Native Earthworms of British Columbia Forests

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Introduction

The earthworm fauna of British Columbia is composed of two distinct components: a large introduced complement and a smaller remnant ancient fauna. The introduced fauna, mainly European Lumbricidae represented by 9 genera and 19 species, is widespread throughout that portion of the Province south of the 56th parallel, especially around urban centres and along roads (Marshall and Fender, unpublished data). The ancient earthworms are comprised of four species (McKey-Fender et al. 1994). *Arctiostrotus perrieri*, *Arctiostrotus vancouverensis*, and *Toutellus oregonensis* are in the Megascolecidae; *Bimastos lawrenceae* is in the Lumbricidae and is restricted to a small area near Douglas Peak, south of Port Alberni, at elevations of 200 to 1200 m. Single records of two other native earthworm families, Octochaetidae and Sparganophillidae, have been published for the mainland of coastal British Columbia. A preliminary survey showed that native earthworm species were generally absent form the southeastern part of Vancouver Island; therefore, sampling for the present study was restricted to chronosequences on the western part of the Island at Nitinat, Klanawa, and Mt. Ozzard (see Trofymow et al. 1997 for locations).

Methods

Ten 0.5-m^2 plots, at least 10 m apart, were randomly selected in each of the four chronosequences or seres: Regeneration (REG) 7-12 years, Immature (IMM) 29-49 years, Mature (MAT) 69-89 years, and Old growth (OLG) >200 years, which were respectively in: plots 71, 72, 73, and 74 at Nitinat (sampled 23-25 November 1994); plots 81, 82, 83, and 84 at Klanawa (sampled 1-3 December 1994); and plots 91, 93, 94, and 95 at Mt. Ozzard (sampled 14-15 November 1994). The plot numbers follow Trofymow et al. (1997). Worms were collected from soil pits by digging and hand sorting, identified by species and age classes, preserved (Fender 1985), and taken to the laboratory for taxonomic confirmation. In the laboratory, biomass including gut content was determined using weight of preserved material (5% formalin). Specimens were allowed to dry five minutes while spread out on paper towel to remove excess moisture from the surface before being weighed. Earlier surveys of the chronosequences at Klanawa (sampled 27 April 1994) and Mt. Ozzard (sampled 26 April 1994) were made from five 1-m^2 plots, but biomass was not determined. Except for the April surveys, analysis of variance was carried out on numbers and biomasses of worms.

Results and Discussion

A. vancouverensis was the most widespread species, being present in all chronosequences, except in the OLG sere at Mt. Ozzard (Table 1). In addition to containing *A. vancouverensis*, the Mt. Ozzard site also contained *A. perrieri* in all chronosequences except the MAT sere, and *T. oregonensis* was found in the IMM sere only. All stages of worms (juveniles, pre-adults and clitellated adults) were found in April, November, or December suggesting that the three species are reproducing during the cooler, wetter period of the year. Variations in numbers of worms and biomasses m^{-2} were large and the total number of worms collected was small. Hence, statistically significant differences were not found among sites nor seres of a given site. However, there seemed to be a slight decrease in the REG seres. Numbers and biomasses then tended to increase, reaching maxima in the intermediate-aged forests. The highest biomass (7.87 for IMM at Nitinat) was at the lower end of values known from other soils (Lee 1985). Factors responsible for the low population numbers and high variations have not been

TABLE 1. Numbers and biomasses m^{-2} of earthworm at three west coast sites on Vancouver Island.

	worms m^{-2}			Biomass (gm^{-2})		
	Nitinat	Klanawa	Mt. Ozzard	Nitinat	Klanawa	Mt. Ozzard
REG				1.11	2.02	0.56
A. perrieri	0.0	0.0 (0)	0.0 (7)[a]			
A. vancouverensis	3.4	4.6 (8)	1.0 (0)			
IMM				7.87	6.47	2.81
A. perrieri	0.0	0.0 (0)	3.0 (10)			
A. vancouverensis	14.0	7.8 (4)	4.8 (6)			
T. oregonensis	0.0	0.0 (0)	0.0 (2)			
MAT				1.29	6.47	1.44
A. vancouverensis	3.6	7.8 (25)	1.8 (2)			
OLG				5.64	7.53	0.28
A. perrieri	0.0	0.0 (0)	0.2 (0)			
A. vancouverensis	9.6	10.0 (4)	0.0 (0)			

[a]Numbers in brackets represent the April 1994 survey.

determined, but the numbers and biomasses of worms in mature and old-growth forests are considered underestimates because of the sampling method used. Digging favours the REG and IMM seres which have a less complex soil profile. In these seres, organic matter is restricted mainly to a few centimetres on the soil surface and this reduces the opportunity for the earthworms to escape during sampling. Disturbance allows adults to quickly disappear into the network of dead-root passages and burrows that are numerous in MAT and OLG seres. Also, the multiplicity of roots in MAT and OLG seres slow the rate of digging, thereby allowing the worms to escape more easily than in REG and IMM seres. Past logging practices, including slash burning, may have only slightly reduced the earthworm population, which seemed to have recovered by canopy closure of the forest. This theory is supported by the results found for stump Collembola in which the populations in the REG sere required about 40 more years before collembolan communities acquired the general characteristics of those of old-growth forests (Setälä and Marshall 1994).

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