COCKLES (COC)

(*Austrovenus stutchburyi*)

1. INTRODUCTION

Commercial picking of cockles, *Austrovenus stutchburyi*, is carried out on Snake Bank, Whangarei Harbour (FMA 1), Pakawau Beach, Ferry Point and Tapu Bay in Tasman and Golden Bays (FMA 7), and Papanui and Waitati Inlets, Otago (FMA 3). Cockles were introduced into the QMS on 1 October 2002.

For assessment purposes, individual reports on the major fisheries have been produced separately:

1. Snake Bank, Whangarei Harbour, in COC 1A.
2. Papanui Inlet, Waitati Inlet, Purakanui and Otago Harbour, Otago Peninsula in COC 3A.
3. Nelson / Marlborough in COC 7A and COC 7B.

Information on the general biology of cockles is included below rather than being repeated in the reports for each fishery.

2. BIOLOGY

The cockle, *Austrovenus stutchburyi*, formerly known as *Chione stutchburyi*, is a shallow-burrowing suspension feeder of the family Veneridae. It is found in soft mud to fine sand on protected beaches and enclosed shores around the North and South Islands, Stewart Island and the Chatham Islands (Morton & Miller, 1968). Suspension feeders such as *A. stutchburyi* tend to be more abundant in sediments with a larger grain size. They are also common in eelgrass (e.g., *Zostera* sp.), which often co-occurs with sand flats.

Cockles are found from the lowest high water neap tide mark to the lowest part of the shore; there is some evidence that they may extend to 20 m depth in some areas. Larcombe (1971) suggested that the upper limit is found where submergence is only 3.5 hours per day. *A. stutchburyi* is often a dominant species and densities as high as 4500/m^2 have been reported in some areas. In Pauatahanui Inlet the biomass has been estimated at 5000 t, 80% of the total intertidal biomass in the Inlet. Cockles may filter 1.6 million cubic metres of water on each tidal cycle at Pauatahanui, with a profound effect on water quality.

Sexes are separate and the sex ratio is usually close to 1:1. Maturity appears to be primarily a function of size rather than age, with sexual maturity occurring at a size of about 18 mm shell length. Spawning extends over spring and summer, and fertilisation is followed by a planktonic larval stage lasting about 3 weeks. Significant depression of larval settlement has been recorded for areas of otherwise suitable substrate from which all live cockles have been removed. This suggests the presence of some conditioning factor.

Quite extensive movements of juveniles and smaller animals have been documented, but individuals >25 mm shell length remain largely sessile, moving only in response to disturbance. Small cockles grow faster than large cockles, but overall, growth is fastest during spring and summer. Growth is slower in the higher tidal ranges and in high density beds. Significant increases in growth rates have been observed for individuals remaining in areas that have been ‘thinned out’ by simulated harvesting.

Given that cockles recruit to the spawning biomass at ~18 mm shell length, but do not recruit to commercial or non-commercial fisheries until closer to 30 mm shell length, there is some protection for the stock against egg overfishing, especially as the Snake Bank and Papanui and Waitati Inlet stocks are probably not isolated as far as recruitment of juveniles is concerned. However, this generality should be treated with some caution, given that some population of adults seems to be required to stimulate settlement of spat.

Natural mortality arises from a number of sources. Birds are a major predator on cockles (up to about 23 mm shell length); however, they appear to have little impact on cockle abundance. Other predators include crabs and whelks. Cockles are also killed after being smothered by sediments shifted during storms or strong tides.

Experimental work on Snake Bank led to estimates of absolute mortality of 17–30% per annum, instantaneous mortality (M) of 0.19–0.35, with a midpoint of M = 0.28. The estimated mortality rates for cockles of >30 mm shell length were slightly greater at 19–37% per annum, (M of 0.21–0.46 with a midpoint of 0.33). This higher estimate was caused by relatively high mortality rates for cockles of >35 mm shell length and, as these are now uncommon in the population, M = 0.30 (range 0.20–0.40) was assumed for yield calculations.

Studies in 1992 and 1993 at Snake Bank to estimate growth rate by sequential length frequency analysis resulted in an estimate of K = 1.10. Such a rate indicates a fairly rapid growth (about 2 years) to the size of interest to both commercial and amateur fisheries (about 30 mm). Further work at Snake Bank in 1996 using length frequency distributions from 1991–96 confirmed the rapid growth rate with an estimate of K = 1.02. This rate is much faster than shown in previous Snake Bank studies (Martin, 1984) where up to 4 or 5 years could be taken for cockles to attain a size of 30 mm. The increased growth rate may be a result of the lower densities of cockles on the bank in recent years.

Growth in Papanui and Waitati Inlets, Purakanui and Otago Harbour (Bed 1) was examined by Breen et al. (1999). They found that notched clams did not exhibit significant growth when recovered after one year, and modes in the length frequency distributions did not shift when measured over four sampling periods within a year. They concluded that it was unlikely that average growth is really as slow as the results indicated, but there may be high interannual variability in growth.

The Snake Bank work also showed moderate differences among years in the level of recruitment of juveniles to the population. The variability of recruitment was estimated as $\sigma_R = 0.41$ using all available data (1983–1996) but as $\sigma_R = 0.31$ using data only from those years since the fishery has been considered to be fully developed (1991–96). Given the variability of most shellfish populations and the shortness of the time series, this is probably an underestimate of the real variability of recruitment in the Snake Bank population.