THE EARTHWORMS OF MINNESOTA (OLIGOCHAETA: ACANTHODRILIDAE LUMBRICIDAE AND MEGASCOLECIDAE).

John Warren Reynolds¹, Dennis R. Linden² and Cindy M. Hale³

¹Oligochaetology Laboratory, 18 Broadview Court, Kitchener, ON Canada N2A 2X8
(e-mail: john.reynolds1@sympatico.ca)

²Soil Scientist, USDA-ARS, Soil Water & Climate Dept.
University of Minnesota, 439 Borlaug Hall
1991 Upper Buford Ctl., St. Paul, MN, USA 55108
(e-mail: dlinden@soils.umn.edu)

³The Natural Resources Research Institute, University of Minnesota-Duluth
5013 Miller Trunk Hwy, Duluth, MN, USA 55811
(e-mail: halex004@tc.umn.edu)

ABSTRACT

This survey of the earthworms from 51 of the 87 counties of Minnesota recorded 15 species of terrestrial Oligochaeta, five of which are reported for the first time from the state: Acanthodrilidae (Diplocardia riparia), Lumbricidae (Allolobophora chlorotica, Bimastos parvus, and Eiseniella tetraedra)) and Megascolecidae (Amynthas loveridgei). The distribution of the earthworm species appears to be mildly influenced by the three physiographic regions found within the state: 1) Northern Lakes States Forest and Forage Subdivision, 2) Central Feed Grains and Livestock Subdivision and 3) Northern Great Plains Spring Wheat Subdivision.

Key words: Minnesota, earthworms, distribution.

RÉSUMÉ

Cet inventaire des vers de terre des 51 comtés sur la 87 que compte la Caroline du Sud, a recensé 15 espèces d’Oligochètes terrestres, dequelles, cinq le sont pour la première fois dans cet état: Acanthodrilidae (Diplocardia riparia), Lumbricidae (Allolobophora chlorotica, Bimastos parvus, and Eiseniella tetraedra)) et Megascolecidae (Amynthas loveridgei). La répartition de ces espèces de vers de terre apparaît influencée doucement par les trois régions physiographiquées que l’on trouve dans cet état: 1) la subdivision de forage des états des lacs du nord, 2) la subdivision centrale de bétails et de cereals et 3) la subdivision de blé printanier des grandes plaines.

Clé mots: Minnesota, vers de terre, répartition.

INTRODUCTION

The history of the presence of earthworms in Minnesota is relatively recent when compared to other states, e.g. Arkansas (Causey, 1952, 1953), Missouri (Olsen, 1936), Ohio (Olson, 1928) and more recently Reynolds et al. (1973) and Reynolds (2001a, 2001b). In 1942, Gates presented the first checklist or bibliography of North American earthworms which brought together in one paper the results of over 100 papers published during the previous 121 years. That paper (Gates, 1942) mentioned no earthworm records for Minnesota.

The first earthworm species recorded from Minnesota was Eisenia fetida as an incidental record in a parasitological study which gave little insight to this species distribution within the state, “At St. Paul, Minn., found only in compost heaps and then not commonly” (Mickel, 1925). It was almost 50 years
before any new verifiable earthworm records were reported for Minnesota (Gates, 1972a). In his important paper on the *trapezoides* complex, Gates reported three species of *Allolobophora* (now *Aporrectodea*): *trapezoides*, *tuberculata* and *turgida*. This brought the state list to four species. In that same year Gates (1972b) reported *Lumbricus terrestris* from Minnesota as a new record without any details; these appeared six years later in Gates (1978).

The year 1973 saw the number of earthworm species recorded from Minnesota rise from five to six with the addition of *Octolasion tyrtaeum* (see Gates, 1973).

The next year, Gates (1974a) added *Eisenia* *rosea* (now *Aporrectodea rosea*) to the state records bringing the list to seven species. In his paper (Gates, 1974b) on *Dendrobaena octaedra*, he did not include this species from Minnesota. It was not until Reynolds (1977) that *D. octaedra* was reported from Minnesota.

rubellus were added to the state list. But it has remained until now for the collection details to be published. Thus, until now there have been ten earthworm species reported from Minnesota.

The results of this paper brings the state list to 15 species with the addition of *Allolobophora chlorotica*, *Amynthas loveridgei*, *Bimastos parvus*, *Diplocardia riparia*, and *Eiseniella tetraedra* species not reported previously from Minnesota.

**COLLECTIONS**

In presenting the considerable amount of data obtained for the state of Minnesota, we have followed the original format as used in Reynolds et al. (1974) for the state of Tennessee and continued through more recent earthworm surveys (Reynolds, 2001a, 2001b). The TF or USNM designation after the collection, refers to the field/collection number of Tall Timbers Research Station, collector, or museum. Any author reference after the location represents a collection which has in total, or in part, been reported previously.

