Summary of further data sources used as input for the assessment of the west coast rock lobster

S.J. Johnston* and S. Brouwer**

*MARAM
Department of Mathematics and Applied Mathematics
University of Cape Town
Rondebosch, Cape Town

** Marine and Coastal Management

1. Commercial Catch size structure data

Catch-size structure data are collected from all areas and separately for both trap and hoopnet catches annually. These data are collected by independent monitors who sample the commercial landed catch.

The data are recorded in 5mm size classes for the legal (i.e. above legal carapace length) portion of the stock. Data are collected for males and females separately. Data have been collected in all areas. When a composite series is required (for example Area 3-6 or area-aggregated), data from the contributing areas are "pseudo-weighted" (see below) to provide the composite series.

The pseudo weighting method for calculating the commercial catch size structure for composite areas:

A pseudo-weighting technique is used to weight the data from each of the four Areas that form the "composite" area, to produce a catch-at-size frequency for that area. The aim of this weighting scheme is to maintain the total sample size for each year, but weight the individual Area data according to each Area's commercial catch contribution that year. The $p_{l,t}^{s}$ values (effectively the catch-at-size proportion for length l, in year t for either sex s) are calculated as follows:

$$p_{l,t}^{s} = \frac{\sum_{a}\left[n_{l,a,t}^{s}\dfrac{C_{a,t}}{\sum_{a}C_{a,t}}\right]}{\sum_{a,l}\left[n_{l,a,t}^{s}\dfrac{C_{a,t}}{\sum_{a}C_{a,t}}\right]}$$

where

a - refers to the Area 3, 4, 5 or 6,

$C_{a,t}$ - refers to the catch in Area a in year t,

$n_{l,a,t}^{s}$ - is the sample catch-at-size number for length l in year t in Area a (for sex s),
  and

$p_{l,t}^{s}$ - is the catch-at-size proportion for length l and time t for sex s.

Tables 1a and b provides the sample sizes for the trap and hoopnet commercial catch size structure sampling scheme respectively.

2. FIMS catch size structure data

FIMS catch-size structure data have been collected for Areas 3-4, Area 7 and Area 8. The data are available in 5mm size classes starting from 40mm. The data across each of these areas are summed to provide the catch size structure data for the area-aggregated assessment. Table 1c provides the samples sizes from the FIMS catch size structure sampling scheme.

Inshore FIMS catch-size structure data are available (2002-2005) for areas 3 to 14. The data are available in 1mm size classes. Currently these data are not used in any of the assessment models.

3. Commercial F% (percent female) data

These data are calculated from the commercial trap and hoop catch size structure samples. Data are available for each area. When a composite F% value is required (for example Area 3-6), values from each contributing area are catch-weighted to produce an F% value for the composite area.

4. Size-at-maturity

Size-at-maturity data have been collected since 1993. For all areas, the size-at-maturity is assumed to be 65mm. Female size-at-maturity data are available from areas 7, 8 and 10 where recently there has been an annual shift in size-at-maturity and is currently at 54 and 59mm CL in for area 8 and 10 respectively – see Figure 1. No data on male maturity are currently available but a project investigating this will begin in 2006 (funding permitting).

5. Egg production

This is assumed in model calculations to be proportional to the female biomass above the assumed size-at-maturity (65mm in the current assessment model). Figure 2 illustrates the relationship assumed in the model between egg production and female carapace length.

6. Length-weight relationship

The model operates on a numbers basis, but the number of lobsters in each size class is readily converted to biomass using the length-weight conversion equations as follows:

$$w_l^m = 0.6518 l^{2.8990} \quad \text{for males, and}$$

$$w_l^f = 0.5869 l^{2.9729} \quad \text{for females}$$

where the total body weight, w, is in grams, and length l, is the carapace length in centimetres.

7. Minimum legal carapace length

The minimum legal carapace length (CL) has changed over time. Currently, the commercial minimum legal carapace length is 75mm, and the recreational legal carapace length is 80mm. The commercial legal size is the same for all areas, except for Area 1-2 where there have been some differences. No minimum legal carapace length was imposed in Area 1-2 prior to 1933.

8. Somatic Growth rate

Annually 28 000 lobster (collectively) are tagged and released in all Zones to estimate male somatic growth of lobsters 75-100 mm CL. The tagging programme is conducted in two ways. Firstly 15 000 pre-moult lobsters are tagged and released prior to the moulting season to estimate growth. These data have been collected since the early 1970's. Secondly, 500 lobsters are tagged monthly from January to September in areas 7, 8 and 10 to assess the effects of tagging on lobster growth. This project commenced in 2003.

Tag recaptures were 10-15% prior to the mid 1980's thereafter the recapture rate declined to 5% but increased in 2005 to 15% when the tag reward was increased.

