Published on paper: 1983. Published online: 2024-10-25.
ISSN 1502-4873 (paper). ISSN 1891-5396 (electronic).
doi: https://doi.org/10.5324/fn.v4i0.6130.

Terrestrial invertebrates of the Faroe Islands: V. Earthworms (Lumbricidae): Distribution and habitats

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Enckell, P.H. & Rundgren, S. 1983. Terrestrial invertebrates of the Faroe Islands: V. Earthworms (Lumbricidae): Distribution and habitats. *Fauna norv. Ser. A, 4,* 11—20.

Sampling in the summers of 1978—1979 in 112 localities on 18 islands in the Faroe group yielded ten species of earthworms. All ten also occur in neighbouring areas (Iceland, the Hebrides, western Norway) with the exception of *Octolasium lacteum* and *Lumbricus castaneus,* which have not been found in Iceland.

One island (Vágar) harboured all ten species and no island had less than three species. Abundance and number of species were higher where human influence and luxuriance of the vegetation were more apparant. All ten species were found within settlements.

Allolobophora caliginosa, Dendrobaena rubida and *Lumbricus rubellus* were most common and occurred on all islands. The deep-burrowing *Lumbricus terrestris, Allolobophora rosea* and *Octolasium cyaneum* were associated with settlements, although *A. rosea* also occurred in natural habitats, in contrast to the situation in Iceland.

Data on habitat distribution and distribution maps are given for all species.

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INTRODUCTION

During 1978 and 1979 a Swedish-Norwegian team (S.-A. Bengtson, P.H. Enckell and T. Solhøy) made a survey of inter- and intra-island distribution of certain taxa of terrestrial invertebrates (mainly Coleoptera, Araneae, Opiliones, Gastropoda and Lumbricidae) in the Faroe Islands in the northern Atlantic. The present report, dealing with the lumbricid earthworms (Lumbricidae) is one in a series presenting the faunistic results of the study (for others see Bengtson & Hauge 1979, Kauri 1980, Bengtson 1981, Solhøy 1981). These reports form the basis of an ecological analysis of the distribution of these taxa in the Faroe Islands.

In this paper the distribution of the earthworm species will be discussed, based on their occurrence on the islands of the archipelago and within various habitats. Comparisons will be made with the distribution of the same species in Iceland, the Hebrides, and western Norway.

STUDY AREA, MATERIAL AND METHODS

The Faroes constitute an isolated group of 18 islands (between 1 and 374 km^2, Bengtson & Hauge 1979, fig. 1) in the northern Atlantic Ocean at about 62°N and 7°W. Their total size, about 1400 km^2, is similar to that of the Shetland Islands, 300 km SE of the Faroes. They rise steeply from the sea and in places (especially on the northern and western coasts of the islands) the perpendicular cliffs rake several hundreds of meters above the sea. The highest point reaches 882 m a.s.l. A large part of the area of the islands (36%) lies above 300 m a.s.l.

The climate is oceanic. The average number of days per year with rainfall is 260, although this differs within and between islands because of differences in exposure to the prevailing winds. The warmest mean monthly temperature (July/August) is 11.2°C and the coldest (January/February) is 4.1°C. A snow cover is present in winter only on the highest peaks. Strong ocean currents between some of the islands make travel difficult in places also today.

The vegetation is very much influenced by the climate and by sheep grazing. Shrubs are scarce and natural woods do not occur. Small plantations of various introduced conifers, rowan, aspen, etc., occur in some islands. Woods have not occurred in the Faroe Islands in postglacial time (Jóhansen 1975).

Grass heath is the dominating habitat in the islands, especially in the outfields. These are extensively used for sheep grazing. In the outfield areas there are also some wetlands and dwarf shrub heaths (the latter dominated by *Calluna*

vulgaris L.). Higher up the vegetation becomes more patchy. Areas inaccessible to sheep (rock walls, cliff shelves, crevices) exhibit a luxuriant vegetation.

The infields in the Faroes form 'islands' in the dominating outfield areas. They consist of the settlement with their surrounding cultivated areas and they are usually fenced off (against sheep). Herbs make up a dominant part of the vegetation (e.g. *Angelica* and ruderate plants). Rich grass and herb meadows dominate on the outskirts of the infields (see Bengtson & Hauge 1979).