![Fig. 1.](image)

The geographical locations of the counties in the state of Minnesota.

Many of the specimens are deposited in the University of Minnesota collections, St.
During his early travels with Schneider National Carriers, Inc., the senior author was able to revisit Minnesota on several occasions and make additional observations and collections on the earthworms present in the state. He is also indebted to several of his colleagues at Schneider National who made collections during their travels throughout the state.

The geographical locations of the counties in the state of Minnesota are presented in Figure 1.

Collection Sites

Aitkin Co. - no records

Anoka Co. [AN]

01 Rt 24, Bethel, Cedar Creek Nature Center, 21 May 68, E.V. Komarek Sr. (USNM 382788)

02 Blaine, Blaine Bros. Maintenance Yard, under lumber and debris, 15 June 01, B. Cox.

Becker Co. [BK]

01 Hwy 10, south of Detroit Lakes, on shore of Detroit Lake, under logs and rocks, 20 June 99, W. London.

Beltrami Co. [BL]

01 Hwy 2, Bemidji, shore of Lake Bemidji, digging and under logs, 4 Oct 94, J.W.R. & P. N. Mayville.

Benton Co. - no records

Big Stone Co. - no records

Blue Earth Co. - no records

Brown Co. - no records

Carlton Co. [CA]

01 Cloquet Forestry Center, 7.5 km w of Cloquet, various plots, 11 July - 17 Sep 73, R.O. Morgenweck.

02 Cloquet Forestry Center, 5 km west of Cloquet, (Twp 49N, Range 17W, Sect. 29-32, mixed hardwoods and pine (Populus tremuloides, Acer rubrum, Pinus strobus, P. resinosa), digging and mustard extraction, August 2001, C.M. Hale.

Carver Co. - no records

Cass Co. [CS]

01 Hwy 2, 19 km east of Cass Lake, to Sucker Bay Road, (Twp 144N, Range 29W, Sect. 19), 100-150 year hardwood forest east side of the road, dominated by sugar maple (Acer saccharum) with yellow birch (Betula alleghaniensis) and basswood (Tilia americana), digging and mustard extraction, Sep 1998, 1999, 2000, C.M. Hale.

02 Same as above only west side of the road.

03 South of Bena, 22.5 km, west on Blackpoint Road, (Twp 142N, Range 28W, Sect. 8), 100-150 year hardwood forest east side of the road, dominated by sugar maple (Acer saccharum) with yellow birch (Betula alleghaniensis) and basswood (Tilia americana), digging and mustard extraction, Sep 1998, 1999, 2000, C.M. Hale.

04 Hwy 2, 19 km east of Cass Lake, to Sucker Bay Road, (Twp 143N, Range 30W, Sect. 12), 100-150 year hardwood forest east side of the road, dominated by sugar maple (Acer saccharum) with yellow birch (Betula alleghaniensis) and basswood (Tilia americana), digging and mustard extraction, Sep 1999, 2000, C.M. Hale.

Chippewa Co. - no records

Chisago Co. [CH]

01 I-35, rest area north of exit 152 near Harris, under logs and rocks, 10 Jun 98, J.W.R.

Clay Co. [CY]

01 I-94, exit 6 near Glyndon, truck stop, under rocks and lumber, 3 Apr 98, J.W.R.

Clearwater Co. [CL]

01 Itasca State Park, University of Minnesota, 24-28 July 68, L.W. Eberley and D.T. Sanwick. (USNM 382788)

Cook Co. - no records

Cottonwood Co. - no records

Crow Wing Co. - no records
Dakota Co. [DK]
01 Hwy 52, Vermillion River, banks under logs, 5 May 01, S. Andersen.

Dodge Co. [DG]
01 Hwy 14, Claremont, ditch under logs, 9 May 01, S. Andersen

Douglas Co. [DO]
01 Satterlie Farm (20-129N-40W), soybean-oats-barley, 29 Jun 87, D.J. Fuchs & D.R. Linden

Faribault Co. [FA]
01 I-90E, rest area mm 118, near Blue Earth, under rocks and logs, 16 June 00, G. van Speybroeck

Fillmore Co. [FL]
01 Hwy 16, Whalen on banks of Root River, 26 May 00, S. Andersen

Freeborn Co. [FR]
01 I-90W, rest area mm 170 near Oakland, under rocks and logs, 12 June 00, G. van Speybroeck

Goodhue Co. - no records

Grant Co. [GR]
01 Hwy 9, north of Norcross at Mustinka River, under debris, 10 Sep 00, L. Carrigan

