Invertebrates in Your Curriculum *March 2008*

Curriculum Context – 'Engage-Connect-Inquire'

Invertebrates ('inverts') are an excellent platform from which to explore local habitats such as vernal pools, playing fields, and the local woods. They are key in small streams, marshes, ponds, estuaries, and any other natural feature your schoolyard is fortunate to be near. Because they are the most numerous multicellular species on Earth, they play a role in every ecosystem and biome you might study as part of elementary science from first grade on up! The curricular outline below is merely a starting point for exploring the realm of invertebrates or incorporating them into your environmental or ecological studies.

Its easy to engage students in the study of inverts by introducing them to red worms, mealworms, butterflies, silkworms, or ant farms. Because most of your students have seen inverts all their lives at the beach in the summer or gardening or as a nuisance of some sort, the connection piece is easy. Most students have never thought about the pervasive influence of invertebrates in their lives until brainstorming with their teacher. You can quickly collect useful specimens and models to show and tell or have students bring them in to share. In any case, you'll have your audience hooked on this unlikely topic. Inquiry can unfold in a natural setting or in a small classroom based habitat. Inverts are easy to maintain, observe at close hand, and perform simple inquiries with.

Who are the invertebrates?

Introduce and brainstorm basic vocabulary – (*see vocabulary pages on the Invert home page for details)*

vertebra (backbone) – exoskeleton – symmetry(radial/bilateral) – animal – cell - multi cellular -

Brainstorm the different kinds of invertebrates while defining the basic structure

Use the 'pie chart of species' to show the predominance of inverts among the multicelled species *(see 'Piechart' page for details)*

What do they look like (structure)?

- exoskeleton or no skeleton at all
- can be colonial like coral or sponges or highly evolved like squid or octopi
- often show radial symmetry like sand dollar or starfish or bilateral symmetry like insects
- can be a few cells or as big as a reef

Hands on activities: 'Model' sort and compare; observe live red worms from a vermiculture bin

Where are they found (habitat)?

- inverts are found in all habitats on Earth, including Antarctic seas and the top of Mt. Everest

How do they move (locomotion)?

- insects can fly
- squid use water jets
- worms use hydrostatic movement of their bodies (moving fluids around internally)
- many insects walk on segmented limbs

- jellyfish maintain neutral buoyancy and can move a bit by taking in and pushing out waer
- small colonials may use cilia or flagella
- some inverts 'go with the flow' of water or wind currents

What do they eat?

- small inverts which live in water eat algae, diatoms, and various plankton through filtration *ex: coral, sponges, mollusks*
- some insects predate on other insects and animals *ex: dragonfly, praying mantis, squid, octopus*
- many land inverts eat plants *ex: weevils, grasshoppers, aphids, corn beetles*
- leafcutter 'wiwi' ants eat fungus they nourish with leaves
- earthworms and dung beetles help digest dead and decaying matter
- some specialized inverts eat pollen or nectar secreted by plants *ex: bees, butterflies*
- some inverts are parasites on other animals or inverts

How do they sense the world?

- many insects have faceted eyes which allow a 'pixellated' view of the world
- worms have photosensitive patches and are 'photophobic'
- inverts are sensitive to temperature since they can't thermoregulate
- squid and octopi have an eightfold brain and the ability to send visual signals by changing skin patterns
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How do they reproduce?

- many invertebrates reproduce by virtually cloning themselves
- ocean inverts do mass fertilizations and dispersals

What are the human and ecological impacts and benefits of invertebrates?

Benefits:

- insects are important pollinators for food crops *ex: bees, moths, butterflies*
- earthworms aerate soils
- coral reefs take in carbon dioxide from the atmosphere
- inverts are an essential food source for many vertebrates
- crustaceans are excellent cleaners of detritus and dead material
- inverts are being recognized as sources of helpful pharmaceuticals
- mollusks such as oysters are seen as vital pollution filters in estuaries
- Do you like to eat lobster or crab?
- ancient inverts deposited what would later become limestone and marble
- dragonflies are used to reduce mosquito populations
- insects and larva are eaten as delicacies in many human cultures

Costs

- insects eat food crops
- ticks, fleas, and , mosquitoes can transmit diseases
- blood meal insects can harass vertebrates in order to reproduce *ex: blackflies, deerflies, ticks*
- jellyfish can inflict painful stings
- some insects are venomous *ex: wasps, spiders, certain ant species*
- inverts are common intestinal parasites of vertebrates