Field work was conducted 29 June—8 August 1978 (Bengtson, Enckell, Solhøy) and 3—16 August 1979 (Bengtson, Solhøy). Additional samples have been collected later (Bengtson, D. Bloch Danielsen). All 18 islands were surveyed. The localities investigated have been classified into nine main habitat types (see Bengtson & Hauge 1979; some of the localities contained more than one habitat type, see Tab. 2): A: Mountain sites (above 250 m a.s.l.), B: Dwarf shrub heaths, C: Plantations, D: Cliffs, shelves and crevices, E: Lowland bogs, F: Grass heaths, G: Infields (the outskirts), H: Infields (within settlements), and I: Sand dunes. No earthworms were found in the last habitat type and it will not be dealt with in this context.

Collecting was done by four main methods: pitfall traps, collecting by hand, sieving and subsequent extraction in Tullgren funnels (litter), and extraction of lumbricids by formalin (Raw 1959). Only the last type of sampling gives any information that may be used for quantitative comparisons between localities as concerns earthworm density. Owing to various factors — e.g., adverse weather and limited time — not all four methods could be used in all 112 localities (for details see Appendix in Bengtson & Hauge 1979). Thus, comparisons are limited as the data do not cover all localities equally. However, the bulk of the data still gives a fairly reliable picture of the distribution of the earthworm species on the islands and in the different habitats and renders comparison with other areas possible.

It is also apparent (from Tab. 2) that the number of localities sampled in different habitat types differs much. This renders statistical comparisons impossible. Some types of habitats were not sampled at all (e.g., compost heaps). This explains that *Eisenia foetida* (Sav.) was not found although it has been reported previously from the Faroe Islands (Ditlevsen 1971).

RESULTS

General distribution of the species in the Faroes

Ten species of lumbricids were found on the islands. An additional three species have been found earlier (Ditlevsen 1971). One of these, *Eisenia foetida,* inhabits the rather special compost heap habitat, which was not sampled. A second species, *Allolobophora remyi* Černosvitov was described from a single specimen found near Tórshavn (Černosvitov 1931) and the validity of the species may be questioned. The third species, *Allolobophora similis* Friend, had previously been found only at Kew in England when it was discovered under stones west of Tórshavn.

The occurrence of the species on the islands is shown in Tab. 1 and the distribution is given in the Appendix. *Allolobophora caliginosa* (Sav.), *Dendrobaena rubida* (Sav.) and *Lumbricus rubellus* Hoffm. were found on all 18 islands. *Dendrobaena octaedra* (Sav.) was found on 15 islands, *Eiseniella tetraedra* (Sav.) and *A. rosea* (Sav.) on 12 islands, *L. castaneus* (Sav.) on 10 islands, *Octolasium lacteum* (Oerley) on nine, *L. terrestris* L. on four, and *O. cyaneum* (Sav.) on two islands.

One single island (Vágar) contained all ten species. Three islands contained nine species each, two islands contained eight species each, four islands contained seven species each, two islands contained six species each, two islands contained five species each, three islands contained four species each, and one island contained three species. None of the islands had less than three earthworm species.

All ten species were found in the infield habitat, within settlements. The outskirts of infields housed nine species. Grass heaths and plantations contained seven species, dwarf shrub heaths six species, and so on along a gradient of decreasing luxuriance (Tab. 2). In general, the degree of human influence and the luxuriance of the habitat positively influenced the number of species present.

The density (ind m^{-2}) in various habitats was obtained from a small number of localities only (Tab. 3). It is, however, similar to the number of species present in that both density and number of species were higher where human influence and luxuriance of the vegetation were more apparent. The differences in mean density were spectacular; from a low of 43 ind m^{-2} in dwarf shrub heath and 54 ind m^{-2} in grass heath it rose to 200 ind m^{-2} in the outskirts of infields and reached a maximum of 273 ind m^{-2} in the settled parts of the infields.

Table 1. Occurrence of earthworms (Lumbricidae) on the 18 islands of the Faroe group.