Hennipin Co. [HN]
01 CR 18, Rice Lake, bank of the Minnesota R. at water’s edge, 19 Jun 57, W.R. Murchie. (USNM 280138)
02 I-94, 5 km w of Jet 1-494, rest area near Enfield, under logs, rocks and debris, 30 Apr 98, J.W.R.
03 Hwy 12, west of Minneapolis in Wayzata, Wood Rill Scientific and Natural Area, (Twp 118N, Range 23W, Sect. 36), old growth (>>120 years) Maple -Basswood forest, digging and mustard extraction, Sep 2000, C.M. Hale

Houston Co. [HO]
01 Hwy 44, north side of Hokah at Root River, under logs and rocks, 26 May 00, S. Andersen

Hubbard Co. - no records

Isanti Co. - no records

Itasca Co. [IT]
01 Hwy 2, La Prairie, bank of Mississippi River, under logs and rocks, 10 June 98, D. Hess

Jackson Co. [JA]
01 I-90E, rest area mm 72 near Clear Lake, under rocks and logs, 16 June 00, G. van Speybroeck

Kanabec Co. - no records

Kandiyohi Co. - no records

Kittson Co. [KT]
01 Hwy 11, at county line, South Branch Two River, digging in ditch and under logs, 4 Oct 94, J.W.R. & P. N. Mayville

Koochiching Co. [KO]
01 Hwy 11, Indus, digging in ditch, 4 Oct 94, J.W.R. & P. N. Mayville
02 Hwy 11, Smokey Bear State Forest, 8 km w of Pelland, in and under logs, 4 Oct 94, J.W.R. & P.N. Mayville

Lac Qui Parle Co. - no records

Lake [LK]
01 Finland, Wolf Ridge Environmental Learning Center (Twp 57N, Range 7W, Sect. 34), young disturbed maple forest (Acer saccharum), digging an mustard extraction, June 2000, C. Johnson-Grow.
02 Finland, Wolf Ridge Environmental Learning Center (Twp 57N, Range 7W, Sect. 27), mature aspen stand (Populus tremuloides), digging and mustard extraction, June 2000, C. Johnson-Grow.
03 Finland, Wolf Ridge Environmental Learning Center (Twp 57N, Range 7W, Sect. 27), mature spruce/fir stand (Picea glauca, Abies balsamea), digging and mustard extraction, June 2000, C. Johnson-Grow.

04 Tettegouche State Park, west side of Mic Mac Lake, mature old growth hardwood forest, digging and mustard extraction, June 2000 & 2001, C. Johnson-Grow.

05 Tettegouche State Park, south side of Mic Mac Lake (Twp 56N, Range 7W, Sect. 8), old-growth northern hardwood forest, mustard extraction, June, July, August 2001, C.M. Hale.

Lake of the Woods Co. [LW]


Le Sueur Co. - no records
Lincoln Co. - no records
Lyon Co. - no records
McLeod Co. - no records

Mahnomen Co. [MH]

01 Hwy 200, east of Mahnomen at Wild River, under logs on river bank, 15 June 99, F. Bartley

Marshall Co. [MA]

01 Hwy 59, Newfolden at Middle River, digging in ditch and under logs, 4 Oct 94, J.W.R. & P. N. Mayville.

02 Hwy 75, Stephen, Tamarac River, under logs and digging, 4 Apr 98, J.W.R.

Martin Co. - no records
Meeker Co. - no records
Mille Lacs Co. - no records
Morrison Co. - no records

Mower Co. [MW]

01 I-90W, rest area mm 204 south of High Forest, 16 June 00, G. van Speybroeck.

Nobles Co. [NO]

01 I-90E, rest area mm 35 near Adrian, under rocks and logs, 16 June 00, G van Speybroeck.

Norman Co. [NR]

01 Hwy 9 south of Ada at Rice River, under logs and rocks, 15 June 99, F. Bartley.

Olmstead Co. [OL]

01 Lawler Farm, soil cores on corn-soybean-corn crops, 18 Apr 87, D.J. Fuchs & D.R. Linden.

02 I-90W, mm 222, rest area near Eyota, under debris, 12 June 00, G. van Speybroeck.

Otter Tail Co. [OT]

01 I-94E, mm 60, north of exit 61, rest area near Fergus Falls, under rocks, logs and debris, 29 Apr 98, J.W.R.

Pennington Co. [PN]

01 Hwy 59, Thief River Falls at Red Lake River, digging in ditch and stream bank, under logs, 4 Oct 94, J.W.R. & P. N. Mayville.

