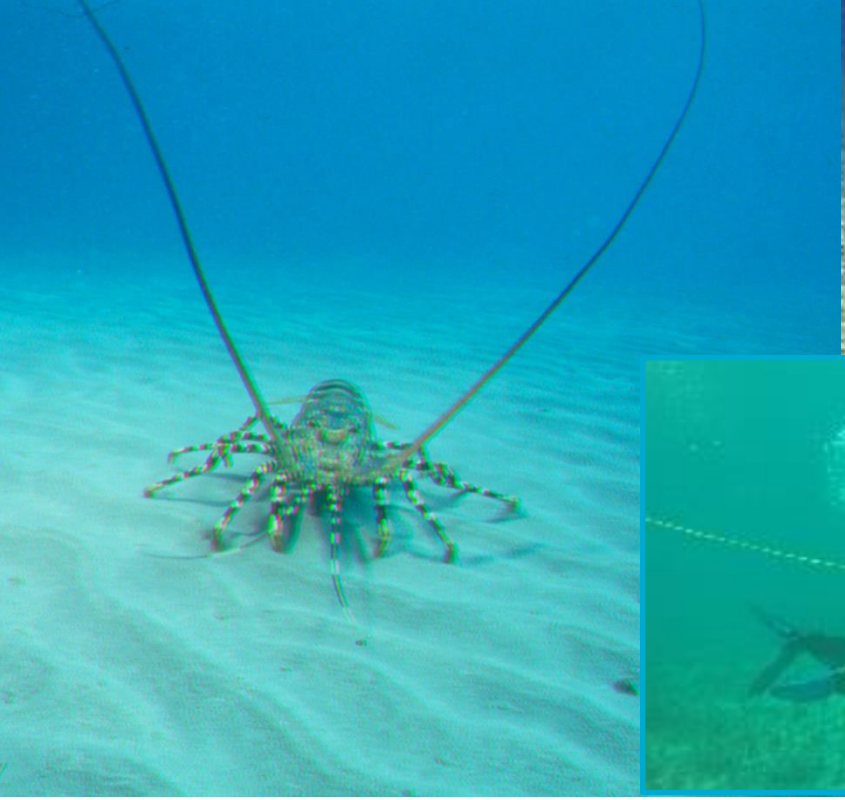




Updated 2016 Integrated Stock Assessment to provide management advice on the Torres Strait rock lobster fishery

Éva Plagányi, Darren Dennis, Rob Campbell, Mark Tonks, Roy Deng, Mick Haywood

CSIRO Oceans & Atmosphere, Brisbane

March 2017

Data used in the assessment

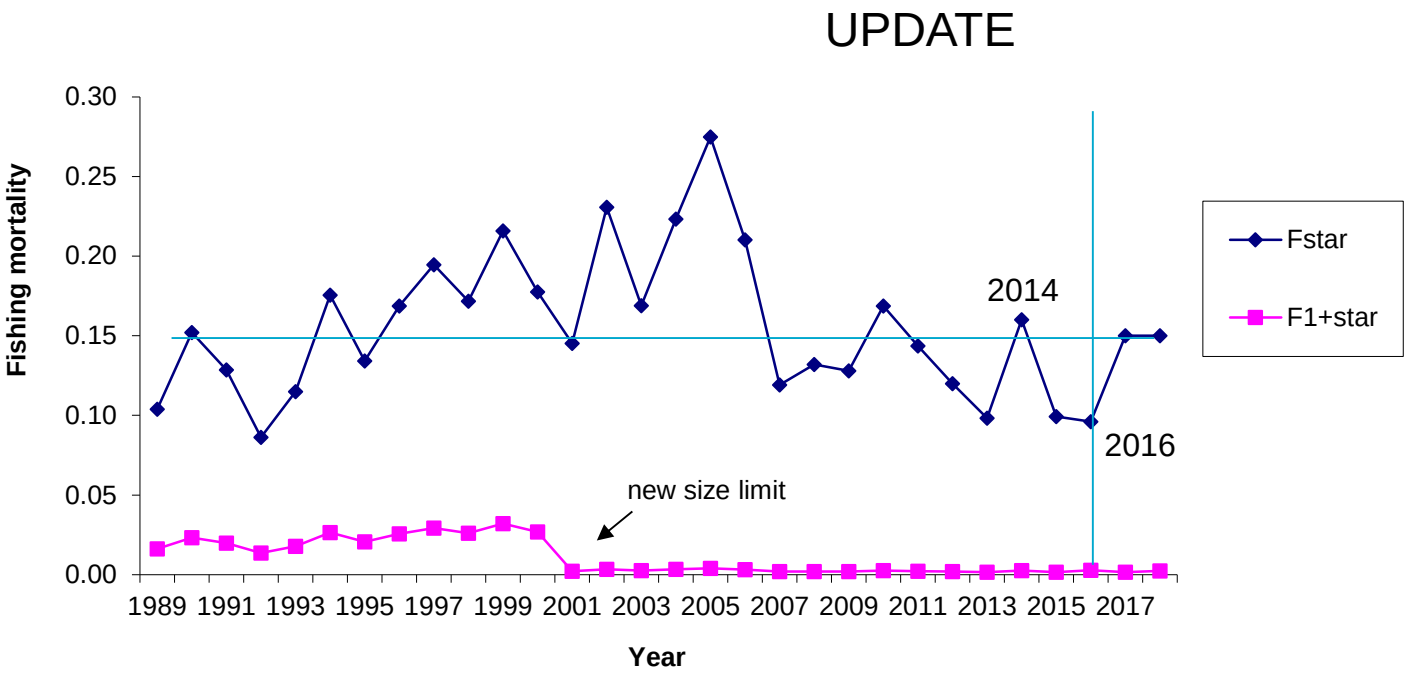
- Data
  - Pre-season survey (7 yrs – gap in data)
  - Mid-year survey data 1989-2014
  - Catch statistics from TS, all sectors
  - Length frequency data (Australian & PNG)
  - CPUE data from TVH sector
  - CPUE data from TIB sector
  - Historic information
- Future:
  - Environmental correlates?

