1.3 Outdoor Research Excursion

Action Synopsis

Students visit their study site to look for animals and clues about their food resources. The next day they process their findings.

Session 1		**1½–2 hours OUTDOORS**
1. Get oriented to the outdoor site.		*familiarizing*
2. Set up study plots, and record observations of animals, animal signs, and food clues.		*observing & recording*
3. Show and describe discoveries.		*processing findings*
4. Make maps of the study plots. (optional)		*documenting*
Session 2		**40 minutes**
1. Refine and compile field notes.		*processing findings*
2. Discuss the biodiversity of the study site.		*introducing new information*
3. Decide what makes the study site an ecosystem.		*introducing new information*

Desired Outcomes

Throughout the lesson, check that students:

✓ Are able to point out evidence of what animals live on the study site and what they eat.

✓ Know how to categorize things in nature, and use the terms biotic and abiotic.

✓ Are able to make some general statements about the biodiversity and food resources on their study plots, and on the site as a whole.

✓ Understand that their site is an ecosystem.

What You'll Need

Session 1

For the class:

- ❑ supplementary field equipment (optional)
  - trays (e.g., cookie sheets, foil pans, dishpans) lined with white paper
  - whistle
  - video or polaroid camera
  - several metal soupspoons
  - field guides (see "Resource List," pages 52, 54)
  - compass
  - sweep nets (see "Getting Ready")

For each group of 3-4 students:

- ❑ pointed metal or wooden stake, about 60 cm long
- ❑ 2.5 meter cord tied to a metal ring that fits over the stake
- ❑ cup of flour in a baggie
- ❑ shopping bag
- ❑ copy of the *Who Eats What* guide (pages 355–382)

For each student:

- ❑ clear plastic cup
- ❑ plastic spoon
- ❑ cotton swab
- ❑ index card
- ❑ hand lens
- ❑ map template (if created in Lesson 1.2)

Session 2

For the class:

- ❑ newsprint sheets for class lists
- ❑ 2 pieces of oak tag for master map (optional)

Vocabulary

ABIOTIC - Something that was never alive (water, rocks); the physical environment.

BIODIVERSITY - The variety of different kinds of living things in an area.

BIOTIC - Something that is alive, or used to be alive.

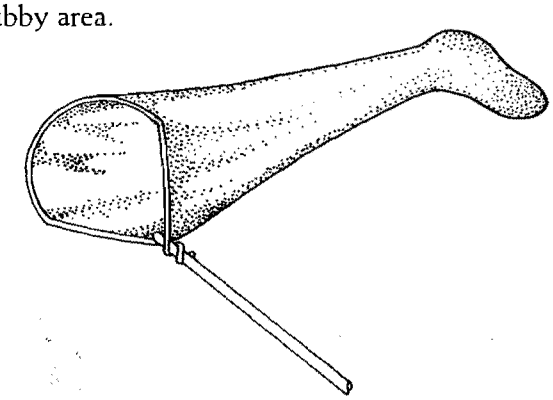
ECOSYSTEM - An area where living things interact with each other and their physical environment.

LEAF LITTER - A layer of dead leaves on the ground.

Getting Ready

Session 1

- The most important preparation for this lesson is to visit the study site to decide on boundaries and placement of students' study plots, and to get familiar with it yourself (see "Scope out a study site," page 49).
- Send home a field trip permission slip along with a list of recommended clothing for the day (e.g., closed-toe footwear, socks, light-colored long pants and long-sleeved shirts, jackets, hats, and rain gear).
- Schedule a school bus if necessary, arranging to spend about two hours at the site. Also try to arrange for some chaperons to help out on the field trip.
- You might want to buy (from a science supply catalog) or make (using a broom handle, nylon stocking or cheesecloth, and a coat hanger) insect sweep nets, especially if your study site is a grassy or shrubby area.



- Decide if you want to document the site with photographs or videotape, and if so gather the necessary equipment.
- Plan groups of three to four students.
- Divide the field equipment into a set for each group. A plastic or paper shopping bag works well as a carrying container for each group's equipment.
- If this field trip will be your only visit to the study site, read the information in Lesson 1.4

about collecting organisms for further study, and make preparations to do that during this trip.

- Read "Hidden Critters" (page 84) to decide if you want to make Berlese funnels as a follow-up to the field trip. If so, bring plastic bags outside to collect soil and leaf litter samples, and have students bring in 2-liter soda bottles.
- If students are going to make maps, prepare a large master map by taping together two pieces of oak tag. Transfer the sketch you made during a preliminary site visit (see page 50) of the site boundaries and prominent features to the oak tag, and mark the approximate locations of each study plot so students will know where to attach their plot maps.

