agriculture,
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RECOMMENDATION OF THE DEMERSAL SCIENTIFIC WORKING GROUP FOR THE SUSTAINABLE MANAGEMENT OF HAKE RESOURCES FOR THE 2011 SEASON

November 2010

SUMMARY

It is **recommended** that:

i) OMP-2010 (see Demersal Scientific Working Group document FISHERIES/2010/OCTOBER/SWG-DEM/59) be accepted as the basis for hake TAC recommendations over the period 2011-2014
ii) in terms of the output from OMP-2010, the TAC for hake for 2011 be set at 131 780 tons (i.e. an increase of 10% from the 2010 level of 119 800 t)
iii) the increase be applied evenly across all sub-sectors of the hake fishing industry, consistent with the existing access rights policy framework, with allocations to each Right Holder and to the handline hake reserve each being increased by 10% and
iv) the portion of the hake TAC set aside as a reserve to account for hake by-catch in the horse mackerel-directed mid-water trawl fishery (about 2% of the horse mackerel allocation for directed mid-water trawl) also be increased by 10%.

BACKGROUND

The South African hake resource comprises two species, the shallow-water Cape hake *Merluccius capensis* and the deep-water Cape hake *M. paradoxus*. Cape hakes are targeted by four fishery sectors: offshore and inshore demersal trawl and hake longline and handline. The inshore trawl and handline operate only on the south coast, while the offshore trawl and longline fleets operate on both the west and south coasts. Although the demersal trawl fisheries also target sole and horse mackerel, hake is the largest and most commercially important component of the catch of all four of the sectors, which collectively provide the basis for some 30 000

jobs and a landed value in excess of R2.5 billion. Prior to the declaration of the 200 nautical mile South African Exclusive Economic Zone (EEZ) in 1977, the Cape hakes were subjected to increasing levels of exploitation after the First World War, with the incursion of foreign fleets during the 1960s culminating in a peak catch of close to 300 000 t in the early 1970s. Subsequent to 1977 and the declaration of the EEZ, South Africa implemented a relatively conservative management strategy by imposing Total Allowable Catches (TACs) in order to rebuild the hake stocks, and annual catches have subsequently remained relatively stable in the 120 000 – 150 000 t range (Figure 1). The TACs were recommended on the basis of assessments of the resources using first steady-state and then dynamic production models. Since 1991, the South African hake resource has been managed using Operational Management Procedures (OMPs). An OMP is essentially a set of rules which specifies exactly how the regulatory mechanism is to be computed each year. In the case of South African hake, the regulatory mechanism is a TAC, the value of which is calculated from stock-specific monitoring data (commercial CPUE indices and indices of abundance derived from demersal research surveys). Implicit in the OMP approach is a schedule of OMP revision to account for updated data sets and possible changes in resource and fishery dynamics. OMP-2007 was developed during 2006 to address the steady decline in catch rates experienced by the fishery (presumed to reflect an unhealthy stock arising from several years of poor recruitment) over the period 2000 – 2005 (Figure 2) and used to compute TAC recommendations for the 2007 – 2010 fishing seasons. A revised OMP (OMP-2010) was developed and finalised during 2010 (see Resource Assessment section below for further details), and it is this OMP that has been used to compute the hake TAC for the 2011 fishing season that is recommended in this document.

A factor that has played a significant role in the development of OMP-2010 is the recent re-certification of the hake trawl fishery by the Marine Stewardship Council (MSC). MSC certification of a fishery is an eco-label that confirms that a given seafood product has been harvested in a sustainable and ecologically responsible manner, and carries profound economic benefits for the fishery concerned. In the case of South African hake, MSC certification (first obtained in April 2004) enables access to markets (primarily in Northern Europe) that would otherwise be closed to the South African hake trawl industry. The re-certification of the SA hake trawl fishery in March 2010 has been subject to a number of stringent conditions largely related to the rebuilding of the *M. paradoxus* stock, and these conditions had to be incorporated into the management objectives of OMP-2010 in order to avoid the loss of the certification.

