What is an insect and how do they live?

MY OWN FOOD CHAIN PROGRAM (K-2)

Introduction to Insects

(ILS 12A, 12B)

Overview

This curriculum explores the relationship between people and the food they eat. It aims to give children in grades K-2 a basic understanding of the flow of energy through the food chain, and the place of people in the food chain. If teachers complete the entire curriculum, their classes will explore food chains in nature, focusing on its individual links and looking at the flow of energy as a whole. Students will then look at the place of people in the food chain, and discover how people have appropriated nature's systems in agricultural practices – making the food chain our own. Classes will compare traditional and sustainable agricultural practices.

Sustainable Agriculture, for the purpose of this curriculum, shall be defined as "a system of food production, supported by consumers, where farming operations, practices and technologies work in harmony with the natural systems that sustain life on earth."

Suggested Grade Level

This curriculum is designed for kindergarten through second grade levels. The topics covered can be built upon in complexity throughout that age range.

Approximate Time

Approximately 60 minutes for each of two sessions; session 1 will need to be conducted in warm early autumn or late spring weather..

Objectives

1. The students will be able to identify the characteristics of an insect.
2. The students will know the life cycle of insects.

Activity Abstract

In this lesson, students will learn what makes an insect an insect by collecting and studying insects. They will learn about the life cycles of insects through literature and observation.

Background Information

"Bug" is a confusing term. In common, everyday language, "bug" is used to mean a small creepy crawly critter, (as it is in the procedure of this lesson). The term encompasses worms, spiders, slugs, butterflies, ants, grasshoppers, lice, and many others, including "true bugs." In reality, some of these creatures are as distantly related, biologically speaking, as humans are to them. All of these creatures are animals, but

several are in completely different phyla. Worms and slugs, for example, are in different phyla that most of what we call bugs, which are arthropods.

An arthropod is a phylum of animal that comes from the Latin meaning "jointed leg". Arthropods all have segmented bodies and limbs (think of an ant or a daddy longlegs) and exoskeletons (hard outer shells). The arthropod phylum has three major subphyla (divided into 11 classes). The three subphyla are the chelicerates (which refers to the jaws and includes horseshoe crabs, sea spiders and arachnids (spiders, ticks and mites); the crustaceans (which mostly live in the water and include crabs, lobsters, shrimp, barnacles, etc., as well as isopods like rolypolies); and uniramia (which includes the insect class as well as centipedes and millipedes.) http://animaldiversity.ummz.umich.edu/site/accounts/information/Arthropoda.html is a website that offers more detailed information.

Teacher note! Appendix A contains information on the parts and life cycles of insects.

In the world of science, there is another meaning for "bug." A bug is a specific type (order) of insects – true bugs – which include shield bugs and box elder bugs.

Appendix A contains more information about insects.

Materials

- Sweep nets (2 per group, groups of 4-6 kids.) If you can't afford to buy them, instructions for making them appear in Appendix C.
- Bug boxes with magnifiers (2 per kid)
- White cloth squares, approx 2' x 2', 1 per group
- Beginning bug guides (2 per group)
- Bug data sheet (included in lesson; 3 per student), clip boards (one per student) and pencils (1 per student)
- Book *Gotta Go! Gotta Go!* By Sam Swope, Sue Riddle, illus. Published by Farrar Straus & Giroux; (March 2000)

Procedure (Session 1)

1. **Tap Prior Knowledge.** Ask how many students know what a bug is? An insect? Do they know the difference?
2. **Share with a neighbor.** Ask if students they like bugs. What are their favorite bugs? The ones they hate?
3. **Introduce scientific concept.** Explain, today we are going outside to look at some bugs. We'll study them and try to figure out what a "bug" is, and an "insect", and maybe some other groups.
4. Head outside with all the materials listed above. Go to a prairie, farm or open field, or some place with a lot of insect life.
5. **Hands-on experience.** Demonstrate the sweep net process. The net should be waved back and forth through the tall grasses. The net should go in a flat figure 8 pattern with the open side always going first. The insects are mostly on the grass, so you should brush them; however, you should not kill grasses as you sweep. At the end of the sweep, close the net by grabbing the top closed. Bring it over to a

white cloth square, turn it over and shake the insects out. Bees and wasps will fly away quickly, this is good.

