig. 4).

REFERENCES

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Plagányi, É.E., Dennis, D., Campbell, R., Haywood, M., Pillans, R., Tonks, M., Murphy, N., McLeod, I. 2015a. Torres Strait rock lobster (TRL) fishery surveys and stock assessment: TRL fishery model, used to calculate the upcoming TAC updated using the 2014 survey data and the previous year's CPUE data. AFMA Project 2013/803. June 2015 Milestone report. 64 pp.

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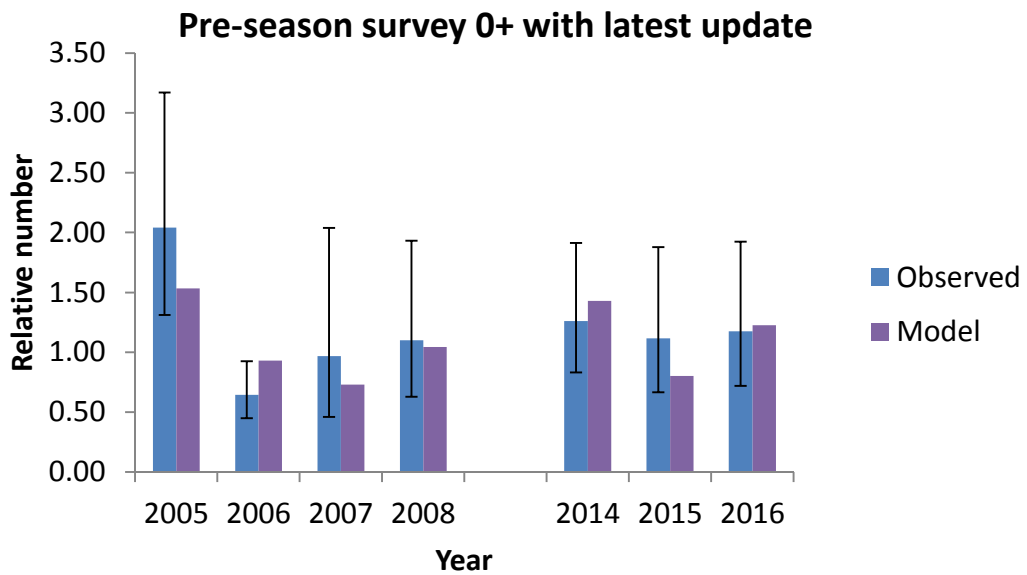
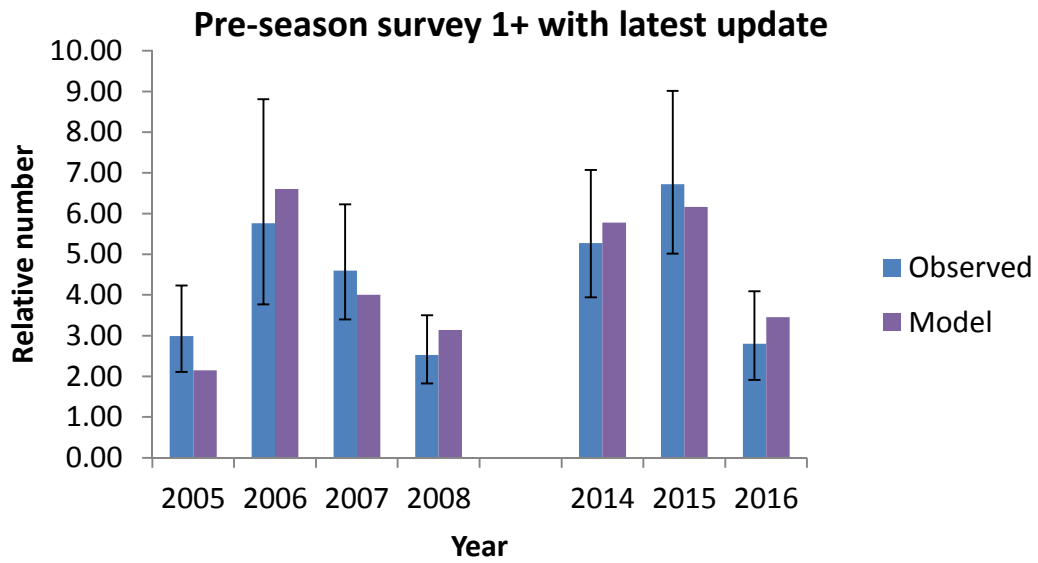


Figure 1. Comparison between observed Pre-season survey data (expressed in terms of number * 10⁴) and corresponding model-predicted estimates.

