Taking account of the new longline data in the updated Reference Case for the South African hake resource

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This paper summarises the assumptions that have been made in previous hake assessments concerning the longline data and makes suggestions for the updated Reference Case.

1. West coast catches

Table 1 summarises the west coast longline catch data currently available for the period 2000-2010, as provided by Somhlaba (pers. commn). For comparison, the total (*M. paradoxus* + *M. capensis*) catches used in previous assessments are also shown.

Previously the longline catch data were not available disaggregated by species and gender. The assessments assumed that the longline catches on the west coast consisted of 70% *M. paradoxus*. The same fishing mortality was assumed for males and females

Since the data are now available disaggregated by species and gender, we suggest that this information be used directly.

- For the period 2000-2010, the species- and gender-disaggregated catches given in Table 1 will be used as input to the model (see Appendix A for details of the equations).
- For 2010, there is a discrepancy between the total catch previously used (4.722 thousand tons) and that provided by Somhlaba (3.794 thousand tons). The data provided by Somhlaba will be used.
- For the species and gender split of the catches pre-2000 and post-2010, as there seems to be no trend in the proportions (see Figures 1 and 2) the average split over the 2000-2010 will be used, i.e.: 45.3% *M. capensis*; 15.2% males *M. paradoxus* and 18.7% males *M. capensis*.

2. South coast catches

Table 2 summarises the south coast longline catch data currently available for the period 2000-2010, provided by Somhlaba (pers. commn). For comparison, the total (*M. paradoxus* + *M. capensis*) catches used in previous assessments are also shown.

Previously the longline catch data were not available disaggregated by species and gender. The assessments assumed that the longline catches consisted of 100% *M. capensis*. The same fishing mortality was assumed for males and females.

- For the period 2000-2010, the species- and gender-disaggregated catches given in Table 2 will be used as input to the model, i.e. the model will NOT assume that this fleet catches *M. capensis* exclusively.

- For the whole period 2000-2010, there is a discrepancy between the total catches previously used and those provided by Somhlaba (see Table 2). The data provided by Somhlaba will be used.
- For the species and gender split of the catches pre-2000 and post-2010, and for the years for which gender-disaggregated data are not available, the average split over the 2000-2010 will be used, as there seems to be no trend in the proportions (see Figures 1 and 2), i.e.: 68.9% *M. capensis*; 46.0% males *M. paradoxus* and 29.3% males *M. capensis*.

3. Length frequencies

Pre-2000 data not disaggregated by species or gender are shown in Table 3. The south coast data were previously assumed to be 100% *M. capensis*, but will now be assumed to consist of both species, as is done for the west coast.

Tables 4 and 5 give the west coast *M. paradoxus* and *M. capensis* gender-disaggregated length frequencies respectively. These data will be used as they are: see Appendix A.

Tables 6 and 7 give the south coast *M. paradoxus* and *M. capensis* length frequencies respectively. The length frequency for 2006 (and possibly 2001) for *M. paradoxus* seems to be based on very few fish and we suggest not using this year's data for *M. paradoxus*.

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Table 1: West coast longline catches for the period 2000-2010, in thousand tons.

| year | M. paradoxus | | | M. capensis | | | Previous | | | % |
	Females	Males	Total	Females	Males	Total	Total	Total	Difference	M. capensis
2000	1.740	0.966	2.706	1.804	0.195	2.000	4.706	4.706	0.000	42.5
2001	1.935	0.110	2.045	1.515	0.235	1.750	3.794	3.794	0.000	46.1
2002	3.294	1.175	4.469	2.059	0.331	2.391	6.860	6.860	0.000	34.8
2003	2.555	0.750	3.305	1.963	0.563	2.526	5.830	5.830	0.000	43.3
2004	2.497	0.358	2.855	2.050	0.247	2.297	5.152	5.152	0.000	44.6
2005	2.912	0.179	3.091	2.359	0.414	2.773	5.864	5.864	0.000	47.3
2006	3.093	0.148	3.241	2.260	0.260	2.520	5.762	5.762	0.000	43.7
2007	2.419	0.093	2.512	1.655	0.867	2.522	5.035	5.036	0.001	50.1
2008	1.751	0.503	2.255	1.370	0.567	1.937	4.192	4.192	0.000	46.2
2009	1.870	0.540	2.410	1.874	0.954	2.828	5.238	5.238	0.000	54.0
2010	1.935	0.110	2.045	1.515	0.235	1.750	3.794	4.722	0.928	46.1

Table 2: South coast longline catches for the period 2000-2010, in thousand tons.

| year | M. paradoxus | | | M. capensis | | | Previous | | | % |
	Females	Males	Total	Females	Males	Total	Total	Total	Difference	M. capensis
2000			3.105			1.977	5.082	2.077	-3.005	38.9
2001	0.175	0.195	0.370	0.832	0.515	1.347	1.717	1.688	-0.029	78.5
2002			1.585	1.616	0.931	2.546	4.131	3.945	-0.186	61.6
2003			1.252	2.103	0.975	3.078	4.330	4.878	0.548	71.1
2004			1.196	2.005	0.726	2.731	3.927	4.429	0.502	69.6
2005			0.472	2.731	0.539	3.270	3.742	4.559	0.817	87.4
2006	0.345	0.139	0.485	2.349	0.878	3.227	3.711	4.032	0.321	86.9
2007			3.021			2.522	5.543	3.834	-1.709	45.5
2008	0.529	0.280	0.809	1.364	0.529	1.893	2.701	2.740	0.039	70.1
2009	0.411	0.657	1.069	1.986	0.534	2.520	3.588	3.841	0.253	70.2
2010	0.175	0.195	0.370	0.832	0.515	1.347	1.717	3.829	2.112	78.5

Table 3: West and south coast species- and gender-aggregated longline length frequencies.

West coast, species and sex-aggregated

Length	1994	1995	1996	1997
25.5	0	0	0	0
27.5	0	0	0	0
29.5	0	0	0	0
31.5	0	0	0	0
33.5	7	0	0	0
35.5	55	0	68	0
37.5	145	0	68	0
39.5	290	151	204	0
41.5	642	227	511	668
43.5	980	113	1498	3339
45.5	1180	605	2519	2893
47.5	1477	794	2927	7345
49.5	1801	1852	4867	10906
51.5	2423	3591	7897	15135
53.5	3299	6993	13105	26264
55.5	4728	8278	20831	27822
57.5	6074	16782	31315	45405
59.5	6937	15837	44896	46296
61.5	7716	20071	56299	45183
63.5	8579	24455	63039	58760
65.5	9525	21696	84959	67218
67.5	11816	28273	80228	74340
69.5	13514	26799	80704	70334
71.5	13935	28689	83870	76121
73.5	14660	31372	73216	77456
75.5	13983	23624	68757	68553
77.5	12424	26081	58988	65437
79.5	10588	22603	50342	49857
81.5	7710	18370	39859	38283
83.5	7026	15535	30736	29603
85.5	4410	12020	25222	25819
87.5	3037	10508	15726	24038
89.5	2015	6312	11062	11574
91.5	1256	3251	7761	6010
93.5	1001	2419	4119	3561
95.5	435	983	2757	2003
97.5	242	643	1123	668
99.5	97	189	579	668
101.5	69	113	374	0
103.5	7	0	204	0
105.5	7	0	34	0

