Preliminary analysis of catch-per-unit-effort data for abalone in Zones A-D

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SUMMARY

The General Linear Model (GLM) approach used last year needs to be updated for use in standardising the commercial abalone CPUE time series (1980 – 2006) of abalone for the influence of other factors on the CPUE apart from resource abundance. The raw data were supplied by A. Mackenzie and G. Maharaj (MCM). The number of new data entries added to the database is 483 (all from Zone B), bringing the total number of data entries to 41432. The comparability of the new data with the older data needs to be discussed. Note that the recent nominal CPUE for Zone B is the lowest yet.

DATA: Catch data (as kg whole mass), and effort data (as total duration of dives in minutes for each day dived) are available for the period 1980 to 2007. Additional information in the database pertains to the dates, the divers, and the areas and zones that were dived.

MODEL YEAR: A standard Model year *y* that is taken to run from October of year *y*-1 to September of year *y*. The CPUE data are analysed for Model years 1980 to 2007.

ZONES/SUBAREAS: All data for zones A, B, C and D are included in this analysis, with Zone C split into a “nonpoached” (CNP) and “poached” (CP) subarea.

SEASONS: Because of a strong seasonal effect on the distribution of effort through the year, dates in the database were used to group the 12 months into four seasons, *viz*. 1) January-March, 2) April-June, 3) July-September, 4) October-December.

FISHER CODE: Includes both the entitlement holders coded in the database as well as "divers". The code numbers were carefully checked and revised last year (see Edwards *et al*. 2006). Some 92 recent divers not yet allocated a code were given a temporary code of 555 last year. There are similarly a number of divers in the updated data with no corresponding diver code and this needs to be discussed before a GLM analysis is carried out.

Another point for discussion pertains to the fact that last year the historic CPUE data were reworked to divide Zone C into turfs C1 and C2 instead of subareas CNP and CP (these do not correspond exactly to C1 and C2), it is advisable in future to use C1 and C2 in the GLM instead. However, this simultaneously requires reworking all the other Zone C data in a similar fashion. The GLM has been applied at the zonal scale rather than the TURF scale because there are currently insufficient data to run the model with separate data for each TURF. In Figure 1 the nominal CPUE data have been plotted per TURF and the trends in each zone compared, suggesting that the trends per TURF are very similar historically. In future it will become increasingly important to analyse CPUE and other data at the scale of TURFS.

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LITERATURE CITED

Edwards, C., Plagányi, É.E and A. MacKenzie. 2006. Update of the South African abalone *Haliotis midae* database. Marine & Coastal Management, South Africa, Internal Abalone Working Group report, WG/AB/06/06/02

Table 1. The number of data entries per Zone to be used in the GLM analysis to standardise the commercial CPUE series. Note the small number of recent entries as well as in Zone C during the 1999 and 2000 fishing seasons. Zone CNP was closed during the 2001 fishing season and Zone CP during both the 2001, 2002 and 2003 fishing seasons as indicated by the absence of data for these years. Model years are defined as the period October to September. The second table shows the abalone catch per zone (in MT).

Model Year	A	B	CNP	CP	D
1980	257	555	73	754	535
1981	192	578	147	622	383
1982	311	610	109	594	608
1983	327	691	144	466	302
1984	334	701	303	366	373
1985	360	620	158	366	583
1986	340	765	222	446	205
1987	446	586	106	494	144
1988	457	434	96	498	147
1989	448	414	91	504	184
1990	527	410	139	458	140
1991	447	404	161	544	167
1992	349	302	98	398	142
1993	299	239	110	336	75
1994	347	290	160	288	162
1995	441	238	138	334	171
1996	514	324	413	460	206
1997	771	249	258	117	197
1998	634	509	225	75	331
1999	725	429	57	8	306
2000	456	335	24	2	315
2001	400	291	1		135
2002	290	229	103	2	96
2003	415	128	54		26
2004	101	576	158	6	69
2005	63	599	170	4	56
2006	42	672	171	0	48
2007	0	823	0	0	0