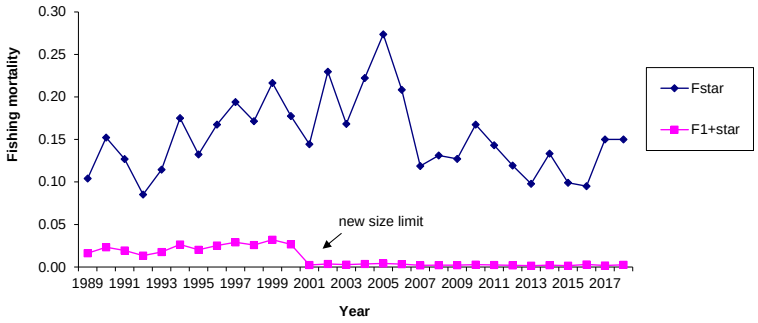
CATCH DATA – note correction to 2014 catch

Year	TiB	TVH	PNG	TS_Total	Aus_TAC	Catch as % of TAC
2004	235.1	481.0	182.0	898.1		
2005	358.5	545.0	228.0	1131.5		
2006	152.3	135.4	142.0	429.7	471	91%
2007	260.0	268.6	228.0	756.6	842	90%
2008	183.9	100.4	221.0	505.4	751	67%
2009	135.9	91.1	161.4	388.4	450	86%
2010	143.3	282.6	292.8	718.7	853	84%
2011	200.7	503.5	165.0	869.2	803	108%
2012	152.9	370.5	173.7	697.0	964	72%
2013	134.2	361.7	108.3	604.2	871	69%
2014	148.5	272.7	261.2	682.4	616	111%
2015	173.9	152.7	235.7	562.3	769	73%
2016	207.1	237.6	127.1	571.8	796	72%

2016 Total Catch = 572 t

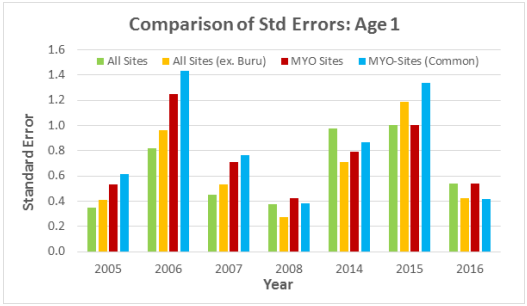
Model-estimated fishing mortality trends for 1+ and 2+ lobsters