MANAGEMENT OBJECTIVES

M. paradoxus recovery to the Maximum Sustainable Yield (MSY) level (in terms of the median under the Reference Set of operating models) should be no slower than intended under OMP-2006, and ideally should occur within a period of 2 to 3 times what would be realised in the absence of any exploitation (this MSY level is the target reference point required to be specified under the MSC re-certification).
The lower 2.5 percentile for the spawning biomass of *M. paradoxus* should not decrease below the 2007 level estimated by the reference set of models (this is the limit reference point required by the MSC re-certification).
The lower 2.5 percentile for the lowest TAC anticipated should be as high as possible.
Interannual increases in TAC may not exceed 10% while decreases may not exceed 5% (to facilitate stability in the industry), except in circumstances where catch rates fall below specified threshold levels.

RESOURCE ASSESSMENT

Fishery independent surveys of hake abundance are conducted twice annually aboard the *F.R.S. Africana* using the swept area approach (see Appendix B of the Addendum to this recommendation document). The summer survey (January) covers the west coast (Orange River to Cape Agulhas) while the autumn survey (April/May) covers the south coast from Cape Agulhas to Port Alfred. When possible, winter (July) and spring (September) surveys are also conducted on the west and south coasts respectively. The time series of abundance estimates are provided in Tables 1 and 2 for *M. paradoxus* and *M. capensis* respectively. An additional series of abundance indices are obtained from the catch rates (CPUE) observed by the fishery. Landings from the offshore trawl fishery generally cannot be identified to species level because of onboard processing of the catch. An algorithm based primarily on depth and fish size information has been developed to split offshore catches into the two species (see Appendix A of the Demersal Scientific Working Group document FISHERIES/2010/OCTOBER/SWG-DEM/59). The species-specific CPUE data are then standardized using a Generalized Linear Modelling approach (see Appendix A of the Demersal Scientific Working Group document FISHERIES/2010/OCTOBER/SWG-DEM/59) to account for differences in various factors such as depth, area, vessel power and year. The standardized CPUE indices for each species show an overall increase (Figure 2) on both coasts. These observations indicate that both stocks are improving, and this is encapsulated in the input data to the OMP-2010 algorithm. Both survey and CPUE indices display an increasing trend over the past 5 years (Tables 3 and 4 and Figure 3), suggesting that the management strategy implemented through OMP-2006 is yielding positive results. The updated data sets, changes in resource and fishery dynamics and perhaps most importantly, the necessity to conform to the MSC requirements for re-certification required that OMP-2006 be revised (as part of the agreed-upon revision schedule).

The development of OMP-2010 was a transparent process that involved regular consultation between DAFF and external scientists, resource managers, industry representatives and representatives of the MSC. In order to fulfil the MSC limit reference point condition, the *M. paradoxus* stock was assessed in terms of recovery from the 2007 minimum spawning biomass. A wide range of Candidate Management Procedures (CMPs) were assessed for performance, culminating in the selection of 6 CMPs that encapsulated two scenarios of interannual TAC change constraints (+10% / - 10% and +10% / - 5%) and three scenarios of median projected TACs (127 000, 132 000 and 137 000 t) over the next decade. The CMPS were subjected to the full range of robustness tests, and agreement was reached on a +10% / -5% interannual TAC constraint (i.e. the TAC could not be increased by more than 10% from one year to the next, or decreased by more than 5%), except in circumstances where the catch rate falls below a threshold level (see Appendix D of the Demersal Scientific Working Group document FISHERIES/2010/OCTOBER/SWG-DEM/59). Results were adjudged to indicate that the larger downward constraint of 10% offered no real benefits to the resource in conservation terms, while exposing industry to greater potential socio-economic dislocation, so that the 5% maximum downward constraint option was accepted. Figure 4 shows median and lower 2.5 percentiles for projections under the Reference Set of operating models, and for the most severe robustness test, under the three TAC target options. The working group considered that the least conservative option (a median projected TAC of 137 000 tons over the next decade) showed inadequate recovery of *M. paradoxus* to be certain of satisfying MSC criteria for certification. It consequently recommends acceptance of the 132 000 option, as reflecting an appropriate compromise between speed of recovery and utilisation of the resource during that recovery period.