South coast, species and sex-aggregated

Length	1994	1995	1996	1997
25.5	0	0	0	0
27.5	0	0	0	0
29.5	0	0	0	0
31.5	0	0	0	0
33.5	0	0	0	0
35.5	0	0	0	0
37.5	0	0	0	0
39.5	219	206	0	0
41.5	109	309	0	173
43.5	1040	155	0	867
45.5	1204	825	545	2139
47.5	3394	1083	5447	3988
49.5	5858	2526	14434	9422
51.5	11278	4898	21788	13814
53.5	17902	9539	41397	21213
55.5	28139	11292	58827	26473
57.5	35201	22893	51473	34045
59.5	41497	21604	65091	34738
61.5	41661	27379	75712	40981
63.5	45822	33360	93142	50576
65.5	42373	29596	101313	59708
67.5	40402	38567	118471	67916
69.5	39472	36557	122011	70575
71.5	33340	39135	125552	69766
73.5	30329	42795	121194	66644
75.5	22719	32225	95594	60691
77.5	18723	35577	79525	51790
79.5	13413	30833	61550	37860
81.5	10402	25058	34043	23930
83.5	7117	21191	32409	18092
85.5	5365	16396	17430	11445
87.5	4161	14334	9260	5664
89.5	3121	8611	3268	3295
91.5	2245	4434	4085	2312
93.5	1533	3300	1906	925
95.5	493	1341	1089	809
97.5	328	877	272	173
99.5	55	258	0	347
101.5	55	155	0	0
103.5	0	0	0	58
105.5	0	0	0	0

Table 4: West coast gender-disaggregated *M. paradoxus* length frequencies.

M. paradoxus females

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5	0	0	0	0	0	0	0	0	0	0	0
26.5	0	0	0	0	0	0	0	0	0	0	0
27.5	0	0	0	0	0	0	0	0	0	0	0
28.5	0	0	0	0	0	0	0	0	0	0	0
29.5	0	0	0	0	0	0	0	0	0	0	0
30.5	0	0	0	0	0	0	0	0	0	0	0
31.5	0	46	0	129	0	0	0	0	0	0	46
32.5	0	0	0	64	0	0	22	0	32	0	0
33.5	0	0	0	96	0	0	0	0	32	0	0
34.5	0	0	0	193	34	28	22	166	0	0	0
35.5	0	0	0	32	0	28	0	0	63	0	0
36.5	127	0	0	161	67	113	0	0	63	155	0
37.5	0	0	0	321	101	85	22	0	95	155	0
38.5	506	0	0	129	34	142	111	0	95	232	0
39.5	0	46	0	161	67	170	89	498	32	464	46
40.5	633	46	0	193	270	312	67	747	979	541	46
41.5	0	92	227	386	337	340	979	249	1232	1082	92
42.5	633	275	567	193	1011	624	1624	332	2590	1159	275
43.5	127	183	1587	482	1854	794	2157	415	1958	1777	183
44.5	1519	275	227	450	2461	1248	2157	581	2369	3863	275
45.5	0	458	794	386	3506	2269	3381	830	4864	4558	458
46.5	1266	687	1927	771	4382	2637	5738	1163	5654	5099	687
47.5	380	1008	1587	1125	5630	3119	7229	2159	6191	8885	1008
48.5	1139	2291	2267	1414	7416	4906	9542	3488	7233	11898	2291
49.5	506	1375	5328	1446	8326	6891	11810	4650	11403	14525	1375
50.5	1393	3162	4421	2989	11293	9443	14880	5647	15856	17615	3162
51.5	1646	2429	6008	4017	13619	12846	19083	11128	16172	22173	2429
52.5	3165	5178	7369	5656	18069	16958	23532	11044	16962	26191	5178
53.5	3165	5362	10543	8805	18136	19624	28002	17605	25079	34071	5362
54.5	7217	8570	14738	10123	23058	25834	31561	23833	28112	40483	8570
55.5	5191	8111	15758	12886	25215	31392	37188	30476	32881	42492	8111
56.5	8103	12511	18819	17578	29901	37688	45417	38282	35471	48827	12511
57.5	8356	13152	23240	21820	32261	41148	49110	44510	40967	56862	13152
58.5	13547	17781	27662	27155	35362	50222	56294	57382	41504	57557	17781
59.5	14053	17094	32650	31622	39845	54306	60453	57714	46842	56862	17094
60.5	18611	23876	44667	34867	49655	57936	65524	63277	48801	54313	23876
61.5	21396	21356	46594	40041	51543	58049	68438	65187	51580	59412	21356
62.5	27347	28230	42626	44251	55891	61735	74688	63859	44694	57789	28230
63.5	28233	24518	51469	44476	58251	63494	75844	68011	40178	54544	24518
64.5	33044	30200	47501	47529	59532	63947	80782	60703	38756	52536	30200
65.5	36336	32812	54983	48782	58824	63238	80226	64938	35440	41642	32812
66.5	38995	35012	52489	46758	55521	61764	72886	68924	31934	38784	35012
67.5	34817	36020	55550	44797	54543	59410	70751	53977	26785	34766	36020
68.5	37729	39457	49882	43319	52554	53228	63344	52316	26880	31367	39457
69.5	32918	37258	49088	46404	48273	47897	59830	44759	21542	22714	37258
70.5	36083	39228	51582	42419	43520	48124	52802	40441	21889	16224	39228
71.5	35576	33683	51355	38370	38868	42424	44016	34960	18130	15374	33683
72.5	28613	36341	50448	35092	35092	37348	38856	31971	14056	15992	36341
73.5	28486	30292	48748	34642	32395	34143	33207	26407	15351	11898	30292
74.5	30385	29879	45914	30272	25182	30173	28380	21591	13772	10816	29879
75.5	23422	25709	43987	28504	22417	25437	23621	17273	11055	9812	25709
76.5	17598	23968	37411	26159	19923	22686	20685	13868	11561	8189	23968
77.5	19624	20577	35597	23395	15911	19964	17638	10297	11118	7803	20577
78.5	17218	18102	30723	21467	14226	16731	15591	8802	9381	5485	18102
79.5	15319	14756	30609	18092	12203	13470	12166	6477	7265	3940	14756
80.5	11268	14161	21880	16871	9135	12704	10253	6809	7075	2550	14161
81.5	7850	9807	17118	15971	7349	10606	8207	4899	5622	2627	9807
82.5	8103	9807	13944	11858	5899	11315	7696	4235	4864	1854	9807
83.5	4178	8524	14738	11794	6068	8678	5649	2491	5022	2627	8524
84.5	6584	6141	14738	9930	4483	7061	4448	2989	2432	2627	6141
85.5	3672	4629	7709	8034	2764	5757	3670	2159	3380	1313	4629
86.5	2532	4445	9976	6299	2731	6863	3848	2242	3854	927	4445
87.5	1899	2887	6575	5142	2663	4707	2669	1163	1263	1313	2887
88.5	1772	2704	9296	5142	2393	3800	2424	1412	2243	927	2704
89.5	886	2108	7482	3888	1281	2978	1401	1080	3822	1236	2108
90.5	1266	1604	5102	3246	1079	2637	1134	581	569	773	1604
91.5	253	642	3401	2217	1315	1843	1090	415	158	232	642
92.5	127	1100	4308	1800	843	1815	1112	498	411	695	1100
93.5	0	733	2948	2121	775	1304	601	249	253	309	733
94.5	127	229	4761	1414	674	1021	467	83	95	155	229
95.5	0	183	2948	900	843	652	400	415	221	155	183
96.5	0	321	1474	1125	506	907	445	0	95	0	321
97.5	0	321	1020	771	270	681	222	0	158	77	321
98.5	0	183	227	868	371	425	133	83	63	0	183
99.5	127	183	0	289	169	312	289	83	32	0	183
100.5	0	46	680	353	337	255	44	0	0	77	46
101.5	0	0	340	225	101	113	44	0	0	77	0
102.5	0	46	0	418	67	85	89	0	0	0	46
103.5	0	0	113	193	34	113	0	0	32	0	0
104.5	0	0	0	225	101	113	22	83	0	0	0
105.5+	0	0	0	225	135	142	22	0	0	0	0