Table 1a: Sample size for the trap catch size structure sampling scheme

	A3-4	A5-6	A7	A8
1976	1765	4330	1193	1217
1977	2493	580	2392	1490
1978	2136	2571	2549	1760
1979	2935	10808	5857	0
1980	6679	1185	3298	2495
1981	1537	14897	1372	755
1982	19185	14968	0	11758
1983	10282	10499	10007	6902
1984	19686	9711	4393	7370
1985	8559	7207	6975	19934
1986	10262	20850	10601	18829
1987	7952	15983	8499	8671
1988	31076	11472	6998	14338
1989	24586	11386	10735	8962
1990	31309	13517	20602	14602
1991	19562	14874	12072	16504
1992	4127	3572	1301	1874
1993	5283	17616	4982	5955
1994	41795	10632	18192	50250
1995	27254	7994	16014	4211
1996	14196	10388	9198	5477
1997	3129	8188	28468	2274
1998	8882	565	70465	1
1999	0	0	0	0
2000	0	0	0	0
2001	0	0	152	367
2002	9955	227	34687	29067
2003	0	0	42360	49579
2004	687	0	56188	25081

Table 1b: Sample size for the hoop catch size structure sampling scheme

	A1-2	A3-4	A5-6	A7	A8
1976	0	6268	947	0	0
1977	0	3353	2082	0	0
1978	0	2760	4259	571	0
1979	0	2015	5116	0	0
1980	0	2542	1071	192	0
1981	0	3957	8223	0	0
1982	0	7555	1119	0	2072
1983	0	5115	2609	818	154
1984	0	8250	2267	0	395
1985	25852	6710	2126	0	1451
1986	19214	6930	3222	0	2979
1987	13785	3892	4616	0	764
1988	7409	10605	5255	0	90
1989	15010	8483	1922	0	312
1990	19588	1393	2114	0	0
1991	17387	525	3536	0	95
1992	14204	1184	5239	0	1061
1993	23161	1700	4584	0	0
1994	27995	10527	724	1100	279
1995	17774	5905	5942	0	696
1996	10574	18609	0	0	2759
1997	12015	15160	0	53	198
1998	7131	16789	0	3065	0
1999	0	0	0	0	0
2000	77	0	0	0	0
2001	0	0	0	0	0
2002	11345	6393	3164	0	0
2003	0	21421	1207	0	10405
2004	0	21801	347	0	7908

Table 1c: Sample size for the FIMS (catch size structure) sampling scheme

	A3-6	A7	A8
1992	5947	8759	26528
1993	1320	3915	29359
1994	3177	3196	31200
1995	5683	1217	33273
1996	7394	3005	30740
1997	450	4284	34535
1998	3197	7063	37998
1999	0	0	0
2000	1820	2807	32932
2001	547	12129	35285
2002	2093	9028	30462
2003	1160	8210	32576
2004	491	7156	32736

Table 2: The commercial and recreational minimum legal carapace lengths (mm) for Areas 3-8, and for Areas 1-2.

	Area 3-8 commercial	Area 1-2 commercial	Area 3-8 recreational	Area 1-2 recreational
1870	50	1	50	1
1871	50	1	50	1
1872	50	1	50	1
1873	50	1	50	1
1874	50	1	50	1
1875	50	1	50	1
1876	50	1	50	1
1877	50	1	50	1
1878	50	1	50	1
1879	50	1	50	1
1880	50	1	50	1
1881	50	1	50	1
1882	50	1	50	1
1883	50	1	50	1
1884	50	1	50	1
1885	50	1	50	1
1886	50	1	50	1
1887	50	1	50	1
1888	50	1	50	1
1889	50	1	50	1
1890	50	1	50	1
1891	50	1	50	1
1892	50	1	50	1
1893	76	1	76	1
1894	76	1	76	1
1895	76	1	76	1
1896	76	1	76	1
1897	76	1	76	1
1898	76	1	76	1
1899	76	1	76	1
1900	76	1	76	1
1901	76	1	76	1
1902	76	1	76	1
1903	76	1	76	1
1904	76	1	76	1
1905	76	1	76	1
1906	76	1	76	1
1907	76	1	76	1
1908	76	1	76	1
1909	76	1	76	1
1910	76	1	76	1
1911	76	1	76	1
1912	76	1	76	1
1913	76	1	76	1
1914	102	1	102	1
1915	102	1	102	1
1916	102	1	102	1
1917	102	1	102	1
1918	102	1	102	1