6. Explain the assignment. Groups will sweep for insects and capture them in the bug boxes. Each student will choose three different ones and fill out a sheet about them. Go over the sheet in detail with the class.
7. Split students into groups and assign them places to work. Allow them ample time to complete the assignment.
8. Release insects where they were found, clean up materials and return to classroom.
9. Compare answers to students' data sheets. Try to determine what is the most common combination of characteristics. This should be an insect, that has 6 legs, two antennae, three body segments, and may have 0 or 4 wings. The other common find will be spiders, which have 8 legs, 2 body parts, and no antennae or wings. Help students arrive at these definitions and supply the terms if needed.
10. Have students draw an insect and a spider and note the characteristics of each on the drawing.
11. **Conclusion/Wrap-up.** Hint to students that more on insects will be coming in the days ahead.

Procedure (Session 2)

1. **Tap prior knowledge.** Ask students to review the insect definition that they came up with in session 1. As they list the characteristics, draw an insect on the board – specifically, make your insect look like a butterfly.
2. Ask students what type of insect your picture looks like. Hopefully they'll know.
3. **Introduce scientific principle.** Tell students that butterflies (and some other insects) are tricky… they don't look like that their whole life.
4. Read *Gotta Go! Gotta Go!* aloud to the class.
5. Discuss what happened in the book. Explain that the book doesn't use a lot of science words, but we know what it's talking about anyway. Get the class to supply the words for the life cycle stages that occur in the book – egg, caterpillar, chrysalis (often called a cocoon), adult butterfly, and egg again.
6. **Conclusion/wrap-up.** Draw/write the life cycle on the board in a circle with arrows. Explain that many insects go through a life cycle like this one. Equate the terms egg, larva, pupa and adult to the butterfly-specific terms.

Literature Links (optional)

Elhert, Lois. *Waiting for Wings.* Harcourt, Inc. 2002. ISBN: 0152026088.

Keller, Holly. *Farfellina and Marcel.* Greenwillow Books, 2002. ISNB: 0-06-623932-X.

Extensions (optional)

Raise butterflies in class. Catch a caterpillar outside, look it up in a book and figure out what it is, eats, needs, etc. Provide it with the right food, a home (such as a screened cage – butterfly houses are available for sale.), etc. Alternately, kits are available from Carolina Biological Supply at 1-800-33405551. Remember to do it at a time when adults

can be released in the wild, and have the class read about/research what to expect, feed it, etc.

There are many craft activities involving insect lifecycles. Tow examples can be found at:
http://www.hhmi.org/coolscience/butterfly/
http://www.enchantedlearning.com/crafts/butterfly/lifecyclemobile/
but there are many other out there! Find a fun one and do it with the class.

References

Naomi's head remembers a lot about bugs!

Appendix A: More Background Information.

What's an insect?

Insects are some of the most common – and least understood – creatures on earth. About 75% of all animal species on the planet are insects, mostly beetles (only 3 % of all animal species have backbones like people!).

Insects are members of the phylum Arthropoda, which means jointed leg. Indeed, this is one of the characteristics that all insects have in common. All insects have six, jointed legs. The legs protrude from their thorax, which is the middle of three body segments (picture an ant). The head is at the "top," the thorax is in the middle part, and the abdomen is the "bottom" part. The head does what our head does – it contains sensory organs and a brain. Insects all have two antennae that help them to sense the world around them. They work similar to our noses – they pick up chemicals in the air and use them to determine what's happening. Insects have compound eyes, which contain many hundreds of lenses (our eyes have one lens each). Insects have mouths, but these vary by species and also life cycle stage. Insects don't have noses or external ears.

The thorax section of the body contains mostly muscles – all six legs and four wings, if present, grow out of the thorax. (Insects usually have 0 wings or 4 wings. If you think it has 2, you're probably missing the other 2). The abdomen is like our abdomen – it's where the food processing occurs. The abdomen also contains spiracles, which are tiny holes through which respiration occurs. Reproductive organs are also located on the abdomen. Insect abdomens often are themselves segmented, which can cause confusion in students counting body parts.

All insects – indeed, all arthropods, are invertebrates, meaning they have no backbones. Actually, they have no bones at all. Instead, they have an exoskeleton, or hard outer shell that provides their structure. If you step on a bug and it goes crunch, that's the exoskeleton breaking. Yum. Exoskeletons can be shed, much like a snake's skin, as the creature grows. (Crabs are arthropods and therefore undergo the same process. A softshell crab is a crab that is caught right after it has shed its exoskeleton and the new one hasn't hardened yet, which takes a few days for crabs. They're very unhealthy to eat, but that's another story.)