M. paradoxus males

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5	0	0	0	0	0	0	0	0	0	0	0
26.5	0	0	0	0	0	0	0	0	0	0	0
27.5	0	0	0	0	0	0	0	0	0	0	0
28.5	0	0	0	0	0	0	0	0	0	0	0
29.5	0	0	0	0	0	0	0	0	0	0	0
30.5	0	0	0	32	0	28	0	0	0	0	0
31.5	0	0	0	96	0	0	44	0	0	0	0
32.5	0	0	0	96	0	0	0	0	0	0	0
33.5	0	0	113	193	34	0	22	83	0	0	0
34.5	0	0	0	96	67	57	111	0	0	77	0
35.5	0	46	227	161	0	28	89	0	32	541	46
36.5	253	46	113	257	236	28	111	83	190	1004	46
37.5	0	0	0	225	67	85	267	83	190	2163	0
38.5	506	0	0	321	270	28	111	0	32	2781	0
39.5	0	92	113	257	34	85	200	83	95	1777	92
40.5	633	92	113	289	169	170	267	166	758	1159	92
41.5	0	46	453	353	202	227	156	166	1737	1700	46
42.5	1013	137	113	418	236	454	334	83	1958	1700	137
43.5	0	92	680	514	775	539	423	332	2337	2318	92
44.5	1393	367	680	803	1450	907	801	332	3064	3554	367
45.5	127	183	1134	900	1214	936	801	581	4738	5717	183
46.5	1899	550	453	1382	1618	993	867	498	3980	6953	550
47.5	506	550	1927	1350	1753	1475	756	581	5054	7417	550
48.5	1519	779	1360	1671	1921	1588	1379	747	6601	9271	779
49.5	506	733	2834	1896	2225	2042	1290	1080	6128	7726	733
50.5	1646	2016	2948	3181	2663	2042	1490	1744	7233	8807	2016
51.5	1013	1283	4535	3921	3169	2722	2046	1578	10013	9348	1283
52.5	3545	3025	6462	5977	3438	2779	2358	2159	7612	10507	3025
53.5	1899	1925	4988	6941	4349	4537	2625	2242	9760	11511	1925
54.5	4305	2887	6235	7006	5124	3601	3403	2491	9823	16611	2887
55.5	4178	1925	7822	8420	6169	4424	4026	2574	10360	18310	1925
56.5	7596	2429	8616	8741	5967	4169	4826	1744	11371	19237	2429
57.5	3798	1421	10430	10251	6540	5445	4982	2574	12445	19237	1421
58.5	7976	3208	13151	9319	7787	5501	5961	2325	12382	13829	3208
59.5	5697	1192	12357	11215	8731	4367	5560	2408	13677	14525	1192
60.5	10002	2704	15758	11472	9304	5757	5294	2657	11971	11743	2704
61.5	8356	1192	14398	12019	8664	4594	5138	1495	9697	11357	1192
62.5	16585	2521	15305	13818	11394	4707	5605	830	10613	11202	2521
63.5	9875	1008	13717	13690	10787	4481	4760	1246	9823	10662	1008
64.5	17851	2200	15985	12694	10450	4282	4537	1495	7107	9657	2200
65.5	12534	1192	13491	14011	10282	4707	3959	1744	8402	10198	1192
66.5	20510	3070	14851	14750	8529	3545	2847	1910	5464	7031	3070
67.5	14306	1787	12697	15040	8124	3318	2669	830	6570	5563	1787
68.5	21650	2933	16098	14011	6978	3176	2002	913	7138	6953	2933
69.5	14053	1146	12244	11055	6000	2552	1757	913	7138	6567	1146
70.5	18864	2521	14964	11890	5528	2042	1468	996	8086	4713	2521
71.5	14053	1283	17572	11087	4113	2013	1468	996	3948	5254	1283
72.5	19497	1971	17572	11068	3809	1588	956	1080	2085	5640	1971
73.5	15193	1283	14964	9962	2731	1446	667	1080	2306	3863	1283
74.5	14433	550	15531	10508	2798	1106	623	1495	3380	3168	550
75.5	13927	1192	13831	7905	1921	737	311	415	4233	3245	1192
76.5	9749	596	12584	7423	2697	624	222	830	4454	2009	596
77.5	9369	917	11677	6042	1584	652	245	498	3948	2472	917
78.5	11141	1054	12811	4756	978	454	200	1246	3601	2395	1054
79.5	7217	275	11450	4274	910	482	111	249	2590	2318	275
80.5	7470	183	9296	3567	910	369	111	249	1642	1700	183
81.5	5317	779	10316	3599	539	284	0	249	1421	927	779
82.5	5191	137	5555	3085	607	255	44	166	411	1622	137
83.5	2532	275	5782	2956	506	142	0	498	1263	695	275
84.5	3039	92	4421	2346	405	57	44	0	1232	1236	92
85.5	3039	46	7482	2314	438	312	44	83	1548	309	46
86.5	1646	46	5442	2025	303	85	22	83	600	1082	46
87.5	1646	46	4421	1478	169	170	22	0	2148	541	46
88.5	1393	0	3628	1189	135	57	0	83	1453	850	0
89.5	3039	46	2494	611	169	0	0	83	884	77	46
90.5	2659	0	3854	611	135	0	0	83	95	0	0
91.5	380	0	1701	546	0	28	44	249	95	0	0
92.5	506	0	3288	546	34	57	22	0	32	0	0
93.5	253	0	1701	482	67	0	0	0	63	0	0
94.5	127	0	1474	321	67	0	0	0	95	0	0
95.5	127	0	1247	482	34	0	0	0	190	0	0
96.5	380	0	227	257	0	0	0	0	63	0	0
97.5	127	0	0	161	0	28	0	0	95	0	0
98.5	1139	0	0	193	0	0	0	0	0	0	0
99.5	2279	0	113	32	34	0	0	0	0	0	0
100.5	0	0	0	64	0	0	0	0	0	0	0
101.5	0	0	0	32	0	0	0	0	0	0	0
102.5	127	0	0	0	0	0	0	0	0	0	0
103.5	0	0	0	0	0	0	0	0	0	0	0
104.5	127	0	0	0	0	0	0	0	0	0	0
105.5+	0	0	0	0	0	0	0	0	0	0	0

Table 5: West coast gender-disaggregated *M. capensis* length frequencies.

