The Consequences of Different Inshore/Offshore splits of the WCRL TAC

S.J. Johnston and D.S Butterworth

Summary

Coarse estimates are provided of relative inshore (<30m depth) and offshore (30m+ depth) biomasses for each of the five super-areas using two methods – one being based on rough estimates provided by van Zyl of the hoop/trap catchability ratio, and the other on using the FIMS relative inshore/density results. Results indicate that the proportion of the biomass inshore in A34 is between 28-42% and between 5-25% for A8+. Constant catch projections for the inshore A34 and A8+ areas are also provided for a range (10%-40% or 10%-30% respectively) of assumptions regarding the inshore biomass as % of total biomass, and indicate that increases in the current inshore allocations in these two super-areas will lead to a rapid and substantial decrease in inshore abundance.

Introduction

With the imminent implementation of the small scale fishing policy, it is important to examine the possible effects increases of quotas in the inshore areas (those areas accessible to small scale fishers) might have on the biomass of lobsters in the inshore areas.

The calculations reported here focus on super areas A34 and A8+ as these two super-areas both have ongoing inshore (hoops and bakkies) and offshore (traps) catches. A12 has only an inshore hoop sector, A56 has for some time had an inshore sector only (although the final DAFF allocations of the 2016 season[1] include an offshore allocation for A56) and there are data limitations for the offshore sector, and A7 has traditionally had only an offshore sector (although DAFF has awarded IR quota to A7 for the 2016 season).

The aims of this study are first to calculate the area of the inshore compared to the offshore fishing areas in each of the super-areas; secondly to produce rough estimates of the biomasses (legal sized) that occur in the inshore and offshore parts of each super-area; and thirdly to project the inshore resource abundances of A34 and A8+ forward under different future constant catch (CC) levels to ascertain the effects which these would have on the inshore biomass trends.

[1] Note that the split season is referenced here by the first year, i.e. 2016 refers to the 2016/2017 season.

Methodology

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

Areal coverage

Fairweather (2017) calculated the areas of west coast rock lobster fishing for the different super-areas and depth ranges. Areas corresponding to depths of 0-30m, 0-50m, 51-100m and 101-200m were produced. A Task Group (van Zyl, Cockcroft, Butterworth, Brandao and Johnston) met to decide which depths correspond to inshore and offshore fishing for each super-area. Table 1 reports a summary of the areas associated with the designated depth categories for each super-area.

Total Abundance

The second objective of this paper is to estimate approximately how much of the total abundance in each super-area is located in the inshore area and how much in the offshore area. Two methods have been used here – the first uses the relative trap to hoop CPUE data, and the second uses the FIMS estimates of relative abundance.

Method 1 (using relative CPUEs)

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

where B_T is the total biomass in that super area,

B_i is the inshore biomass in that super area, defined here as 0-30m in depth range,

B_o is the offshore biomass in that super area, defined here as 30-100 or 200m depth range (see Table 1 for details)

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.

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

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

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 (see Table 2), and

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

Note that calculations require information on what the trap to bakkie efficiency is in Area 34 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=15

Because these catchability ratio estimates are somewhat coarse, results are explored for all three ratio options for each area to indicate sensitivity, with the "mid" option being the reference case.

Method 2: Using the FIMS relative indices of abundances (between offshore and inshore areas)

Brandao and Butterworth (2017) provide details of how the annual FIMS data are used to calculate mean CPUE by depth classes for each of the super-areas that are surveyed. These mean CPUE values have been computed over 15-30m (inshore) and 30-105m (offshore) for Dassen (A7), Lamberts Bay (A34) and Saldanha (A56), and 15-30m (inshore) and 0-**200**m (offshore) for Cape Point. Note that as very few FIMS stations fall in the 0-15m depth zone, the FIMS density estimate for the 15-30m zone has been assumed to apply to the full 0-30m zone in computing inshore abundance estimates. Zones E and F (False Bay and EOH respectively) are considered to comprise only inshore areas (15-30m). Note A8+ consists of A8+ Zone E + Zone F.

The FIMS indices represent relative lobster densities in the inshore and offshore areas. These data have been analysed for two data collection periods:

- 1992-2014 (all years)
- 2011-2014 (last five years)

Results are presented for both periods to allow for a check whether there has been any trend in the proportion inshore over time.