The final OMP selected to compute TAC recommendations (OMP-2010) is described in detail in "The 2010 Operational Management Procedure for the South African *Merluccius paradoxus* and *M. capensis* Resources" (Demersal Scientific Working Group document FISHERIES/2010/OCTOBER/SWG-DEM/59). Tables 3 and 4 provide the data that were used as input to the OMP algorithm to compute the hake TAC for the 2011 fishing season. The resulting value from these computations was a TAC of 134 658 tons (*M. capensis* contributing 26 400 t and *M. paradoxus* contributing 108 258 t). Due to the constraint that the TAC cannot increase by more than 10% from one year to the next, however, the final TAC that is recommended for 2011 is **131 780** tons (i.e. an increase of 10% from the 2010 level of 119 800 t). Implicit in the OMP is a set of agreed-upon metarules that govern the actions to be taken in the event of "Exceptional Circumstances" (see Appendix C of the Demersal Scientific Working Group document FISHERIES/2010/OCTOBER/SWG-DEM/59).

ECOSYSTEM CONSIDERATIONS

[Work in progress. Recommendations to be finalised and submitted in early November 2010]

ASSOCIATED ADVICE

It is important to note that all model testing and projections undertaken during the OMP development assumed that the proportional allocation among sectors remained fixed at the current proportions. Therefore it is recommended that adjustments of the TAC be applied evenly across sectors. If the proportional allocation among sectors is changed, then the test results and associated projection results for OMP-2010 will differ from those reported, and further testing will need to be undertaken.

It is recommended that, provided there is no basis to invoke "Exceptional Circumstances", OMP-2010 is used to provide TAC recommendations for the period 2011 – 2014.

OMP-2010 is scheduled to be revised in 2014 and implemented in 2015 to provide TAC recommendations for the period 2015 - 2019, provided there is no basis to invoke "Exceptional Circumstances"

RECOMMENDATION

It is **recommended** that:

i) OMP-2010 be accepted as the basis for hake TAC recommendations over the period 2011-2014
ii) in terms of the output from OMP-2010, the TAC for hake for 2011 be set at 131 780 tons (i.e. an increase of 10% from the 2010 level of 119 800 t)
iii) the increase be applied evenly across all sub-sectors of the hake fishing industry, consistent with the existing access rights policy framework, with allocations to each Right Holder and to the handline hake reserve each being increased by 10% and
iv) the portion of the hake TAC set aside as a reserve to account for hake by-catch in the horse mackerel-directed mid-water trawl fishery (about 2% of the horse mackerel allocation for directed mid-water trawl) also be increased by 10%.

Deon Durholtz

Acting Chair of the Demersal Scientific Working Group

Date:

Table 1: Survey abundance estimates and associated standard errors (in thousand tons) for *M. paradoxus* for the depth range 0 – 500 m. Values in bold are for surveys conducted by the *F.R.S. Africana* using new gear.

	West coast				South coast			
Year	Summer		Winter		Spring (Sept)		Autumn (Apr/May)	
	Biomass	(s.e.)	Biomass	(s.e.)	Biomass	(s.e.)	Biomass	(s.e.)
1985	169.959	(36.680)	264.839	(52.949)	-	-	-	-
1986	196.111	(36.358)	172.477	(24.122)	13.758	(3.554)	-	-
1987	284.805	(53.101)	195.482	(44.415)	21.554	(4.605)	-	-
1988	158.758	(27.383)	233.041	(64.003)	-	-	30.316	(11.104)
1989	-	-	468.780	(124.830)	-	-	-	-
1990	282.174	(78.945)	226.862	(46.007)	-	-	-	-
1991	327.020	(82.180)	-	-	-	-	26.638	(10.460)
1992	226.687	(32.990)	-	-	-	-	24.304	(15.195)
1993	334.151	(50.234)	-	-	-	-	198.849	(98.452)
1994	330.270	(58.319)	-	-	-	-	111.469	(34.627)
1995	324.554	(80.357)	-	-	-	-	55.068	(22.380)
1996	430.908	(80.604)	-	-	-	-	85.546	(25.484)
1997	569.957	(108.200)	-	-	-	-	135.192	(51.031)
1998	-	-	-	-	-	-	-	-
1999	562.859	(116.302)	-	-	-	-	321.478	(113.557)
2000	-	-	-	-	-	-	-	-
2001	-	-	-	-	19.929	(9.956)	-	-
2002	267.487	(35.068)	-	-	-	-	-	-
2003	411.177	(69.431)	-	-	**88.442**	(36.051)	108.857	(37.528)
2004	**259.527**	(56.021)	-	-	**63.900**	(17.894)	**48.898**	(20.343)
2005	**286.416**	(39.849)	-	-	-	-	**26.605**	(7.952)
2006	315.310	(49.490)	-	-	72.415	(15.500)	34.799	(8.325)
2007	**392.812**	(70.043)	-	-	**52.287**	(19.231)	**129.646**	(60.661)
2008	**246.542**	(51.973)	-	-	**24.816**	(8.775)	**39.505**	(11.408)
2009	**330.235**	(28.526)	-	-	-	-	**102.834**	(28.670)

Table 2: Survey abundance estimates and associated standard errors (in thousand tons) for *M. capensis* for the depth range 0 – 500 m. Values in bold are for surveys conducted by the *F.R.S. Africana* using new gear.