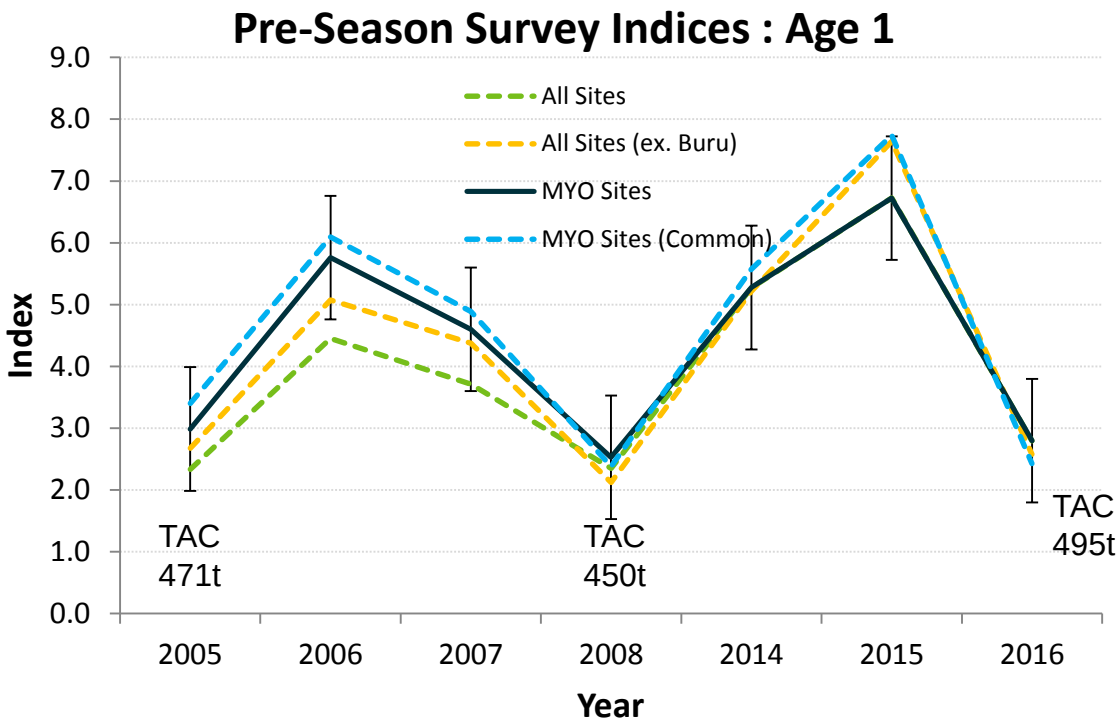




Dec 2016 REF CASE

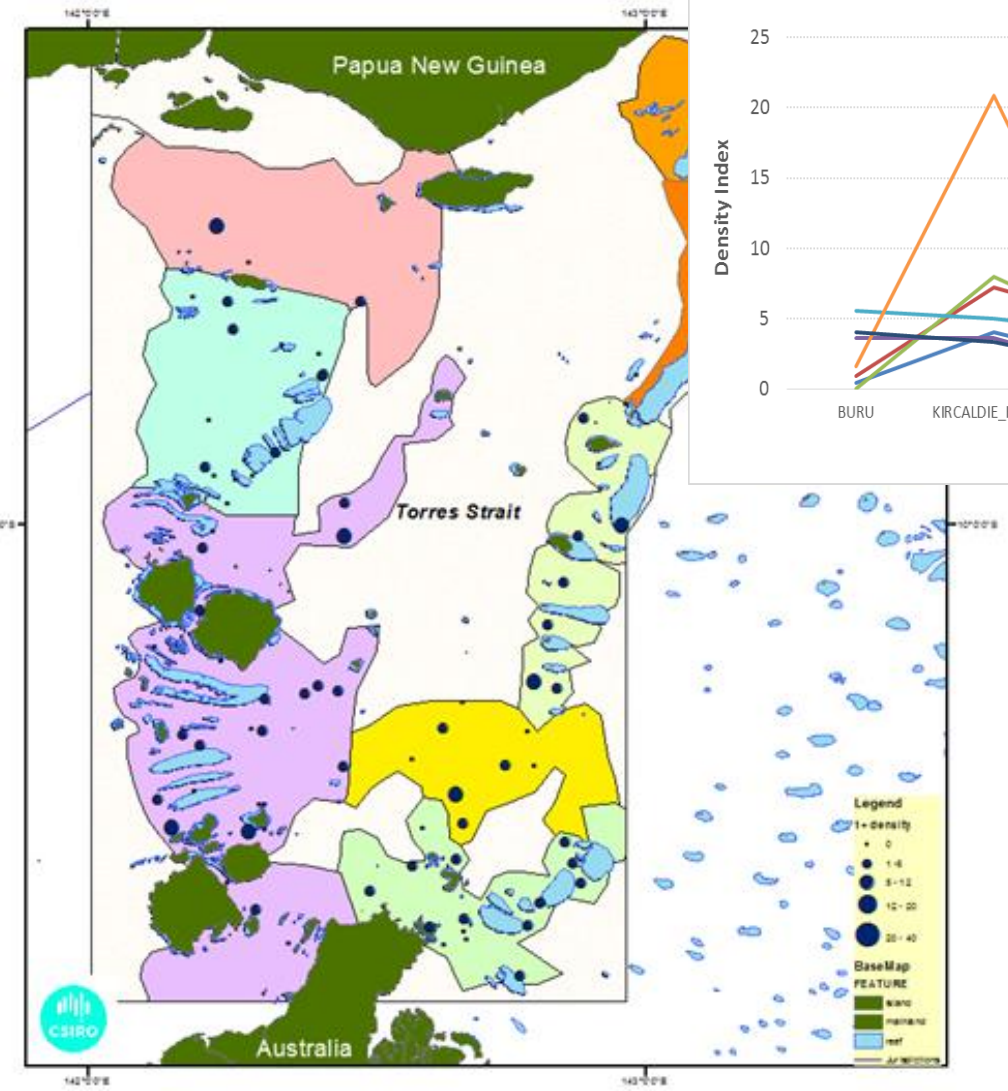
Preseason survey indices

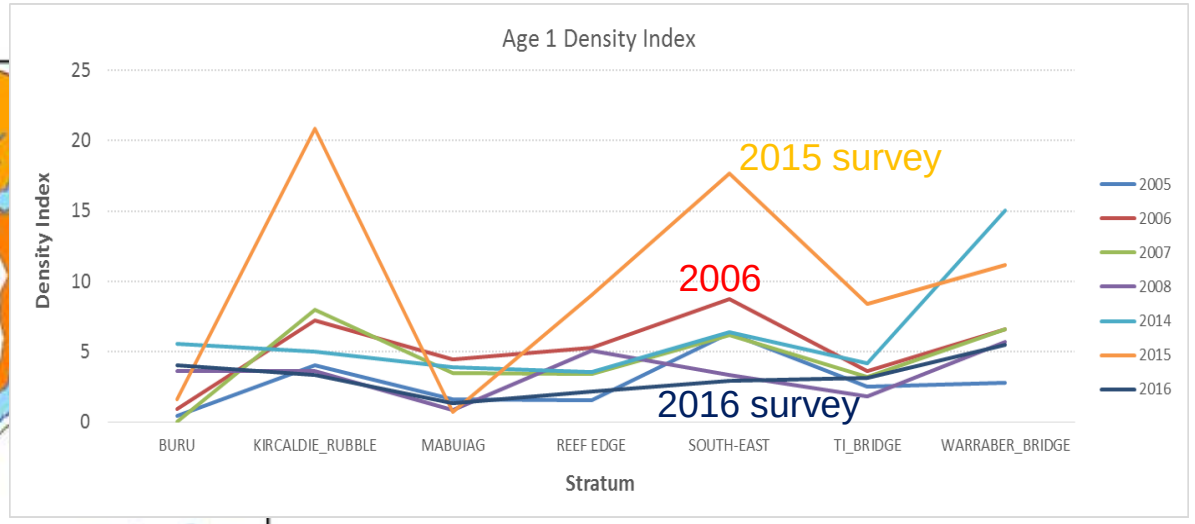




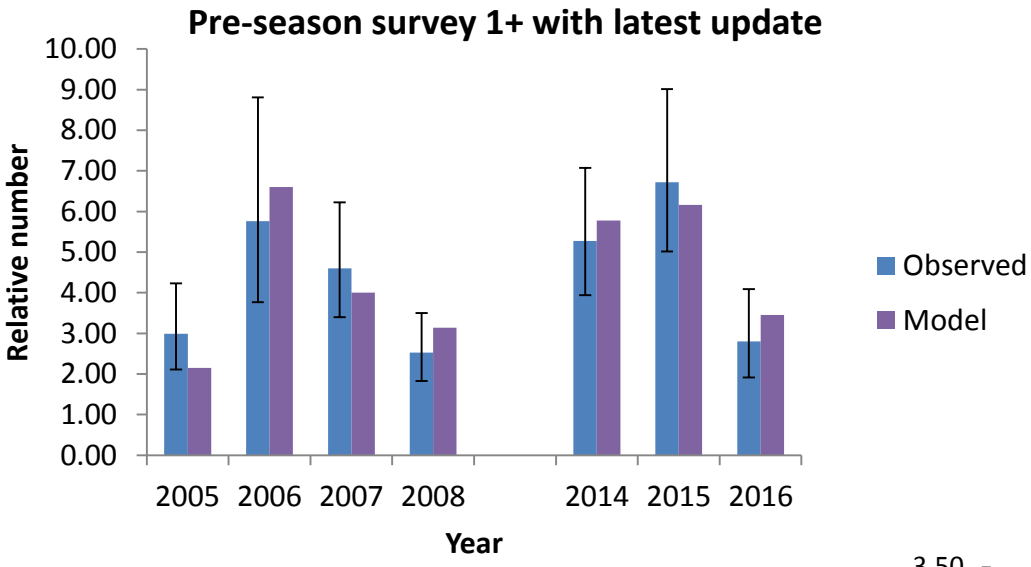
Four comparative indices of abundance of recruiting (1+) ornate rock lobsters (*Panulirus