The relative biomass of lobsters inshore and offshore in each super area is thus calculated simply from:

$$B_i^F = A_i * D_i^F$$

$$B_o^F = A_i * D_o^F$$

where F refers to FIMS, and

D_i^F and D_o^F are the (relative) densities and B_i^F and B_o^F are the (relative) biomasses inshore and offshore in that super-area.

Projections

The projections of the inshore biomass were conducted by changing the full (inshore+offshore) stock assessment model biomass estimate for 2016 to the proportion considered to be located inshore, and then projecting ahead with this revised 2016 biomass for the starting year. Recruitment remained as defined for the full resource, but does not play a role as here projections are for five years only, which is too short a period for future recruitment to have entered the legal sized fishery.

Assumptions regarding poaching in A34

A reference case scenario for future poaching was been agreed upon in 2016 by the SWG. This is called "Scenario 5" – see DAFF WCRL SWG (2016).

For the current and future years for A34, poaching inshore is assumed to be 46% of the total "Scenario 5" poaching level defined for A34 each year. This value comes from the original SWG 2016 TAC recommendation where 46% of the A34 Global TAC was to be allocated to the hoop (inshore) fisheries. For earlier years, poaching in A34 has been allocated to the inshore area using the agreed historic poaching record for A34 and proportioning those poaching values to the inshore area using the reported proportion of hoop catches since 1950.

Assumptions regarding poaching for A8+

Similarly, for the current and future years for A8+, poaching inshore is assumed to be 34% of the total "Scenario 5" poaching level defined for A8+ for each year. This value comes from the original SWG 2016 TAC recommendation where 34% of the A8+ Global TAC was to be allocated to the hoop (inshore) fisheries. For earlier years, poaching in A8+ has been allocated to the inshore area using the agreed historic poaching record for A8+ and proportioning those poaching values to the inshore area using the reported proportion of hoop catches since 1950.

A34 inshore

The final 2016 DAFF TAC decision for A34 was 218 MT Globally, 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 55% of the 2016 A34 Global TAC decision (i.e. 119 MT = 0.55*218)
2) 60% of the 2016 A34 Global TAC decision (i.e. 131 MT = 0.6*218)
3) 80% of the 2016 A34 Global TAC decision (i.e. 174 MT = 0.8*218)
4) 100% of the 2016 A34 Global TAC decision (i.e. 218 MT)

These projections are produced for four levels of the inshore biomass as a percentage of the total A34 biomass: 10%, 20%, 30% and 40%.

A8+ inshore

The final 2016 DAFF TAC decision for A8+ 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 three scenarios.

1) Current 33%of the 2016 A8+ Global TAC decision (i.e. 412 MT = 0.33*1248)
2) 60% of the 2016 A8+ Global TAC decision (i.e. 749 MT = 0.6*1248)
3) 80% of the 2016 A8+ Global TAC decision (i.e. 998 MT = 0.8*1248)
4) 100% of the 2016 A8+ Global TAC decision (i.e. 1248 MT)

These projections are produced for three levels of the inshore biomass as a % of the total A8+ biomass: 10%, 20% and30%.

Results

Table 1 reports the inshore and offshore areas (km^2) for each of the super-areas. The different depths corresponding to the inshore/offshore areas are also indicated.

Table 2 reports the nominal CPUE values for A34 and A8 from 2009-2015, as well as the CPUE values averaged over this time period.

Table 3 reports estimates of inshore and offshore biomasses for each of the five super-areas using "Method 1" (relative selectivities of hoops and traps).

Table 4 provides a summary of inshore and offshore biomass estimates for A34 and A8+ from Table 4.

Table 5 reports the relative lobster densities obtained from the FIMS analyses for the inshore/offshore areas as designated (taken from Brandao and Butterworth 2017). Results are reported for both where either data from all years are used, or only from the most recent five years.

Tables 6a and 6b report summaries of the inshore and offshore relative biomass estimates for A34, A7 and A8+ using ”Method 2” (the FIMS data). Table 6a reports results where data from all years of FIMS are used, whereas Table 6b reports results where only the last five years of FIMS data have been considered.

Table 7 is a summary comparing the proportions of biomass inshore and offshore using the two methods discussed.