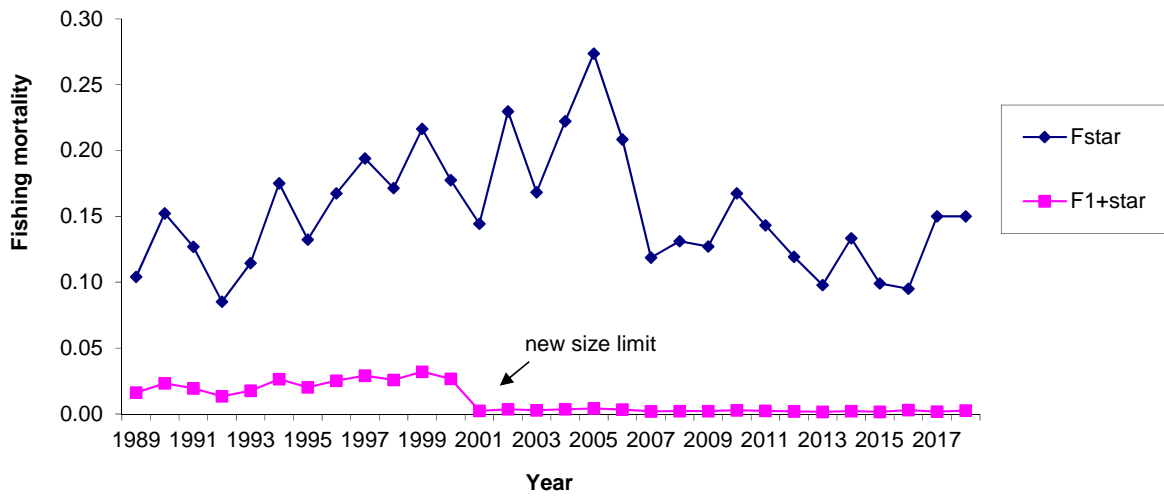


Figure 2. Model-estimated fishing mortality trends for 1+ (F 1+star) and 2+ (F 2+ star) lobsters. The 2002 change in size limit is highlighted and the 2017 fishing mortality set equal to the target value of 0.15.

