



INSECTS/INVERTEBRATES

MATERIALS INVENTORY	
<ul style="list-style-type: none"> • Carnegie Natural History Museum Insect Displays • Grasshopper model • Compound eye viewer • Metamorphosis material • Discovery Question Sheet • Mouthparts game - includes sponge, syringe, file, party blower, pliers, knives, straw and scoop; and pictures of fly, mosquito, slug, butterfly, grasshopper/cricket, tick, bee, and earthworm. 	<ul style="list-style-type: none"> • Containers for live Invertebrates • Tape • Paper for labels • 4 Ladybug magnifying glasses • External anatomy of grasshopper card • Plastic bags to sit on if the log is soaked • Map of the park with scheduled times
ADVANCE PREPARATION	
<ul style="list-style-type: none"> • Verify all materials are in your kit • Capture and label live invertebrates - needs to be done the day before and possibly during the week depending on survival of specimens. If possible, look specifically for examples of insect eggs, larvae, pupa and adult. • Prepare individual invertebrates in containers with label identifiers. Do not use actual labels as are hard to remove for future use of containers. Use slips of paper and tape. • Prepare 5 search-through containers with forest floor invertebrates such as earthworms, pill/sow bugs, millipedes, snails, slugs, caterpillars, and grubs. Include dirt and leaf compost in the container. DO NOT include spiders and centipedes as these are predators, which can escape the container. • At the end of the day, spritz the specimens with water and feed to keep them alive. If the specimen dies, it is still useful to view. 	
MORNING SETUP	
<ul style="list-style-type: none"> • If log is wet (and it is not raining) cover the log in plastic bags • Select a location for the invertebrates that is in the shade. Be careful during the day to make sure specimens remain in the shade as the sun will kill them. • Separate insects from other invertebrates (eg, spiders, worms, centipedes, etc) • Set aside the search-through containers with the magnifying glasses in the shade. • Scan the area for poison ivy around the log. 	

- Review the mounted insects from the Museum so that you know what is there

Objectives:

- What does it mean to be an invertebrate
- What are three characteristics of an insect
- What helpful things do insects do

Overview

This station provides some insight to the diversity and importance of invertebrates and insects. Some kids and adults are afraid of beneficial invertebrates like spiders and bees. Children should understand that these creatures all have a role to play in the ecosystem.

INSTRUCTION:

The insect habitat is located in a secluded part of Bird Park. The session begins with the children seated on a log.

Introduce yourself and your high school helpers

We are here to talk about Invertebrates.... so what is an Invertebrate?

An animal without a backbone or an internal skeleton.

Are you an invertebrate?

No... we are vertebrates. (Have the students reach around and feel their spine.)

What would you look like if you were an invertebrate?

Encourage the students to demonstrate what they would look like as an invertebrate.

Can you name an invertebrate?

worms
pill/sow bugs
centipedes
millipedes
slugs/snails
insects - so many options here...
daddy long legs
spiders



ticks

octopus/squid

jellyfish

clams/mussels

crabs/lobsters

What is the largest group of invertebrates that have been named?

Insects - approximately 1,000,000 different species have been named so far. There are 90,000 species in Pennsylvania.

If we divided up all the insects in the world and gave each person their share, how many do you think you would bring home?

There are about 200 million insects per person in the world

So let's talk a little about insect characteristics using our model here (green plastic grasshopper - may have the students name him) SHOW INSECT MODEL

[Also, if a live specimen of an ant - preferably a carpenter ant for size - is available, pass it around as you talk about body segments and where the legs attach as these are very easy to see on an ant]

How do they keep their shape if they do not have a skeleton?

They have exoskeleton made of Chitin *-(ky-tin)*

Does their exoskeleton grow as they grow?

No - they have to shed their exoskeleton when they outgrow it.

How many body segments does an insect have? What are they?

3, head, thorax, abdomen

How many legs does an insect have? What body part do the legs attach to?

6, thorax

Do all insects have wings? Where do they attach? Can you think of an insect without wings?

No, thorax. Silverfish, fleas, ants or termites do not have wings- but termites can produce winged adults that swarm to start new hives.

What features are on the insect's head?

Eyes and antennae

Is an insect's eye like ours?



No, our eyes are simple with one lens, insect eyes are compound with multiple lens. Compound eyes give an insect wraparound vision, which may help them escape predators or aid in catching prey.