Pine Co. [PI]

01 I-35, rest area north of exit 195, near Askov, under logs and rocks, 10 Jun 98, J.W.R.

Pipestone Co. - no records

Polk Co. [PO]

01 Crookston, spring wheat, 10 Jun 87, D.J. Fuchs & D.R. Linden.

02 Hwy 59, at Poplar River, digging in ditch and under logs, 4 Oct 94, J.W.R. & P. N. Mayville.

Pope Co. [PP]

01 Westport, 7A, corn-corn-oats, 23 Apr 87, D.J. Fuchs & D.R. Linden.

02 Westport, 7B, established grasses, 23 Apr 87, D.J. Fuchs & D.R. Linden.
**Earthworms of Minnesota**

**Ramsey Co. [RA]**


02 St. Paul, 15 Sep 59, H.L. Osborne. (USNM 125921)

03 Roseville, near St. Paul, 21 May 68, E.V. Komerek Sr. (USNM 382788)

04 St. Paul, parking lot of Paul Bunyan Motel, 22 May 68, E.V. Komarek Sr. (USNM 382788)

**Red Lake Co. [RL]**

01 Hwy 59, 2 km n of Plummer at Clearwater River, digging in ditch and under logs, 4 Oct 94, J.W.R. & P. N. Mayville.

**Redwood Co. [RW]**

01 Lamberton Swaes, sites 4A, B, soybeans, corn, 9 Apr 87, D.J. Fuchs & D.R. Linden.

02 Lamberton Swaes, sites 4C, established grasses, 9 Apr 87, D.J. Fuchs & D.R. Linden.

**Renville Co. - no records**

**Rice Co. [RI]**

01 I-35N, rest area mm 68 near Dakota Co. line, under rocks and logs, stream bank, 15 May 00, B. Cox.

02 County Rd 40, 1.5 km west of Nerstrand, Nerstrand State Park, (Twp 110N, Range 19W, Sect. 9), mature maple-basswood forest, mustard extraction, 27 Oct 00, Amanda Ista.

03 Nerstrand State Park, similar to above only (Twp 110N, Range 19W, Sect. 16).

04 Norway Valley, similar to above only (Twp 111N, Range 20W, Sect. 35).

05 Health Creek, similar to above only (Twp 111N, Range 20W, Sect. 35).

06 similar to above mature maple-basswood forest, west side Cannon River Wilderness Area (Twp 110N, Range 20W, Sect. 16).

07 similar to above mature maple-basswood forest, east side Cannon River Wilderness Area (Twp 110N, Range 20W, Sect. 16).

**Rock Co. [RC]**

01 I-90E, Welcome Center, under barrel, 16 June 00, G. van Speybroeck.

**Roseau Co. [RO]**

01 Baudette, birdsfoot trefoil, 18 Jun 87, D.J. Fuchs & D.R. Linden.

**Saint Louis Co. [SL]**

01 Duluth Experimental Station, 10, established grasses, 8 July 87, D.J. Fuchs & D.R. Linden.

02 Hwy 53, Virginia, parking lot under concrete, 8 May 99, J.W.R.

**Scott Co. [SC]**

01 I-35S, south of exit 76, rest area near Elko, under rocks, logs and debris, 4 Apr 98, J.W.R.

**Sherburne Co. - no records**

**Sibley Co. - no records**

**Stearns Co. [ST]**

01 Kimball, corn-corn-soybean crops, 15 Apr 87, D.J. Fuchs & D.R. Linden.

**Steele Co. [SE]**

01 I-35N, rest area mm 33 near Steele Corner, under rocks and logs, 15 May 00, B. Cox

**Stevens Co. [SV]**

01 Morris NC Experimental Station, 6A, corn, 30 June 87, D.R. Fuchs & D.R. Linden.

02 Morris NC Experimental Station, G alfalfa, 30 June 87, D.J. Fuchs & D.R. Linden.

03 Morris NC Experimental Station, B, C, D, F, G corn, 30 June 87, D.J. Fuchs & D.R. Linden.
MEGADRILOGICA

04 Morris NC Experimental Station, E small grains, 30 June 87, D.J. Fuchs & D.R. Linden.

Swift Co. - no records
Todd Co. - no records

Traverse Co. [TR]
01 Hwy 9, south of Tintah, in ditch, under debris, 10 Sep 00, L. Carrigan.

Wabasha Co. [WB]
01 Kottshack Farm, sites 3A, B, C, corn-soybean-corn crops, 17 Apr 87, D.J. Fuchs & D.R. Linden.
02 Kottshack Farm, sites 3D, A, B, C, corn-soybeans-soybeans, 17 Apr 87, D.J. Fuchs & D.R. Linden.
03 Kottshack Farm, sites 3E, F, corn-soybean-corn crops, 17 Apr 87, D.J. Fuchs & D.R. Linden.

Wadena Co. - no records
Waseca Co. - no records

Washington Co. [WA]
01 I-94W, Welcome Center, just west of Wisconsin state line, under logs and rocks, 10 June 98, J.W.R.

Watonwan Co. - no records

Wilkin Co. [WL]
01 Hwy 9, north of Doran at Otter Tail River, river bank, under debris, 10 Sep 00, L Carrigan.