Session 2

- Prepare a wall or bulletin board where class lists and a master map can stay posted for a while.

Action Narrative

Session 1

Before we go outside, let's review the purpose of our study trip.

Have students tell you their goals for the outdoor excursion — finding out what animals live on the site and what they use as food resources.

I'm going to bring out some books that might be useful for looking things up in the field.

Show students the field guides you've collected. Distribute a copy of the *Who Eats What* guide to each group. Tell them that they can use the "Where to Look" (page 359) and the "How to Figure Out What an Animal Eats" (page 366) sections to remind them of procedures they practiced during the last session.

Each group needs one set of field equipment, and each person needs to bring your journal and a pencil.

As students collect their materials and gather into groups, assign a number to each group so that you can refer to each study plot by the group's number.

Remember that we'll see more by being quiet and moving carefully within our study plots. And we should treat the environment with care.

When you arrive at the study site, gather students in an open area.

This is our meeting spot. Leave your lunches and packs here so they don't clutter your study plots. When you hear this signal (demonstrate a whistle or some other attention-getting sound), **finish up what you're doing and gather back at this spot.**

While still gathered at the central meeting location, point out key landmarks that serve as site boundaries.

Show each group to its plot location, and oversee the setting up of study plots. If the ground is too hard for the stake to penetrate, one student can hold the stake upright while the others walk around it, holding the outstretched cord and marking a circular border with flour.

Once the plots are outlined, visit each group to remind everyone to look at all levels, from below their feet to above their heads.

Caution! In regions where there are venomous creatures such as snakes, scorpions, and spiders, caution students against reaching underneath anything before looking. They should stand behind rocks they are lifting to keep a barrier between themselves and anything poisonous, or use a stick to turn things over.

Let students explore freely for a while before reminding them to take notes. They'll want to feel they've done and seen things worth recording before they write.

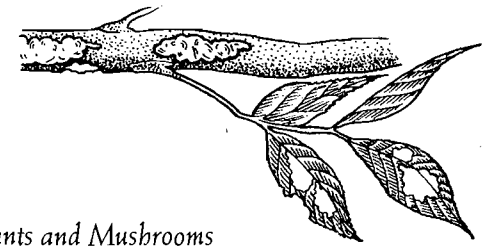
Initially students might think there is nothing to see if animals are not jumping out at them within their study plots. Children vary in their inclination towards observation, and in what they find interesting. Some will get absorbed in one pursuit while others ricochet around their study plot. Invite these less-focused students to show you what they've found, and ask them questions about their findings. With focusing and encouragement, children soon tune in to the subtleties of nature, and end up finding more than most adults would!

As important as it is to set the atmosphere for focused field work right away, it's also important to respond to the students' level of excitement. If someone finds something right away that causes a lot of commotion, gather the group around to see it, then remind them that they have a lot to do, so they need to get back to their work. If students are too wound up to focus, lead a "silent nature walk" by having them follow you around the site without talking, collecting images to report at the end of the walk. Give students who are uncomfortable in the outdoors some individual attention and guidance. You might capture a small critter for them to observe to show them that there is nothing to be afraid of.

Provide groups with supplementary equipment such as trays, metal spoons, and field guides. If you have sweep nets, have students sweep different areas (e.g., a mown lawn and a tall patch of weeds) and compare how many different kinds of insects they find in each location.

If you have brought a camera or camcorder, involve each group in deciding what aspects of its study plot to document on film.

Help each group look for signs of animals eating plants and mushrooms, other animal signs, animals, and other notable features.



Signs of Animals Eating Plants and Mushrooms

Remind students to look for nibbles and holes on leaves, stems, trunks, fruits, seeds, and mushroom caps.

Ask focusing questions such as:

What parts of the plant are being eaten? Are those parts tough, juicy, tender?

