Inshore versus offshore split of available quota

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Summary

Although each of the five super-areas used in the management of the West Coast rock lobster fishery is treated as homogenous in assessments, it is clear that there are inshore areas where predominantly hoops and bakkies are deployed, and offshore areas where the larger trap boats operate in deep waters, and further that resource dynamics may differ in these two regions.

The first objective of this paper is to estimate approximately how much of the abundance in each super-area is located in the inshore area and how much in the offshore area.

$$\begin{aligned} B_T &= B_i + B_o \\ &= D_i A_i + D_o A_o \end{aligned}$$

where B_T is the total biomass in that super area,

B_i is the inshore biomass in that super area, defined here as 0-50m in depth range,

B_o is the offshore biomass in that super area, defined here as 51-200m depth range,

D_i is the average density of lobster in the inshore area,

A_i is the ocean surface area of the inshore area,

D_o is the average density of lobster in the offshore area,

A_o is the ocean surface area of the offshore area.

$$D_i = \frac{CPUE_{bakkie}}{q_{hoop}} \quad \text{and}$$

$$D_o = \frac{CPUE_{trap}}{q_{trap}}$$

where

q_{hoop} is the catchability for the hoops,

q_{trap} is the catchability for the traps,

$CPUE_{bakkie}$ is the average nominal bakkie data for that super-area for 2009-2015[1], and

$CPUE_{trap}$ is the average nominal trap data for that super-area for 2009-2015.

[1] Note that the split season is referenced here by the first year, i.e. 2015 refers to the 2015/2016 season.

Note that calculations require information on what the trap to bakkie efficiency is in Area 3+4 and Area 8+ (where both traps and bakkies fish at the same time). Danie van Zyl (DAFF, pers. comm.) provided the following perceptions:

Area 3+4: 6-10 traps = 1 bakkie catch per day.

Area 8+: 15-25 traps = 1 bakkie catch per day.

From this information, three different levels of bakkie to trap efficiencies ($\frac{q_{hoop}}{q_{trap}}$) are used which are:

Area 3+4: Upper=10

Mid=8

Lower=6

Area 8+: Upper=25

Mid=20

Lower=25

Results are explored for all three catchability ratio options for each area, with the "mid" option being the reference case.

Projections

A3+4 inshore

The SWG recommended a TAC for 2016 for A34 of 150 MT – 46% of this (69 MT) was to be allocated to the hoop fishery through the nearshore, recreational and interim relief sectors. The final DAFF decision was 218 MT, with 55% (119 MT) to be allocated to the hoop fishery (through the nearshore, recreational and IR sectors).

Constant catch projections (for the inshore A34 area) are reported for four scenarios.

1) Current 2015 TAC=46% of the TAC A34 recommendation (i.e. 69 MT)
2) 60% of the 2016 TAC A34 recommendation (i.e. 90 MT)
3) 80% of the 2016 TAC A34 recommendation (i.e. 120 MT)
4) The final DAFF 2016 TAC A34 decision (54%for inshore sectors) (i.e. 119 MT)

These projections are produced for five levels of the Inshore biomass as a % of the total A34 biomass: 10%, 20%, 30% 40% and 50%.

Assumptions regarding poaching

For the current and future years, poaching inshore is assumed to be 46% of the A34 total poaching. For the past, poaching is allocated to the inshore area using the reported percent hoop catches since 1950.

A8+ inshore

The SWG recommended a TAC for 2016 for A8+ of 840 MT – 34% of this (286 MT) was to be allocated to the hoop fishery through the nearshore, recreational and interim Relief sectors. The final DAFF decision was 1248 MT, with 33% (412 MT) to be allocated to the hoop fishery (through the nearshore, recreational and IR sectors).

Constant catch projections (for the inshore A8+ area) are reported for four scenarios.

5) Current 2015 TAC=34% of the TAC A8+ recommendation (i.e. 286 MT)
6) 60% of the 2016 TAC A8+ recommendation (i.e. 504 MT)
7) 80% of the 2016 TAC A8+ recommendation (i.e. 672 MT)
8) The final DAFF 2016 TAC A8+ recommendation (34% for inshore sectors) (i.e. 412 MT)

These projections are produced for five levels of the Inshore biomass as a % of the total A8+ biomass: 10%, 20%, 30%, 40% and 50%.

Assumptions regarding poaching

For the current and future years, poaching inshore is assumed to be 34% of the A8+ total poaching. For the past, poaching is allocated to the inshore area using the reported percent hoop catches since 1950.

