Further updates to the 2013 Tristan da Cunha rock lobster assessment

Susan Johnston and Doug Butterworth

MARAM

Department of Mathematics and Applied Mathematics

University of Cape Town

Rondebosch, 7701

Summary

The Tristan da Cunha assessment reported in April is adjusted to take into account some minor coding corrections. Sensitivity tests lead to little change in estimates of current spawning biomass depletion unless the level of recruitment variability assumed is modified.

Introduction

The Tristan assessment was updated in April 2013 and reported in Johnston and Butterworth (2013). Subsequently, MRAG have undertaken a comprehensive review of both this assessment and the OMP development that followed for the Tristan da Cunha lobster resource. MRAG identified a number of minor errors in the MARAM code and made some suggestions for improvement of the assessment/coding (Edwards and Rademeyer, 2013). This document updates the MARAM Tristan Reference Case (RC) assessment taking these suggestions into account and correcting the minor errors. Updates to the various robustness tests are provided for completeness.

Reference case model

The Reference case model fixes the natural mortality M=0.1 and the fishing proportion in 2009 (F(2009)) to be 0.3. It also assumes the stock recruit residual variation parameter σ_R to be 0.4. The catch-at-length data are down-weighted by a factor of 0.10 in the likelihood maximised in the model fitting process. It has been found that the model consistently overestimates the number of male lobsters in the larger size classes. For this reason two further adjustments were made to improve the model fit:

i) Increase M to 1.5 for lobsters (both sexes) aged 10+.
ii) Decrease selectivity on male lobsters by 25% for lobsters of CL greater than 110mm.

The RC model fits to biomass survey data from Leg1 only. Leg1 is the survey conducted at the start of the season and is thought to be more reliable as an index of pre-harvest abundance that the Leg2 survey which is conducted at or near the end of the season.

Sensitivity tests

A number of sensitivity tests relating to underlying RC OM assumptions are carried out (changes to the RC are shown in bold).

RC *M*=0.10, *F*(2009)=0.3, $\sigma_R = 0.4$

R1 *M*=0.10, ***F*(2009)=0.2**, $\sigma_R = 0.4$

R2 *M*=0.10, ***F*(2009)=0.4**, $\sigma_R = 0.4$

R3 ***M*=0.05**, ***F*(2009)=0.2**, $\sigma_R = 0.4$

R4 ***M*=0.05**, *F*(2009)=0.3, $\sigma_R = 0.4$

R5 ***M*=0.05**, ***F*(2009)=0.4**, $\sigma_R = 0.4$

R6 ***M*=0.20**, ***F*(2009)=0.2**, $\sigma_R = 0.4$

R7 ***M*=0.20**, *F*(2009)=0.3, $\sigma_R = 0.4$

R8 ***M*=0.20**, ***F*(2009)=0.4**, $\sigma_R = 0.4$

SIGR1 *M*=0.10, *F*(2009)=0.3, $\boldsymbol{\sigma_R = 0.2}$

SIGR2 *M*=0.10, *F*(2009)=0.3, $\boldsymbol{\sigma_R = 0.8}$

Results

Table 1 and Figure 1 compare the original April Tristan RC assessment (“APR”) with the now further updated results of October 2013 (“OCT”) taking into account the MRAG suggestions and corrections. The updated assessment results are now in line with the MRAG results. Fits to CPUE data are near unchanged (see Figure 2). The main difference is that the updated and corrected October assessment estimates the current spawning biomass to be lower relative to pristine than the earlier assessment. The current value of Bsp(2013)/K is now estimated to be 0.75 (this was 1.0 in April assessment), which is still healthy as it is well above the biomass at which would yield MSY. The assessment indicates that the high catch rates centered on 2005 which lead to the spawning biomass exceeding the pristine level around that time were a consequence of particularly good recruitment in the late 1990.

Table 2 provides updated sensitivity test results. These show little change in estimates of current depletion except for the instances where the stock-recruit residual variability level is modified.

References

Edwards, C.E. and Rademeyer, R. A. 2013. Fisheries advice to the Tristan da Cunha Administration. Phase ii: Development of a new management plan for rock lobster fisheries in the Tristan da Cunha archipelago. MRAG Ltd London, 23 pp.

Johnston, S.J. and D.S. Butterworth. 2013. Updated 2013 Tristan da Cunha rock lobster assessment. MARAM/Tristan/2013/APR/08.

Table 1: Tristan RC assessment results. Shaded values are fixed on input.

	RC Apr 2013	**RC updated Oct 2013**
# parameters	41	41
K (MT)	977	1449
h	0.96	0.96
M	0.1	0.1
d (discard mortality rate)	0.1	0.1
σ_R	0.4	0.4
F_{2009} fixed at	0.3	0.3
θ	0.381	0.373
-lnL total	-46.49	-42.81
-lnL commercial CPUE (σ)	-35.21 (0.10)	-35.28 (0.09)
-lnL Bio Sur Index Leg1 (σ)	-11.60 (0.16)	-8.69 (0.15)
-lnL commercial CAL (σ)	-0.37 (0.10)	6.23 (0.11)
-lnL Bio Surv Leg 1 CAL (σ)	-32.39 (0.08)	-30.21 (0.08)
SR pen	4.28	4.25
Bsp(2012) (MT)	961	1084
Bsp(2013) (MT)	963	1085
Bsp(1990)/Ksp	0.38	0.35
Bsp(2012)/Ksp	0.98	0.75
Bsp(2013)/Ksp	1.00	0.75
Bsp(2013)/Bsp(1990)	2.67	2.17
Bexp(2011)/Bexp(1990)	2.60	2.15
Bexp(2012)/Bexp(1990)	2.51	2.06
Bexp(2011) (MT)	451	444
Bexp(2012) (MT)	434	424
Program	Trcnx.tpl	Tnewup.tpl, tup.rep

Table 2: Sensitivity test results.