M. capensis females

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5	0	0	0	0	0	0	0	0	0	0	0
26.5	0	0	0	0	0	0	0	0	0	0	0
27.5	0	0	0	0	0	0	0	0	0	0	0
28.5	0	0	0	0	0	0	0	0	0	0	0
29.5	0	0	0	0	0	0	0	0	0	0	0
30.5	0	0	0	0	0	0	0	93	0	0	0
31.5	0	0	0	0	0	0	0	0	0	53	0
32.5	0	0	0	0	0	0	0	93	0	212	0
33.5	0	0	0	17	0	0	0	278	0	212	0
34.5	0	0	0	0	0	0	0	0	0	478	0
35.5	0	0	0	0	0	114	56	0	0	797	0
36.5	0	54	0	34	0	57	112	93	32	319	54
37.5	0	54	0	0	0	0	168	0	0	425	54
38.5	0	163	0	0	0	0	503	278	0	531	163
39.5	78	109	0	0	0	114	1565	278	0	691	109
40.5	0	326	0	17	0	143	2739	556	32	1594	326
41.5	156	543	0	34	0	29	2627	3704	288	2125	543
42.5	390	380	67	34	23	257	1901	4260	639	2922	380
43.5	545	597	0	17	113	571	2348	3334	767	3347	597
44.5	935	543	67	169	180	599	1118	8798	1407	3134	543
45.5	1481	1140	67	152	180	742	2404	11761	1471	5206	1140
46.5	1948	760	200	186	450	1028	3298	8335	1662	5950	760
47.5	3818	923	266	506	721	1513	5255	19355	1534	7809	923
48.5	3429	1357	533	506	1036	1884	5367	16114	2014	8181	1357
49.5	5221	2496	400	641	1058	3225	8050	22597	2526	11634	2496
50.5	5455	3256	932	861	1711	4424	8777	20559	6074	13387	3256
51.5	6546	4125	1199	1131	2409	6422	11236	14447	5818	13015	4125
52.5	6312	5427	1998	1620	3918	10190	12354	13151	7257	12431	5427
53.5	8260	7761	2664	2160	5359	11360	12131	14632	11413	15405	7761
54.5	9896	10746	3397	2700	5494	14329	13193	16855	13203	19974	10746
55.5	9741	13893	6194	3375	8196	16070	14255	21300	10454	18380	13893
56.5	13247	16336	5395	4573	10876	20066	17330	17874	11956	26455	16336
57.5	13949	20243	7926	5467	12632	24177	18560	20745	13555	25286	20243
58.5	17143	23825	13788	7745	14952	28744	19454	22412	16272	27676	23825
59.5	21507	25290	17784	11255	16213	34281	22417	20096	15377	30386	25290
60.5	22598	27298	22247	12234	19027	38334	26386	25005	17359	31501	27298
61.5	25170	23011	26176	15997	20986	42958	27113	16299	27845	41329	23011
62.5	24235	22360	31971	20080	23081	46641	30914	20204	20189	38620	22360
63.5	24546	21112	36434	23168	23801	49409	35722	14447	18222	39416	21112
64.5	25871	17258	41762	24636	25377	49695	36281	17874	19437	40479	17258
65.5	26962	19646	47224	29361	26976	49695	41032	17133	20620	40054	19646
66.5	30157	16607	46758	32466	29070	48239	46846	24449	18222	43294	16607
67.5	31170	18561	51287	34997	30219	46212	46287	20467	14130	39894	18561
68.5	30001	18181	44293	35706	31435	44300	46119	19263	16080	35910	18181
69.5	29923	16661	45958	36870	32065	39961	45393	25560	15697	31820	16661
70.5	29144	16281	38499	36735	33236	36308	44275	26764	21866	32192	16281
71.5	27741	16227	37499	37309	32448	33282	42542	21115	19788	25870	16227
72.5	28832	18398	30772	34744	32583	28401	38796	15558	14737	25870	18398
73.5	27352	14165	26643	32804	31322	25347	33877	14818	11732	20133	14165
74.5	26261	11723	22247	31032	30917	22064	27672	17225	11509	16255	11723
75.5	24858	12374	19782	26510	27427	20123	25212	22226	11956	14396	12374
76.5	21975	13893	15319	24130	24274	15870	20069	15651	12532	14449	13893
77.5	18546	10637	12589	21042	21865	16070	15485	22597	9271	10146	10637
78.5	12702	9606	11923	18056	20649	14129	11069	17411	8536	7915	9606
79.5	14026	10474	9458	13955	17068	12103	11236	18707	6266	5578	10474
80.5	8961	11017	9658	12284	12948	10504	5186	11285	2709	651	11017
81.5	7715	6730	7060	10293	11214	8820	7323	5464	7513	4197	6730
82.5	6312	8466	6994	8994	8737	8706	7435	6112	7896	2125	8466
83.5	3896	5536	5795	7661	8241	7107	6093	3427	4412	4197	5536
84.5	3507	5156	5928	5771	6913	6280	3745	3427	4220	1966	5156
85.5	2494	4613	5262	4320	5719	4738	4472	4353	4188	1700	4613
86.5	1948	15033	3264	3982	3468	2883	2907	2778	5882	1859	15033
87.5	1481	3962	2931	3155	3580	2911	1845	1389	4284	744	3962
88.5	1481	3528	2931	2548	2657	2055	1174	1389	4252	1062	3528
89.5	1481	4070	1998	1738	1374	1941	894	741	6266	478	4070
90.5	1013	2931	3064	1671	1396	1627	1342	3334	480	637	2931
91.5	701	1899	1465	1114	1531	1170	671	185	1023	425	1899
92.5	545	868	1266	810	1937	1028	615	278	1247	212	868
93.5	1091	814	533	928	1284	1056	559	741	448	372	814
94.5	1558	434	666	692	1486	856	503	370	991	372	434
95.5	545	597	266	591	946	714	280	370	511	53	597
96.5	78	380	333	287	1171	542	168	93	1758	266	380
97.5	156	380	266	270	698	428	168	278	160	0	380
98.5	78	977	200	236	495	314	168	0	639	0	977
99.5	156	109	67	236	203	200	56	185	543	0	109
100.5	0	868	266	152	270	314	168	0	0	0	868
101.5	0	0	67	202	180	86	168	0	64	0	0
102.5	0	380	67	135	315	86	56	93	0	0	380
103.5	0	54	0	101	180	29	0	0	128	0	54
104.5	0	0	0	67	68	0	0	0	0	0	0
105.5+	78	0	266	135	90	257	112	93	128	0	0