Results

Table 1 reports the nominal CPUE values for A34 and A8+, whilst Table 2 reports estimates of inshore and offshore biomasses for each of the five super-areas. Table 3 provides a summary table of inshore and offshore biomass estimates for A34 and A8+.

Tables 4a and 4b report the **A34** inshore biomass projections for **B75m(2021/2006)** and **B75m(2021/2006)** respectively. Results are reported for four levels of inshore TAC: current levels (2015) (69MT), a 60% and a 80% increase in these (90 and 120 MT) and the DAFF final 2016 TAC (119 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% 30%, 40% or 50% of the total area for A34.

Similarly, Tables 5a and 5b report **A8+** inshore biomass projections for **B75m(2021/2006)** and **B75m(2021/2006** respectively. Results are reported for four levels of inshore TAC: current levels (2015) (286 MT), a 60% and a 80% increase in these (504 and 672 MT) and the DAFF final 2016 TAC

(412 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% 30%, 40% or 50% of the total area for A8+.

Figure 1 plots the B75m (MT) projections for **A34** inshore biomass expressed either as **B75m(2021/2006)** – top panel, or **B75m(2021/2015)** – bottom panel. Results are reported for four levels of inshore TAC: current levels (2015) (69MT), a 60% and a80% increase on these (90 and 120 MT) and the DAFF final 2016 TAC (119 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% 30%, 40% or 50% of the total area for A34.

Similarly, Figure 2 plots the B75m (MT) projections for **A8+** inshore biomass expressed either as **B75m(2021/2006)** – top panel, or **B75m(2021/2015)** – bottom panel. Results are reported for four levels of inshore TAC: current levels (2015) (286MT), a 60% and a 80% increase on these (504 and 672 MT) and the DAFF final 2016 TAC (412 MT). Results are also reported assuming the inshore biomass corresponding to either 10%, 20% 30%, 40% or 50% of the total area for A8+.

Discussion

The estimation conducted suggests that the proportion of the biomass that is inshore in super-areas A34 and A8+ is small (~10%) in each case.

The projections developed show that for such proportions, increases in the current inshore allocations in these two super-areas will lead to a rapid and substantial decrease in inshore abundance. This impact is however, rather less if the proportion of the abundance inshore is actually some 30% or more. These projections would also be less pessimistic if depletion of the inshore component was partially offset by migration inshore of some of the offshore component.

Table 1: Nominal CPUE values for A34 and A8+ by season.

	A34	A34	A8-11	A8-11
	Traps Kg/trap/day	Bakkies Kg/bakkie/day	Traps Kg/trap/day	Bakkies Kg/bakkie/day
2009	6.025	58.5	8.99	143.1
2010	8.48	52.7	9.65	134.1
2011	8.69	65.2	9.99	125.6
2012	8.84	49.8	8.70	123.5
2013	11.78	43.5	6.14	95.5
2014	7.49	91.1	5.59	68.4
2015	7.20	23.9	4.22	55.1
ave 2009-15	**8.36**	**55.0**	**7.61**	**106.5**

Table 2: Estimates of inshore and offshore biomasses for each of the five super-areas.

		Zone A (A1+2)	ZONE B (A3+4)	ZONE C (A5+6)	A7 (Dassen)	A8+
	CPUE_hoop		54.97			106.47
	CPUE_trap		8.36			7.61
	q_trap_upp		0.001			0.04
	q_trap_mid		0.13			0.05
	q_trap_lower		0.17			0.07
	q_bakkie		1.00			1.00
0-50m	A_in (km^2)	1461	1721	628	733	1816
51-200m	A_off (km^2)	33100	17799	1830	3277	9768
	B_i (tons)		95			193
upper	B_o (tons)		1488			1859
upper	B_i/B_o		0.06			0.10
upper	%B_i/T		**5.98**			**9.42**
upper	%B_o/T		94			91
mid	B_o (tons)		1190			1487
mid	B_i/B_o		0.08			0.13
mid	%B_i/T	100	**7.36**	100.00	0.00	**11.51**
mid	%B_o/T	0	93	0.00	100.00	88
lower	B_o (tons)		893			1115
lower	B_i/B_o		0.11			0.17
lower	%B_i/T		**9.58**			**14.77**
lower	%B_o/T		90			85
	B total (tons)	**736**	**4131**	**3579**	**3084**	**3934**
upper	B_inshore	736	247	3579	0	371
upper	B_offshore	0	3884	0	3084	3563
mid	B_inshore	736	304	3579	0	453
mid	B_offshore	0	3827	0	3084	3481
lower	B_inshore	736	396	3579	0	581
lower	B_offshore	0	3735	0	3084	3353