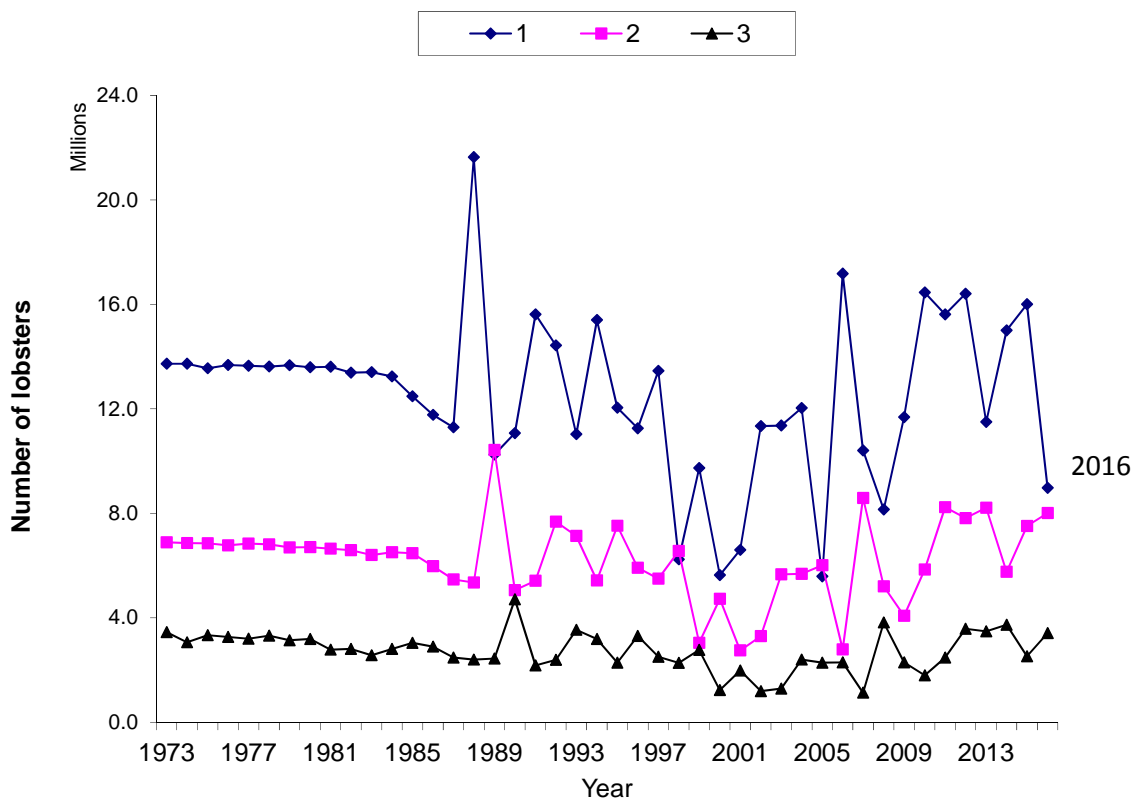


Fig. 3. Model trajectories of the annual numbers of lobsters in each age class at the start of each of years 1973 to 2016. The increased variability from 1985 onwards is because the model estimates stock recruit residuals for years from 1985 to 2016.