Table 8 lists the Inshore (inshore+IR+recreational) TACs for each super-area for 2015, the 2016 SWG recommended values, and the final DAFF inshore 2016 TAC (with % Global indicated in parentheses). The final Global TACs for 2016 are then indicated, with the last three columns showing different percentages of the 2016 Global TAC apportioned to inshore (60%, 80% or 100%).

Tables 9a and 9b report the **A34** inshore biomass projections for **B75m(2021/2006)** and **B75m(2021/2015)** respectively. Results are reported for four levels of inshore TAC relative to the Global TAC: 55% (as currently specified), 60%, 80% and 100% of the DAFF final 2016 Global TAC (218 MT). Results are reported assuming the inshore biomass corresponds to either 10%, 20%, 30% or 40% of that for the total area for A34.

Similarly, Tables 10a and 10b report **A8+** inshore biomass projections for **B75m(2021/2006)** and **B75m(2021/2015)** respectively. Results are reported for four levels of inshore TAC relative to the Global TAC: 33% (as currently specified), 60%, 80% and 100% of the DAFF final 2016 Global TAC (1248 MT). Results are reported assuming the inshore biomass corresponds to either 10%, 20% or 30%of that for 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: the current level (55%), 60%, 80% and 100% of the DAFF final 2016 Global TAC (218 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20%, 30% and 40% of that for 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: the current level (33%), 60%, 80% and 100% of the DAFF final Global 2016 TAC (1248 MT). Results are also reported assuming the inshore biomass corresponding to either 10%, 20% or 30% of that for the total area for A8+.

Discussion

The estimation conducted here suggests that the proportion of the biomass that is inshore in super-areas A34 ranges from 28-42%, and are somewhat lower for A8+ at between 5-25% (depending on the method used). There could be a concern that the offshore proportion is estimated too high because the calculations assume a constant density throughout the offshore area, when this may fall with depth and most of the offshore catches take place in the shallower sections of these areas. However an analysis of the FIMS data suggests that there is no such trend with depth except for a small decrease for A56 (Brandao and Butterworth 2017).

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 somewhat higher.

The calculations have assumed that there is no mixing between the offshore and inshore areas. The projections would also be less pessimistic if depletion of the inshore component was partially offset by migration inshore of some of the offshore component.

However, there is indirect evidence or indications that any net inshore movement of lobsters inshore would likely be slow and hence insufficient to compensate for any inshore depletion. For example recoveries inshore from black tides are on the decadal time scale (Cockcroft 2001). Furthermore lobster tagging is almost exclusively offshore, and proportionately there are very few recoveries inshore compared to offshore (Danie van Zyl, DAFF, pers. comm.).

Results calculated using the FIMS ("Method 2") for Dassen island suggest that the inshore area is only some 12-14% of the total area (see Table 7) – this indicates there is not much scope for inshore fishing to be developed there.

It is also to be noted that there is some discrepancy between the areas regarding the depths to which the inshore/offshore sectors legally may fish.

References

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Table 1: Inshore and offshore areas (km^2) for each of the super-areas. Note A8+ includes areas E (False Bay) and F (EOH). The offshore area normally extends only to 100m depth, but deeper to 200m in the Cape Point part of A8+

Super-area	**Inshore/offshore**	**Depth**	**Area km^2**	**Relative proportions**
A12 (Zone A)	Inshore	0-30m	1980	0.45
	Offshore	30-100m	2396	0.55
A34 (Zone B)	Inshore	0-30m	1910	0.37
	Offshore	30-100m	3230	0.63
A56 (Zone C)	Inshore	0-30m	476	0.37
	Offshore	30-100m	824	0.663
A7 (Dassen)	Inshore	0-30m	299	0.17
	Offshore	30-100m	1518	0.84
A8 (Cape Point)	Inshore	0-30m	203	0.05
	Offshore	30-**200**m	3577	0.95
E (False Bay)	Inshore	0-30m	520	1.00
	No Offshore			
F(EOH)	Inshore	0-30m	280	1.00
	No Offshore			
A8+ (A8+E+F)	Inshore	0-30m	1004	0.22
	Offshore	30-**200**m	3577	0.78

Table 2: 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 3: Estimates of inshore and offshore biomasses for each of the five super-areas based on trap and hoopnet CPUE ratios.