Model Year	A	B	CNP	CP	D
1980	144.2	173.6	17.1	162.3	183.8
1981	111.0	173.8	38.5	140.7	127.3
1982	144.8	186.6	26.7	131.1	191.1
1983	158.5	200.5	37.0	105.4	78.4
1984	165.2	205.1	82.6	95.4	101.0
1985	136.8	176.4	41.6	98.7	153.8
1986	132.0	229.4	57.3	120.6	50.3
1987	171.8	166.1	29.7	126.4	45.2
1988	194.9	138.7	26.2	139.5	49.2
1989	190.9	137.3	28.6	134.8	51.0
1990	199.2	142.4	40.3	116.6	46.3
1991	182.9	138.0	41.0	119.0	49.6
1992	184.1	147.5	30.3	113.9	56.3
1993	179.2	152.1	31.9	105.2	53.7
1994	174.0	150.0	44.1	91.2	92.5
1995	210.8	152.3	39.1	84.7	90.2
1996	204.1	146.8	64.6	61.3	89.9
1997	196.8	145.9	36.7	16.1	92.6
1998	162.4	148.4	24.3	7.6	108.5
1999	191.5	155.5	11.3	1.0	103.8
2000	179.6	139.7	3.6	0.2	100.1
2001	156.5	113.4	0.2	0.0	34.1
2002	112.6	84.6	30.0	0.5	19.0
2003	119.5	36.5	5.1	0.0	1.4
2004	31.9	149.8	8.6	0.3	10.9
2005	10.1	140.3	8.6	0.2	8.5
2006	7.6	137.9	8.1	0.0	7.2
2007	0.0	124.4	0.0	0.0	0.0

Table 2. Nominal commercial CPUE series for abalone for model years (October to September) 1980 to 2005 and Zones A, B, C (shown separately for subareas CNP and CP) and D.

Model Year	A	B	CNP	CP	D
1980	2.225	1.481	1.364	1.336	1.691
1981	2.170	1.485	1.401	1.324	1.553
1982	1.905	1.503	1.377	1.324	1.497
1983	1.879	1.466	1.468	1.389	1.349
1984	2.039	1.565	1.497	1.414	1.483
1985	1.910	1.583	1.437	1.533	1.509
1986	2.120	1.760	1.599	1.753	1.435
1987	2.181	1.693	1.772	1.678	1.618
1988	2.339	1.859	1.852	1.824	1.926
1989	2.136	1.889	1.804	1.772	1.666
1990	2.451	2.304	2.216	1.929	2.321
1991	2.450	2.383	1.909	1.745	2.295
1992	2.704	2.507	1.974	1.954	2.168
1993	2.932	2.960	1.702	2.048	3.557
1994	2.784	2.575	1.887	2.097	3.185
1995	2.590	2.776	1.957	1.795	2.734
1996	2.547	2.624	1.521	1.451	2.683
1997	2.424	2.790	1.406	1.146	2.791
1998	2.532	2.561	1.554	1.173	2.886
1999	2.096	2.191	1.535	1.068	1.899
2000	2.182	2.194	1.732	1.775	1.772
2001	2.157	2.050	1.790		1.567
2002	2.183	2.100	1.909	2.075	1.417
2003	1.771	2.001	1.254		0.901
2004	1.655	1.465	0.871	1.146	0.827
2005	1.075	1.317	0.797	1.100	0.731
2006	1.134	1.112	0.738		0.807
2007		0.962			