	West coast				South coast			
Year	Summer		Winter		Spring (Sept)		Autumn (Apr/May)	
	Biomass	(s.e.)	Biomass	(s.e.)	Biomass	(s.e.)	Biomass	(s.e.)
1985	124.647	(22.707)	181.487	(27.476)	-	-	-	-
1986	117.810	(23.636)	119.587	(18.489)	121.197	(16.625)	-	-
1987	75.693	(10.241)	87.391	(11.198)	159.088	(17.233)	-	-
1988	66.725	(10.765)	47.120	(9.568)	-	-	165.939	(21.871)
1989	-	-	323.833	(67.295)	-	-	-	-
1990	455.798	(135.237)	157.800	(23.561)	-	-	-	-
1991	77.357	(14.995)	-	-	-	-	274.298	(44.395)
1992	95.407	(11.744)	-	-	-	-	138.085	(15.357)
1993	92.598	(14.589)	-	-	-	-	158.340	(13.733)
1994	121.257	(35.951)	-	-	-	-	160.555	(23.701)
1995	199.142	(26.812)	-	-	-	-	236.025	(31.840)
1996	83.337	(9.285)	-	-	-	-	244.410	(25.107)
1997	257.293	(46.056)	-	-	-	-	183.087	(18.906)
1998	-	-	-	-	-	-	-	-
1999	198.716	(32.467)	-	-	-	-	191.203	(14.952)
2000	-	-	-	-	-	-	-	-
2001	-	-	-	-	133.793	(20.858)	-	-
2002	106.253	(15.813)	-	-	-	-	-	-
2003	75.960	(13.314)	-	-	**82.928**	(9.010)	128.450	(20.062)
2004	**205.939**	(33.216)	-	-	**106.119**	(15.596)	**99.902**	(12.027)
2005	**70.983**	(13.845)	-	-	-	-	**76.932**	(5.965)
2006	88.420	(22.851)	-	-	99.867	(9.803)	130.900	(14.816)
2007	**82.270**	(11.441)	-	-	**74.615**	(7.383)	**70.940**	(5.615)
2008	**50.877**	(5.355)	-	-	**94.232**	(11.456)	**108.195**	(9.978)
2009	**175.289**	(39.920)	-	-	-	-	**124.004**	(11.808)

Table 3: GLM-standardised CPUE series and survey abundance estimates used as input in the 2011 TAC computation. The abundance estimates shaded are for surveys that have been conducted with the new gear on the *F.R.S. Africana*.

	M. paradoxus				*M. capensis*			
	West Coast CPUE	South Coast CPUE	West coast summer survey	South Coast autumn survey	West Coast CPUE	South Coast CPUE	West coast summer survey	South Coast autumn survey
2004	2.0610	1.3252			0.8383	1.9092		
2005	2.2117	1.3150	286.42	26.61	0.4944	1.5028	70.98	76.93
2006	2.3641	1.3678	315.31	34.80	0.5640	1.1991	88.42	130.90
2007	2.7567	1.4412	392.81	129.65	0.5972	1.0488	82.27	70.94
2008	3.4236	1.3913	246.54	39.51	0.5028	1.6515	50.88	108.20
2009	3.6006	1.6309	330.24	102.83	1.0335	3.0417	175.29	124.00
2010			592.57	169.56			164.66	184.96

Table 4: Log of GLM-standardised CPUE series and survey abundance estimates (the surveys conducted with the old gear have been recalibrated) and resulting slopes (s_{2011}^{spp}) and current levels (J_{2011}^{spp}).