ornatus*) recorded during pre-season surveys in Torres Strait between 2005 and 2016 (note surveys were not done during 2009-2013). Error bars of MYO indices represent standard errors

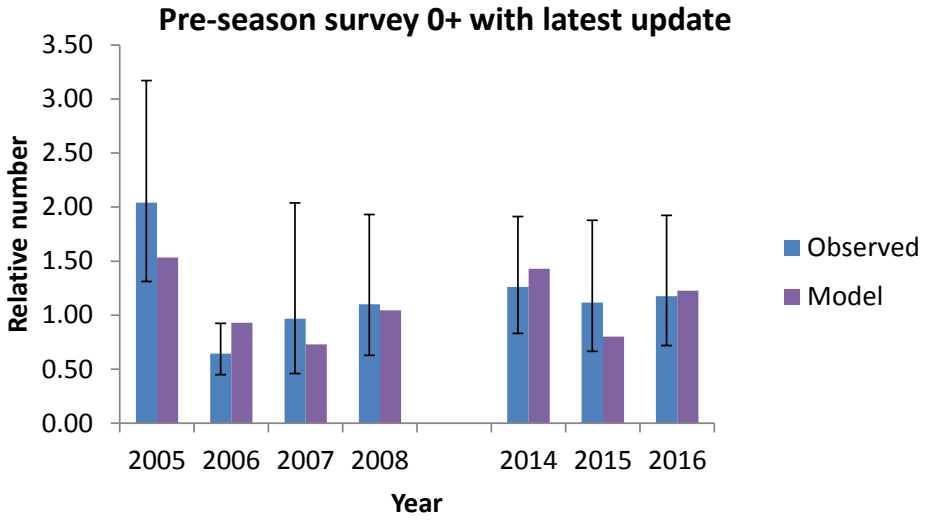
Preseason survey - November 2016: low densities observed in all survey regions