Winona Co. [WI]
01 I-90E, mm 243, rest area, under debris and log and stream bank, 16 June 00, G. van Speybroeck.

Wright Co. [WR]
01 I-94, south of exit 183, rest area near Enfield, 30 Apr 98, J.W.R.

Yellow Medicine Co. - no records

RESULTS

The format for reporting the collection data for Minnesota is the same as was used for Tennessee and the other southeastern states (Reynolds et al., 1974, Reynolds, 1994a-e). The site codes, e.g. AN-01, refer to the county, using the letters followed by the collection number for that county. The polynomial which follows refers to the number of juveniles-aclitellate adults-clitellate adults-postclitellate adults (if a fourth is used).

ACANTHODRILIDAE

*Diplocardia riparia* Smith, 1895

HN-01, 0-0-4;

No. of collections: 1; No. of specimens: 0-0-4.

LUMBRICIDAE

*Allolobophora chlorotica* (Savigny, 1826)

CA-01, 0-1-0; RI-01, 0-0-1; WI-01, 0-0-1.

No. of collections: 3;

No. of specimens: 0-1-2.
Aporrectodea rosea  
(Savigny, 1826)

BK-01, 0-0-2; CS-01, 259-7-208; CL-01, 0-0-5; FA-01, 0-0-1; GR-01, 0-1-4; HN-03, 0-0-13; HO-01, 0-1-1; JA-01, 0-0-1; KT-01, 0-0-2; LK-02, 57-0-2; LW-01, 0-0-4; MN-01, 1-0-2; NR-01, 1-0-1; PI-01, 0-0-1; PP-01, 0-0-1; RA-01, 0-0-1; RL-01, 0-0-1; SL-01, 10-0-3; WL-01, 1-0-1.

No. of collections: 19;  

Aporrectodea trapezoides  
(Dugès, 1828)

CS-04, 0-0-1; FA-01, 0-0-1; PP-01, 4-0-1; PP-02, 1-0-2; RW-01, 60-0-36; RI-02, 7-0-3; RI-03, 0-0-7; RI-04, 0-0-3; RI-05, 0-0-2; RI-07, 4-0-3; SL-01, 314-0-34; SV-04, 2-0-2.

No. of collections: 12;  
No. of specimens: 392-0-95.

Aporrectodea tuberculata  
(Eisen, 1874)

AN-01, 7-10-7; AN-02, 0-0-2; BK-01, 0-0-1; BL-01, 1-0-1; CA-01, 8-1-1; CA-02, 10-0-3; CS-01 892-20-10; CS-02, 667-0-30; CS-03, 18-3-53; CS-04, 0-0-167; CH-01, 0-0-1; CY-01, 0-0-2; CL-01, 210-44-145-2; DK-01, 0-0-1; DG-01, 0-0-1; DO-01, 105-0-14; FA-01, 0-0-1; FL-01, 0-0-1; FR-01, 0-0-1; GR-01, 2-2-2; HN-02, 0-0-1; HN-03, 182-0-5; IT-01, 0-2-1; JA-01, 0-0-1; KT-01, 1-0-1; KO-01, 1-0-1; LK-01, 75-0-3; LK-03, 7-0-2; LW-01, 1-0-2; MA-01, 0-0-1; MA-02, 0-0-1; MW-01, 0-0-1; NO-01, 0-0-2; NR-01, 2-2-2; OL-01, 200-0-24; OL-02, 0-0-1; OT-01, 0-0-2; PN-01, 1-0-2; PI-01, 0-0-1; PO-01, 5-0-9; PO-02, 1-0-2; PP-01, 12-0-1; PP-02, 150-0-40; RA-02, 0-0-1; RA-03, 0-0-56; RA-04, 1-3-10; RL-01, 1-0-1; RW-01, 34-0-58; RW-02, 200-0-50; RI-01, 0-0-1; RI-03, 9-0-5; RI-04, 19-0-1; RI-05, 12-0-2; RI-06, 1-0-1; RC-01, 0-0-1; RO-01, 51-0-10; SL-01, 314-0-34; SL-02, 0-0-2; SC-01, 0-0-3; ST-01, 302-0-34; SE-01, 0-0-1; SV-01, 16-0-16; SV-02, 781-0-46; SV-03, 930-0-101; SV-04, 12-0-12; WB-01, 589-0-85; WB-02, 245-0-41; WB-03, 340-0-23; WA-01, 0-0-1; WI-01, 0-0-2; WR-01, 0-0-3.

No. of collections: 72;  
No. of specimens: 6,418-87-1,153-2.

Aporrectodea turgida  
(Eisen, 1873)

CS-01, 0-0-1; CS-02, 0-0-37; CS-03, 22-0-2; CL-01, 6-4-7; HN-01, 0-0-50; HO-01, 0-0-2; PP-02, 4-0-1; SV-01, 16-0-16; TR-01, 1-1-1.