	M. paradoxus				*M. capensis*			
	West Coast ln(CPUE)	South Coast ln(CPUE)	West coast summer ln(survey)	South Coast autumn ln(survey)	West Coast ln(CPUE)	South Coast ln(CPUE)	West coast summer ln(survey)	South Coast autumn ln(survey)
2004	0.723	0.282			-0.1763	0.6467		
2005	0.794	0.274	5.657	3.281	-0.7043	0.4073	4.262	4.343
2006	0.860	0.313	5.702	3.498	-0.5727	0.1816	4.259	4.651
2007	1.014	0.365	5.973	4.865	-0.5155	0.0476	4.410	4.262
2008	1.231	0.330	5.508	3.676	-0.6876	0.5017	3.929	4.684
2009	1.281	0.489	5.800	4.633	0.0330	1.1124	5.166	4.820
2010			6.333	5.082			4.881	4.997
weight	1	0.75	0.5	0.25	1	0.75	0.5	1
$s_{2011}^{i,spp}$	12.154%	3.598%	9.16%	32.06%	3.297%	7.080%	15.24%	12.00%
$J_{2011}^{i,spp}$	0.680	0.703	0.611	0.609	0.439	1.516	0.740	0.711
s_{2011}^{spp}	10.979%				8.684%			
J_{2011}^{spp}	0.666				0.817			