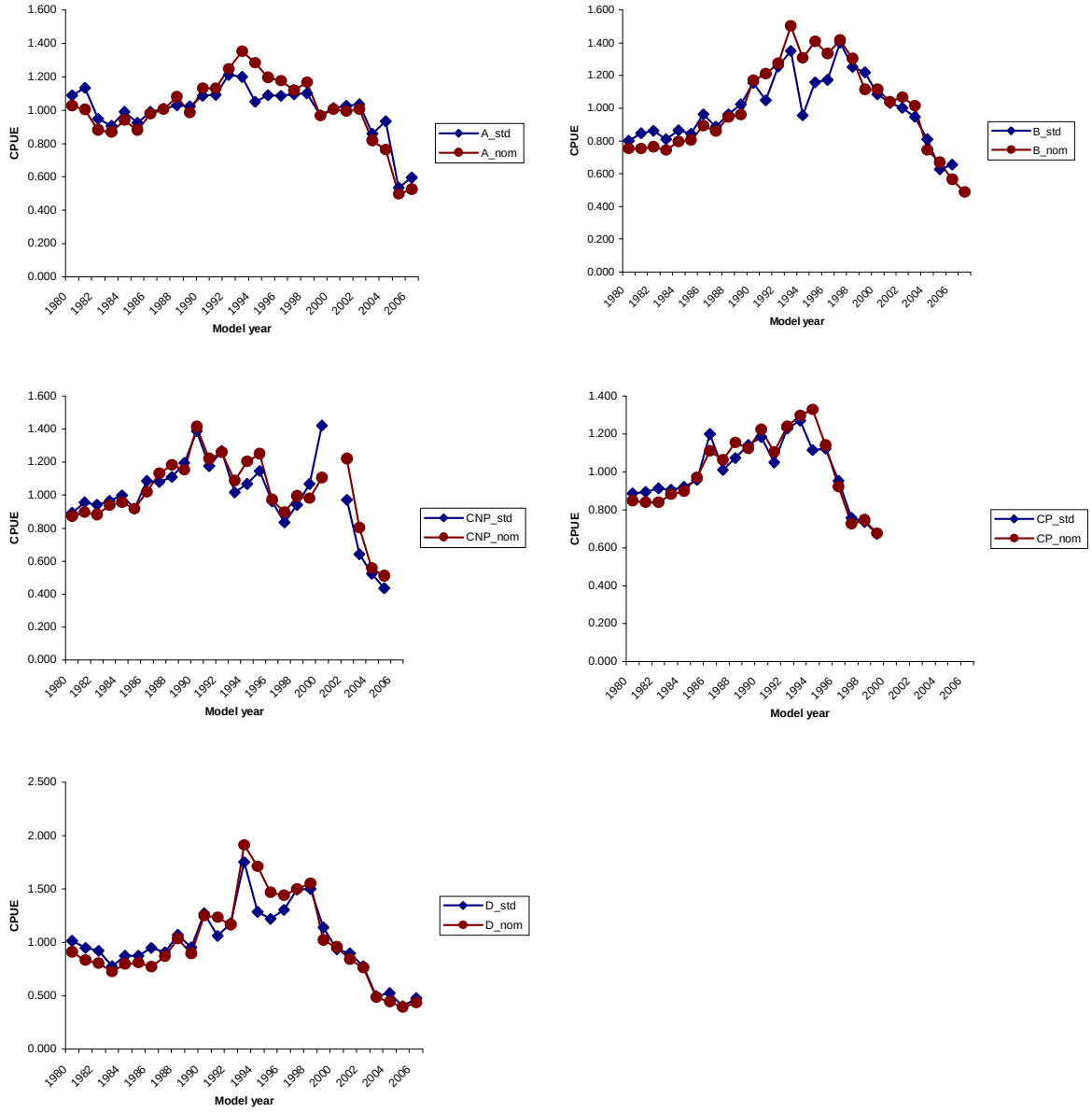

Fig. 1a-e. Comparisons between the updated nominal and last year's GLM-standardised catch-per-unit-effort (CPUE) trends for zones A, B, CNP, CP and D. For ease of viewing, both the nominal and the standardised values have been divided by the mean value of the respective series. Values are derived from an iterative effort weighted GLM (see text).