No. of collections: 9;  
No. of specimens: 49-5-117.

Bimastos parvus  
(Eisen, 1874)

HN-01, 0-0-12.

No. of collections: 1;  
No. of specimens: 0-0-12.
Dendrobaena octaedra (Savigny, 1826)

AN-01, 0-0-1; BL-01, 0-0-3; CA-01, 217-11-7; CA-02, 10-0-5; CS-01, 1580-0-230; CS-02, 733-0-118; CS-03, 1263-0-304; CS-04, 829-0-63; CH-01, 0-2-1; CY-01, 0-0-1; CL-01, 0-0-10; DK-01, 0-2-1; FR-01, 0-0-1; GR-01, 0-0-1; HN-01, 0-0-1; HN-02, 0-1-3; KO-02, 1-1-1; LK-03, 1-0-1; LK-04, 1680-0-720; LW-01, 0-0-1; MN-01, 1-0-1; NO-01, 0-0-1; NR-01, 1-0-1; OT-01, 0-1-1; PI-01, 0-1-2; RI-02, 0-0-1; RI-05, 0-0-4; SL-02, 0-0-1; SC-01, 0-0-1; WA-01, 0-0-2; WI-01, 0-0-1; WL-01, 2-0-1; WR-01, 0-0-1.

No. of collections: 33;
No. of specimens: 6,318-19-1,491.

Dendrodrilus rubidus (Savigny, 1826)

BK-01, 0-1-2; BL-01, 0-0-2; CA-01, 7-0-3; CS-02, 4-0-4; CS-03, 22-0-12; CH-01, 0-1-3; CY-01, 0-0-1; CL-01, 0-0-1; DG-01, 0-1-1; FL-01, 0-1-2; FR-01, 0-0-2; HN-02, 0-0-2; HO-01, 0-0-1; IT-01, 0-0-1; KT-01, 0-0-1; KO-02, 0-0-1; LW-01, 0-0-3; MH-01, 0-0-3; MA-01, 0-0-2; MA-02, 0-0-1; NO-01, 0-0-1; NR-01, 0-0-2; OT-01, 0-0-1; PN-01, 0-0-2; PI-01, 0-0-2; PO-02, 0-0-4; RL-01, 0-0-2; SC-01, 0-0-1; TR-01, 1-1-1; WA-01, 0-0-1; WR-01, 0-0-1.

No. of collections: 31; No. of specimens: 34-5-66.

Eisenia fetida (Savigny, 1826)

RA-01, 0-0-1; SL-01, 1-0-1; WB-02, 1-0-1.

No. of collections: 3;
No. of specimens: 1-0-3.

Eiseniella tetraedra (Savigny, 1826)

BE-01, 0-2-1; LW-01, 0-0-1; PN-02, 0-0-2; RL-01, 0-0-1.

No. of collections: 4;
No. of specimens: 0-2-5.

Lumbricus rubellus
Hoffmeister, 1843

AN-02, 0-0-1; BK-01, 0-0-1; BL-01, 1-1-1; CA-01, 105-4-28; CA-02, 40-0-20; CA-03, 86-0-295; CS-02, 129-0-284; CS-04, 86-0-3; CH-01, 2-1-2; CY-01, 0-0-1; CL-01, 3-3-6; DK-01, 0-0-1; FA-01, 0-0-1; FL-01, 1-1-2; FR-01, 0-0-1; GR-01, 0-0-2; HO-01, 0-0-1; HN-02, 0-2-1; IT-01, 0-1-2; JA-01, 0-0-1; KT-01, 1-1-1; KO-01, 1-1-1; LK-01, 38-0-10; LK-02, 56-0-4; LK-03, 10-0-0; LK-04, 3-0-2; LW-01, 1-1-1; MA-01, 1-1-1; NO-01, 0-0-1; OT-01, 0-0-1; PN-01, 1-0-1; PI-01, 0-0-1; PO-02, 1-1-3; RL-01, 1-1-1; RI-01, 0-0-1; RI-02, 2-0-31; RI-03, 0-0-2; RI-04, 4-0-48; RI-05, 18-0-25; RI-07, 21-0-10; SL-02, 0-0-1; SC-01, 0-0-1; SE-01, 0-0-2; TR-01, 1-3-1; WA-01, 0-0-1; WI-01, 0-0-1; WL-01, 0-0-2; WR-01, 0-0-1.