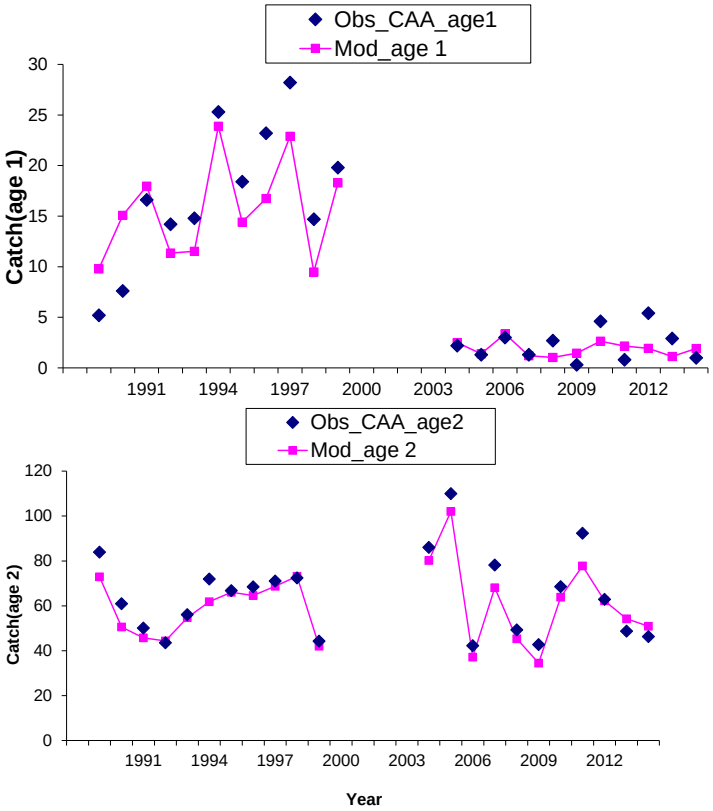
Fit to Pre-season survey



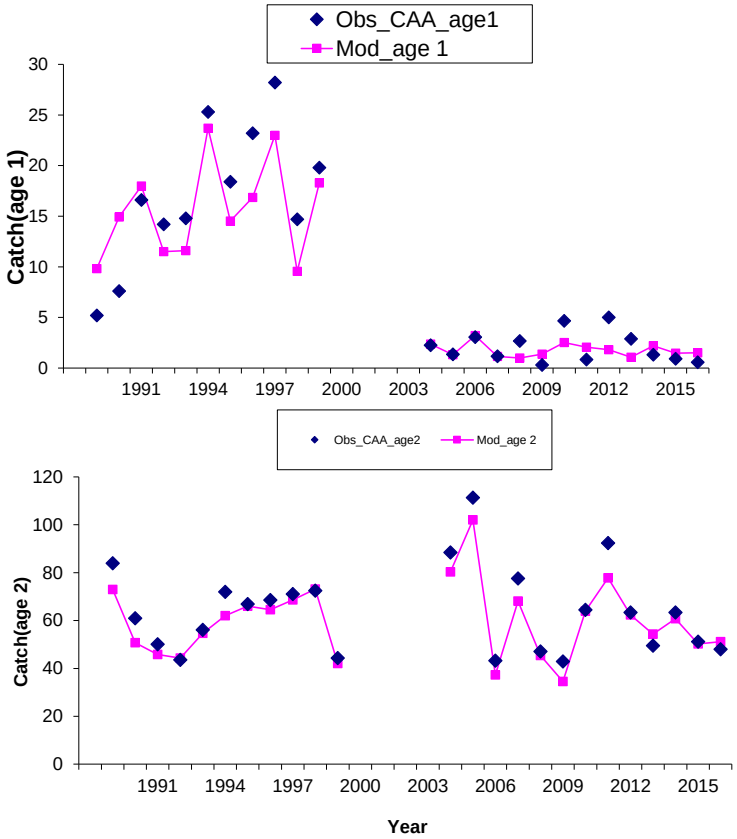


Comparison between observed and model catch-at-age from commercial catch data

DEC 2016 REF CASE



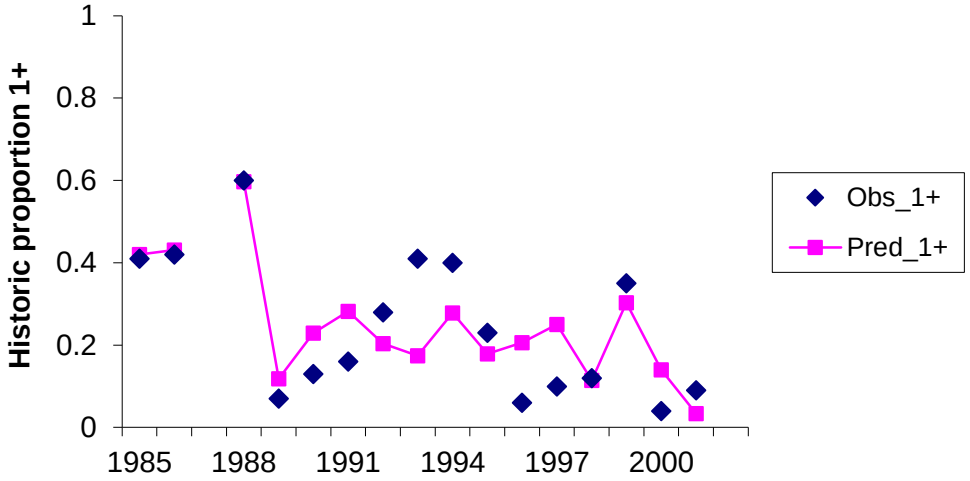
UPDATE INCLUDING DATA UP TO 2016

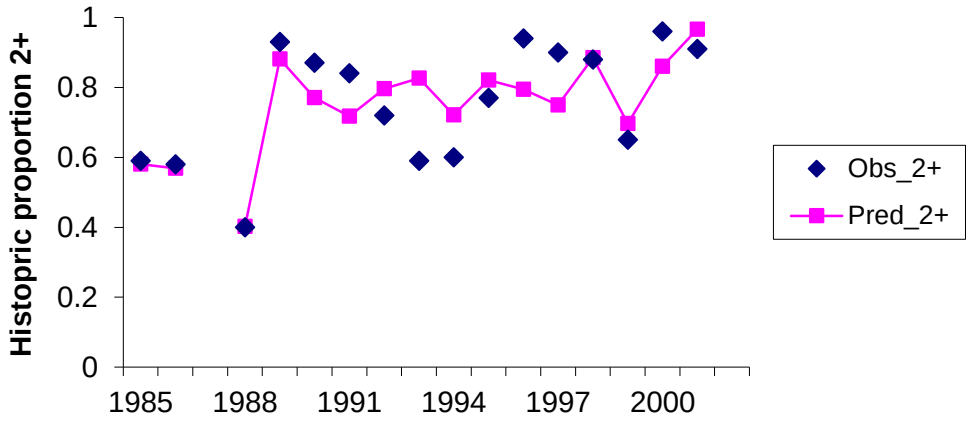


See Dennis et al. 2017. Summary of Torres Strait and QLD East Coast lobster commercial catch monitoring by MG Kailis Pty Ltd 2001-2017

