

Using molecular tools to identify New Zealand endemic earthworms in a mine restoration project

(Oligochaeta: Acanthodrilidae, Lumbricidae, Megascolecidae)

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Abstract. A restoration ecology project was commenced on the West Coast region of New Zealand to re-establish the local fauna of endemic *Powelliphanta* spp. carnivorous landsnails at an opencast coal mine site after mining activities. The aim of the current research is to provide recommendations for the use of earthworms to improve the restoration of ecological communities, especially the landsnails. To provide such recommendations, different aspects of the ecology and bio-systematics of the New Zealand endemic earthworm fauna have been studied using molecular techniques. About 1,500 earthworm individuals have been collected across 17 sampling sites in the Stockton mine area. In New Zealand, 173 endemic earthworm species are known. Only minor revisions to the earthworms' taxonomic status have been made since 1959. Species identification was performed by morphological analysis (following Lee's taxonomic key) and molecular analysis (using the mitochondrial 16S gene). The latter analyses conducted on a selection of 83 individuals revealed the existence of at least 17 different taxa, most of which are probably undescribed species. Some of these earthworm species are predated by an endangered carnivorous landsnail, *Powelliphanta augusta* Walker, Trewick & Barker. Because the conservation of *P. augusta* may rely greatly on the understanding of their diet, earthworm DNA was sought after in the snails' feces, using molecular analyses. Molecular analyses have been helpful in establishing an inventory of the species present in the study site, facilitating new species taxonomic descriptions and elucidating the predator-prey relationship.

Key words. Earthworms, landsnails, New Zealand, restoration, mining, DNA.

Introduction

Opencast mining causes several environmental impacts, which require land rehabilitation when mining operations are finished (DOWN & STOCKS 1977). For this reason, rehabilitation after extractive industries' work is common and has been well studied (e.g., LYLE 1987, HOSSNER 1988, SMYTH & DEARDEN 1998, BELL 2001, HÜTTL & WEBER 2001, KOCH 2007, XI-JUN et al. 2008). However, many ecological rehabilitation schemes do not examine to what extent complete and functioning ecosystems have been restored above and below ground (GRANT et al. 2007).

A research project in collaboration with Solid Energy New Zealand Limited (SENZ; www.coalnz.com) aims at using endemic earthworms to improve the restoration of ecological communities after opencast coal mining has finished. This mining in New Zealand presents particular environmental problems including threats to rare endemic flora and fauna. SENZ is engaged in an environmental policy that aims to minimize the ecological disruption caused by mining activities through rehabilitation of native flora and fauna to the mine site once the mine is retired.