Islands	Species										No. of species
	E. tetraedra	A. caliginosa	A. rosea	D. octaedra	D. rubida	O. lacteum	O. cyaneum	L. rubellus	L. castaneus	L. terrestris	
Suduroy	x	x	x	x	x	x		x	x	x	9
Lítla Dímun		x		x	x			x			4
Stóra Dímun		x			x			x			3
Skuvoy		x		x	x			x	x		5
Sandoy	x	x	x		x			x	x		6
Hestur	x	x			x			x			4
Koltur	x	x	x	x	x			x	x		7
Mykines		x	x	x	x			x	x		6
Vágar	x	x	x	x	x	x	x	x	x	x	10
Nólsoy		x		x	x			x			4
Streymoy	x	x	x	x	x	x	x	x		x	9
Eysturoy	x	x	x	x	x	x		x			7
Kalsoy	x	x	x	x	x	x?		x	x		8
Kunoy		x	x	x	x			x			5
Bordoy	x	x	x	x	x	x		x	x	x	9
Vidoy	x	x	x	x	x	x?		x	x		8
Svínoy	x	x	x	x	x	x		x			7
Fugloy	x	x		x	x	x			x		7
No. islands	12	18	12	15	18	9	2	18	10	4	(total 18)
No. locs	28	86	25	40	88	21	3	104	21	6	(total 112)

Table 2. The occurrence of earthworm species in each habitat type sampled in the Faroes. The number of localities sampled in each habitat type, the number of species found in each habitat type, and the total number of localities where the respective species was found, are also given.

	Mountain sites above 250 m a.s.l.	Dwarf shrub heaths	Plantations	Cliffs, shelves and crevices	Lowland bogs	Grass heaths	Infields: the outskirts	Infields: within settlements	Sand dunes	Grass heaths + cliff areas	Lowland bogs + grass heaths	Infields: outskirts + churchyard	Dwarf shrub heath + cliff areas	Grass meadow (infields) + cliff areas	Total no. of localities
Eiseniella tetraedra	2	1	1	1		3	9	7		2		1		1	28
Allolobophora caliginosa	1	8	3	2	1	21	27	18		2		1	1	1	86
Allolobophora rosea		3	1			5	11	4		1					25
Dendrobaena octaedra		3	4		1	14	9	5		3				1	40
Dendrobaena rubida	3	6	1	3	1	22	26	20		3		1	1	1	88
Octolasium lacteum						4	10	6				1			21
Octolasium cyaneum							1	2							3
Lumbricus rubellus	3	9	4	3	2	28	30	19		3		1	1	1	104
Lumbricus castaneus				1			8	10		1				1	21
Lumbricus terrestris			1					4				1			6
No. of localities	4	9	4	3	2	29	32	21	1	3	1	1	1	1	112
No. of species in habitat type	4	6	7	5	4	7	9	10	0	7	0	6	3	6	

Table 3. Abundance (ind/m^2) of earthworms in different habitat types in the Faroe Islands.

Habitat	No. locs	Abundance	Range
Dwarf shrub heath	3	42.7 (41.1)	8-88
Grass heath	18	54.4 (40.5)	8-116
Infields: the outskirts	18	200.4 (195.7)	52-728
Infields: in settlements	5	272.8 (392.46)	12-948

The species

Eiseniella tetraedra was found in 28 of the 112 localities sampled (locs 10, 15, 28, 29, 31, 34, 39, 41, 44, 45, 48, 56, 59, 67, 68, 73, 75, 79, 81, 83, 84, 85, 90, 94, 95, 96, 97, 104). Most of these 28 were within infields, and the species occurred over a variety of habitats. It was not especially searched for; had it been, the frequency would probably have been higher (on account of its common occurrence in moist habitats).

Allolobophora caliginosa occurred in 86 localities (locs 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 24, 27, 28, 29, 30, 32, 33, 34, 35, 36, 39, 40, 41, 42, 43, 45, 46, 48, 50, 52, 54, 55, 56, 57, 59, 60, 61, 62, 64, 65, 67, 68, 69, 70, 74, 75, 76, 79, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 110, 111, 112). It was mostly found in infields (47 locs) and grass heaths (23 locs). In sum, it occurred in all those habitat types where earthworms were found.

A. rosea was found in 25 localities (locs 3, 4, 13, 33, 35, 42, 46, 50, 53, 55, 57, 62, 63, 65, 68, 69, 75, 76, 79, 84, 87, 89, 90, 95, 101). Fifteen of these were in infields and six in grass heaths.

Dendrobaena octaedra was found in 40 localities (locs 1, 2, 5, 6, 9, 10, 12, 13, 17, 18, 19, 20, 21, 28, 44, 45, 46, 47, 49, 50, 51, 52, 53, 55, 57, 59, 61, 62, 70, 79, 85, 89, 95, 99, 101, 102, 105, 108, 110, 112). Most of these were located in grass heaths (14) and the outskirts of infields (9).