SHOW INSECT EYE VIEWERS

What are the antennae used for?

Varies depending on the insect, but may be used for touching, tasting, smelling and/or hearing. (Losing antennae leaves an insect shocked and helpless)

(Optional)

Ears for example may be located on different parts of the body. For example, ears of katydids and crickets are located on the knees of the forelegs. Grasshopper ears are visible as an oval plate on the abdominal segment.

Insect “voices” are produced by specialized structures – wings, mouth parts, legs scraped against wings or bodies. The male cicada vibrates miniature “drumheads” on the lower surface of the abdomen. Insect voices are used to: 1) attract the opposite sex, 2) communicate with others in the groups, and 3) frighten enemies.

What word do we use to describe an insect’s life cycle?

Metamorphosis - life cycle involving a number of changes before reaching adulthood.

Metamorphosis progresses in different stages. How many stages in *Complete Metamorphosis* like that of a butterfly? What are they?

4, egg, larvae, pupa, adult

Not all insect species go through complete metamorphosis. But they all start out as an egg.

[If you have live examples of the different stages, pass them around at this time. Have them labeled as such. If you have larvae that they can touch, carry it to them and let them touch it gently (e.g. caterpillar or grub).]

(Optional)

Some go through:

- *Incomplete metamorphosis* - with 3 stages, where the egg hatches a nymph that lives in water until it crawls out of the water, sheds its skin the last time and



- becomes an adult. example: dragonfly [2nd group on - Ask if they saw any insect nymphs at Stream]
- *Gradual Metamorphosis* - with 3 stages, where the egg hatches to a wingless nymph. When it sheds the last time, it has wings and is an adult. example: grasshopper
 - *Simple Growth* - where the egg hatches and the hatched insect looks like a smaller version of itself and grows and sheds until it reaches adulthood. example: silverfish

Insects can be both helpful and harmful. Can you name at least 3 ways in which insects can be harmful?

1. Carry disease. - mosquito, flea
2. Inflict painful bites and stings - mosquitoes, bees, wasps, ants, flies
3. Devour crops. - beetles, caterpillars, grasshoppers
4. Destroy wood in a home - termites, carpenter ants

Even though some insects can be harmful, the majority of them play a very important role in the environment. Can you name at least 3 ways in which insects can be helpful?

1. Pollinate flowers - bees
2. Provide food for other animals. - almost all - very low on the food chain
3. Help bring about vital decomposition. - beetles, carpenter ants, termites
4. Produce such things as honey, shellac, and silk. - bees, lac bug, silk worm/caterpillar
5. Add color and beauty to our lives. - butterflies, moths, beetles

What role do insects play in pollination?

They carry pollen between flowers which allows for formation of seeds and fruit.

What kind of insects carry pollen?

Butterflies, moths, beetles, flies, wasps and bees can carry pollen.

Many of the fruits we eat form after pollination by bees. Honey bees are not native to N. American, and we brought to American by colonist. There are native bees such as mason bees which do not form colonies and are a little smaller than honey bees. They lay eggs in small holes sealed with mud which is how they get their name.

VIEW Insect Collections. Pass around the mounted insects from the Carnegie Museum of Natural History. They are real... just not alive.

Other Invertebrates....

If you look at invertebrate in Bird Park and it has 8 legs, what might it be?

Spider, daddy long legs or harvestman, tick

These are not insects, but arachnids.

If you look at invertebrate in Bird Park and it has no legs, what might it be?

Earthworm (annelida), slug, snail (gastropods)

If you look at invertebrate in Bird Park and it has 14 legs, what might it be?

Pill or sowbug - woodlouse (isopod crustacean) - eats mostly dead vegetation - helps with decomposition of plants and turning over the soil

15 or more pairs of legs and you are looking at a centipede or a millipede (myriapods).

Centipedes have 15 or more pairs of legs with one pair of legs per segment - they always an odd number of pairs and can have 30 - 354 legs. They are predators, move quickly and have venom.

Millipedes generally have 34 - 400 legs with two pair on each segment. One kind of millipede has been noted to have 750 legs - the most legs of anything on earth! They are slow moving and mostly eat rotting vegetation aiding in decomposition.

Would you like to see some invertebrates that specialize in decomposition - helping to break down plants back into the soil?