M. capensis males

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5	0	0	0	0	0	0	0	0	0	0	0
26.5	0	0	0	0	0	0	0	0	0	0	0
27.5	0	0	0	0	0	0	0	0	0	0	0
28.5	0	0	0	0	0	0	0	0	0	0	0
29.5	0	0	0	0	0	0	0	0	0	0	0
30.5	0	0	0	0	0	0	0	93	0	106	0
31.5	0	0	0	0	0	0	0	0	0	478	0
32.5	0	0	0	0	0	0	0	93	0	106	0
33.5	0	0	0	34	0	0	447	0	96	372	0
34.5	0	0	0	51	0	0	727	93	64	478	0
35.5	0	0	0	0	0	0	1621	185	32	1169	0
36.5	0	0	0	67	0	57	2236	463	32	637	0
37.5	0	0	0	84	0	0	2572	370	128	372	0
38.5	0	0	0	67	68	0	1509	185	64	1222	0
39.5	0	109	0	34	315	29	2236	93	96	1381	109
40.5	0	0	0	101	293	29	2963	1111	0	1647	0
41.5	78	326	0	17	383	57	727	3797	352	2019	326
42.5	78	1031	0	17	766	257	168	2778	991	2656	1031
43.5	312	380	0	118	721	257	1062	2686	927	4250	380
44.5	156	597	67	84	1058	257	1453	6853	831	4144	597
45.5	234	868	200	84	676	228	1621	4075	1471	4568	868
46.5	468	1248	400	84	1148	514	1174	8242	1151	5684	1248
47.5	1013	814	266	304	991	628	503	9631	1886	6481	814
48.5	857	1303	333	287	1351	1113	2516	7964	2110	9137	1303
49.5	1247	1031	67	371	1036	1970	3019	10743	3964	7543	1031
50.5	1091	3745	400	388	1891	2569	2292	13336	4220	8393	3745
51.5	1481	2117	733	607	1937	2911	3745	13058	5626	8659	2117
52.5	2026	3745	1199	844	2499	4567	2348	9261	6170	11899	3745
53.5	2104	3528	2131	1569	2882	4424	2460	15929	5147	9190	3528
54.5	2494	5698	1865	2025	3423	5652	3745	12688	9463	13387	5698
55.5	2338	6404	3197	2481	2972	6679	5367	21578	9654	13918	6404
56.5	3662	7978	2864	3324	5224	8449	4360	14077	12020	14502	7978
57.5	3818	7435	3930	3797	4864	8877	5311	14725	12500	13599	7435
58.5	3818	6133	6194	4522	6733	11132	5367	13428	10614	18221	6133
59.5	3429	7978	7127	5029	7679	11046	7044	13984	8504	19496	7978
60.5	4208	8629	9658	6834	7543	11532	6876	11947	10805	20877	8629
61.5	4987	5916	9392	8758	7521	12045	7100	12410	9303	20983	5916
62.5	5221	4776	9258	10192	7431	12274	8329	13428	11413	18911	4776
63.5	5143	5101	9658	10918	7026	11674	8665	13058	7481	20611	5101
64.5	4831	4287	8659	11896	6395	11018	8385	8705	7001	19496	4287
65.5	4130	5319	8259	12369	6800	9591	8385	9261	4987	17211	5319
66.5	3740	2605	8526	11998	6643	8706	7100	9817	5467	18061	2605
67.5	3117	4884	6661	12200	4751	6908	5478	13151	4060	15671	4884
68.5	2805	3908	6527	11407	5112	6194	3801	7872	4412	15910	3908
69.5	3039	2496	5928	11441	3243	5423	3410	11206	5754	11368	2496
70.5	2182	2008	2598	9686	2567	4995	2404	10558	4731	9190	2008
71.5	1870	2117	4130	8927	2027	4412	1733	5649	6426	8181	2117
72.5	1714	2117	3597	8201	2274	4053	1565	8613	4859	8393	2117
73.5	1403	1574	2797	8117	1531	3140	1174	7872	4412	8499	1574
74.5	1013	1194	1066	6125	1554	2569	727	4908	5435	6534	1194
75.5	701	1194	2065	4927	991	1970	894	7501	3069	5843	1194
76.5	156	597	1266	4421	518	1427	615	8613	3453	5525	597
77.5	312	488	599	4016	811	1399	615	8242	1566	4568	488
78.5	545	380	733	3088	248	1028	168	7131	3740	3825	380
79.5	701	271	533	3088	383	1028	335	8057	3165	2975	271
80.5	312	651	1332	2497	405	799	280	2778	4156	1912	651
81.5	156	163	1199	2092	270	913	112	2037	3932	1966	163
82.5	0	380	333	1654	225	428	224	1667	3644	2337	380
83.5	0	326	1066	1552	90	400	168	1297	1918	1009	326
84.5	78	109	1532	1299	135	457	56	1019	1982	1594	109
85.5	0	163	266	962	23	571	224	2964	1982	850	163
86.5	78	0	67	1046	45	314	56	3704	3165	956	0
87.5	0	0	1732	827	45	228	112	1482	1471	691	0
88.5	0	109	599	726	23	143	56	1297	2494	106	109
89.5	0	271	333	709	68	143	0	833	2877	425	271
90.5	2572	109	266	523	23	200	0	1482	384	319	109
91.5	234	54	67	439	0	29	0	463	192	1753	54
92.5	468	0	0	439	23	86	0	556	96	1541	0
93.5	468	0	0	270	0	143	0	93	96	956	0
94.5	156	0	0	169	0	57	0	926	64	1328	0
95.5	78	0	0	169	0	143	0	93	799	1222	0
96.5	78	0	0	169	0	0	0	0	0	1859	0
97.5	156	0	0	51	0	29	0	0	384	956	0
98.5	0	0	0	84	0	29	0	0	0	744	0
99.5	78	0	0	67	0	0	0	278	0	1275	0
100.5	0	0	0	17	0	29	0	0	0	0	0
101.5	0	0	0	51	0	0	0	0	0	0	0
102.5	0	0	0	51	0	0	0	0	0	0	0
103.5	0	0	0	0	0	0	0	0	0	0	0
104.5	0	0	0	17	0	0	0	0	0	0	0
105.5+	0	0	0	0	0	29	0	0	0	0	0

Table 6: South coast gender-disaggregated *M. paradoxus* length frequencies.

M. paradoxus females

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5		0					0		0	0	0
26.5		0					0		0	0	0
27.5		0					0		0	0	0
28.5		0					0		0	0	0
29.5		0					0		0	0	0
30.5		544					0		0	0	544
31.5		0					0		124	0	0
32.5		544					0		0	0	544
33.5		544					0		124	0	544
34.5		0					0		0	0	0
35.5		0					0		124	0	0
36.5		0					0		0	0	0
37.5		0					0		0	0	0
38.5		0					0		373	0	0
39.5		0					0		249	0	0
40.5		0					6078		124	4388	0
41.5		0					6078		0	4388	0
42.5		0					6078		1369	2925	0
43.5		0					0		1369	4388	0
44.5		0					24311		2987	1463	0
45.5		0					12156		2862	5851	0
46.5		0					18234		2738	11702	0
47.5		544					0		3235	11702	544
48.5		1087					6078		5102	11702	1087
49.5		0					12156		4604	16090	0
50.5		544					6078		5973	13165	544
51.5		544					12156		7342	10239	544
52.5		0					18234		8835	17553	0
53.5		544					12156		8462	20478	544
54.5		544					6078		10951	14627	544
55.5		2718					0		12071	13165	2718
56.5		1631					0		11697	21941	1631
57.5		2718					0		13315	19016	2718
58.5		1087					6078		12444	23404	1087
59.5		2174					0		13564	14627	2174
60.5		2174					6078		17671	10239	2174
61.5		8697					0		15182	5851	8697
62.5		3261					6078		12942	7314	3261
63.5		1631					0		13689	2925	1631
64.5		3261					0		17671	2925	3261
65.5		2718					6078		14435	2925	2718
66.5		2174					12156		13813	4388	2174
67.5		4892					6078		12693	7314	4892
68.5		5436					6078		10080	4388	5436
69.5		2174					0		7093	0	2174
70.5		3805					0		6346	5851	3805
71.5		1631					0		5227	0	1631
72.5		4348					0		4107	1463	4348
73.5		3261					0		3360	0	3261
74.5		544					6078		2240	0	544
75.5		2174					6078		2240	0	2174
76.5		1631					6078		996	0	1631
77.5		1631					0		124	0	1631
78.5		1087					0		498	0	1087
79.5		0					0		0	0	0
80.5		2174					0		0	1463	2174
81.5		0					0		0	0	0
82.5		544					0		0	0	544
83.5		0					0		0	0	0
84.5		0					0		0	0	0
85.5		0					0		0	0	0
86.5		0					0		0	0	0
87.5		0					0		0	0	0
88.5		0					0		0	0	0
89.5		0					0		0	0	0
90.5		0					0		0	0	0
91.5		0					0		0	0	0
92.5		0					0		0	0	0
93.5		0					0		0	0	0
94.5		0					0		0	0	0
95.5		0					0		0	0	0
96.5		0					0		0	0	0
97.5		0					0		0	0	0
98.5		0					0		0	0	0
99.5		0					0		0	0	0
100.5		0					0		0	0	0
101.5		0					0		0	0	0
102.5		0					0		0	0	0
103.5		0					0		0	0	0
104.5		0					0		0	0	0
105.5+		0					0		0	0	0