Other arthropods you might encounter in this lesson include arachnids (spiders) and myriapods (from the Latin many-feet, these are centipedes and millipedes). Arachnids have eight legs, which come out of the cephalothorax. A cephalothorax is like a head/thorax combination – spiders only have two body segments. Spiders have simple eyes, no antennae, and no wings. Their mouths have large fangs that may look like antennae, but they're not. A spider's abdomen is like an insect's basically, but will contain spinnerettes, which make webs.

Insect Life cycles

Insects undergo metamorphosis, or a changing of form during the course of their life cycle. Insects can have complete or incomplete metamorphosis.

Complete metamorphosis has four stages. An adult lays an egg; an egg hatches into a larva. The parva pupates, and the pupa metamorphoses into an adult. The most well-known example of this transformation are the lepidopterans -- butterflies and moths.

Mother butterflies lay eggs, usually on the underside of a leaf of a host plant. Most only stay in the egg for about a week before the larva, commonly called a

caterpillar or an inchworm (for some moths), comes out. Caterpillars are munching machines. They will basically spend their entire larval life – usually 2-3 weeks, eating leaves, growing and storing energy. In fact, if a typical butterfly caterpillar started out the size of a human baby and grew in the same proportions as they do, at the end of three weeks it would be as big as a school bus. The caterpillars are storing energy that they will need as pupae.

When the caterpillar is full grown, it will find a place where the pupa, commonly called a chrysalis or cocoon*, will blend in, usually a stick or leaf. It will grab the place with its prolegs and shed its final exoskeleton. Underneath, it will look different; it will have no visible legs or anything. Inside the pupa, the cells are rearranging themselves into the adult form of the insect – with four wings, a proboscis (rather than munching mandibles) and 6 long legs. When the transformation is complete, the butterfly or moth will break free, spend a few hours pumping fluids into its wings and fly off to live its adult life.

As an adult, the lepidopteran will fly around finding food – in many cases, they are excellent pollinators as they eat nectar – and they will mate. Females will lay eggs, thus starting the whole process again.

The entire lifecycle of a butterfly or moth often takes about 8 weeks, with the insect spending no more than a few weeks in any one stage. The exception is the overwintering generation, which will spend the entire winter in one stage and then continue the cycle in warm weather. Most commonly, lepidopterans overwinter as pupae or eggs (that stages that don't move or eat.) There are notable exceptions, such as the monarch butterfly, which overwinters as an adult after a long migration south.

*What's the difference between a chrysalis and a cocoon? Butterflies make chrysalides and moths make cocoons. The cocoon of the moth is made of spun silk (often using leaves or other natural materials as well). The butterfly's chrysalis is actually its exoskeleton. Touching a cocoon is analogous to touching someone's sweater, whereas touching a chrysalis is like touching their skin.

While butterflies and moths are the most famous, about 88% of all insects undergo complete metamorphosis (http://www.uen.org/utahlink/activities/view_activity.cgi?activity_id=2024). Other insects that undergo complete metamorphosis include beetles (including ladybugs and squash borers), dipterans (flies and mosquitoes), trichopterns (caddisflies), and hymenopterans (wasps, bees, ants) and fleas.

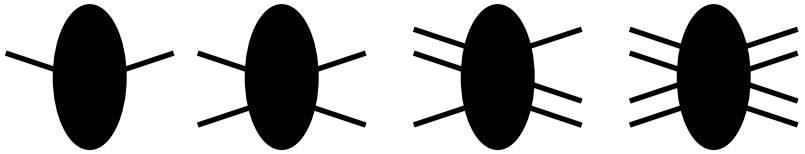
Incomplete or simple metamorphosis has only three stages; these insects don't pupate. They begin as eggs. Eggs hatch into nymphs. An insect may go through several nymph stages as it sheds its exoskeletons, each looking more like the adult insect. When the last nymph sheds its exoskeleton, it is an adult. Generally, the nymph looks more like an adult than in the case of complete metamorphosis, but this is not always true. Consider the case of dragonflies, that spend up to 7 years as a nymph swimming underwater, looking rather like a sea monster, before finally emerging as the flying adult (a stage which, despite being the most well-known, lasts only a short summer season). Examples of insects that have simple metamorphosis include odonata (dragonflies and damselflies), mayflies, earwigs, true bugs (such as box elder bugs, squash bugs and other shield bugs), orthopterans (crickets, grasshoppers and cockroaches), cicadas, termites, lice and aphids.