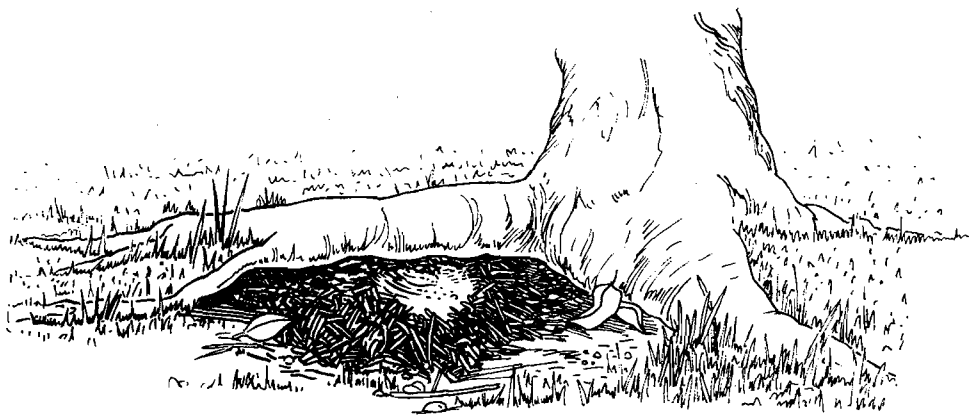
Do some kinds of plants have more evidence of being eaten than others?

Why would insects prefer certain types of plants?

Can you tell what kinds of mouthparts made the signs?

How big do you think the animal was that made the marks?

Did more than one kind of animal feed on this plant? How can you tell?



Other Animal Signs

Help students look for: burrows and holes in the ground, especially near tree roots; bird and mammal nests in branches and among grass; trails, tunnels, and runways in tall grass and rotten logs; scat on rocks or soil; bedding areas in grass; anthills and termite mounds in sandy soil; digging and scratching marks on the ground or on tree trunks; tracks on moist sand or mud; bones and feathers on the ground; galls on plant stems and leaves; and cocoons and webs on or between plants stems or hanging from branches. Remind students that trash and other human debris are also animal signs. Food wrappings and containers give direct evidence of what humans eat, and sometimes provide habitats for non-human animals.

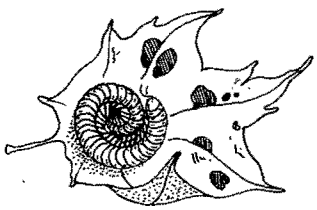
Ask students questions such as::

What animal might have made the sign?

Is it a recent or an old sign? How can you tell?

Was it made by one animal or several animals?

What was the animal doing or looking for when it made the sign? Was its activity related to getting food? If not, what other aspect of survival does the sign tell us about?



Animals

Help students look for insects on plants, especially on leaf and flower buds, on the tips of branches, in curled leaves, and on the underside of leaves. You might find other small animals among dead leaves on the ground. Shake leaves gently over a white tray or use the tray for sorting through the dead leaves, where small critters will stand out against the white background.

Tree stumps, dead logs, and the underside of fallen branches and rocks also provide dark, humid environments where students are likely to find small animals. Make sure that they treat these microhabitats with care — ripping bark off a fallen log, for instance, will ruin the covering and climate that the animals need — and replace anything they moved. Students should also look and listen for animals overhead, such as flying or perched birds, and squirrels leaping from limb to limb.

When students see a small animal, encourage them to watch its behavior before capturing it. As they observe it, first within its context and then in a cup using a hand lens, ask:

Can you guess what it eats based on where your found it?

What behaviors help it get food?

What body parts help it get food?

Is its mouth like a straw, a needle, a scraper, a sponge, a chisel, or scissors?

Based on its shape, mouthparts, legs, and behaviors, do you think it eats other animals?

What helps it escape from becoming another animal's food?

Which area of the LEAF LITTER, the layer of dead leaves on the ground, has the most animals?

Most animals stay in the inner, moist layer of a leaf stack.

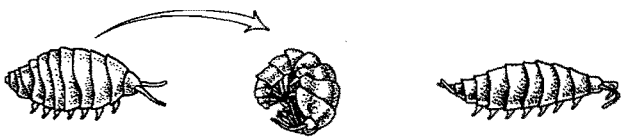
Are different kinds or amounts of animals in different kinds of leaf litter?
There will most likely be a greater number and diversity of animals in moist, tender leaves.

Do the animals in dead leaves behave the same or differently from one another?
Some will "scram" and some will "freeze" when their leaf covering is removed.

How do these behaviors help them survive?
Escaping predators or blending into the background by being still are survival tactics.

Can you tell which animals eat the leaves, and which eat the animals that eat the leaves?
Sow bugs and millipedes eat dead leaves, whereas centipedes with their pincers, agile bodies, and quick movements, eat small animals among the leaves.

