modified from John Mertus **Act 80 -Earthworm Natural History** **Name _____**

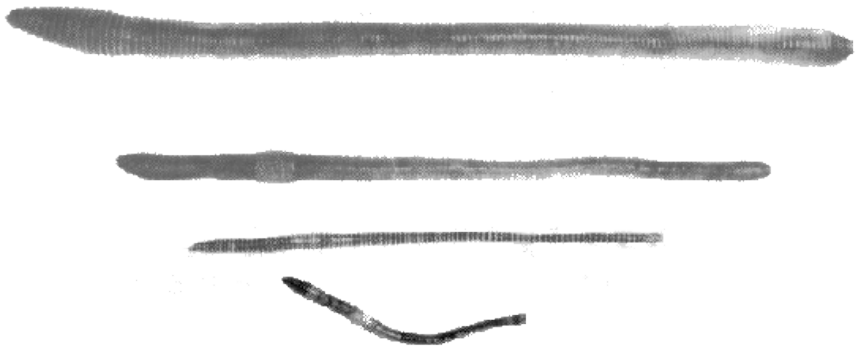
http://www.infoplease.com/t/sci/earthworms/ **Per _____**

I've been following with interest the thread on using worms to eat the garbage. Since there seems to be growing interest in earthworms, I am reposting a combination of three posts from one to two years ago. I live in the Northeast so most of this is about earthworms of this area; the South and Southwest are different.

As gardeners we have all come to love the earthworm and want our soil to hold as many as possible. I'm a firm believer that understanding the earthworm means we can understand how to help keep them. That's because earthworms are nature's clean-up crew, aiding in the production of lush, humus-rich topsoil from spent plant and animal materials. These elegantly efficient organisms have been on earth for hundreds of thousands of years longer than humankind, largely untouched by evolution due to their nearly perfect adaptation to their role in nature. Researchers have identified and named more than 4400 distinct species of earthworms, but only a half dozen or so are important to cultivation.

If you dig in typical northeast garden soil, you are likely to find three different types of worms. The canonical Night crawler, Lumbricus terresti, the common Field worm, Allolobophora caliginosa, and the Green worm, Allolobophora chlorotica,. The new world did not have any of these worms before the Europeans. The worms were inadvertently brought over in pots and spread throughout the Northern American soil. We often think that foreign fauna as bad, witness the Japanese beetle or Gypsy moth; but the earthworm is an import, that without, our soils and gardens would be so much more poorer.

The Night crawler, Lumbricus terrestis, is the largest and likes soils that are heavy in organic matter like lawns and meadows. When the soil becomes poorer, the common Field worm, Allolobophora caliginosa, and all its variants become more common. This is a smaller worm with a pronounced raised band, called the clitellum, about 1/4 of the way down its body. Both these worms are quite active and feed by bringing down organic debris in to their borrows from the surface, their holes aerate the soil and their execrate, called casts, improves the friability of the soil. The last common worm is called the Green worm, Allolobophora chlorotica, which is a stout greenish colored worm that is quite dormant and does little to improve the soil.



From top to bottom:
Night crawler,
Field Worm,
Red (manure) worm, and
Green worm.

The very active Red Wriggler, or manure worm, can be found in compost piles. You know you have a Red Wiggler when you pick it up: it thrashes about, wiggling and squirming. The true Red Wiggler, Eisenia foetida, has alternating bands of yellow and maroon down the length of its body. (A similar worm, Lumbricus rubellus, is a deep maroon color without the yellow bands.) These worms build no permanent burrows, preferring the loose topsoil layer rich in organic matter to the deeper mineral soil environment. Red Wrigglers need extremely high organic matter, such as manure or rich kitchen scraps to survive. Manure worms just cannot live in common garden or lawn soil. (Unless the soil is very very rich.) So if you shovel your Red Wigglers from your compost pile into the garden soil, you are dooming these guys to provide nitrogen for your plants with their bodies.