Missing data excluded

Comparison between historic data and model estimates of the proportions of 1+ and 2+ lobsters in the catch

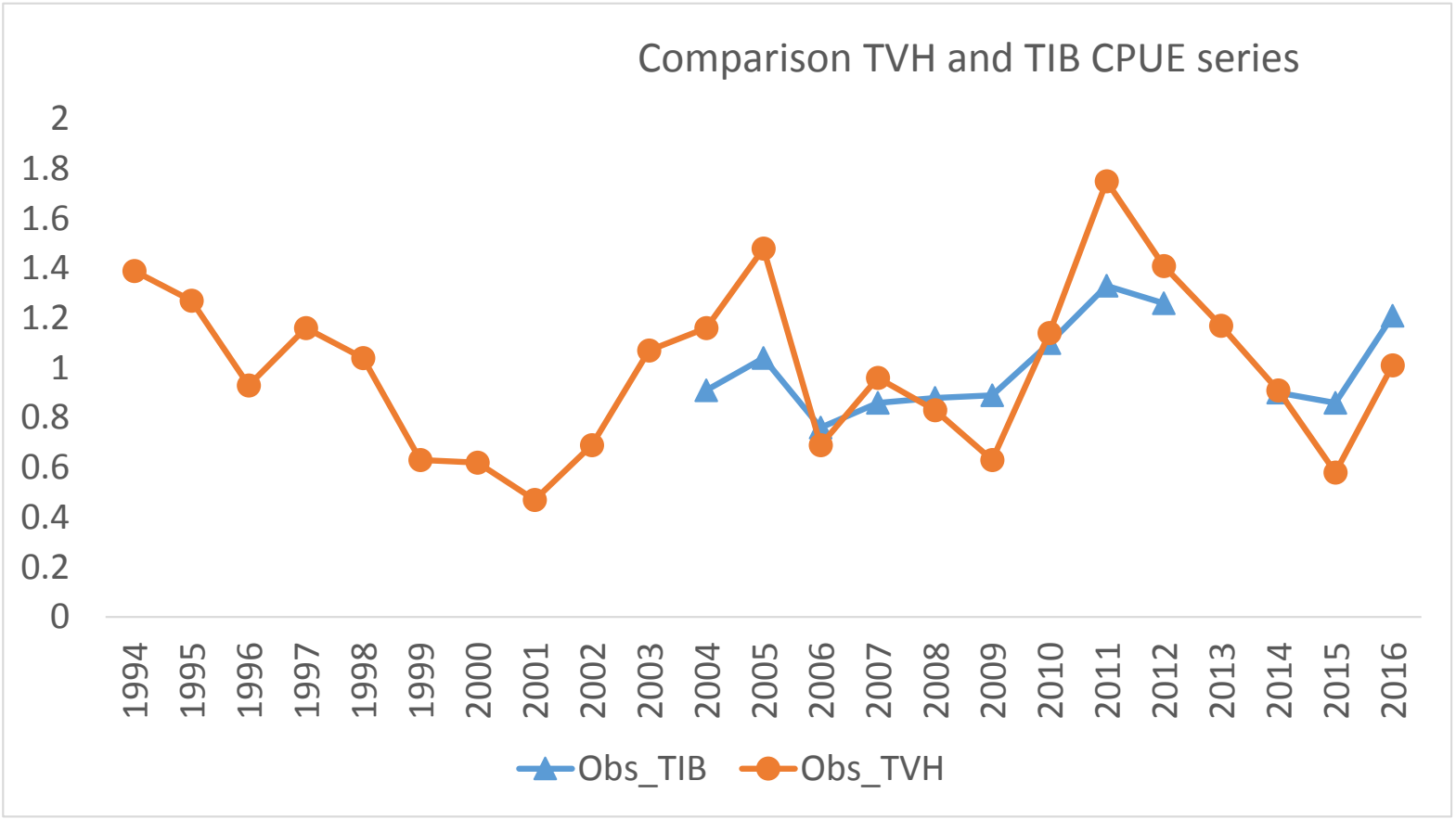




Comparing CPUE indices of abundance

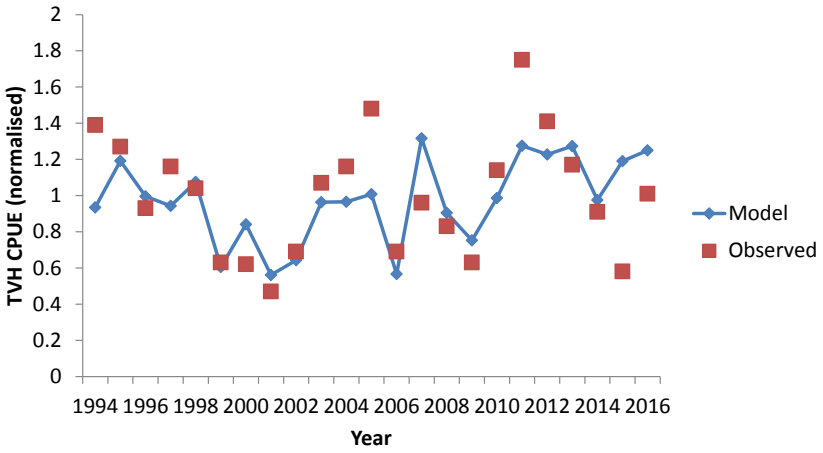
TVH – Main Effects Int1

TIB – Seller&QA

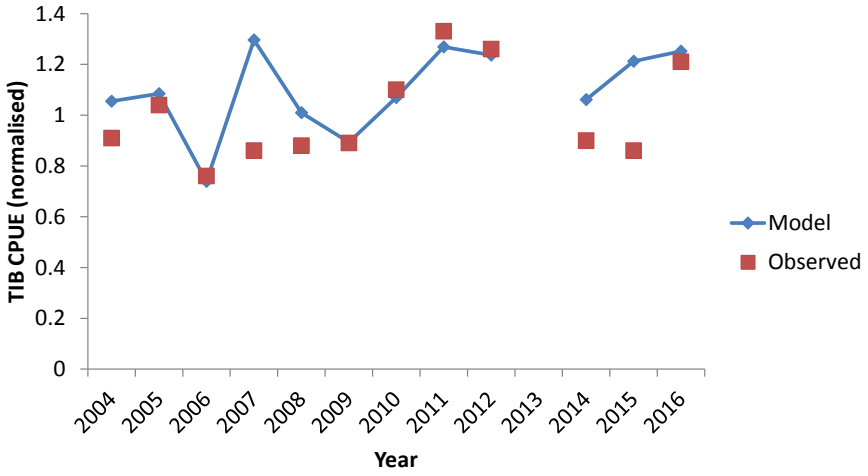


TVH & TIB CPUE data – standardised series

TVH – Main Effects Int1

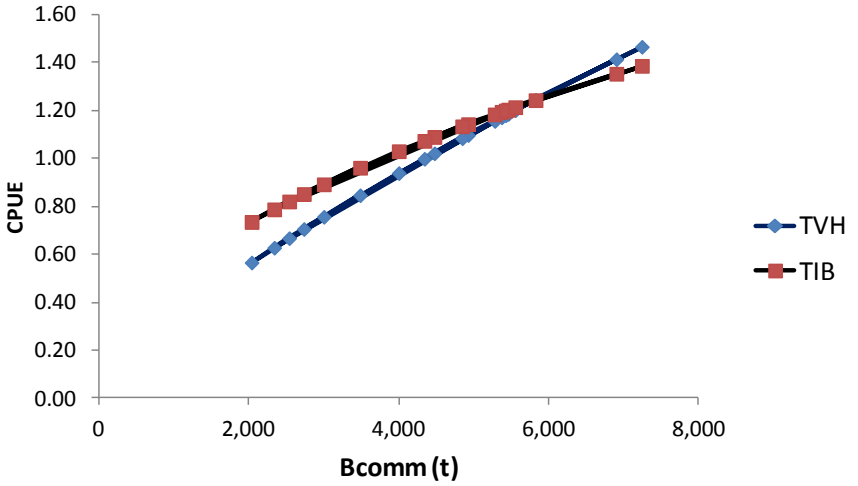


TIB – Seller&QA

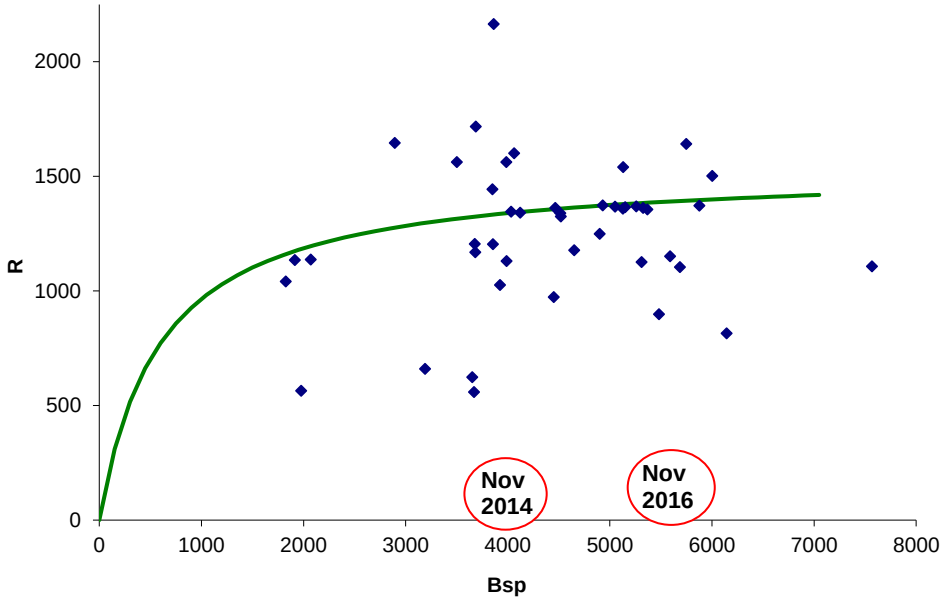


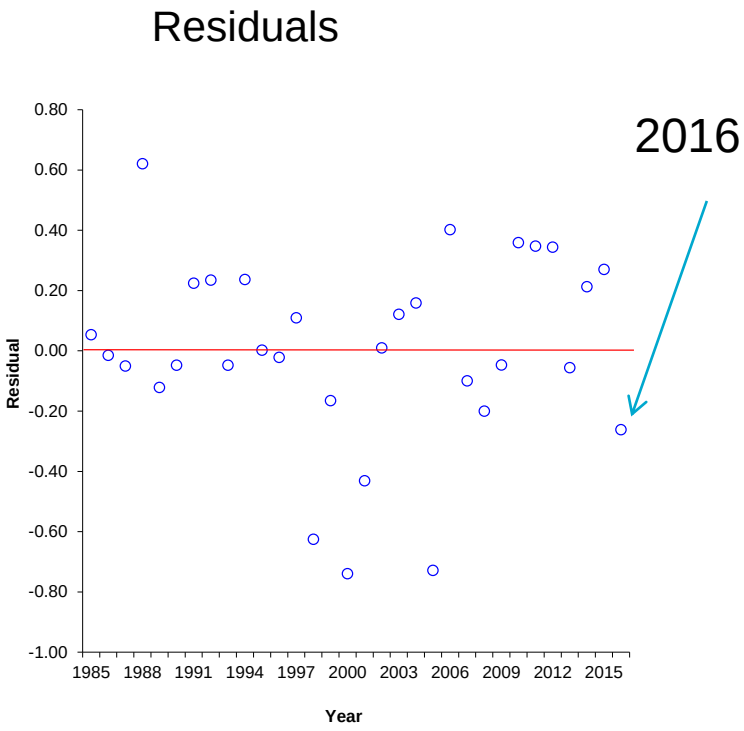
b) Hyperstable relationship

(shape parameter = 0.75 for TVH & 0.5 for TIB)