		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
Inshore	A_in (km^2)	1980	1910	476	299	1004
offshore	A_off (km^2)	2398	3230	824	1518	3577
	B_i (tons)		105			107
upper	B_o (tons)		270			1859
upper	B_i/B_o		0.39			0.06
upper	%B_i/T		**28.00**			**5.44**
upper	%B_o/T		72			95
mid	B_o (tons)		215			1487
mid	B_i/B_o		0.49			0.07
mid	%B_i/T	100	**32.71**	100.00	0.00	**6.71**
mid	%B_o/T	0	67	0.00	100.00	93.29
lower	B_o (tons)		161			1115
lower	B_i/B_o		0.65			0.01
lower	%B_i/T		**39.33**			**8.76**
lower	%B_o/T		61			91.24
	B total (tons)[#]	**736**	**4131**	**3579**	**3084**	**3934**
upper	B_inshore	736	1157	3579	0	247
upper	B_offshore	0	2974	0	3084	3884
mid	B_inshore	736	1351	3579	0	304
mid	B_offshore	0	3842	0	3084	3827
lower	B_inshore	736	1625	3579	0	396
Lower	B_offshore	0	2506	0	3084	3735

[#]taken from most recent stock assessment analyses of each super-area

Table 4: Summary of inshore and offshore relative biomass estimates in Table 3 for A34 and A8+ which are based on relative trap and hoopnet availability estimates.

		A34			A8+		
		Inshore	Offshore	Total	Inshore	Offshore	Total
Percentage %	Upper	28.00	72.00	100	5.44	94.56	100
	Mid	32.71	67.29	100	6.72	93.29	100
	Lower	39.33	60.67	100	8.76	91.24	100
Biomass (MT)	Upper	1157	2974	4131	247	3884	3934
	Mid	1351	3841	4131	304	3827	3934
	Lower	1624	2506	4131	396	3735	3934

Table 5: Relative lobster densities between the designated inshore/offshore areas obtained from the FIMS monitoring data for the periods 1992-2014 and 2011-2014 (Brandao and Butterworth 2017) – values normalised to 1 for the offshore part of each super-area.

Super-area	**Depth class (m)**	**Whole period**	**Last 5 years**
		1992/93-2015/16	**2011/12-2015/16**
Cape Point (A8)	**15 ≤ x < 30**	1.210	0.736
	30 ≤ x ≤ 195+	1.000	1.000
		1992/93-2014/15	**2010/11-2014/15**
Dassen Island (A7)	**15 ≤ x < 30**	0.672	0.830
	30 ≤ x < 105	1.000	1.000
		1992/93-2014/15	**2010/11-2014/15**
Saldanha Bay (A56)	**15 ≤ x < 30**	1.477	2.361
	30 ≤ x < 105	1.000	1.000
		1992/93-2014/15	**2010/11-2014/15**
Lamberts Bay (a34)	**15 ≤ x < 30**	1.240	1.191
	30 ≤ x < 105	1.000	1.000

Table 6a: Inshore and offshore relative biomass estimates for A34 and A8+ using the relative CPUE index obtained from the FIMS analyses and using **all years** data.

	A3+4		**A7**		**A8+**	
	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore
Area	1910	3230	299	1518	1004	3577
FIMS relative density	1.240	1.000	0.67	1.000	1.21	1.00
Area*FIMS relative density	2368	3230	200	1518	1213	3577
Percentage biomass	42	58	12	88	25	75

Table 6b: Inshore and offshore relative biomass estimates for A34 and A8+ using the relative CPUE index obtained from the FIMS analyses for only the **last five years'** of data (2011-2015).

	A3+4		**A7**		**A8+**	
	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore
Area	1910	3230	299	1518	1004	3577
FIMS relative density	1.191	1.000	0.83	1.000	0.736	1.000
Area*FIMS relative density	2275	3220	248	1518	739	3577
Percentage biomass	41	59	14	86	17	83

Table 7: Summary of the relative inshore and offshore biomass using different methods of calculation.