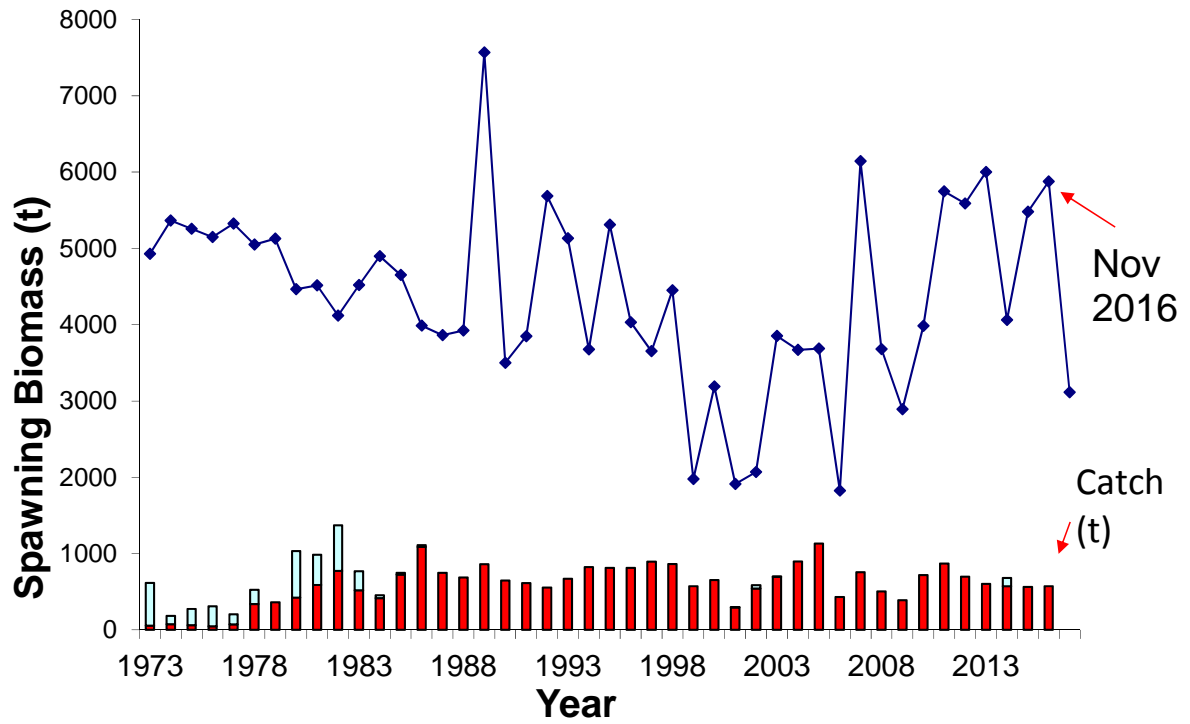
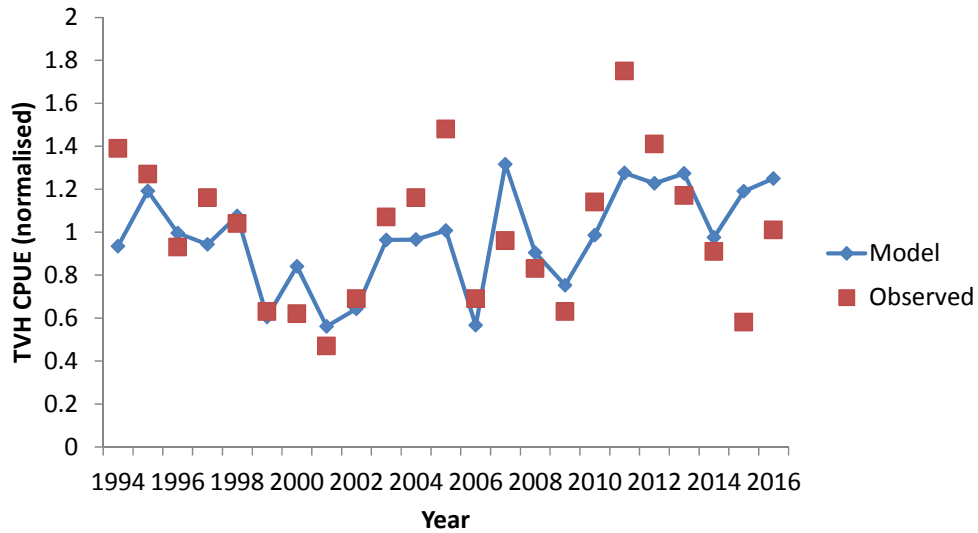


Fig. 4. Model trajectories of the lobster spawning biomass (t) over the model period shown together with annual catches by the trawling and other sectors combined.



b) REFERENCE CASE FIT TO TIB CPUE (nominal)