D. rubida was found in 88 localities (locs 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 20, 21, 22, 24, 26, 27, 28, 29, 33, 34, 36, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 67, 68, 69, 70, 71, 73, 74, 75, 77, 78, 79, 81, 84, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 104, 105, 106, 107, 111, 112). A majority of these were located in grass heaths (22), the outskirts of infields (26) and within settlements (20). Like *A. caliginosa*, it occurred in all those habitats where earthworms were found.

Octolasium lacteum was found in 21 localities of which 17 were in infields and four in grass heaths (locs 5, 6, 15, 17, 20, 27, 29, 42, 43, 46, 50, 57, 60, 68, 70, 74, 79, 81, 90, 91, 107).

O. cyaneum was found in three localities, all in infields (locs 41, 67, 68).

Lumbricus rubellus was the most widespread species and was found in 104 of the 112 localities sampled (locs 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 81, 82, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 101, 102, 103, 104, 105, 106, 107, 108, 110, 111, 112). Grass heaths (28 locs) and infields (49 locs) made up the majority of the localities.

L. castaneus was found in 21 localities (locs 32, 33, 35, 46, 55, 56, 58, 59, 60, 61, 62, 67, 68, 74, 93, 94, 99, 101, 104, 105, 107), of which 19 were in infields.

L. terrestris was found in six localities (locs 29, 41, 55, 68, 107, 110); of these five were in infields and the sixth was in a plantation.

Table 4. Occurrence in neighbouring areas of the earthworm species found in the Faroes (references in the text).

	Faroes	Iceland	Hebrides	W. Norway
Eiseniella tetraedra	x	x	x	x
Allolobophora caliginosa	x	x	x	x
A. rosea	x	x	?	x
Dendrobaena octaedra	x	x	x	x
D. rubida	x	x	x	x
Octolasium lacteum	x		x	x
O. cyaneum	x	x	x	x
Lumbricus rubellus	x	x	x	x
L. castaneus	x		x	x
L. terrestris	x	x	x(?)	x

Occurrence in neighbouring areas

Eight of the ten species found in the Faroes have previously been reported from Iceland (Bengtson et al. 1975), ten (nine?) from the Hebrides (Boyd 1956, 1957), and ten from western Norway (Støp-Bowitz 1969, Olsen 1978) (Tab. 4).

It is evident that the earthworm fauna of the Faroe Islands is very similar to those neighbouring areas that may be considered as source areas. The only striking difference is the occurrence of *Lumbricus castaneus* and *Octolasium lacteum* in the Faroes and the probable absence of these species in Iceland (Bengtson et al. 1975).

Many of the species of earthworms occurring in North Atlantic islands are likely to have been dispersed by man. This is also indicated by the fact that the infields in the Faroes contain all the ten species found, while other habitat types contain at most seven species (Tab. 1). Communication within the Faroe Islands and with other countries has always primarily been between settlements. This has favoured the dispersal of organisms like earthworms that are normally not easily dispersed by natural means, and explains the concentration of anthropochorous species in the infields around the settlements. In addition, the settlements are naturally found on the 'best' soils, and species like *L. castaneus, L. terrestris, O. cyaneum* and *O. lacteum* are found only in such soils in the marginal areas of their distribution. That is, they are found in soil that is easily penetrated, improved with manure, and with a cover of luxuriant vegetation.

The relative abundance and occurrence within the islands seems to reflect the pattern found in Iceland (Bengtson et al. 1975) and in northern U.K. and Scandinavia (Julin 1949, Boyd 1957, Svendsen 1957, Støp-Bowitz 1969). *Dendrobaena rubida* is more common than *D. octaedra* (in contrast to the occurrence in Fennoscandia, Nordström & Rundgren 1973, 1974). There are slight differences in between-species patterns (e.g., in Iceland *L. rubellus* seems to have a narrower ecological amplitude than the *Dendrobaena* species, while the reverse seems to be the case in the Faroe Islands).

The deep-burrowing species *L. terrestris, A. rosea* and *O. cyaneum* are associated with settlements, although *A. rosea* appears to have a wider distribution in the Faroe Islands than in Iceland, where it was not found in natural habitats (Bengtson et al. 1975). In the Faroes it occurred both in grass heaths and in dwarf shrub heaths (although never abundantly and in a few localities only).