SHOW LIVE SPECIMES

Pass out the search-through containers and the magnifying glasses- one to every 2-3 students. Ask the students to pick up small sticks to search through the containers. Ask them to try and find at least 3 different organisms. Stress to them that these are living organisms so they have to be very gentle so not to harm them. (worm, sowbug, millepede, grub, snail, slug, etc.) Let them look for 3-5 minutes.

(Optional)



MOUTH PARTS GAME

Just to show how diverse - or different - these organisms are, would you like to play a mouth parts game?

Have the students match the item to the invertebrate given their mouth structure.



earthworm - scoop
butterfly - party blower
mosquito - syringe
fly - sponge
tick - knife
grasshopper/cricket - pliers
bee - straw
snail/slug - file

(Optional)

There are some invertebrates that are found in Bird Park that do not belong. Can you tell me what an invasive organism is?

An invasive organism is not native to an area, but is from somewhere else. It thrives here and has no predators or diseases to keep its population in check, allowing it to overrun native organisms or do harm to the environment. (gypsy moth, viburnum beetle, ash borer)

Wrap-up:

Invertebrates are a very important part of any habitat. So treat them with respect. They come in many shapes and colors, live in many different habitats and perform many functions. They are wonderful to observe and learn about.

If you have extra time, pass around some of the live invertebrates asking the students to observe the number of legs and to think about whether or not they are insects.



Background Information:

General Insect Information:

- Insects are invertebrates (animals without a backbone)
- Insects are the world's most abundant creatures.
- Insect species outnumber all other animals and plants combined;
- There are about 200 million insects for each human on the planet.
- More than 1 million insects have been named.
- It is estimated that there may be 2 to 30 million species in the world,
- There are about 90,000 insect species in Pennsylvania.
- They are small, have small food requirements and reproduce in large numbers (dragonflies may produce 100,000 eggs at a time).
- Insects can be found in almost any habitat where life is possible. However, there are few insects in marine environments.
- Many, but not all insects fly or are descended from ones that could fly.
- Insect mouths are a variety of shapes and function like pliers, straws, sponges, syringes and saws.
- Ears are located on different parts of the body. For example, ears of katydids and crickets are located on the knees of the forelegs. Grasshopper ears are visible as an oval plate on the abdominal segment.
- Insect "voices" are produced by specialized structures – wings, mouth parts, legs scraped against wings or bodies. The male cicada vibrates miniature "drumheads" on the lower surface of the abdomen.
- Insect voices are used to:
 - attract the opposite sex
 - communicate with others in the groups
 - frighten enemies.
- Insect blood is rarely red, but usually clear, yellow, or green.

Despite their diversity, insects share common characteristics:

1. Segmented body consisting of three parts – head, thorax, and abdomen (*insect* Latin for "segmented"). Each part is further segmented.
2. Six legs attach to thorax.
3. Multiple simple or compound eyes (multiple lenses). Dragonflies have as many as 30,000 lenses per eye.
4. Exoskeleton – hard outside covering made of chitin. Gives shape and must be shed in order for the insect to grow.
5. Antennae – organs of taste touch, smell, or hearing (losing a pair leaves an insect shocked and helpless).
6. Life cycles which involve complete or incomplete metamorphosis (several changes before adulthood).

Words and Concepts: The following may be useful:



1. Arachnid- spider, having 8 legs and 2 body parts.
2. Annelida – having a soft body (i.e., earthworm).
3. Metamorphosis – life cycle involving a number of changes before reaching adulthood.
Complete metamorphosis involves egg, larva, pupa and adult.
4. Gall – a growth produced by an insect on a plant.
5. Camouflage – method of disguising or concealing by blending into the surroundings.
6. Entomologist – a scientist that studies insects.

Field Study: The emphasis in the field study is to approach it as a scientist would: being mindful of minimizing the impact on the environment; observing in a systematic way the features of the space: carefully collecting specimens of organism or evidence of insect life: using knowledge and observation to draw conclusions about the specimens.

Insect Trivia:

1. How fast can insect fly? A tabanid fly (related to horse flies) was clocked at 90 mph, honey bees at about 7 mph.
2. How fast can insects flap their wings? Midges (no-see-ums) can flap 1,046 times per second, male mosquitoes 450-600 times per second.
3. How fast can insects run? Cockroaches can run at a little over 1 mph.
4. Biggest group of insects? Beetles numbering 330,000 species.
5. How long can insects live? Wood beetles can live up to 51 years.