Method		**A34**		**A7**		**A8+**	
		Inshore %	Offshore %	Inshore %	Offshore %	Inshore %	Offshore %
Catchability method	Upper	**28**	72	**-**	**-**	**5**	95
	Mid	**33**	67	**-**	**-**	**7**	93
	Low	**39**	61	**-**	**-**	**9**	91
FIMS relative biomass – All years		**42**	58	**12**	88	**25**	75
FIMS relative biomass – last five years		**41**	59	**14**	86	**17**	83

Table 8: Inshore (inshore+IR+recreational) TACs for each super-area for 2015, the 2016 SWG recommended value, and the final DAFF 2016 TAC. The Global TACs for 2016 are shown in grey. To the right of those are three options of alternate possible Inshore TACs corresponding to either 60%, 80% or 100% of the 2016 DAFF Global TAC. Units are MT.

	inshore	**inshore**	**Inshore**	**Global**	**Inshore**	**Inshore**	**Inshore**
	2015	**2016 SWG**	**2016 DAFF (% Global)**	**2016 DAFF**	**60% of Global**	**80% of Global**	**100% of Global**
A12	42	30	81 (100%)	81	(81)	(81)	(81)
A34	119	65	119 (55%)	218	131	174	218
A56	96	100	96 (42%)	227	136	182	227
A7	0	0	12 (8%)	150	90	120	150
A8+	424	255	412 (33%)	1248	749	998	1248

Table 9a: A34 inshore biomass projections for **B75m(2021/2006).** Results are reported for four levels of inshore TAC relative to the Global TAC: 55% (as currently specified), 60%, 80% and 100% of the DAFF final 2016 Global TAC (218 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20%, 30% or 40% of that for the total area of A34. The specific estimates for this fraction summarised in Table 8 are sufficiently close to the values reported here to render inter/extrapolation reliable to obtain the associated projection values (similarly for Tables below).

	55% of final 2016 Global TAC (119 MT)	60% of final 2016 Global TAC (131 MT)	80% of final 2016 Global TAC (174 MT)	100% of final 2016 Global TAC (218 MT)
10% Inshore	0.001	0.001	0.000	0.000
20% Inshore	0.092	0.080	0.037	0.012
30% Inshore	0.223	0.221	0.167	0.123
40% Inshore	0.355	0.343	0.300	0.255

Table 9b: A34 inshore biomass projections for **B75m(2021/2015).** Results are reported for three levels of inshore TAC: 60%, 80% and 100% of the DAFF final 2016 TAC (218 MT). Results are also reported assuming the inshore biomass corresponds to 10%, 20%, 30% or 40% of that for the total area of A34.

	55% of final 2016 Global TAC (119 MT)	60% of final 2016 Global TAC (131 MT)	80% of final 2016 Global TAC (174 MT)	100% of final 2016 Global TAC (218 MT)
10% Inshore	0.008	0.001	0.000	0.000
20% Inshore	0.414	0.359	0.165	0.054
30% Inshore	0.671	0.634	0.504	0.369
40% Inshore	0.801	0.773	0.675	0.574

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Table 10a: A8+ inshore biomass projections for **B75m(2021/2006).** Results are reported for three levels of inshore TAC: 60%, 80% and 100% of the DAFF final 2016 TAC (1248 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20% or 30% of that for the total area of A8+.

	33% of final 2016 Global TAC (412 MT)	60% of final 2016 Global TAC (749 MT)	80% of final 2016 Global TAC (998 MT)	100% of final 2016 Global TAC (1248 MT)
10% Inshore	0.000	0.000	0.000	0.000
20% Inshore	0.059	0.012	0.004	0.000
30% Inshore	0.205	0.152	0.113	0.075

Table 10b: A8+ inshore biomass projections of **B75m(2021/2015).** Results are reported for three levels of inshore TAC: 60%, 80% and 100% of the DAFF final 2016 TAC (1248 MT). Results are also reported assuming the inshore biomass corresponding to either 10%, 20% or 30% of that for the total area of A8+.

	33% of final 2016 Global TAC (412 MT)	60% of final 2016 Global TAC (749 MT)	80% of final 2016 Global TAC (998 MT)	100% of final 2016 Global TAC (1248 MT)
10% Inshore	0.000	0.000	0.000	0.000
20% Inshore	0.284	0.055	0.019	0.001
30% Inshore	0.657	0.488	0.364	0.239

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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: the current level (55%), 60%, 80% and 100% of the DAFF final 2016 Global TAC (218 MT). Results are also reported assuming the inshore biomass corresponds to either 10%, 20%, 30% and 40% of that for the total area of A34.