But the life of an earthworm in general is hard. Their bodies are about 70% protein; rich food for many predators. Their major enemies are insect eating birds, like robins, and mammals like moles. If you watch a

robin hunting, it pauses, cocks it head and then hops. The robins ears can actually hear the earthworm moving underground. But the earthworm, although sightless and ear-less can feel the vibrations of the bird on the surface. It's the deadly game of survival.

Another major earthworm predator is the mole. This voracious insect predator loves to dine on white grubs and any earthworm it can find. Grubs, attached to the root from which they gain their food, can't escape, but the earthworm can feel the vibrations of the mole digging and quickly try to flee. The moles own digging conceals the noise of the earthworm fleeing, so the star nose mole developed a unique method to find earthworms. It uses its funny looking nose to detect the faint electrical fields that earthworms (and some other insects) radiate. Not only does this mole detect and find an earthworm, but it knows how to bite it so it is paralyzed but does not die. The mole stores the living worm along the burrow as food for dining at leisure. Once again, nature ain't nice!

Tilling the soil does reduce the earthworm population. Not because it kills or disturbs them, but because tilling ariates the soil, and the oxgen in the air quickly reduces (decomposes) the organic matter that the earthworm uses as food. Mulching with green matter will help provide food to earthworms to replenish what is lost in tilling.

The population of earthworms, in the north, follows a different cycle then most garden fauna. The population of adults is highest in the spring, and decreases in the dry summer months, followed by a increase of young in the wetter, cooler fall. In the hot dry months of July and August, you often don't find many earthworms. For a high number of earthworms to be around in the spring, its important to protect the young and the eggs over winter.

Earthworms can freeze solid and still live if the freeze is slow and they do not thaw out and refreeze often. Cocoons are tougher. They can be frozen, submerged in water for extended periods of time, dried and exposed to temperatures far in excess of what can be tolerated by adult worms without damage to the young worms inside. Any form of ground cover, cover crops, leaves, mulch or even boards help mediate the freezing and allow more earthworms to survive the winter. Thus, fields that are plowed and left bare are almost devoid of earthworms in the spring. Luckily, earthworms have a high K (reproduction) factor. Practically, a worm's temperature range varies from a Min of 38° F to a Max of 88°F, with an ideal temperature range from 70°- 80°F.

Earthworms are hermaphrodites with both male and female organs. They mate by lying head to tail with each worm producing a temporary skin canal through which the sperm flows into each other to be stored in a sperm sack. The girdle like ring around the front of an earthworm, called the clitellum, later slides along the worm and picks up the mature eggs and sperm. It falls off the worm and the combination tube, egg, sperm and mucous form a well-protected nest, or cocoon, for the worm's eggs. Usually one to three worms hatch from each egg. The young look similar to the adults. Thus the worm's three stage life cycle consists of the egg, the juvenile, and the adult.

Earthworm cocoons are easy to spot in the worm bed. They are roughly the size of a large grape seed and similarly shaped, with one end rounded and the other drawn out to a point. When first dropped from the body of the parent the cocoon is a creamy, pearlescent yellow, darkening to a cola brown as the young worms within mature and prepare to emerge.

It's quite amazing to watch earthworms "do it", how they form almost into one body, incredibly long and slimy, and then break away each darting back into its own hole. (To chew on some tobacco leaves I suppose.)

In any event, Red Wrigglers (Eisenia foetida) reproduce at a rate of approximately 10 young per worm per week under ideal conditions. The average number of young per cocoon is about 3 and these young emerge from thier cocoon in 30-75 days under ideal conditions. Eisenia foetida become sexually mature in 85-150 days under ideal conditions.