No. of collections: 49;
No. of specimens: 613-21-810.
**Lumbricus terrestris** Linnaeus, 1758

AN-01, 0-0-1; BL-01, 0-0-1; CS-01, 20-0-29; CS-02, 37-0-38; CS-04, 10-0-30; CH-01, 0-0-1; CY-01, 0-0-1; CL-01, 0-0-3; DG-01, 0-0-1; HN-01, 0-0-1; HN-02, 0-0-1; HN-03, 31-0-10; JA-01, 0-0-1; LW-01, 0-0-1; OL-01, 0-0-1; OT-01, 0-0-1; PI-01, 0-0-1; RA-01, 0-0-1; RI-01, 0-0-1; RI-02, 0-0-3; RI-04, 0-0-9; RI-07, 0-0-5; RC-01, 0-0-1; SL-01, 1-0-1; SL-02, 0-0-1; SC-01, 0-0-1; WB-01, 3-0-5; WA-01, 0-0-1; WI-01, 0-0-1; WR-01, 0-0-1.

No. of collections: 31; No. of specimens: 102-0-154.

**Octolasion tyrtaeum** (Savigny, 1826)

CA-01,2-0-4; CS-01, 22-0-15; CS-02, 798-0-316; CS-04, 0-0-1; CH-01, 0-2-4; CL-01, 0-0-2; HN-01, 0-0-2; HN-03, 15-0-23; IT-01, 0-0-1; PI-01, 0-0-1; RA-04, 0-0-1; RI-02, 4-0-15; RI-03, 8-0-18; RI-04, 15-0-13; RI-05, 16-0-15; RI-06, 5-0-8; RI-07, 2-0-4.

No. of collections: 17; No. of specimens: 887-2-443.

**MEGASCOLECIDAE**

*Amynthas loveridgei* (Gates, 1968)

CL-01, 0-0-5;

No. of collections: 1; No. of specimens: 0-0-5.

**DISCUSSION**

Modern keys and discussion of the taxonomic characters required to use these keys have been reported elsewhere: Acanthodrilidae (Gates, 1977), Lumbricidae (Reynolds *et al.*, 1974; Reynolds, 1977) and Megascolecidae (Gates, 1972b).

The state of Minnesota is completely above the southern limit of glaciation in the United States (N 43°30' - 49°23'; W 89°30' - 96°30') except for a small section of southeastern portion of the state. Minnesota is divided into three general physiographic regions (Fig. 2): 1] the Northern Lake States Forest and Forage Sub-division, 2] the Central Feed Grains and Livestock Subdivision and 3] North Great Plains Spring Wheat Subdivision (Merz, 1978). These physiographic regions, with their associated topography, soils, vegetation and climate, do not appear to have a significant influence on the distribution of the recorded earthworm species within the state. This is in contrast to earthworm surveys of the southeastern United States wherein the Coastal Plain, Piedmont, Ridge and Valley Province, etc. did have an effect on the earthworm distribution within those states (see Reynolds 1994b-f, 2001a). The number and diversity of earthworm species present in the southeastern states (25-51) was considerably greater than those present in Minnesota (15).

**Northern Lakes States Forest and Forage Subdivision**

This area was heavily glaciated so that gravel hills and sandy plains remain with many swamps lakes, and streams. Elevations range from 183 m on the shores of Lake Superior to 610 m in the north-eastern part of the state.

The greatest diversity of soils are found in this subdivision of the state: Eutroboralfs, Haplorthods, and Histosols in the north: Eutroboralfs, Udipsamments, Hapludalfs and Histosols in the centre of the subdivision with Borolls, Hapludalfs and Udipsamments in the southern portion.

The forest types are aspen-birch (*Populus tremuloides*-Betula papyrifera), spruce-fir (*Picea mariana, P. glauca*-Abies balsamea) and White-redjack pine (*Pinus strobus*-P. resinosa-P. banksiana). There are some Maple-beech-birch (*Acer saccharum, A. rubrum*-Fagula grandiflora-Betula papyrifera) in the...
This region has a short growing season with between 610-813 mm mean annual precipitation. The frost free period is approximately 120 days.

**Central Feed Grains and Livestock Subdivision**

Most of this area was also glaciated, but not as extensively as the previous subdivision.

The soils in this subdivision are predominantly Udalfs (Hapludalfs), Borolls (Agriborolls) and Udolls.

The forest types are restricted to bottomlands as the majority of the area is agricultural land: Elm-ash-cottowood (*Ulmus americana-Fraxinus americana-Populus deltoides*) and maple-beech-birch.

Growing season is longer than in the other subdivisions with 120-150 frost-free days and a mean annual precipitation between 610-813 mm.

**Northern Great Plains Spring Wheat Subdivision**

This smallest subdivision in Minnesota was also less glaciated that the Northern Lakes States Forest and Forage Subdivision.

The soils are primarily Aquolls (frequently Caliaquolls) with a limited area of Borolls (primarily Agriborolls) along the southeastern edge.

The area is primarily agricultural with a couple of thin east/west belts of elm-ash-beech.

