Below the radar: foreign earthworms infiltrate Alaskan forests

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Outline

- Diversity and distribution in Alaska
- Dispersal
- Ramifications of earthworm infestations
  - Direct effects
  - Effects on other species
- Highlighted species
- Earthworms on the Kenai National Wildlife Refuge
- Recommendations
Earthworm distribution in Alaska

Alaskan earthworm specimen and literature records as of October 2010
Alaska earthworm diversity

Family Lumbricidae
- Allolobophora chlorotica (Savigny, 1826)
- Allolobophoridella eiseni (Levinsen, 1884)
- Aporrectodea rosea (Savigny, 1826)
- Aporrectodea trapezoides (Dugès, 1828)
- Aporrectodea tuburculata (Eisen, 1874)
- Aporrectodea turgida (Eisen, 1873)
- Dendrobaena attemsi (Michaelsen, 1902)
- Dendrobaena octaedra Savigny, 1826
- Dendrodrilus rubidus (Savigny, 1826)
- Eisenia foetida (Savigny, 1826)
- Eiseniella tetraedra (Savigny, 1826)
- Lumbricus castaneus (Savigny, 1826)
- Lumbricus rubellus Hoffmeister, 1843
- Lumbricus terrestris Linnaeus, 1758
- Octolasion cyaneum (Savigny, 1826)
- Octolasion tyrtaeum (Savigny, 1826)

Family Megascolecidae
- Arctiostrotus sp.

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| Native (?) | 1 |
| Feral exotic | 15 |
| Synanthropic exotic | 1 |
| **Total** | **16** |
Earthworm Dispersal

- Slow natural rates of dispersal (5-10 m/yr)
- Almost all long-range dispersal is human-caused:
  - Eggs and cocoons can be spread in tire treads
  - Transport of soil (e.g., potted plants)
  - Transport of wood and other material stored on the ground
  - Bait abandonment
Ramifications of earthworm infestations: direct effects

- Can completely remove litter and duff layers
  (up to 10 cm/yr!)
  - Reduction or loss of organic layers
  - Formation of well-developed A horizon
- ↑ aeration
- ↑ water infiltration
- Generally accelerates nutrient cycling
Ramifications of earthworm infestations: indirect effects

- ↓ species dependent on a thick organic layer, mycorrhizal symbionts

- ↑ species adapted to soils worked by earthworms (Old World exotics?); non-mycorrhizal species

Invasional meltdown

— where exotic species interact positively. In this case, earthworms alter soil properties in a way that is likely to favor exotic plants.
Before

After
Octagonal-Tail Worm
*Dendrobaena octaedra*

- Probably the most widespread earthworm in Alaska; often spread by vehicles
- Parthenogenic
- Extremely cold-hardy and tolerant of acidic soils
- Small worms
- Restricted to organic soil layers, causing comparatively limited changes to soil
Nightcrawler
*Lumbricus terrestris*

- Commonly sold as live bait; spread by bait abandonment, gardening
- Apparently limited distribution in Alaska at present
- Very large worms
- Deep burrowers, bringing C from leaf litter into mineral soil
Red Marsh Worm
*Lumbricus rubellus*

- Apparently limited distribution in Alaska at present; spread by gardening and bait abandonment
- Large worms
- Quickly consume organic material, incorporating it into mineral soil
Earthworm distribution on the Kenai National Wildlife Refuge

- 70 sites sampled over Kenai NWR
  - Roads
  - Boat launches
  - Remote sites
• Earthworms found at 70% of sites.
• Octagonal-Tail Worm at 50% of sites.
• Nightcrawlers present only in small areas at three nearby boat launches.
• 90% of road sites were infested.
• 50% of remote sites were worm free.
• Distance from roads was the best predictor of earthworm presence.
Recommendations

- Fishing regulations should explicitly and clearly disallow the use of live earthworms as bait.
- Infested soil, compost, worm castings, and plantings should not be transported to worm-free areas.
- 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.
Before and after photos courtesy Great Lakes Worm Watch (http://www.nrri.umn.edu/worms/default.htm).


Earthworm paintings courtesy Nature Canada (http://www.naturewatch.ca/english/wormwatch/).

How to help animation from Alberta Worm Invasion Project (http://worms.biology.ualberta.ca).