Exotic Earthworms in Alaska: an Insidious Threat

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As with much of northern North America, most of Alaska is naturally devoid of earthworms due to extensive glaciations over the last 100,000 years. All of the earthworms commonly encountered in Alaska are recent introductions from Europe. A checklist of the 16 earthworm species known from Alaska (1 native, 13 established exotics, and 2 exotics collected from artificial situations) and distribution records are provided.

Introduced earthworms have the potential to dramatically alter natural systems by rapidly consuming the upper organic soil layers. In the Upper Midwest, European earthworms have removed litter and duff from the forest floor at rates of up to 10 cm/yr, causing direct harm to native biota dependent on a thick organic layer. Declines of native plants, ovenbirds, red-backed voles, shrews, and salamanders have been attributed to the activities of earthworms. A more insidious threat is the prospect of invasional meltdown, where exotic species interact positively. In this case, earthworms alter soil properties in a way that is likely to favor exotic plants.

Little can be done to control earthworms once they have become established. However, earthworms have limited dispersal ability; almost all long-range dispersal of earthworms is human-caused.

Recommendations

- The public should be educated about earthworms as potentially harmful exotic species.
- Infested soil, compost, worm castings, and plantings should not be sold or transported.
- Fishing regulations should explicitly and clearly disallow the use of live earthworms as bait.
- Tires of forestry equipment, trucks, and ATV's should be cleaned to prevent the spread of eggs and cocoons trapped in soil between tire treads.

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Earthworms as Invasives

As with much of northern North America, most of Alaska is naturally devoid of earthworms due to extensive glaciations over the last 100,000 years. All of the earthworms commonly encountered in Alaska are recent introductions from Europe (but see *Arctiostrotus*, below).

Figure 1. An invasive Octagonal-Tail Worm (*Dendrobaena octaedra*) from the Kenai National Wildlife Refuge.

Consequences of Earthworm Invasion

Earthworms are generally perceived as beneficial because they improve properties of soil for the purposes of agriculture. However, the very fact that worms can alter soil means that when they successfully invade areas naturally devoid of earthworms, something is likely to change.

Exotic earthworms have the potential to dramatically alter natural systems by rapidly consuming the upper organic soil layers. European earthworms have already brought about drastic changes in formerly worm-free Minnesota hardwood forests. Historically, leaf litter in these forests decomposed slowly, leaving a thick layer of litter and duff on the forest floor. The introduced earthworms consumed organic material so quickly in some areas (up to 10 cm of duff consumed per year) that plants were left with their roots exposed above bare soil (Frelich et al., 2006). Declines of ovenbirds, red-backed voles, shrews, salamanders, and forset floor herbaceous plants have been attributed to loss of forest floor thickness due to earthworm invasion (Migge-Kleian et al., 2006; Frelich et al., 2006).

Perhaps the worst consequence of earthworm invasion is "invasional meltdown," where exotic species interact positively. In this case, earthworms may encourage the growth of invasive plants. Having come from Europe where soils are thoroughly mixed by the indigenous earthworm fauna, most of our exotic weeds are well-adapted to soils that have been modified by earthworms. By favoring exotic weeds, the activities of earthworms may make Alaska's native habitats more susceptible to successful invasion by additional exotic species.

Dispersal

Most long-range dispersal of exotic earthworms is due to the activities of man. Earthworms have extremely slow natural dispersal rates of 5–10 m/yr (but see Costello et al., 2010). They are spread by transolcation of worm-infested soil and compost; by the release of earthworms used for fishing bait (bait abandomnent); and by movement of trucks, ATV's, and forestry equipment, which can carry eggs and cocoons in soil trapped in tire treads.

Figure 2. Minnesota Maple forest, upper soil horizons, and understory plants before and after invasion by earthworms[1].

Recommendations

Little can be done to control earthworms once they become established. However, it is possible to limit their spread to worm-free areas because most long-range transport is human-caused.

- The public should be educated about earthworms as potentially harmful exotic species.
- Infested soil, compost, worm castings, and plantings should not be sold or transported.
- Fishing regulations should explicitly and clearly disallow the use of live earthworms as bait.
- Tires of forestry equipment, trucks, and ATV's should be cleaned to prevent the spread of eggs and cocoons trapped in soil between tire treads.

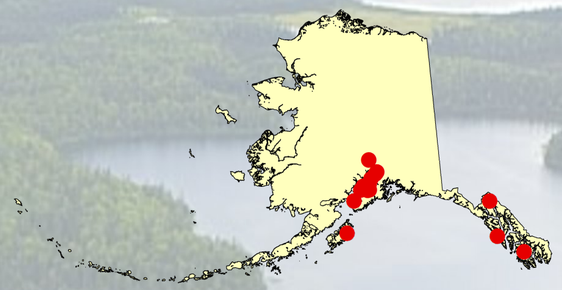

Figure 3. Map of exotic earthworm records from Alaska.

Checklist of Earthworms from Alaska

Nearctic and world distribution records below are from Reynolds (1977) and Reynolds and Wetzel (2008).

Family Lumbricidae

Allolobophora chlorotica (Savigny, 1826)
Green Worm
Distribution. Native to the Palaearctic, *A. chlorotica* is now widespread in the Nearctic. **Alaska Records:** Alaska (Reynolds, 1977; Reynolds and Wetzel, 2008).