In contrast to the man-associated species, *E. tetraedra, A. caliginosa, Dendrobaena* spp. and *L. rubellus* seem to have a more or less spontaneous distribution in the Faroes. This is in accordance with the distribution of these species in Iceland (Bengtson et al. 1975) and in the Hebri-

des (Boyd 1957). The differences that exist in the occurrence and distribution of the species between (and within) the Faroes and the neighbouring areas will have to be explained by a thorough site- and species-specific analysis.

Supplement

Field work during May, 1983 (S.-A. Bengtson, P.H. Enckell, T. Enckell) yielded the anthropochorous species *Octolasium cyaneum* and *Lumbricus terrestris* (which were especially searched for) at localities (all within settlements) where they had not been collected before, viz.:

Octolasium cyaneum: At Debesatrød, Tórshavn (Streymoy) and at loc. 107 (Klaksvík, Bordoy). This increases the number of islands where the species has been found from 2 to 3 and the number of localities from 3 to 5.

Lumbricus terrestris: At Debesatrød, Tórshavn (Streymoy) and at locs 46 (Vidareidi, Vidoy), 67 (Midvágur, Vágar) and 90 (Sydrugøta, Eysturoy). In addition the occurrence of the species near loc. 6 (Eidi, Eysturoy; the empty circle for this species in the Appendix) has been confirmed. This increases the number of islands where the species has been collected from 4 to 6 and the number of localities from 6 to 10 (incl. Eidi).

No doubt further sampling will increase the number of localities where these species occur. However, we are reasonably sure that further finds will still strengthen the fact that these species are associated with settlements and do not occur in grass heath and similar habitats.

ACKNOWLEDGEMENTS

Dr. D. Bloch Danielsen and Mr. J.K. Baerentsen, Tórshavn, assisted us in various ways during the field work. We acknowledge the assistance of Stödisúubúgvingin (Academia Faeroensis) for laboratory facilities and the royal Danish Navy for helicopter transportation to otherwise inaccessible localities. The prosject was supported by grants from the Norwegian Research Council for the Science and Humanities (to S.-A. Bengtson) and the Nordic Council for Ecology (to T. Solhøy);it is currently supported by the Swedish Natural Science Research council (to S.A.B.).

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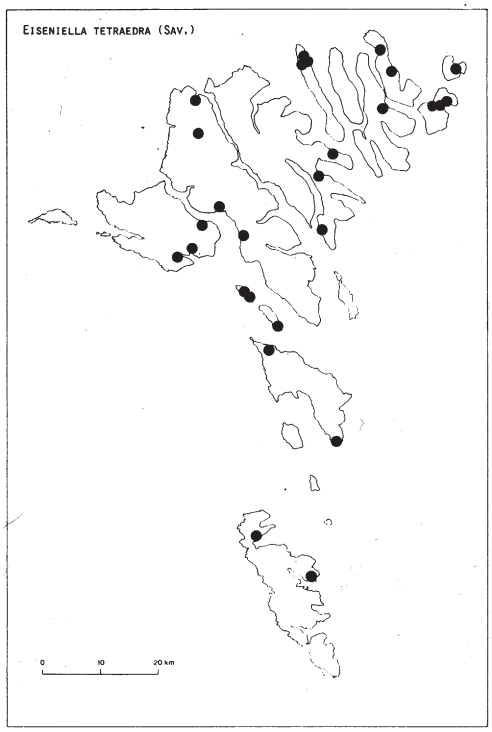
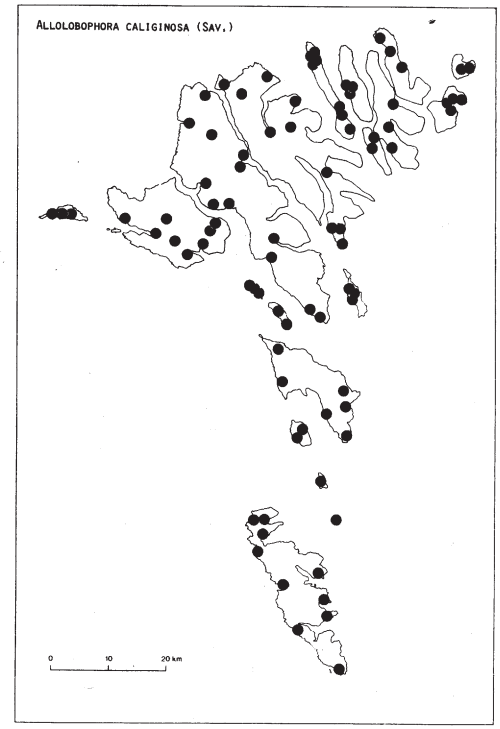
APPENDIX