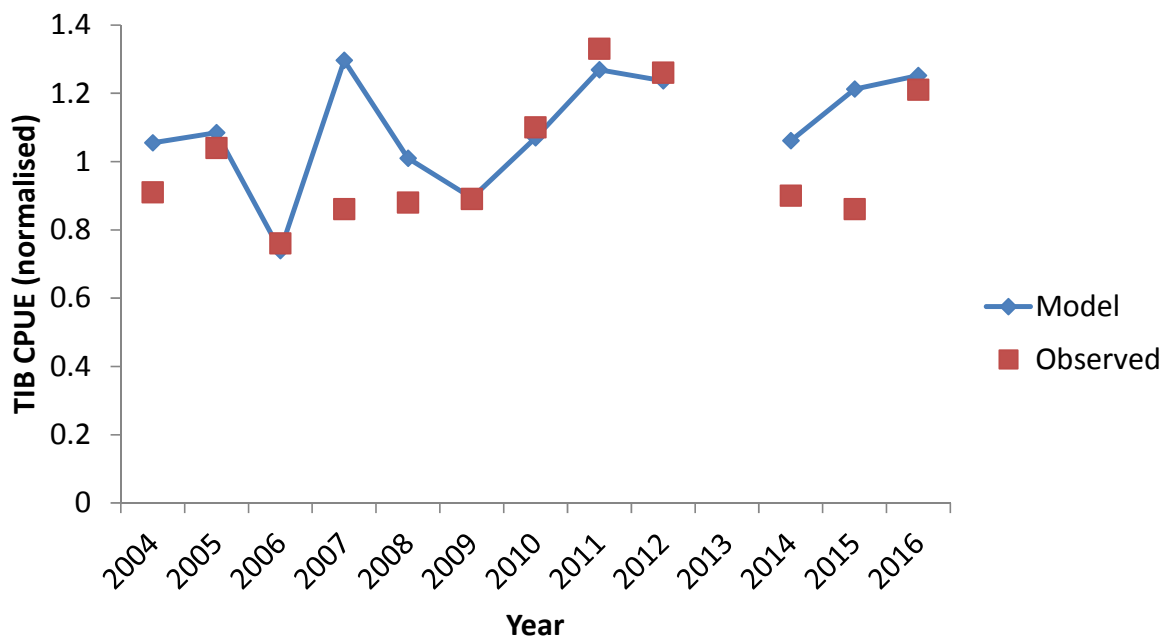


Figure 5. Comparison between CPUE data and corresponding model-predicted estimates. The plots are respectively a) Reference-Case fit of the model to CPUE standardised estimates from the TVH sector with lower bound for sigma set at 0.15, b) fit to TIB CPUE standardised estimates available from 2004-2016 (no data for 2013); assuming 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. Stock-recruit residuals.



Table 1. Updated Catch data and comparison with TACs.

Year	TiB	TVH	PNG	TS_Total	Aus_TAC	Catch as % of TAC
2004	235.116	480.968	182	898.084		
2005	358.474	544.977	228	1131.451		
2006	152.259	135.448	142	429.707	471	91%
2007	260.011	268.596	228	756.607	842	90%
2008	183.948	100.438	221	505.386	751	67%
2009	135.898	91.061	161.4	388.359	450	86%
2010	143.319	282.614	292.8	718.733	853	84%
2011	200.691	503.533	165	869.224	803	108%
2012	152.859	370.482	173.7	697.041	964	72%
2013	134.212	361.661	108.3	604.173	871	69%
2014	148.538	272.685	151.4	572.623	616	93%
2015	173.873	152.709	235.7	562.282	769	73%
2016	207.074	237.613	127.1	571.787	796	72%