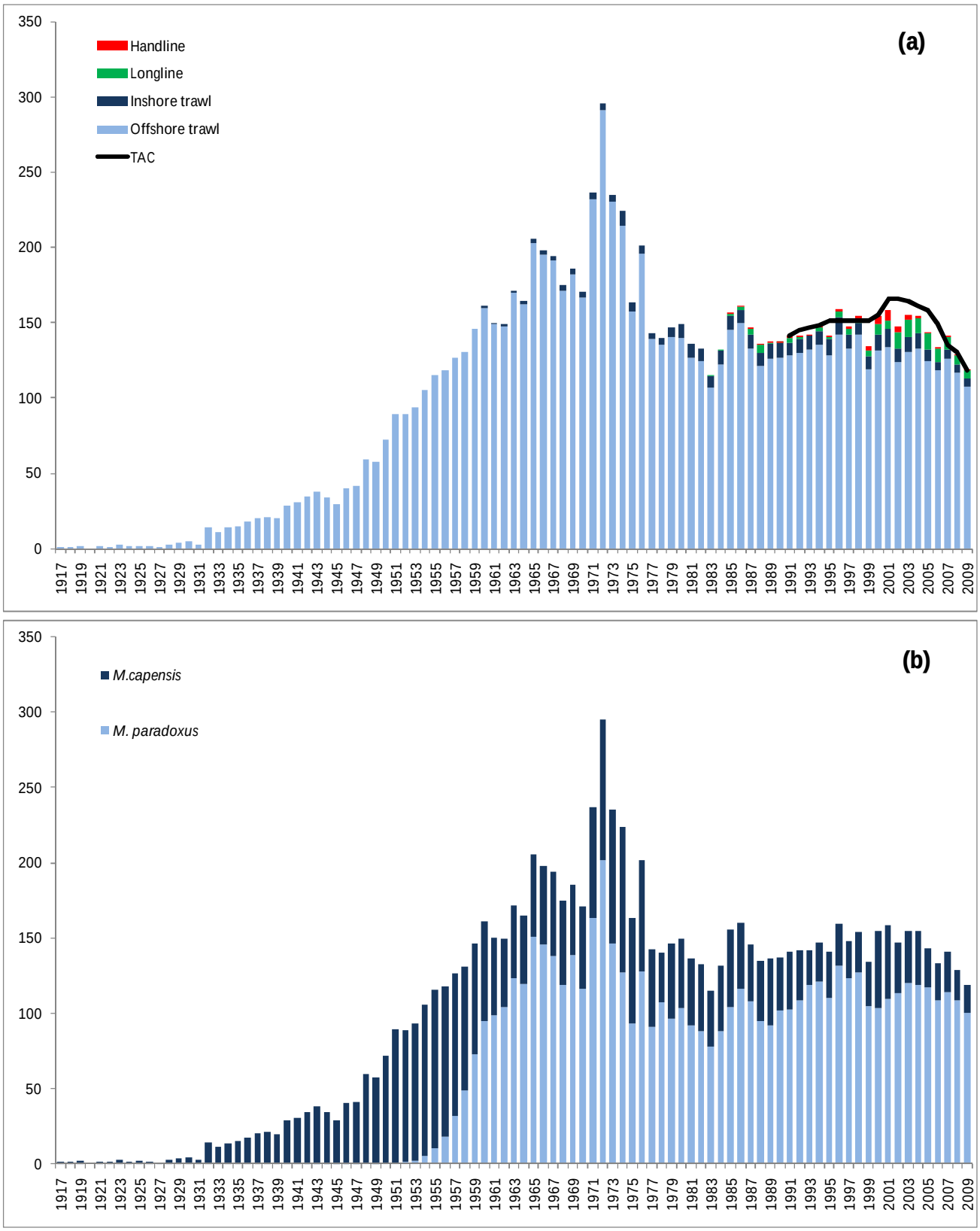

Figure 1: (a) Total catches (thousand tons) by fishing sector of Cape hakes over the period 1917 – 2009 and the TAC set each year since the implementation of the OMP approach in 1991 (b) Catches of Cape hakes split by species. Prior to 1978, when the data required to split the catch by species are not available, the split is calculated using an algorithm that assumes 1958 as the centre year for the shift from a primarily *M. capensis* to a primarily *M. paradoxus* offshore trawl catch.