Maps showing the distribution of ten species of Lumbricidae recorded in 1978—1979 in the Faroes. Black circles denote records from the present study, while empty circles refer to previously published records. The latter have only been entered when they markedly supplement the data of the present study (e.g. occurrence on an island where the species in question was not found in the present study).


EISENIELLA TETRAEDRA (SAV.)
0
10
20 km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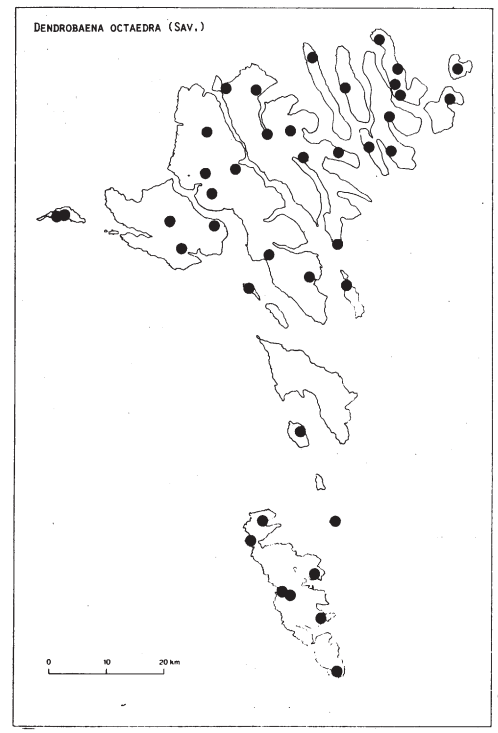
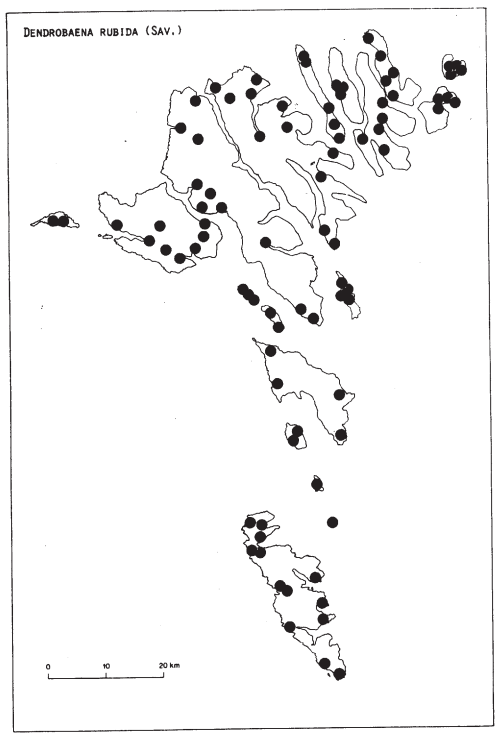
0
10
20 km