The mean annual precipitation is between 508-609 mm with about 120 frost-free days.

Although 59 per cent of the counties were sampled in this survey, many counties were represented by only one or two small collections. Based on current earthworm surveys of other states and provinces in glaciated North America, 12-15 species for such a state or province is to be expected when you exclude the rare accidental introductions (see Reynolds, 1976, 1977, 1978, 2000a, 2000b; Reynolds and Clapperton, 1996; Reynolds and Khan, 1999; Reynolds and Mayville, 1994; Reynolds and Reynolds, 1992; Utter et al., 1995). An interesting example is that of the state of Indiana (Reynolds, 1994a), where the southern limit of glaciation cuts across the state so that the southern third of Indiana is unglaciated. This produced a species list similar to those states of the unglaciated southeastern United States and correspondingly higher numbers, e.g. 37 species of terrestrial oligochaetes were reported for Indiana.

The small southeastern portion of Minnesota did not received extensive sampling in this survey. As a result there were no expected species recovered from this unglaciated area. Several species were collected in only one or two isolated locations so that no pattern can be determined regarding their distribution within the state, i.e. *Diplocardia riparia*, *Allolobophora chlorotica*, *Bimastos parvus*, *Eisenia foetida*, *Eiseniella tetraedra*, and *Amynthas loveridgei*. Three of these species are probably accidental introductions, not because they were found in single isolated cases, but they are normally restricted to unglaciated southern areas, e.g. *Diplocardia riparia*, *Bimastos parvus*, and *Amynthas loveridgei*.

*Eisenia foetida* has in recent years been distributed widely throughout North America under various names as the species for vermi-composting.
Despite this wide distribution, it has remained essentially in culture and not widely distributed in natural habitats. If we were to sample more often in urban gardens and composting areas, *E. foetida* would become more dominant in our collections.

*Aporrectodea trapezoides* is reaching its northern range in Minnesota. The distribution of the *Aporrectodea* species group is well illustrated in Reynolds (1995) where it is evident that this species is dominant in the southern United States. Conversely, it is not a surprise to find *Aporrectodea tuberculata* to be the dominant species of this group and of all species within this state. This is equally true for all areas of glaciated North America, except Quebec (Reynolds, 1976). The French influence and connections in that province have shifted the dominant *Aporrectodea* species from *tuberculata* to *turbida*, and also the surprising presence of *Lumbricus festivus*, in contrast to *L. rubellus*, which is the dominant species of this genus in most areas of that province (Reynolds, 1976; Reynolds and Reynolds, 1992).

*Lumbricus rubellus* is the dominant species of the genus in Minnesota and its absence in the southeastern and south central portions of the state is most likely due to the lack of collection sites rather than the absence of the species. *L. terrestris* is generally present in glaciated states and provinces, but not in as great numbers or frequency as *L. rubellus* (or *L. festivus* in Quebec) unless closely associated with human activity.

Octolasion tyrtaeum is a woodland species and would be expected to be present in the forested portions of Minnesota. Additional collecting in suitable habitats of the Northern Great Lakes Forest and Forage Subdivision and portions of the Central Feed Grains and Livestock Subdivision should increase the distributional pattern of this species within the state.

Thirteen species of Lumbricidae were found within the state of Minnesota. Utter et al. (1995) found ten of these in neighbouring North Dakota and no members of other families. They did not find *Allolobophora chlorotica, Bimastos parvus or Eisenia foetida*. Reynolds (1977) found all of the Minnesota lumbricids in his list of 18 reported from the neighbouring province of Ontario. In a recent limited earthworm survey of the neighbouring province of Manitoba, Reynolds (2000b) reported eight lumbricid species, all of which are included in the Minnesota list. The neighbouring states of South Dakota, Iowa and Wisconsin have not been surveyed extensively for earthworms, or had significant data published in the literature (see Gates, 1979).

This is a significant earthworm survey, as earthworms surveys go, but it is far from producing a complete picture of the presence and distributional pattern of the earthworm species present within the state. Currently graduate students are working on earthworm projects in Minnesota. Hopefully, this survey will give them the necessary information to help us fill in many of the areas where data are lacking.

**ACKNOWLEDGEMENTS**

The senior author wishes to thank his colleagues at Schneider National Carriers for assisting him to obtain additional samples from Minnesota. Appreciation is also extended to Dr. Marion Pettibone, Linda Ward and others at the Smithsonian who have given us access to material at their institution for examination over the years. We acknowledge former colleagues at Tall Timbers Research Station, Tallahassee, for sharing their specimens and records, which provided us with a more complete survey for Minnesota. Our gratitude extends to W.M. Reynolds of the Oligochaetology Laboratory for reviewing the manuscript, her comments and suggestions.

**LITERATURE CITED**


Reynolds, J.W. 2001b. The earthworms of New