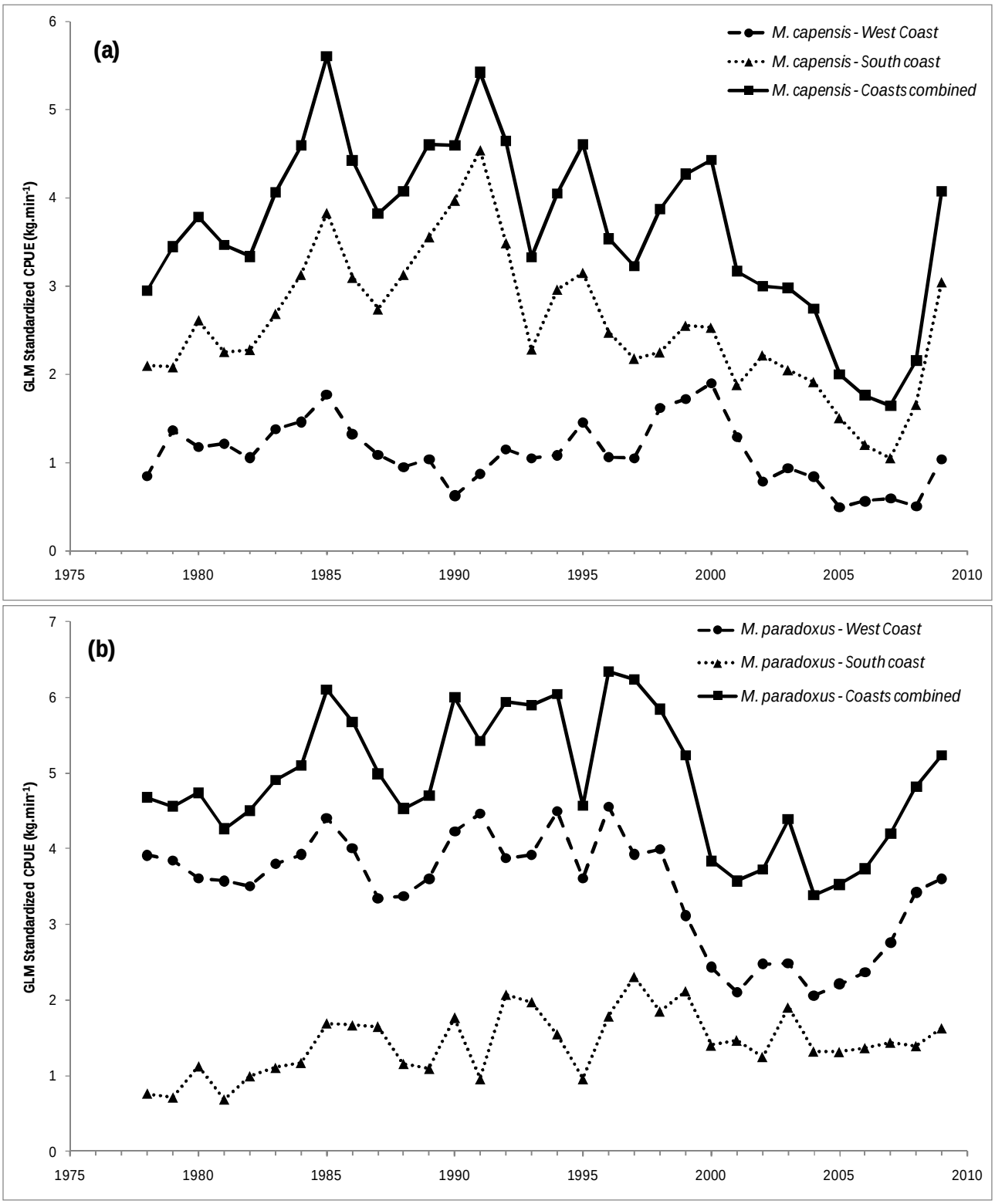

Figure 2: Time series of GLM-standardized CPUE indices (kg.min^{-1}) for (a) *M. capensis* and (b) *M. paradoxus*, split by coast and for both south and west coasts combined.

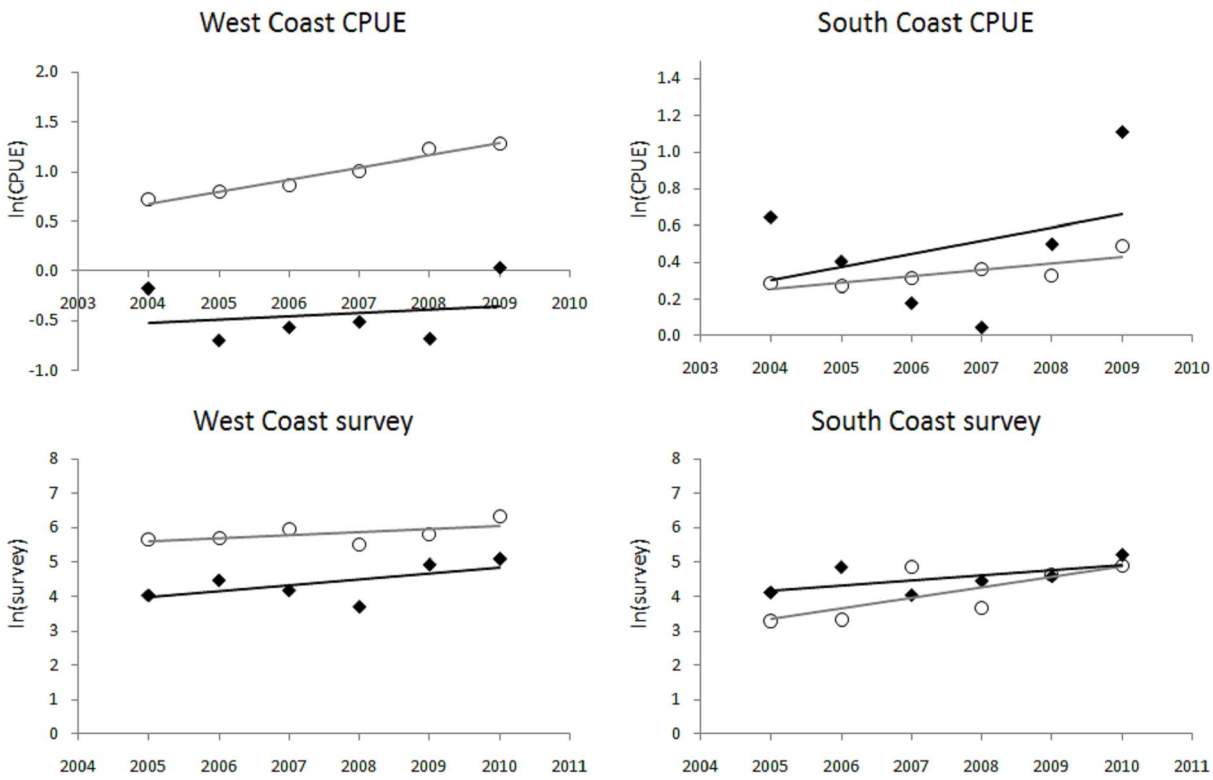

Figure 3: Recent trends in the GLM-standardised CPUE and survey abundance indices for *M. paradoxus* (open circles) and *M. capensis* (filled diamonds) which are used in the TAC computation. The survey abundance estimates shown include the calibration factors specified in the OMP for the years in which the new gear was used on the *F.R.S. Africana*.