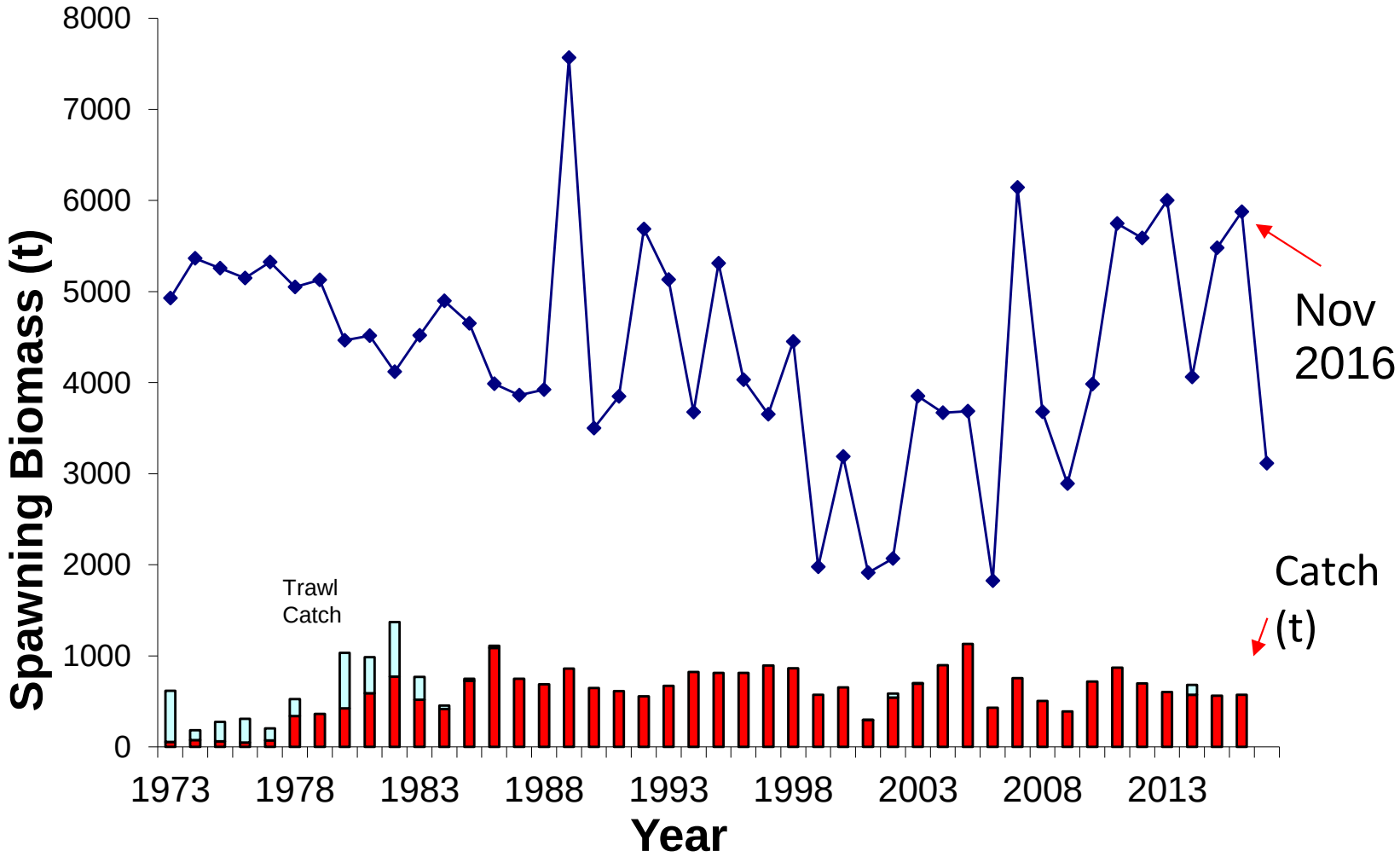


Stock recruitment relationship





Spawning biomass



MODEL PARAMETER ESTIMATES

	(a) Reference Case			(b) Update with CAA data		
Parameter	**Parameter**	**Value**	**90% CI**	**Parameter**	**Value**	**90% CI**
B(1973) sp (tons)	4947	3497	6397	4947	3499	6396
M	0.69	0.56	0.82	0.69	0.56	0.82
h	fixed 0.7			fixed 0.7		
Sel (age 1+) 1973-1988	0.44	0.24	0.63	0.44	0.24	0.63
Sel (age 1+) 1989-2001	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
Recruitment residuals (1985-2016)		32 parameters			**32 parameters**	
Model estimates and depletion statistics						
B(2016) sp (tons)	5877	3671	8083	5872	3668	8077
RBCprelim(2017) model	495	315	676	495	315	675
RBCforecast(2018) model	758	546	970	757	545	970
Current Depletion (Nov)						
B(2016) sp / B(1973)sp	1.19	0.84	1.55	1.19	0.84	1.55
Bexp(2016) (tons)	6306	4179	8432	6300	4175	8424
No. parameters estimated	37			37		
'-lnL:overall	**-182.974**			-189.056		
AIC	**-291.948**			-304.112		
Likelihood contributions		**Sigma**	**q**		Sigma	q
'-lnL:CAA	-53.93	0.05		-60.38	0.05	
'-lnL:CAAsurv	-19.17	input from data		-19.17	input from data	
-lnL:CAA historic	-21.77	0.13		-21.77	0.13	
-lnL:Survey Index 1+	-24.53	input from data	3.761E-07	-24.31	input from data	3.780E-07
-lnL:Survey Index 2+	-13.20	input from data	3.935E-07	-13.04	input from data	3.953E-07
-lnL:Survey benchmark	-3.14	input from data		-3.14	input from data	
'-lnL:PRESEASON	-8.28	input from data	7.262E-07	-8.22	input from data	7.305E-07
-lnL:PRESEASON 0+	-5.79	input from data	8.436E-08	-5.82	input from data	8.504E-08
-lnL:CPUE (TVH)	**-26.02**	0.20	1996.0000	-26.02	0.20	1996.0000
-lnL:CPUE (TIB)	**-13.31**	0.20	2006.0000	-13.31	0.20	2006.0000
'-lnL:RecRes	6.15	0.50	(input sigma 0.5)	6.13	0.50	(input sigma 0.5)

Same RBC

Fit to CAA (catch at age)