Table 3: Summary table of inshore and offshore biomass estimates for A34 and A8+

		A34			A8+		
		Inshore	Offshore	Total	Inshore	Offshore	Total
Percentage %	Upper	6.0	94.0	100	9.4	90.6	100
	Mid	7.4	92.6	100	11.5	88.5	100
	lower	9.6	90.4	100	14.8	85.2	100
Biomass (MT)	Upper	247	3884	4131	371	3563	3934
	Mid	304	3827	4131	453	3481	3934
	lower	396	3735	4131	581	3353	3934

Table 4a: A34 inshore biomass projections for **B75m(2021/2006).** Results are reported for four levels of inshore TAC: current levels (2015) (69MT), a 60% and a 80% increase in these (90 and 120 MT) and the DAFF final 2016 TAC (119 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% 30%, 40% or 50% of the total area for A34.

	Current inshore TAC (69 MT)	60% inc (90 MT)	80% inc (120 MT)	Final 2016 TAC (119 MT)
10% Inshore	0.010	0.003	0.0001	0.0002
20% Inshore	0.144	0.123	0.093	0.094
30% Inshore	0.275	0.255	0.224	0.225
40% Inshore	0.408	0.387	0.356	0.358
50% Inshore	0.540	0.519	0.489	0.490

Table 4b: A34 inshore biomass projections for **B75m(2021/2015).** Results are reported for four levels of inshore TAC: current levels (2015) (69MT), a 60% and a 80% increase in these (90 and 120 MT) and the DAFF final 2016 TAC (119 MT). Results are also reported assuming the inshore biomass corresponds to 10%, 20% 30%, 40% or 50% of the total area for A34.

	Current inshore TAC (69 MT)	60% inc (90 MT)	80% inc (120 MT)	Final 2016 TAC (119 MT)
10% Inshore	0.092	0.032	0.001	0.002
20% Inshore	0.648	0.554	0.418	0.423
30% Inshore	0.828	0.765	0.674	0.677
40% Inshore	0.919	0.871	0.803	0.805
50% Inshore	0.974	0.936	0.881	0.883

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Table 5a: A8+ inshore biomass projections for **B75m(2021/2006).** Results are reported for four levels of inshore TAC: current levels (2015) (286 MT), a 60% and a 80% increase in these (504 and 672 MT) and the DAFF final 2016 TAC (412 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% 30%, 40% or 50% of the total area for A8+.

	Current inshore TAC (286 MT)	60% inc (504 MT)	80% inc (672 MT)	Final 2016 TAC (412 MT)
10% Inshore	0	0	0	0
20% Inshore	0.078	0.046	0.020	0.059
30% Inshore	0.225	0.191	0.165	0.205
40% Inshore	0.373	0.339	0.313	0.354
50% Inshore	0.552	0.488	0.461	0.502

Table 5b: A8+ inshore biomass projections of **B75m(2021/2015).** Results are reported for four levels of inshore TAC: current levels (2015) (286 MT), a 60% and a 80% increase in these (504 and 672 MT) and the DAFF final 2016 TAC (412 MT). Results are also reported assuming the inshore biomass corresponding to either 10%, 20% 30%, 40% or 50% of the total area for A8+.

	Current inshore TAC (286 MT)	60% inc (504 MT)	80% inc (672 MT)	Final 2016 TAC (412 MT)
10% Inshore	0	0	0	0
20% Inshore	0.377	0.220	0.098	0.285
30% Inshore	0.721	0.612	0.528	0.658
40% Inshore	0.897	0.815	0.751	0.849
50% Inshore	1.004	0.937	0.886	0.965