One of the major myths, reported by many otherwise informed authors, is that earthworms come out of their burrows during a rain to avoid drowning. Worms have no lungs, they take their oxygen directly through their thin skin either from the air or from water. Oxygen dissolves into the mucous coating the worm's thin skin and passes through the skin into the walls of capillaries (ultrafine blood vessels) lacing the skin. There it is picked up by hemoglobin in the worm blood and carried throughout the body. In fact, the moisture range for most worm species is from 60-85%. So, the point is rather then fear water, worms love it. It's drying out worms fear. Dry soil kills them.

When it rains, worms come to the surface because it's easier to find a mate in the flat open ground then in the three dimensional burrows. The wet ground allows them to move without fear of drying out. To an earthworm, the wet ground is a wild singles bar.

Earthworms use lots of water since they produce 60% of their body weight in urine every day. Urea is very high in nitrogen and provides an excellent fertilizer. The worms in a field easily produce about 50 lbs. of nitrogen/acre. This is the same amount of nitrogen that a crop of hay takes out of an acre! The earthworm casts contain concentrated nitrate, phosphorous, exchangeable magnesium, potassium and calcium, all are essential to plant growth. The organic material bound to earthworms and other soil dwellers is about 1 ton/acre. The organic material is released gradually as they die in the dry summer, providing a great nutrient reservoir for our plants.

As a society, we are used to going out and purchasing what we need to solve our problems... need to chop vegetables quickly? Buy a food processor. Need to water the garden easily.... buy a drip system and an automatic timer. It is so tempting to do the same for insects: need to eliminate some grasshoppers? Buy some Praying Mantises? No worms in your soil, buy some earthworms. But gardening just doesn't work like that. You must provide proper conditions for the worms to flourish.

Earthworm populations are limited by the amount of organic matter, water, and survival over the winter. To grow a good earthworm crop, feed the soil. The ultimate factors limiting worm population are usually food and water! Night crawlers have been kept alive for 10 years but in the garden their life span is usually no more than one year, maybe two. It's necessary to insure the eggs and young survive the winters.

Organic gardening always comes back to feeding the soil. The rest takes care of itself. Earthworms need organic debris and mineral soil for food. The use of artificial fertilizers, chemical or organic, does not provide the necessary food for earthworms. Neither do dry leaves. Before leaves fall, the tree sucks out all the essential chemicals it can and leaves the leaf with almost no nitrogen in it. At least, not enough for the earthworm to eat and survive. Grass clipping, corn stalks, green leaves, and even maple whirlly birds seeds provide good sources.

So when you dig up a worm, realize it is all part of a wonderful cycle, its life improves the soil, its wastes add great fertilizer, and even in death, the worms body contributes its nitrogen at a time when nitrogen on Earth may be becoming scarce.

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Please answer these questions using Complete, Quality, and Correct sentences.

1. How many species of earthworms are there?

2. How many of these species are important to cultivation? _____

3. Tell both the common and scientific names of the three different types of earthworm that are found in the Northeast. _____

4. Challenge EC How do you know if you have a red wriggler, or manure worm, just by picking it up? ___

5. What is the scientific name for the true Red Wriggler? _____

6. What type of food do red worms need to survive? _____

7. What percent protein does the average earthworm contain? (By the way, corn fed cows average about 58% or higher) _____

8. How can robins detect earthworms? _____

9. How can earthworms detect robins, or other birds of prey? _____

10. Tell what underground dwelling mammal is a major earthworm predator AND explain how this predator stores worms for later consumption? (eating)_____

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11. Why does tilling (turning over) the soil reduce the earthworm population?_____

12. Tell if earthworms can freeze and still survive AND also describe their ideal temperature._____

13. How can you tell male earthworms apart from females? _____

14. Challenge EC How does a worm produce an egg case? _____

15. How do earthworms take in oxygen? _____

16. Why do earthworms come to the surface when it rains?_____

17. What is earthworm urine good for? _____

18. What valuable elements do earthworms release to the soil?_____

19. What three factors limit earthworm populations? _____

20. Challenge EC: Why are dry leaves not a good food for earthworms?_____