Aporrectodea rosea[2]

Allolobophoridella eiseni (Levinsen, 1884)
Small-tailed worm
Distribution. Native to the Palearctic, *Ad. eiseni* was first reported in North America from Alaska, Oregon, Tennesse and Washington from only a few sites (Reynolds et al., 1974) and subsequently from one site in Missouri (Reynolds, 2008). **Alaska Records:** Alaska (Reynolds et al., 1974).

Aporrectodea rosea (Savigny, 1826)
Pink Soil Worm
Distribution. Native to the Palearctic, *Ap. rosea* is now widespread in the Nearctic. **Alaska Records:** Prince of Wales Island (Costello et al., 2010).


Aporrectodea tuburculata[2]

Aporrectodea tuburculata (Eisen, 1874)
Canadian Worm
Distribution. Native to the Palearctic, *Ap. tuburculata* is now widespread in the Nearctic. **Alaska Records:** Sitka (Gates, 1972), Alaska (Reynolds and Wetzel, 2008).

Aporrectodea turgida (Eisen, 1873)
Pasture Worm
Distribution. Native to the Palearctic, *Ap. turgida* is now widespread in the Nearctic. **Alaska Records:** Anchorage (Gates, 1972), Haines (Gates, 1972), Sitka (Gates, 1972), Prince of Wales Island (Costello et al., 2010, as *Aporrectodea caliginosa* (Savigny, 1826), Alaska (Reynolds and Wetzel, 2008).


Aporrectodea turgida[2]

Dendrobaena octaedra Savigny, 1826
Octagonal-Tail Worm
Distribution. Native to the Palearctic, *D. octaedra* is now widespread over much of North America, ranging from Alaska to Newfoundland and south into Mexico. **Alaska Records:** Kodiak (Gates, 1974), Anchorage (Gates, 1974), Palmer (Gates, 1974), Trapper Creek vicinity (Berman and Marusik, 1994), Kenai Peninsula (Gates, 1974), Haines (Gates, 1974), Prince of Wales Island (Costello et al., 2010), Alaska (Reynolds and Wetzel, 2008).


Dendrobaena octaedra[2]

Dendrodrilus rubidus (Savigny, 1826)
European Bark Worm
Distribution. Native to the Palearctic, *Dd. rubidus* is now broadly distributed over much of the world. In North America, it occurs from Alaska to Newfoundland and south into Mexico (Reynolds and Wetzel, 2008). **Alaska Records:** Trapper Creek vicinity (Berman and Marusik, 1994), Prince of Wales Island (Costello et al., 2010), Alaska (Reynolds and Wetzel, 2008).

Eisenia foetida (Savigny, 1826)
Red Wiggler
Distribution. Native to the Palearctic, *E. foetida* is now present in essentially all of North America in vermicomposting cultures, but seldom surviving in natural, outdoor situations (Reynolds and Wetzel, 2008). **Alaska Records:** Soldotna, from a worm farm (Kenai National Wildlife Refuge Collection).

Eiseniella tetraedra (Savigny, 1826)
Square-Tail Worm
Distribution. Native to the Palearctic, *El. tetraedra* has been distributed over much of North America and the world. **Alaska Records:** Prince of Wales Island (Costello et al., 2010), Alaska (Reynolds and Wetzel, 2008).

Lumbricus castaneus (Savigny, 1826)
Chestnut Worm
Distribution. Native to the Palearctic, *L. castaneus* is known from scattered localities over North America. **Alaska Records:** Alaska (Reynolds and Wetzel, 2008).


Lumbricus rubellus[2]

Lumbricus rubellus Hoffmeister, 1843
Red Marsh Worm
Distribution. Native to the Palearctic, *L. rubellus* is now widespread in the Nearctic. **Alaska Records:** Anchorage (Kenai National Wildlife Refuge Collection), Kenai Peninsula (Kenai National Wildlife Refuge Collection), Prince of Wales Island (Costello et al., 2010), Alaska (Reynolds and Wetzel, 2008).

Lumbricus terrestris Linnaeus, 1758
Nightcrawler
Distribution. Native to the Palearctic, *L. terrestris* has successfully invaded much of North America. **Alaska Records:** In Alaska, no feral populations have been documented, but this species is sold as bait in Soldotna (Kenai National Wildlife Refuge collection).

Octolasion cyaneum (Savigny, 1826)
Woodland Blue Worm
Distribution. Native to the Palearctic, *O. cyaneum* is now known from scattered localities across the Nearctic. **Alaska Records:** Prince of Wales Island (Costello et al., 2010).

Octolasion tyrtaeum (Savigny, 1826)
Woodland White Worm
Distribution. Native to the Palearctic, *O. tyrtaeum* is now distributed over much of the world. **Alaska Records:** Prince of Wales Island
(Costello et al., 2010), Alaska (Reynolds, 1977).


Lumbricus terrestris[2]


Octolasion tyrtaeum[2]

Family Megascolecidae

Arctiostrotus sp.
Distribution. *Arctiostrotus* spp. are endemic to northwestern North America (Fender, 1995). It is not known whether the *Arctiostrotus* from Prince of Wales Island is native to the island or introduced from farther south (Costello et al., 2010). **Alaska Records:** Prince of Wales Island (Costello et al., 2010).

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See Also

Great Lakes Worm Watch
http://www.nrri.umn.edu/worms/default.htm

Canada Worm Watch
http://www.naturewatch.ca/english/wormwatch/

Alberta Worm Invasion Project
http://worms.biology.ualberta.ca/

Image Credits

[1] Images courtesy Great Lakes Worm Watch.
[2] Images courtesy Nature Canada.