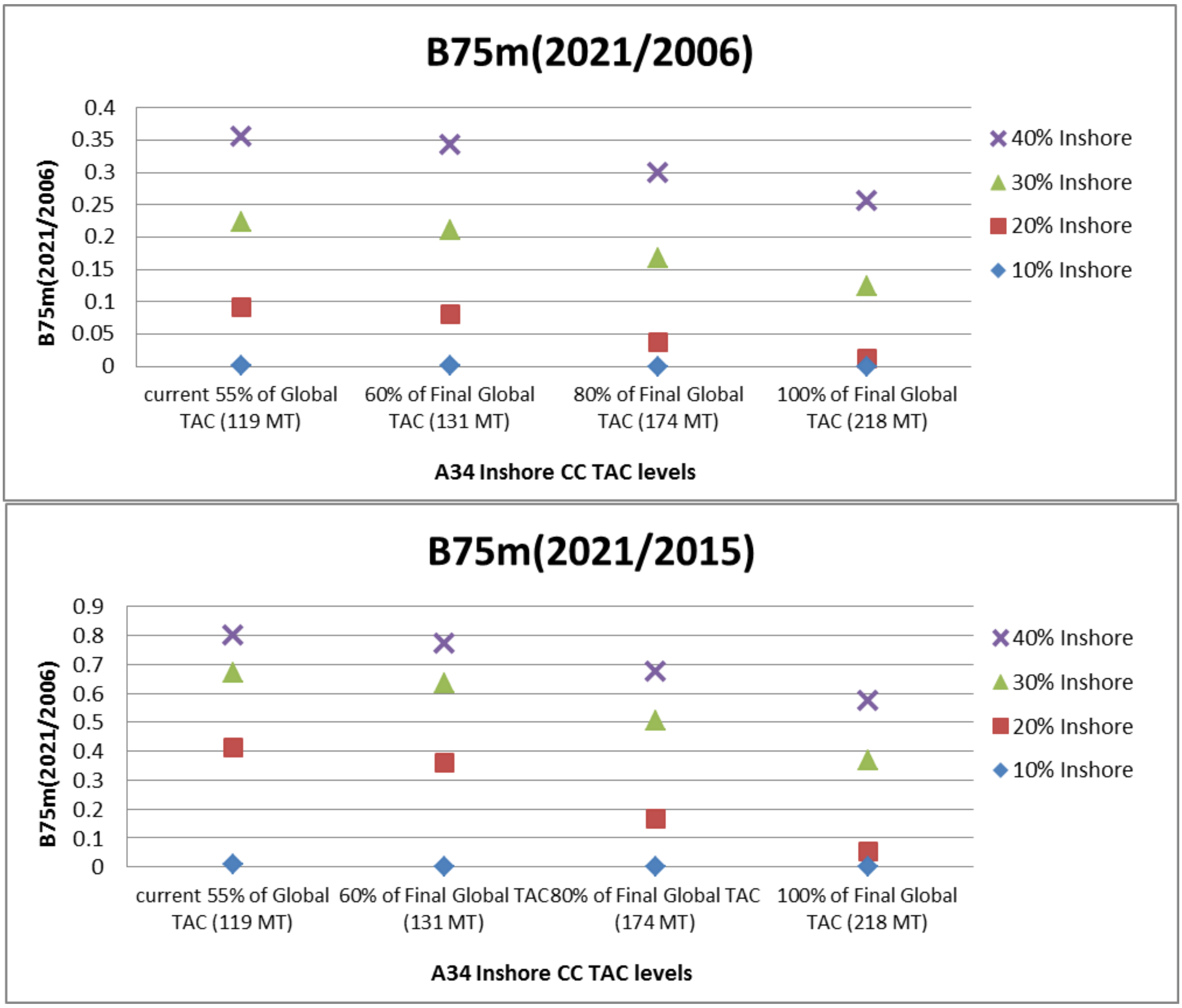

Figure 2: B75m (MT) projections for **A8+** inshore biomass expressed either as **B75m(2021/2006)** – top panel, or **B75m(2021/2015)** – bottom panel. Results are reported for four levels of inshore TAC: the current level, (33%) 60%, 80% and 100% of the DAFF final 2016 Global TAC (1248 MT). Results are also reported assuming the inshore biomass corresponding to either 10%, 20% or 30% of that for the total area of A8+.