	-lnL	Bsp(2013)	Bsp(2013)/Ksp	Bexp(2012)
RC *M*=0.10, *F*(2009)=0.3, $\sigma_R = 0.4$	-42.81	1085	0.75	424
R1 *M*=0.10, *F*(2009)=0.2, $\sigma_R = 0.4$	-42.16	1501	0.76	669
R2 *M*=0.10, *F*(2009)=0.4, $\sigma_R = 0.4$	-42.06	899	0.75	319
R3 *M*=0.05, *F*(2009)=0.2, $\sigma_R = 0.4$	-42.85	1405	0.76	661
R4 *M*=0.05, *F*(2009)=0.3, $\sigma_R = 0.4$	-43.70	1025	0.74	419
R5 *M*=0.05, *F*(2009)=0.4, $\sigma_R = 0.4$	-43.36	862	0.74	364
R6 *M*=0.20, *F*(2009)=0.2, $\sigma_R = 0.4$	-40.56	1727	0.76	682
R7 *M*=0.20, *F*(2009)=0.3, $\sigma_R = 0.4$	-40.99	1236	0.76	434
R8 *M*=0.20, *F*(2009)=0.4, $\sigma_R = 0.4$	-39.22	997	0.76	334
sigR1 *M*=0.10, *F*(2009)=0.3, $\sigma_R = 0.2$	-34.55	1134	0.82	448
sigR2 *M*=0.10, *F*(2009)=0.3, $\sigma_R = 0.8$	-47.06	1061	0.61	410

Figure 1: Tristan RC model results comparing the APR and OCT results.

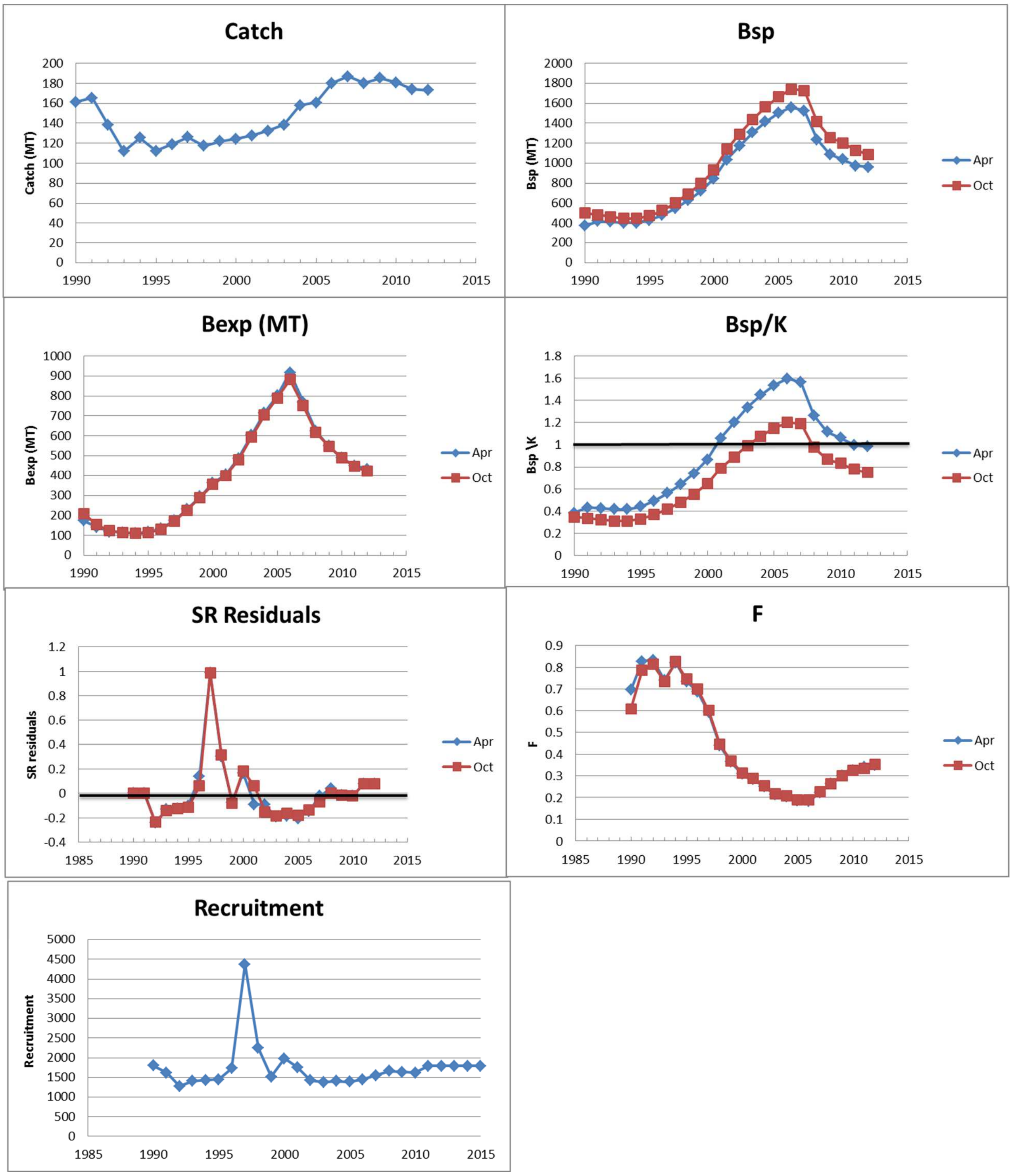

Figure 2: Tristan RC model fits to CPUE and Biomass survey index data.