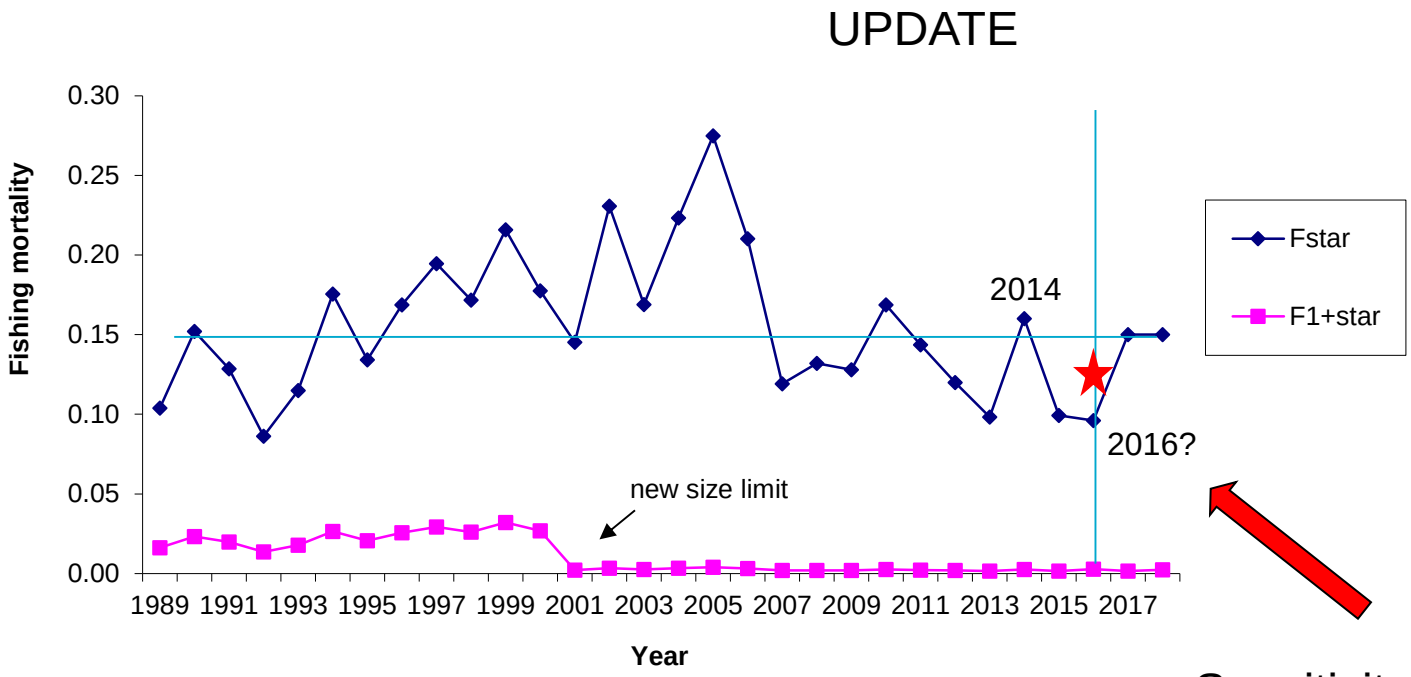
Key Sensitivities

- A) Pre-RAG Reference Case
- B) Alternative CPUE TVH & TIB standardisation series (Main effects)
- C) Alternative CPUE TIB - nominal series
- D) TIB hyperstability par = 0.75 vs 0.5
- E) Higher natural (environmental) mortality rate in 2015

Future work:

- environmental correlates – 2015 (catchability or abundance decline?)
- review 2016 catch total

Model-estimated fishing mortality trends for 1+ and 2+ lobsters



Sensitivity with 2016 catch increased by 100t

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 75th 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	495
Catch	697t	604t	682t	562t	572t	-

Revised HCR spreadsheet

Torres Strait tropical lobster / Kaiar *Panulirus ornatus*

Harvest Control Rule Recommended Biological Catch Calculator

Australian Government
Australian Fisheries Management Authority

A. Instructions

> Cells shaded light yellow can receive entered values. Cells shaded light blue show results, but cannot be changed.

> Enter data updates in the yellow-shaded cells in Section B below. Example values have been entered for 2016. These need to be changed to the real values when these are available. Data will be provided annually.

> Total Catch to be entered = TIB+TVH+PNG catch in tons (live weight).

> Preseason survey indices = the standardised values obtained from the November survey; the last 5 values of each series need to be checked

> CPUE = the standardised values obtained from the analyses run in October; note that if the earlier values change in the standardisation, the last 5 values of each series all need to be updated for the calculations below.

> The resulting 2017 recommended biological catch (RBC) calculated using the Harvest Control Rule is shown in Section C, together with comparative values for the 2015 and 2016 HCR RBCs for comparison. Historical TACs and the 2017 RBC are plotted compared to the historical average TAC.
> Consolidated historical and entered data are summarised in Section D and the Survey and CPUE regressions through the recent data are plotted. Further information on the HCR is provided in Section E.
(Spreadsheet by CSIRO, contact Dr Eva Plaganyi-lloyd: Eva.Plaganyi-lloyd@csiro.au)

B. Data Entry Section

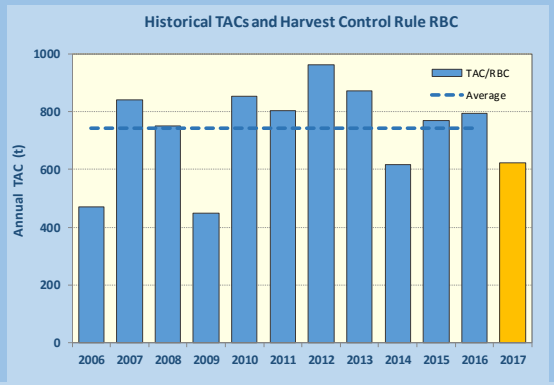
Year	Total Catch	Survey indices		CPUE indices	
		Preseason			
2015	562.3	0+	Preseason 1+	CPUE_TIB	CPUE_TVH
2016	**571.8**	**1.18**	**2.80**	**1.21**	**1.01**

ENTER UPDATED DATA HERE

C. RBC Calculator

Year	RBC	Forecast RBC		RBC-Forecast
2015	724.2	*604.3*		
2016	681.4	*606.8*		77.1
2017	**624.1**	***539.3***	HCR	17.3

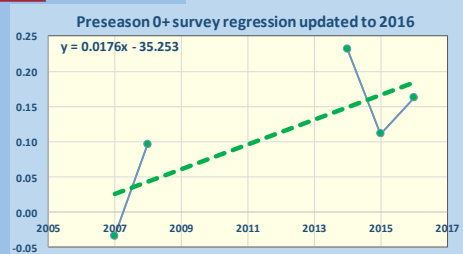
RBC (AUS AND PNG) CALCULATED FOR NEXT YEAR



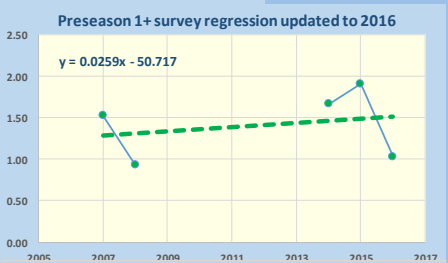
D. Consolidated Catch, Indices and RBCs table

Seller+QA Int-1

Year	Total Catch	Survey indices		CPUE indices		TAC / RBC	Average TAC
		Preseason 0+	Preseason 1+	CPUE_TIB	CPUE_TVH		
2006	429.7	0.64	5.76	0.76	0.69	471	744
2007	756.6	0.97	4.60	0.86	0.96	842	744
2008	505.4	1.10	2.53	0.88	0.83	751	744
2009	388.4			0.89	0.63	450	744
2010	718.7			1.10	1.14	853	744
2011	869.2			1.33	1.75	803	744
2012	697			1.26	1.41	964	744
2013	604.2				1.17	871	744
2014	682.4	1.26	5.27	0.90	0.91	616	744
2015	562.3	1.12	6.72	0.86	0.58	769	744
2016	**571.8**	**1.18**	**2.80**	1.21	1.01	796	744
2017						624	



CPUE_TIB regression updated to 2016



CPUE_TVH regression updaed to 2016

$$TAC_{y+1} = \left[0.7 \cdot \left(1 + s_y^{presurv,1}\right) + 0.1 \cdot \left[\left(1 + s_y^{presurv,0}\right) + \left(1 + s_y^{CPUE,TVH}\right) + \left(1 + s_y^{CPUE,TIB}\right)\right]\right] \cdot \bar{C}_{y-4,y}$$

Comments and suggestions…

COMMUNITY SUMMARY

Torres Strait Tropical Rock Lobster (TRL) Fishery

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