Appendix B: Bug data sheet.

Bug Data Sheet

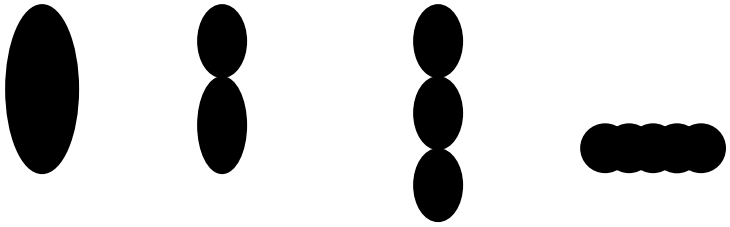
Study your bug carefully. Circle the correct answer.

1. How many legs does the bug have?



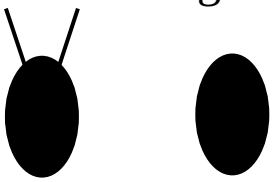
2 4 6 8

2. How many parts does the bug's body have?



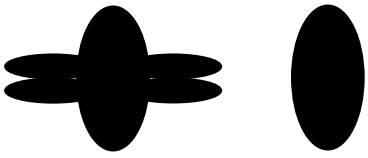
1 2 3 more than 3

3. Does the bug have antenna?



yes no

4. Does the bug have wings?



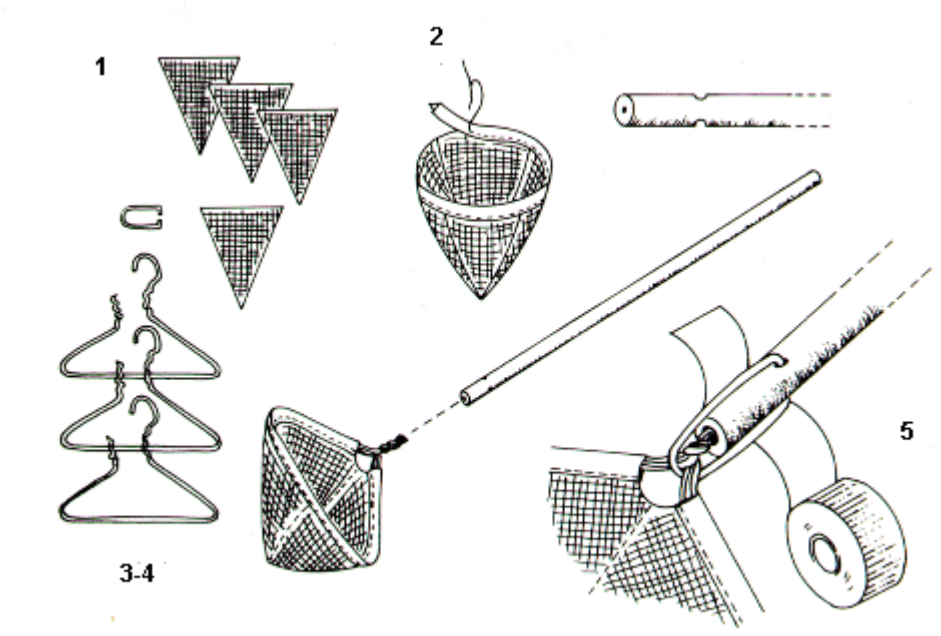
yes no

Appendix C. Sweep Net Instructions.

Sweep sampling net
The materials needed to construct a D-frame net for sweep sampling are:

- four 60 cm x 30 cm pieces of flywire netting (250 um mesh)
- 1.5-m piece of bias tape or equivalent fabric scrap (3 cm wide)
- broom handle or wooden dowel (over 1 m long)
- thread, scissors, sewing machine, 3 wire coat-hangers, drill with 0.5-cm wood bit, pliers and binding.

1. To construct the net, cut the netting into four triangular pieces (50 cm high with 30-cm bases) and sew together.
2. Sew the 1.5-m strip of bias tape into the net opening as casing, leaving it open to insert the wires.
3. Take the 3 wire coat-hangers and untwist, cut off and reserve the 'hook', slip the main part into net casing, and retwist.
4. If necessary, cut the twisted stem to 5 cm with the wire-cutters. Drill a hole in the broom handle and insert the stem.
5. Take the remaining 'hook' of the coat hangers and bend it into a U shape, put into position, push into holes and wrap with binding tape to secure the handle (see illustrations).



from http://redtail.eou.edu/streamwatch/swm29a.html