

Landcare Research Ltd has now completed research into whether brushtail possums forage on Mexican dung beetles in New Zealand. On the face of it, the results are very encouraging, as no possums consumed dung beetles in captive feeding trials, nor was there any evidence of possums feeding on dung beetles in the wild. However, there are several issues with the methodology (or reporting thereof) which limit the ability of LCR's work to really lay this issue to rest.

The captive feeding trials conducted were 'choice' tests conducted over a two day period. Possums were offered the choice between dung beetles (in dung placed on grassed soil in a plastic container), and 'their normal captive diet of apple and cereal'. The issues with this set-up are several-fold. Firstly, a 'no choice' test is standard practice in testing for potential non-target impacts of herbivorous biocontrol agents prior to release. LCR discounted the use of no choice testing on the basis that possums are generalist omnivores which consume a wide variety of vegetation, and therefore in the wild are unlikely to be faced with a no choice food situation. While this is true to a certain degree, there is considerable evidence showing that the extent to which invertebrates are incorporated into the diet of possums and other mammalian pest in New Zealand is strongly dependant on relative food availability, and consequently shows significant seasonal variation (e.g. Cowan and Moeed 1987; Cuthbert et al 2000; Owen and Norton 1995; Purdey et al 2004; Smith et al 2005). It therefore seems unsurprising that when apple and cereal are on offer, possums would not bother to investigate dung beetles. Furthermore, although the possums were wild caught, the phrase 'their normal captive diet...' raises questions as to whether the possums had been pre-fed on apples and cereal prior to being offered dung beetles in addition to this. Whether or not this occurred is not clear from the methods as described, but I certainly hope this was not the case, as it would likely further reduce the chances that the possums would bother to investigate dung beetles, reducing practical applicability of the experiment. LCR themselves acknowledge that the trial lasted only two days, and that this may have been insufficient time for possums to learn to use dung beetles as a food source.

Similar issues of trial duration apply to the data collected by LCR with respect to possum predation of dung beetles in the field. No dung beetles were identified from stomach contents of possums which had clearly been foraging in pasture habitat, as evidenced by a substantial component of pasture grass in the possums' stomachs. Furthermore, LCR did find that other invertebrate species had been consumed by 63% of the possums. These results are very reassuring. However, again, this trial was of very short duration. Given the evidence cited above with respect to seasonal variation in possum predation on invertebrates, appropriate trials to thoroughly lay this issue to rest should span an entire year. In contrast, the LCR trial is based on possums trapped over only two consecutive nights in April. In addition, it is unclear from LCR's description of methodology how many of the possums came from each of the three sites. As dung beetles were evidently present at all three sites, and were not detected in any possum stomachs, this information would not be likely to substantially change any evaluation of the results. Nonetheless, more thorough methodological information would provide readers with more confidence in the rigour of the experimental set-up.

One final area of concern is the narrow focus on possums as the sole predator species tested. The narrow focus derives from the primary motivation of dispelling concerns around livestock disease transmission, for which possums are the vector of most concern. Nevertheless, there are several other

mammalian pest species, such as rats, hedgehogs and mustelids which also eat invertebrates, and which could be of concern primarily from a wild-life ecology perspective rather than as vectors for livestock diseases. In Australia, Gonzales-Bernal et al. (2012; 2013) found dung beetles facilitated cane toad invasion. Ideally, research in New Zealand should address a wider range of mammalian pests as potential predators of dung beetles (studied over a full year to address seasonal variations in diet) to comprehensively rule out the potential of dung beetles to support elevated predator populations with concomitant wildlife impacts.