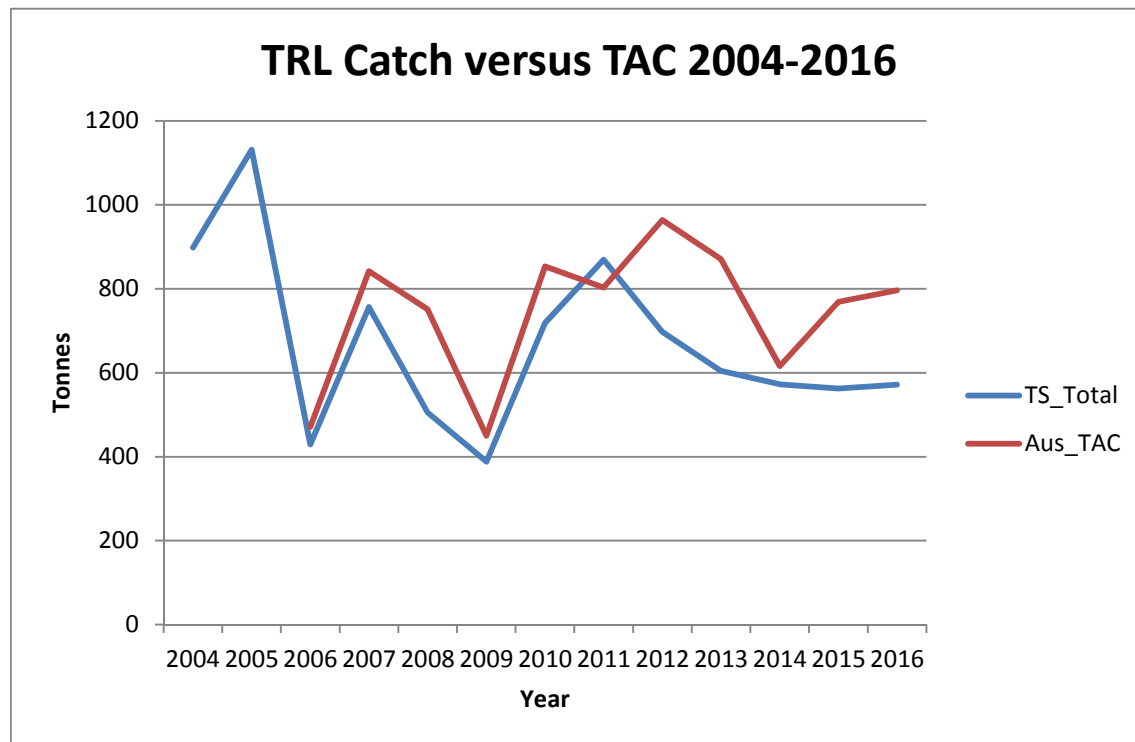


Table 2. Reference Case model results

Parameter	Parameter	Value	90% CI
<i>B(1973)^{sp} (tons)</i>	4947	3497	6397
<i>M</i>	0.69	0.56	0.82
<i>h</i>	fixed 0.7		
<i>Sel (age 1+) 1973-1988</i>	0.44	0.24	0.63
<i>Sel (age 1+) 1989-2001</i>	0.16	0.14	0.19
<i>Sel (age 1+) post2002</i>	0.02	0.00	0.03
<i>Recruitment residuals (1985-2016)</i>	32 parameters		
<u>Model estimates and depletion statistics</u>			
<i>B(2016)^{sp} (tons)</i>	5877	3671	8083
<i>RBCprelim(2017) model</i>	495	315	676
<i>RBCforecast(2018) model</i>	758	546	970
Current Depletion (Nov)			
<i>B(2016)^{sp} / B(1973)_{sp}</i>	1.19	0.84	1.55
<i>Bexp(2016) (tons)</i>	6306	4179	8432
No. parameters estimated	37		
'-lnL:overall	-182.974		
AIC	-291.948		
<u>Likelihood contributions</u>		<u>Sigma</u>	<u>q</u>
'-lnL:CAA	-53.93	0.05	
'-lnL:CAA _{surv}	-19.17	input from data	
-lnL:CAA historic	-21.77	0.13	
-lnL:Survey Index 1+	-24.53	input from data	3.761E-07
-lnL:Survey Index 2+	-13.20	input from data	3.935E-07
-lnL:Survey benchmark	-3.14	input from data	
'-lnL:PRESEASON	-8.28	input from data	7.262E-07
-lnL:PRESEASON 0+	-5.79	input from data	8.436E-08
-lnL:CPUE (TVH)	-26.02	0.20	1996.0000
-lnL:CPUE (TIB)	-13.31	0.20	2006.0000
'-lnL:RecRes	6.15	0.50	(input sigma 0.5)

Table 3. SUMMARY OF Preliminary allocation for 2017 for Tropical Rock Lobster (*Panulirus ornatus*) Fishery in the Torres Straits

TAC/Catch (t)	2012	2013	2014	2015	2016	2017
Forecast TAC (90% CI)	532 (282-782)	769 (485-1053)	767 (518-1016)	751 (556-945)	719 (515-923)	677 (489-866)
Preliminary TAC (90% CI)	964 (497-1432)	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
Preliminary TAC allocation* (lower 75 th percentile)	637	573	391	668 TIB: 254 t TVH: 194 t PNG: 220 t	568t TIB: 216 t TVH: 165 t PNG: 187 t	
Final TAC	964	871	616	Mar 2015 (revision with preseason survey = 769t)	796	Dec 2016
Catch	697t	604t	682t	562t	572t	-