M. paradoxus males

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5		0					0		0	0	0
26.5		0					0		0	0	0
27.5		0					0		0	0	0
28.5		0					0		0	0	0
29.5		0					0		0	0	0
30.5		544					0		0	0	544
31.5		0					0		0	0	0
32.5		0					0		0	0	0
33.5		0					0		0	0	0
34.5		544					0		0	0	544
35.5		544					0		0	0	544
36.5		0					0		0	0	0
37.5		0					0		0	0	0
38.5		0					0		0	2925	0
39.5		544					0		0	2925	544
40.5		0					0		249	5851	0
41.5		0					0		622	4388	0
42.5		544					6078		622	4388	544
43.5		0					0		996	2925	0
44.5		0					6078		1493	5851	0
45.5		1631					6078		1369	5851	1631
46.5		0					6078		1991	10239	0
47.5		544					12156		2489	10239	544
48.5		2718					0		3733	13165	2718
49.5		1087					12156		3235	14627	1087
50.5		544					6078		4604	20478	544
51.5		1631					0		5849	17553	1631
52.5		3805					6078		7466	26329	3805
53.5		4892					12156		6595	29255	4892
54.5		2718					0		8338	38031	2718
55.5		2718					6078		7840	32180	2718
56.5		4892					12156		8338	52659	4892
57.5		3805					6078		10453	33643	3805
58.5		6523					6078		7964	32180	6523
59.5		3805					0		8586	23404	3805
60.5		1631					6078		10702	16090	1631
61.5		5436					0		10826	11702	5436
62.5		4892					6078		7591	11702	4892
63.5		5979					0		6969	10239	5979
64.5		4892					0		9706	7314	4892
65.5		2174					0		7466	10239	2174
66.5		544					0		6346	4388	544
67.5		1087					0		7715	7314	1087
68.5		5436					0		5227	1463	5436
69.5		4348					0		4480	7314	4348
70.5		3805					0		2489	7314	3805
71.5		3261					0		2240	5851	3261
72.5		2174					0		2613	2925	2174
73.5		2174					0		1867	4388	2174
74.5		1631					0		373	2925	1631
75.5		3805					0		1120	2925	3805
76.5		1631					0		498	1463	1631
77.5		1631					0		747	0	1631
78.5		1087					0		124	0	1087
79.5		3261					0		0	0	3261
80.5		544					0		0	0	544
81.5		1087					0		0	0	1087
82.5		0					0		0	0	0
83.5		0					0		0	0	0
84.5		0					0		0	0	0
85.5		0					0		0	0	0
86.5		0					0		0	0	0
87.5		0					0		0	0	0
88.5		0					0		0	0	0
89.5		0					0		0	0	0
90.5		0					0		0	0	0
91.5		0					0		0	0	0
92.5		0					0		0	0	0
93.5		0					0		0	0	0
94.5		0					0		0	0	0
95.5		0					0		0	0	0
96.5		0					0		0	0	0
97.5		0					0		0	0	0
98.5		0					0		0	0	0
99.5		0					0		0	0	0
100.5		0					0		0	0	0
101.5		0					0		0	0	0
102.5		0					0		0	0	0
103.5		0					0		0	0	0
104.5		0					0		0	0	0
105.5+		0					0		0	0	0

Table 7: South coast gender-disaggregated *M. capensis* length frequencies.

M. capensis females

Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5		0	0	0	0	0	0		0	0	0
26.5		0	0	0	0	0	0		0	0	0
27.5		0	0	0	0	0	0		0	0	0
28.5		0	0	0	0	0	0		0	0	0
29.5		0	0	0	0	0	0		0	0	0
30.5		0	0	0	0	0	0		23	0	0
31.5		0	0	0	0	0	0		23	138	0
32.5		0	0	0	0	40	0		0	138	0
33.5		0	0	0	0	0	0		23	92	0
34.5		0	0	0	0	0	0		69	230	0
35.5		0	0	0	0	40	75		0	230	0
36.5		0	0	0	0	0	0		0	230	0
37.5		0	0	0	0	40	149		0	691	0
38.5		0	0	0	0	80	75		46	691	0
39.5		0	0	0	0	0	0		0	691	0
40.5		0	237	64	0	80	75		69	1105	0
41.5		0	237	193	98	0	224		345	1519	0
42.5		0	356	128	0	322	298		276	1887	0
43.5		47	296	385	98	241	821		805	1703	47
44.5		47	1185	578	586	402	821		1380	1933	47
45.5		70	889	1027	2441	644	2163		2530	2486	70
46.5		210	2608	1765	3515	1569	3208		3564	3361	210
47.5		512	3971	2921	5370	2896	5147		5358	4696	512
48.5		838	5334	3884	6005	4143	7460		7083	5662	838
49.5		1257	7053	4590	7763	6717	10443		9015	7734	1257
50.5		1723	8535	7479	7519	8769	14994		13338	10266	1723
51.5		2515	10135	8345	11180	11544	18052		13637	13350	2515
52.5		3912	12803	10881	13084	15929	23572		16718	14501	3912
53.5		4610	15174	14957	19822	21158	28272		20168	19519	4610
54.5		5705	17307	17236	22214	25824	32524		22536	23984	5705
55.5		6380	18196	20671	24655	29645	35657		24169	30751	6380
56.5		7567	23175	22179	27780	35196	41923		27343	32823	7567
57.5		7404	22997	24715	28610	40184	43937		23640	35815	7404
58.5		7963	23590	25967	32467	42075	47145		27573	38577	7963
59.5		7707	23235	25549	33297	44528	45130		28332	41661	7707
60.5		7591	22227	26801	30270	45775	43862		28010	42582	7591
61.5		7823	25783	28053	31930	50562	44161		26193	41984	7823
62.5		7823	24420	26256	36275	52091	45280		26239	43457	7823
63.5		7893	26613	27186	36129	46580	44832		28263	42582	7893
64.5		7637	21397	27604	30172	45775	45876		26998	40510	7637
65.5		8126	24242	29305	33883	44368	43340		26147	41385	8126
66.5		9523	21041	28342	31783	43523	40580		23571	38071	9523
67.5		9546	20923	28021	36178	41109	36254		20950	36598	9546
68.5		9663	19086	27636	28512	37891	39909		20651	34066	9663
69.5		9942	20330	28438	27731	35438	36999		19593	27943	9942
70.5		10198	19560	28534	26804	34714	32076		16212	25043	10198
71.5		10944	16003	27892	23679	33547	30733		15477	23846	10944
72.5		10804	18196	27507	23728	32461	31778		15109	21176	10804
73.5		11502	20449	28631	22019	33547	24766		10716	17907	11502
74.5		11246	14344	21634	21140	28479	21633		8854	17263	11246
75.5		10082	13751	23450	17478	29364	17679		8118	15376	10082
76.5		11060	14759	20285	14940	25140	14173		6692	12798	11060
77.5		8964	12743	18616	12352	22325	12085		6002	10220	8964
78.5		8778	14403	14893	10643	19790	10070		4783	8655	8778
79.5		6589	12091	12293	10155	16492	7683		4392	6537	6589
80.5		5448	9246	11555	7567	14159	5595		3242	4281	5448
81.5		5705	7290	10817	8251	11263	6266		3013	3913	5705
82.5		4657	5334	8153	6786	9573	5222		2737	2854	4657
83.5		3539	4742	7575	6396	7964	3581		2438	3453	3539
84.5		3306	3556	6387	5370	6074	2835		2070	2486	3306
85.5		2654	5453	5681	3076	4666	3208		2047	2210	2654
86.5		2678	3201	4943	2295	2977	1939		1426	1979	2678
87.5		1933	2489	3338	2392	2413	1492		1173	921	1933
88.5		1583	1600	3370	1806	1689	1641		897	921	1583
89.5		1350	1482	2247	928	1126	1119		782	552	1350
90.5		1281	1600	2118	1074	1368	597		1058	506	1281
91.5		489	1482	2247	1074	804	373		322	598	489
92.5		512	830	1637	684	402	448		437	368	512
93.5		349	1245	1252	439	362	0		483	552	349
94.5		466	711	706	879	161	298		805	598	466
95.5		210	356	835	439	201	75		253	92	210
96.5		163	237	1091	342	201	224		437	138	163
97.5		116	296	514	0	40	0		115	46	116
98.5		116	59	481	342	0	75		230	46	116
99.5		70	119	96	293	0	75		368	0	70
100.5		23	59	193	391	40	0		23	0	23
101.5		0	59	225	342	121	0		0	0	0
102.5		23	0	96	195	0	0		0	0	23
103.5		23	0	193	98	0	0		23	0	23
104.5		0	0	128	0	0	0		0	0	0
105.5+		23	0	32	781	0	0		0	0	23