Pill Bugs and Sow Bugs



Pill Bug Sow Bug

Two small critters that are common among dead leaves and wood are pill bugs and sow bugs. They are both members of a group of animals called isopods and look very much alike, but have a few noticeable differences. A pill bug (also called a roly poly) rolls into a ball when it is disturbed. Its back is round like a dome and it can't flip back over when it is turned upside-down. A sow bug has a flat body, two tail-like appendages, can quickly flip right side up, and scrams when disturbed.

Other Notable Features

Encourage students to record other interesting things. These could include topography and prominent features of their plot, names or descriptions of plants, and a list of non-living things.

Everyone come to our meeting spot to tell the other groups about one interesting thing you found.

Students will be ready to share some of their findings with the whole class after they've spent about an hour exploring. Have everyone think about what each group's discovery tells about potential feeding interactions on the study site. Even if every student made just two observations, such as a hole in a leaf and a millipede, the class will have enough information to begin to build food chains and webs. If they didn't see as many animals or animals signs as they expected, ask them to think about why.

Optional Mapping Activity

Hand out the map templates students prepared (see "Mapmaking Preparation," page 70). Show them which way is north (either use a compass or make your best guess), and make sure mapmakers stand in their plots and orient their papers so that the N is pointing to the north before they begin drawing.

If there is time, students can test their maps by inviting a neighboring group member to see if they can locate the features shown on the map, then make adjustments to make their maps more accurate.

Session 2

Take a few minutes to talk over your field notes in your groups. Complete any observations or ideas you didn't finish recording outside. Choose someone to be the group reporter, and make sure that person has a complete list of everything you found in your study plot.

Discussing and refining their notes helps students process their study trip findings. Especially encourage them to expand the "Comments and Questions" section of their notes, by sharing thoughts about what animals might have made what signs, and who eats what.

If students have made plot maps, this is a good time to have one person from each group cut out a circle map and attach it to the master map you've outlined on oak tag.

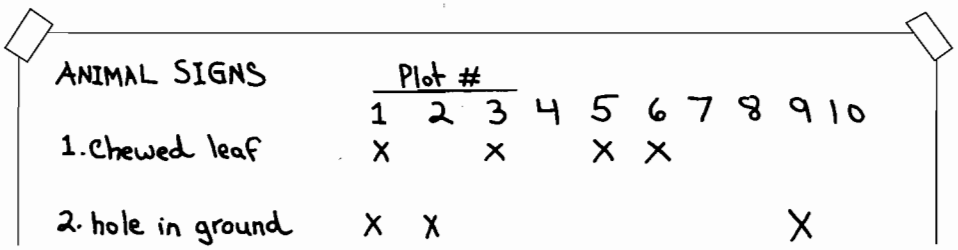
What would be the best way for us to pool our information to get a complete picture of the study site? We need a way to present our findings to (the group that requested the study).

Students are likely to decide to compile their results by listing findings by category or by listing findings by study plot:

Listing Findings by Category

Students decide on the major categories within which their observations fall (e.g., plants,

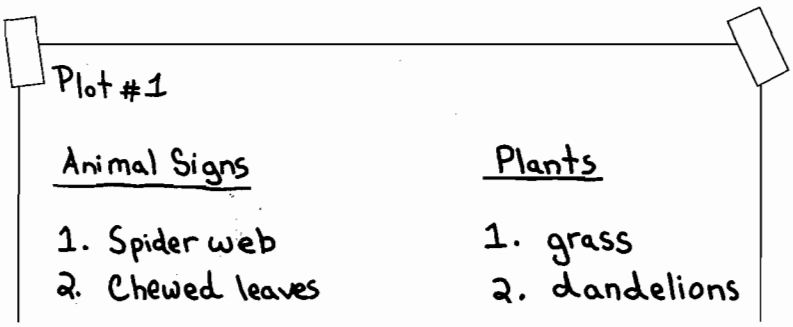
insects, other animals, animal signs, non-living things) and assign a recorder to each category. Groups read their findings for the recorders to list. It is helpful for later analysis if the recorder puts the plot numbers where each item was found next to each listing.



As groups read their findings, students will debate in which category some of the items belong. Encourage them to refine or expand their category titles as they encounter examples that are difficult to categorize, or as you see an opportunity to teach them how scientists group plants, animals, and fungi. For example "Plants" might become "Plants and Mushrooms"; "Insects" might be changed to "Insects and Spiders"; "Animals" might be divided into "Mammals" and "Other Small Animals"; "Animal Signs" might be elaborated to include the names of the animals they think made the sign; "Non-living" might become "Things that were never alive" (e.g., rocks, water, soil) and "Things that were once alive" (e.g., dead plants, animal bones). Students might decide to record the number of each item they found as well as its name. As they sort out where to list items and how to deal with the overlap between categories, students will be thinking like professional biologists and ecologists.