1919	102	1	102	1
1920	102	1	102	1
1921	102	1	102	1
1922	102	1	102	1
1923	102	1	102	1
1924	76	1	76	1
1925	76	1	76	1
1926	102	1	102	1
1927	102	1	102	1
1928	102	1	102	1
1929	89	1	89	1
1930	89	1	89	1
1931	89	1	89	1
1932	89	1	89	1
1933	89	89	89	89
1934	89	89	89	89
1935	89	89	89	89
1936	89	89	89	89
1937	89	89	89	89
1938	89	89	89	89
1939	89	89	89	89
1940	89	89	89	89
1941	89	89	89	89
1942	89	89	89	89
1943	89	89	89	89
1944	89	89	89	89
1945	89	89	89	89
1946	89	89	89	89
1947	89	89	89	89
1948	89	89	89	89
1949	89	89	89	89
1950	89	89	89	89
1951	89	89	89	89
1952	89	89	89	89
1953	89	89	89	89
1954	89	89	89	89
1955	89	89	89	89
1956	89	89	89	89
1957	89	89	89	89
1958	89	89	89	89
1959	89	89	89	89
1960	89	89	89	89
1961	89	89	89	89
1962	89	89	89	89
1963	89	76	89	76
1964	89	76	89	76
1965	89	76	89	76
1966	89	76	89	76
1967	89	76	89	76
1968	89	76	89	76
1969	89	76	89	76
1970	89	89	89	89
1971	89	89	89	89
1972	89	89	89	89

1973	89	89	89	89
1974	89	89	89	89
1975	89	89	89	89
1976	89	89	89	89
1977	89	89	89	89
1978	89	89	89	89
1979	89	89	89	89
1980	89	89	89	89
1981	89	89	89	89
1982	89	89	89	89
1983	89	89	89	89
1984	89	89	89	89
1985	89	75	89	75
1986	89	75	89	75
1987	89	75	89	75
1988	89	75	89	75
1989	89	75	89	75
1990	89	75	89	75
1991	89	75	89	75
1992	80	75	80	80
1993	75	75	80	80
1994	75	75	80	80
1995	75	75	80	80
1996	75	75	80	80
1997	75	75	80	80
1998	75	75	80	80
1999	75	75	80	80
2000	75	75	80	80
2001	75	75	80	80
2002	75	75	80	80
2003	75	75	80	80
2004	75	75	80	80
2005	75	75	80	80

Figure 1: Ogives showing lobster maturity for three years in Areas 8 and 10 (plots supplied by MCM).
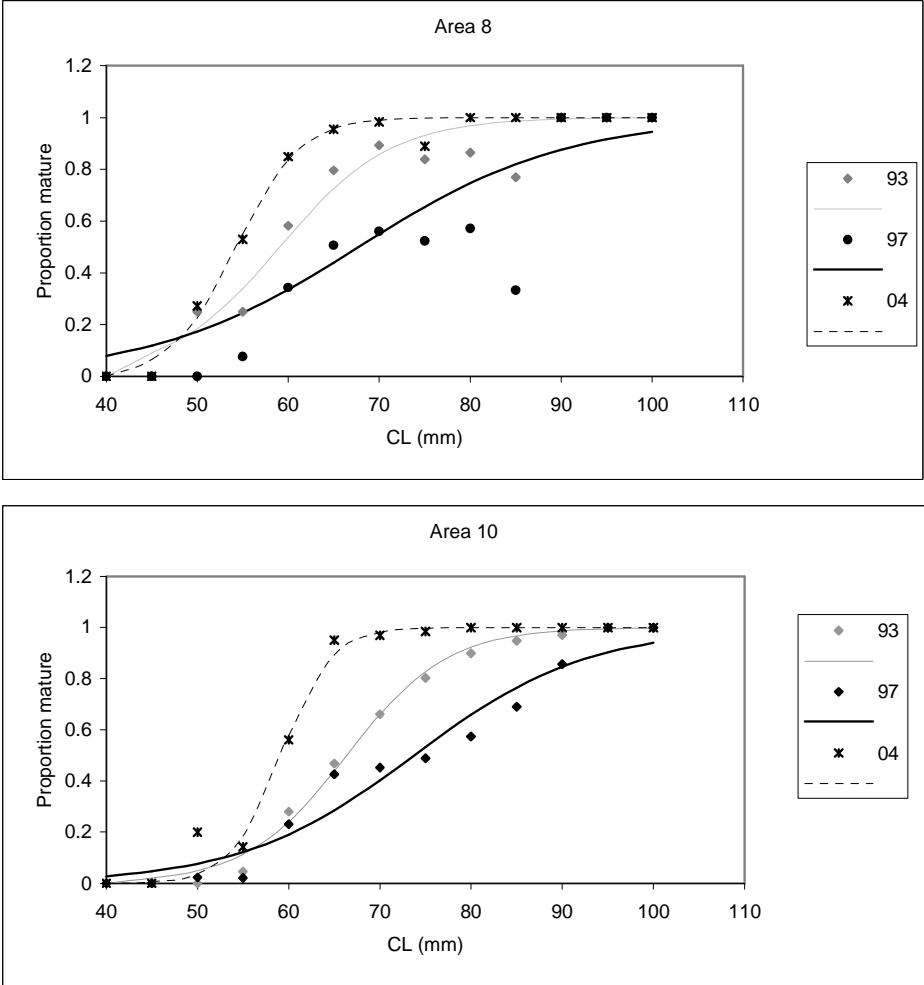
Figure 2: Relationship used in the assessment models between egg production (#s) and carapace length for female west coast rock lobster.