M. capensis males

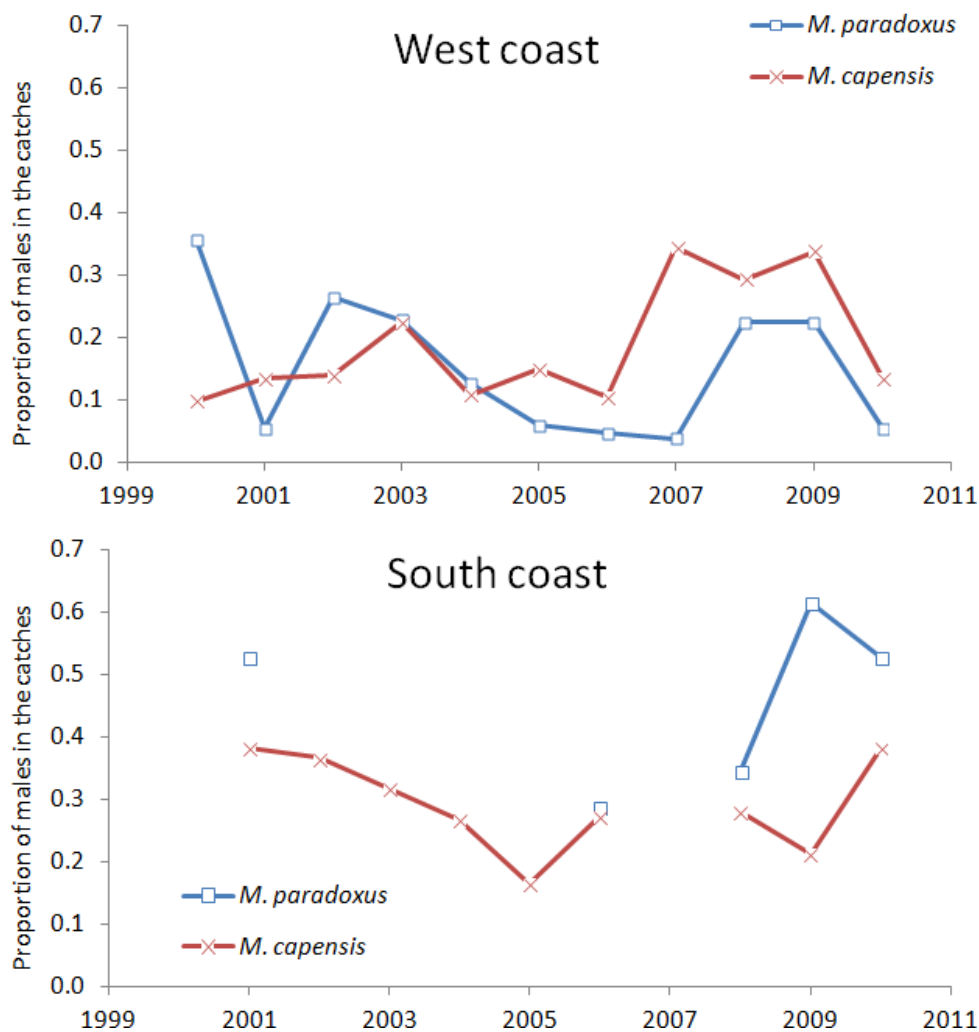| Length	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.5		0	0	0	0	0	0		0	0	0
26.5		0	0	0	0	0	0		0	0	0
27.5		0	0	0	0	0	0		0	0	0
28.5		0	0	0	0	0	0		0	0	0
29.5		0	0	0	0	0	0		0	0	0
30.5		0	0	0	0	40	0		0	92	0
31.5		0	0	0	0	161	0		0	276	0
32.5		0	0	0	0	40	0		115	368	0
33.5		0	0	0	0	40	0		0	276	0
34.5		0	0	0	0	282	0		69	460	0
35.5		0	0	0	0	201	0		230	322	0
36.5		0	0	0	0	241	0		230	967	0
37.5		0	0	32	0	121	75		529	1519	0
38.5		0	0	0	146	282	0		161	1427	0
39.5		0	59	0	146	362	75		368	2026	0
40.5		0	0	225	49	80	0		437	1243	0
41.5		23	59	193	98	80	149		552	1427	23
42.5		0	0	160	293	121	298		897	2486	0
43.5		93	415	353	1074	322	149		2116	2670	93
44.5		233	593	321	2636	483	970		3242	1565	233
45.5		442	1778	321	3320	684	1716		3978	2946	442
46.5		559	2845	931	2832	1529	2984		5128	2946	559
47.5		815	5927	1316	5126	1649	3655		6807	4465	815
48.5		1444	7765	2632	5810	1810	7534		7290	4926	1444
49.5		1327	10135	3723	6542	2856	10220		8785	5662	1327
50.5		2026	12506	5328	9423	4103	12532		11153	8056	2026
51.5		3190	13277	5745	10985	4948	17157		13177	7964	3190
52.5		4238	17189	8313	16893	5873	22603		14534	10128	4238
53.5		4703	20864	10817	16844	9010	26705		16695	10174	4703
54.5		5379	26139	12261	20115	9493	28421		17523	11877	5379
55.5		5099	26020	15022	21140	11263	28570		16649	12245	5099
56.5		6636	24716	16145	18260	13194	27451		17109	12613	6636
57.5		7195	27858	17525	25046	14843	32151		15339	13718	7195
58.5		7754	24894	17942	22165	14481	29764		15661	14271	7754
59.5		8289	24835	18295	20164	15124	31181		14810	14501	8289
60.5		9337	21871	16691	20798	16934	31629		15845	14593	9337
61.5		8662	19263	18873	20408	15326	26183		15362	16066	8662
62.5		9127	17011	16819	19675	15567	23348		13568	14087	9127
63.5		9546	20389	16305	17820	13636	22528		11337	13120	9546
64.5		9779	19797	17557	13768	14038	18649		10877	12061	9779
65.5		10129	16596	18103	12645	12912	16709		9314	11647	10129
66.5		10804	14107	16273	12157	10901	14322		8831	9207	10804
67.5		11130	11558	17300	12254	9935	12159		7474	7366	11130
68.5		11246	11914	15342	7372	8286	9697		6439	6031	11246
69.5		10129	10787	14026	8202	7281	8056		4829	4742	10129
70.5		9640	9543	12839	6884	6315	6639		3863	3821	9640
71.5		8685	8654	11748	5322	5913	5296		2967	2992	8685
72.5		8662	7883	12069	5468	4666	4177		2576	2992	8662
73.5		6357	7409	9501	5273	3862	2984		2921	3268	6357
74.5		5891	5927	9950	4638	2092	2984		1357	2394	5891
75.5		5262	6224	8185	2490	1850	2089		1081	1381	5262
76.5		3819	4505	6580	2295	2132	970		897	1887	3819
77.5		3283	4268	5649	1904	1368	746		345	1519	3283
78.5		2561	2667	4847	2441	804	970		414	1427	2561
79.5		1397	2904	4044	1562	1207	522		529	829	1397
80.5		1933	1600	3434	586	523	224		184	829	1933
81.5		862	1778	2792	391	684	224		161	1335	862
82.5		419	1423	2825	586	282	522		184	1105	419
83.5		349	948	1669	293	483	597		46	921	349
84.5		536	474	2407	146	201	746		138	829	536
85.5		396	533	1476	0	201	149		92	1243	396
86.5		140	415	1605	0	40	373		230	368	140
87.5		279	237	995	0	0	149		253	230	279
88.5		23	178	835	0	0	0		23	414	23
89.5		70	237	867	0	121	0		138	46	70
90.5		23	119	546	0	40	0		0	0	0
91.5		0	237	738	0	0	0		46	0	0
92.5		23	59	738	0	40	0		0	0	23
93.5		0	296	321	0	40	0		0	0	0
94.5		0	0	514	0	0	75		0	0	0
95.5		0	59	289	0	0	0		0	0	0
96.5		0	0	481	0	40	0		0	0	0
97.5		0	0	353	0	0	0		0	0	0
98.5		0	0	128	0	0	0		0	0	0
99.5		0	0	128	0	0	0		0	0	0
100.5		0	0	32	0	0	0		0	0	0
101.5		0	0	64	0	0	0		23	0	0
102.5		0	0	96	0	0	0		23	0	0
103.5		0	0	32	0	0	0		0	0	0
104.5		0	0	32	0	0	0		0	0	0
105.5+		0	0	96	0	0	0		0	0	0