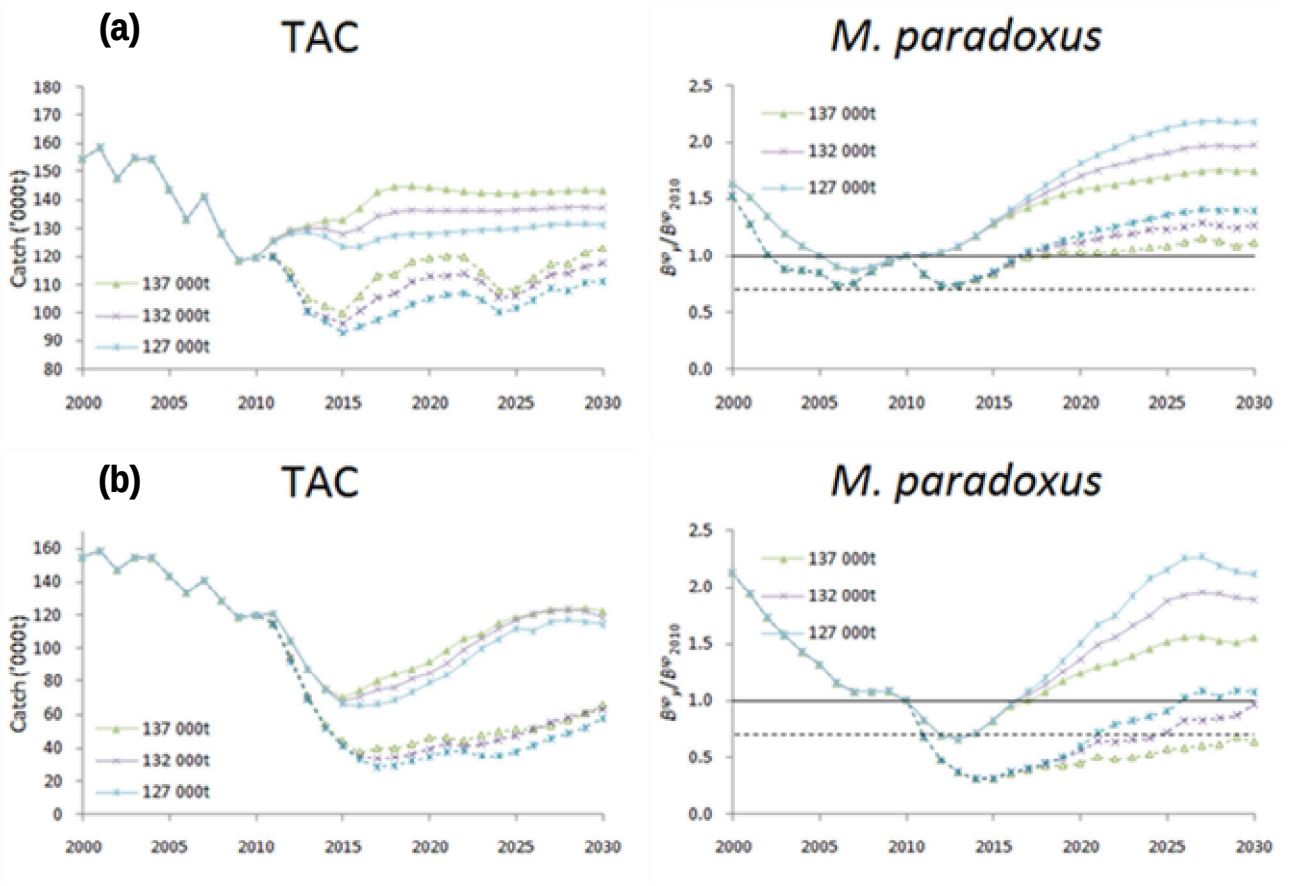

Figure 4: Projections based on (a) the Reference Set of operating models (RSa) and (b) the most severe robustness test (a decrease in *K* in the past) for the final set of CMPs. Projected TACs and *M. paradoxus* spawning biomass (expressed in terms of the 2010 level) are illustrated as the median (full lines) and lower 2.5%iles (dashed lines). The horizontal dashed line shows the 2007 level. The final set of CMPs illustrated here are the Base Case tuned to average annual catches over 2011-2020 of 137 000t (CMPf1a), 132 000t (CMPf1b) and 127 000t (CMPf1c), subject to an interannual TAC change constraint of +10% -5%.