ALLOLOBOPHORA ROSEA (SAV.)
0
10
20 km


DENDROBAENA OCTAEDRA (SAV.)
0
10
20 km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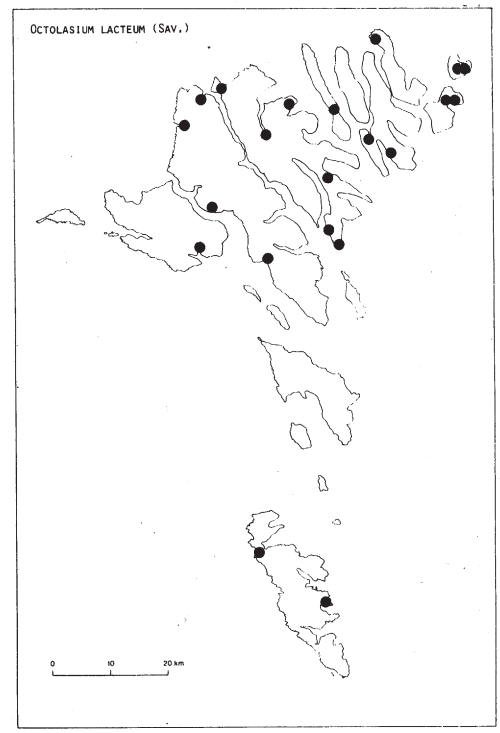
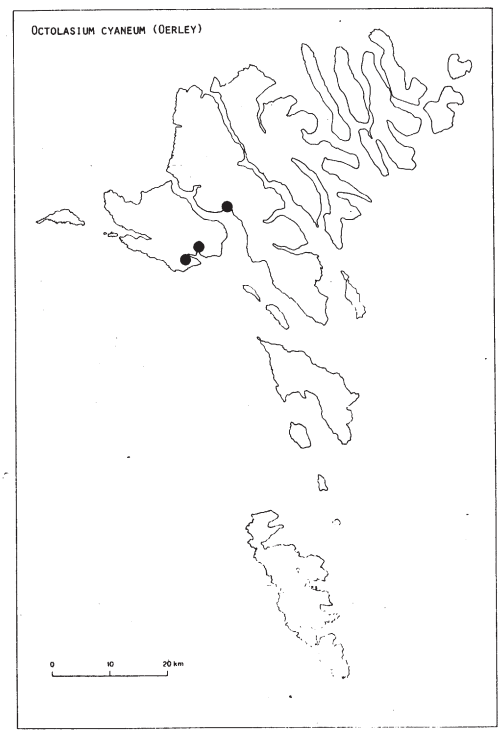
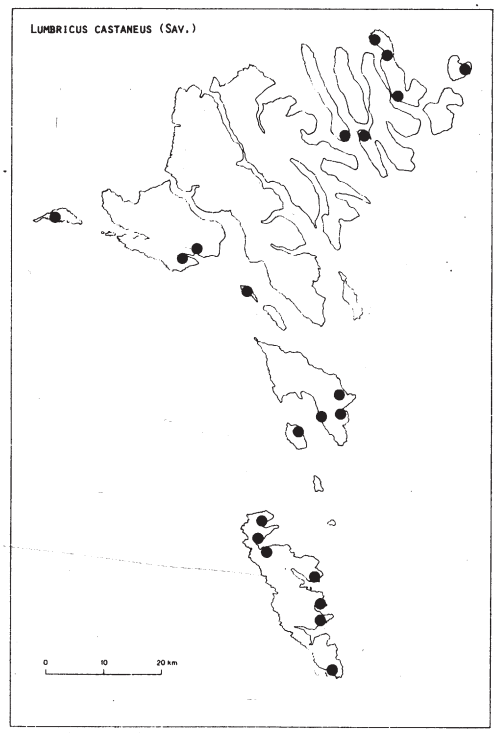
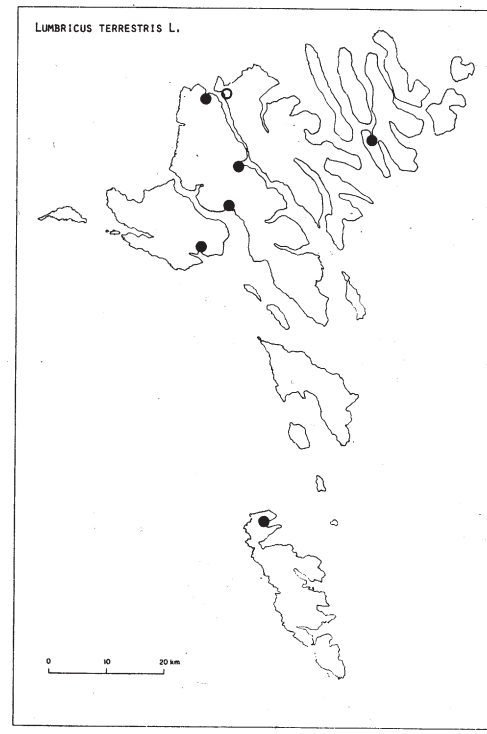
0
10
20 km


OCTOLASIUM LACTEUM (SAV.)
0
10
20 km


OCTOLASIUM CYANEUM (OERLEY)
0
10
20 km


LUMBRICUS RUBELLUS HOFFM.
0
10
20 km


LUMBRICUS CASTANEUS (SAV.)
0
10
20 km


LUMBRICUS TERRESTRIS L.
0
10
20 km