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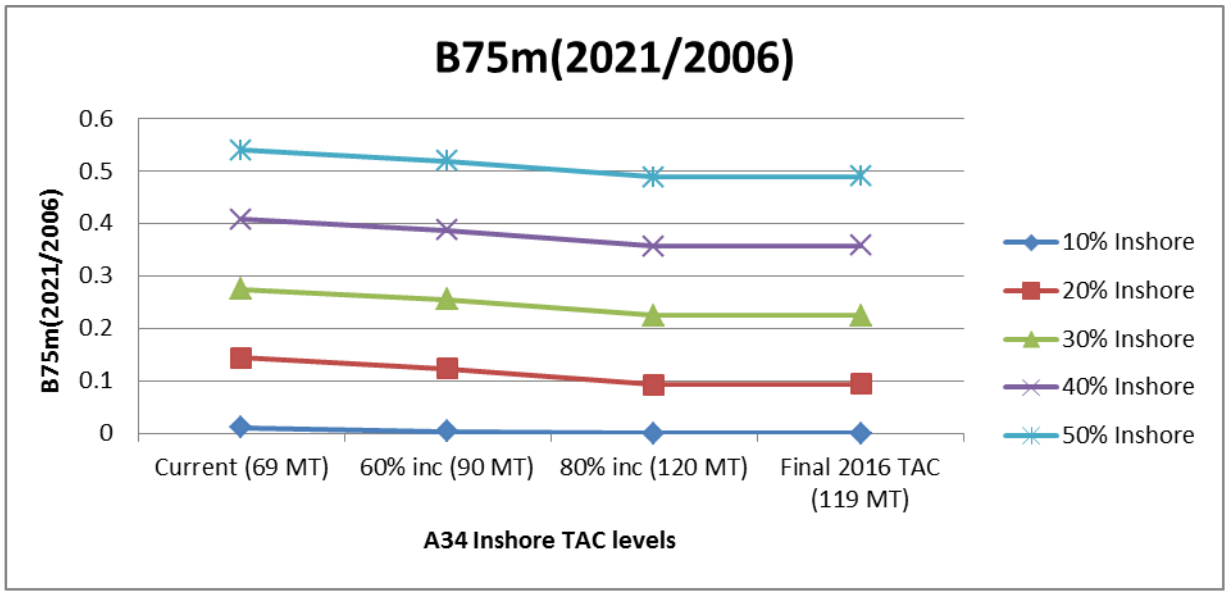
Figure 1: B75m (MT) projections for **A34** inshore biomass expressed either as **B75m(2021/2006)** – top panel, or **B75m(2021/2015)** – bottom panel. Results are reported for four levels of inshore TAC: current levels (2015) (69MT), a 60% and a 80% increase on these (90 and 120 MT), and the DAFF final 2016 TAC (119 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% 30%, 40% or 50% of the total area for A34.



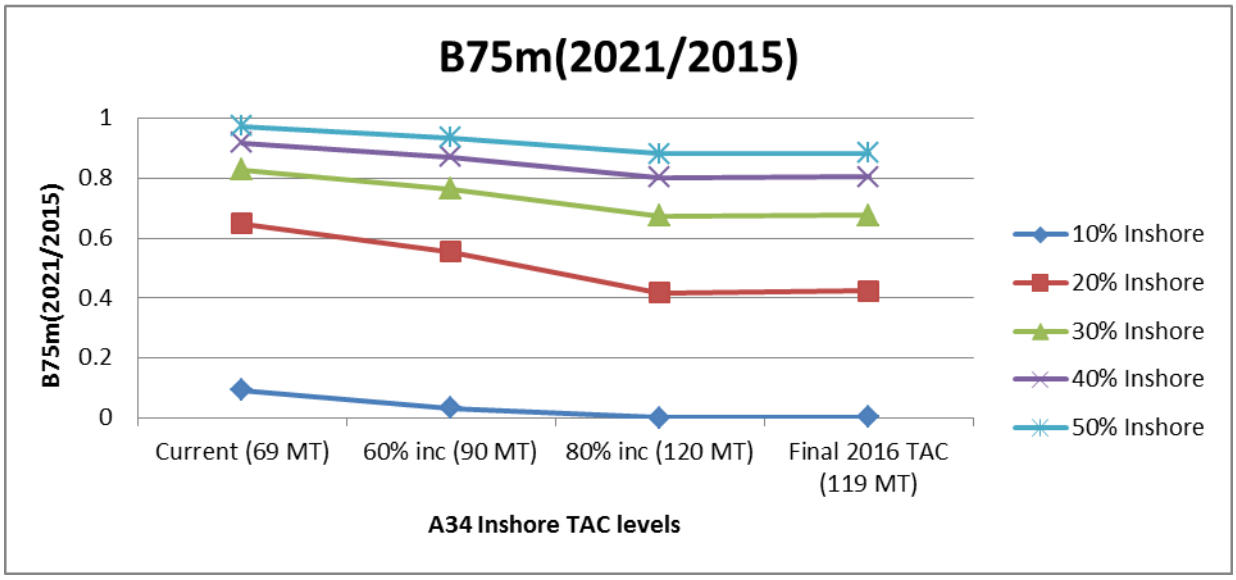


Figure 2: B75m (MT) projections for **A8+** inshore biomass expressed either as **B75m(2021/2006)** – top panel, or **B75m(2021/2015)** – bottom panel. Results are reported for four levels of inshore TAC: current levels (2015) (286MT), a 60% and a 80% increase on these (504 and 672 MT), and the DAFF final 2016 TAC (412 MT). Results are also reported assuming the inshore biomass corresponding to either 10%, 20% 30%, 40% or 50% of the total area for A8+.