DATA REPOSITORY ITEM 2006055

New Zealand molluscan database supplementary information.

Roger A. Cooper[1] Institute of Geological and Nuclear Sciences, PO Box 30368, Lower Hutt, New Zealand

Phillip A. Maxwell Bathgates Road, R.D. 10, Waimate, South Canterbury, New Zealand

James S. Crampton } Institute of Geological and Nuclear Sciences, PO Box 30368,

Alan G. Beu } Lower Hutt, New Zealand

Craig M. Jones }

Bruce A. Marshall Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington, New Zealand

The following notes supplement information given in our paper (Completeness of the fossil record: estimating losses due to small body size published in GEOLOGY) on the database used for our analysis.

1. ***Standard samples:*** Most of 56,000 fossil collections recorded in the New Zealand Fossil Record File were collected by field geologists during geological mapping in order to determine age of the enclosing sediments. The samples vary greatly in degree of completeness of sampling, but in general, were not intended to be comprehensive. Most of the remaining samples were collected for the purpose of taxonomic,

[1] E-mail address: r.cooper@gns.cri.nz

paleoenvironmental or paleoecological studies and are much more comprehensive. The collections are housed in the main research institutions around the country, and by far the largest proportion are held by the Institute of Geological and Nuclear Sciences at Lower Hutt. We refer to this unsorted full set of samples as “standard samples”.

2. ***Comprehensive samples:*** Eleven “comprehensive samples” comprise a subset of the full set of standard samples. They were collected as bulk samples and processed with the specific aim of recovering as many of the species present as possible. Seven of the eleven were collected and processed by us (Maxwell); Meyers Hill (Eocene, South Canterbury), Chatton (Oligocene, Southland), Hollands Point (Miocene, Northland), Pukeuri (Miocene, South Canterbury), Sisters Creek (Miocene, South Canterbury), Karoro (Miocene, Westland), McCullochs Bridge (Eocene, South Canterbury). A variety of methods was used to disaggregate the samples, set out in full in Beu and Maxwell (1990, pp 370-373), including soaking in hydrogen peroxide, kerosene or sodium sulphate, followed by careful washing, sieving and hand picking under a binocular microscope. A 0.5 mm mesh size sieve was used for sieving. The remaining four comprehensive samples were compiled from the literature: Boulder Hill, Dunedin (Paleocene, Finlay & Marwick, 1937), Otahuhu, Auckland (Pliocene, Marwick, 1948; Laws, 1950), Te Piki, East Cape (Pleistocene, Richardson, 1997), and Wanganui (Pleistocene, Fleming, 1953). Processing methods range from those similar to ours, to somewhat less thorough. Recovery is likely to be a little lower than for the 7 samples processed by us.

On average therefore, the 11 comprehensive samples are likely to be a good, if slightly conservative, estimate of what can be recovered by careful collecting and processing.

The eleven comprehensive samples were chosen to be more or less representative through time, and range from Paleocene to Pleistocene in age. The improvement in recovery over standard collections is indicated in two ways. Firstly, 34% of the species present in the comprehensive samples are not known from other samples. Secondly, the size frequency distribution of the comprehensive samples shows a significantly higher proportion of the smallest size class than in standard samples (Fig. 1) indicating a lower level of loss of small species. This contrast is conservative because the standard sample set includes the comprehensive subset.

3. ***Lithification***: Lithification (here taken to include cementation) strongly affects the extent to which sampled sediments can be processed for the extraction of fossils. There is a preferential loss of small sized specimens in hard rocks due to collection failure (Hendy 2005). Lithification no doubt accounts for much of our estimated collection failure.

In the New Zealand Fossil Record File there are 9085 Cenozoic molluscan localities and, of these, about half (4969) have sediment hardness (lithification) data recorded. These represent all depth habitat zones. The hardness estimates are qualitative, field assessments only. The proportions within shelf environments alone is not known. The proportions are as follows:

Hard = 679 (13.6%)

Moderately hard = 1420 (28.6%)

Moderately soft = 2754 (55.4%)

Unconsolidated = 116 (2.3%).

All 11 of our comprehensive collections are in readily disaggregated sediments that lie within the unconsolidated or moderately soft classes of the field classification above. So far as sediment lithification is concerned, the comprehensive samples are not representative of the collections as a whole. Our conclusion that a "little under half of the losses due to size culling result from collection failure" is true for soft sediments. For all sediments, this estimate will be conservative and for lithified sediments it will be very conservative.

4. ***Size measurement:*** Body size is measured as the maximum skeletal dimension of an average adult specimen. Our measurements are based on the original published descriptions supplemented with our own observations and data.

3. ***Mineralogy, fragility of shell:*** All species, both calcitic and aragonitic, are known from complete shells with almost 100% mineral (calcite or aragonite) preserved. None are known only from moulds. Ignoring scaphopods, which comprise only 1% or less of the fauna, we show that the ratio of gastropods to bivalves in fossils (73:28) is almost identical to that in Recent molluscs (76:24). Since the incidence of aragonitic shell composition is more common in gastropods than in bivalves, there is therefore no significant preferential loss of aragonitic taxa. This finding is consistent with live-dead studies by Kidwell (2005). We have not compiled data on the size frequency

distribution of taxa with fragile shells, but from our knowledge, there is no reason to believe that any one size class is over-represented.

4. ***Depth habitat:*** Our depth habitat estimates are based on regional paleoenvironment interpretation (King et al., 1999 and references therein) derived from such sources as sediment lithofacies, field relationships, sedimentary structures, regional setting etc. but also from comparison of general fossil content with equivalent Recent faunas.

5 ***Substrate type*****:** Only 1% of fossil samples represent hard substrate environments and all of these are in the littoral zone, which has been removed from our analysis, as explained in text. Our analysis therefore deals only with soft substrate environments.

Acknowledgements

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FIGURES

Figure 1. Size frequency distribution of all fossils compared with comprehensive samples

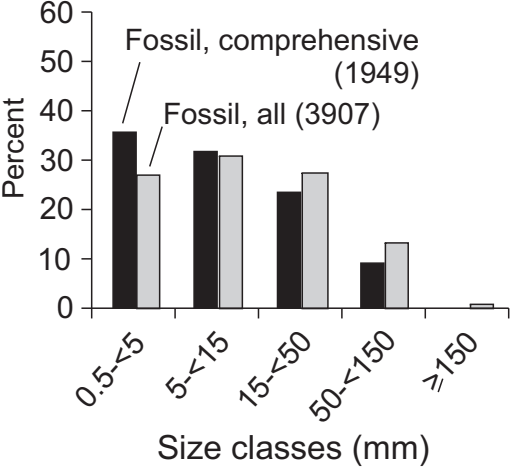

FIGURE 1 SUPPLEMENTARY ONLIN DATA
COOPER ET AL.