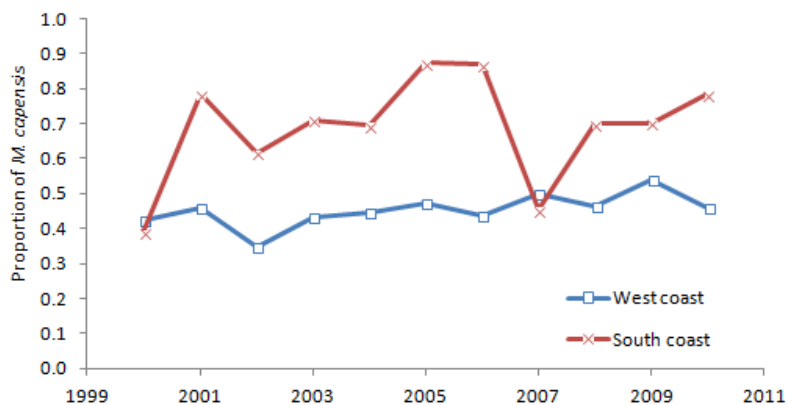Figure 1: Proportion of males (by weight) in the longline catches for each species.

Figure 2: Proportion of *M. capensis* in the longline catches.

Appendix A - Taking account of the gender-disaggregated longline catches and length frequencies

In previous assessments of the South African hake resource, the catches available were all aggregated over the genders and the fishing mortality for fleet *f* in year *y* (F_{fy}) was taken to be independent of gender:

$$F_{fy} = \frac{C_{fy}}{\sum_{g} \sum_{a=0}^{m} \widetilde{w}_{fy,a+1/2}^{g} \, N_{ya}^{g} e^{-M_{a}^{g}/2} S_{fya}^{g}} \tag{1}$$

where

F_{fy} is the fishing mortality of a fully selected age class, for fleet *f* in year *y* (independent of *g*) ;

S_{fya}^{g} is the commercial selectivity of gender *g* at age *a* for fleet *f* and year *y*, obtained from the corresponding commercial selectivity at length; and

$\widetilde{w}_{fy,a+1/2}^{g}$ is the selectivity-weighted mid-year weight-at-age *a* of gender *g* for fleet *f* and year *y*.

For the longline fleet for which gender-disaggregated catches are now available, equation (1) above will be replaced by:

$$F_{gy}^{g} = \frac{C_{fy}^{g}}{\sum_{a=0}^{m} \widetilde{w}_{fy,a+1/2}^{g} \, N_{ya}^{g} e^{-M_{a}^{g}/2} S_{fya}^{g}} \tag{2}$$

Gender-aggregated commercial proportions at length

For the commercial proportions at length that cannot be disaggregated by species and gender, the model is fit to the proportions at length as determined for both species and gender combined.

The catches at length are computed as:

$$C_{fyl} = \sum_{s} \sum_{g} \sum_{a=0}^{m} N_{sya}^{g} F_{sfy} S_{sfyl}^{g} P_{s,a+1/2,l}^{g} e^{-M_{sa}^{g}/2} \left(1 - \sum_{f} S_{sfya}^{g} F_{fy} \Big/ 2 \right) \tag{3}$$

with the predicted proportions at length:

$$\widehat{p}_{yl}^{i} = C_{fyl} \Big/ \sum_{l'} C_{fyl'} \tag{4}$$

The contribution of the proportion at length data to the negative of the log-likelihood function when assuming an "adjusted" lognormal error distribution is given by:

$$-\ell n\, L^{\text{length}} = 0.1 \sum_{y} \sum_{l} \left[\ell n \left(\sigma_{len}^{i} / \sqrt{p_{yl}^{i}} \right) + p_{yl}^{i} \left(\ell n p_{yl}^{i} - \ell n\, \widehat{p}_{yl}^{i} \right)^{2} \Big/ 2 \left(\sigma_{len}^{i} \right)^{2} \right] \tag{5}$$

where

the superscript '*i*' refers to a particular series of proportions at length data which reflect a specified fleet, and species (or combination thereof); and

σ_{len}^{i} is the standard deviation associated with the proportion at length data, which is estimated in the fitting procedure by:

$$\hat{\sigma}_{len}^{i} = \sqrt{\sum_{y}\sum_{l} p_{yl}^{i}\left(\ln p_{yl}^{i} - \ln \hat{p}_{yl}^{i}\right)^{2} / \sum_{y}\sum_{l} 1} \tag{6}$$

Gender-disaggregated commercial proportions at length

For the longline commercial data that are disaggregated by species and in some years further disaggregated by gender:

$$p_{syl}^{g} = \frac{C_{syl}^{g}}{\sum_{l'} C_{syl'}^{g}} \tag{7}$$

is the observed proportion of fish of species *s*, gender *g* and length *l* in year *y*.

The expected proportion of fish of species *s*, gender *g* and length *l* in year *y* is given by:

$$\hat{p}_{syl}^{g} = \frac{\sum_{a=0}^{m} N_{sya}^{g} F_{sfy}^{g} S_{sfyl}^{g} P_{s,a+1/2,l}^{g} e^{-M_{sa}^{g}/2}\left(1 - \sum_{f} S_{sfya}^{g} F_{sfy}^{g}\Big/2\right)}{\sum_{l'}\sum_{a=0}^{m} N_{sya}^{g} F_{sfy}^{g} S_{sfyl'}^{g} P_{s,a+1/2,l'}^{g} e^{-M_{sa}^{g}/2}\left(1 - \sum_{f} S_{sfya}^{g} F_{sfy}^{g}\Big/2\right)} \tag{8}$$

The gender-disaggregated proportions at length are incorporated into the negative of the log-likelihood in an analogous manner to the gender-aggregated commercial proportions at length, assuming an adjusted log-normal error distribution (equation 5).