Listing Findings by Study Plot

Each group prepares, posts, and presents a large chart of its findings to the rest of the class. Categorization discussions go on in small groups as members figure how best to arrange their findings. With this method it is easy to see the character of each study plot, but more difficult to see the composition of the overall site at a glance. Students who choose this method might decide to create a whole class chart later, as well.



Scientists use the term BIOTIC for things that are alive or used to be alive. They call things that were never alive ABIOTIC.

Have students name examples of biotic and abiotic components of the study site.

Now that we have our findings all together, let's see what comparisons and general statements we can make.

Help students process their findings with questions such as:

The term scientists use to describe how many different kinds of organisms live in a place is BIODIVERSITY. Which plots have high biodiversity (a lot of different kinds of living things)? Which have low biodiversity (only one or two kinds of living things)?

Did the physical conditions of plots with high biodiversity differ from plots with low biodiversity?

What organisms were found in many plots, or in other words were common on the study site?

Why do you think some organisms are more common than others?

Could how common something is have anything to do with the food it eats? How?

How well were you able to figure out what's eating what on your plots? What clues did you use? What are you still unsure about?

Where within each plot did you find the most evidence of feeding activity?

What signs of animals did you find that you aren't sure what made them?

On plots that had the same kind of animal sign, like a chewed leaf or a hole in the ground, how would you know if it was the same animal that made it in all the plots?

Have people had a high, medium, or low amount of impact on the site?

Does anyone know what an ECOSYSTEM is?

Students have usually heard the word *ecosystem*, but often aren't able to define it. You might want to break the word into its components, ECO and SYSTEM. Talk about ecology relating to the living and non-living environment, and systems having parts that work together, like stereo systems or the digestive system.

After students have shared their ideas, either write on the board or tell them the following definition: "An ecosystem is an area where living things interact with each other and their physical environment."

Can we call our study site an ecosystem?

Students should support their answers by stating if there are living things and a physical environment on their study site, and citing examples of interactions. They might mention animals interacting with the water they drink and the air they breathe; animals interacting with plants and animals they eat; animals interacting with the plants or soil where they make their homes; or plants interacting with the soil, air, water, and sunlight they use to make food.

Ongoing Assessment

Student Reflections

Have students send a C-Mail message or record thoughts in their journals. Optional writing prompts include:

The most interesting, amazing, or surprising discovery I made was...

Something I figured out was...

Some things I did that are like what a scientist does are...

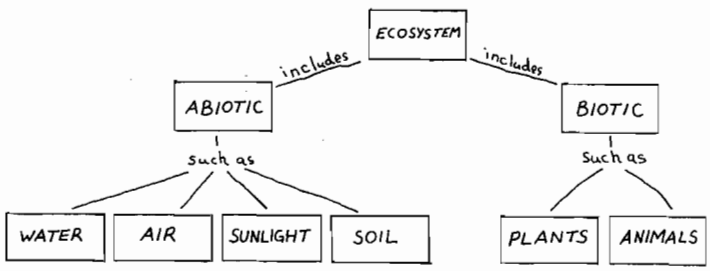
Is the site a good place for animals to live? Why or why not?

Teacher Reflections

- ❑ Were students able to use their observations to generate ideas about what animals live on the site and what they eat?
- ❑ Were they able to compile their findings in a logical and useful way?
- ❑ Can they define an ecosystem and explain what makes their study site an ecosystem?

Extensions

Concept Map. Introduce concept mapping to students (see pages 25–27). Select all or some of the concept map cards on pages 43–44, then copy one set of cards for each group of 3–4 students. Help students construct concept maps that display their prior ideas about ecosystems. Have them save their concept maps so that they can compare them to maps they'll make as an extension to Lesson 1.8, to see how their knowledge grows.



Mini-Ecosystem. Help students plan and make a terrarium that functions like a mini-ecosystem. They can start by writing a list of ingredients and what each needs to stay alive. Gallon jars, old aquaria, and 2-liter plastic bottles are good containers. Suggest that they plant some seeds in the terrarium as well as whole plants. Post an observations chart next to the terrarium for students to fill in. Keep the terrarium partly covered and out of direct sun. It should not need frequent watering.

Microclimates. Challenge students to collect and compare data on the air and soil temperature, moisture, and light intensity in different locations, such as under trees, out in the open, and on concrete. Try to correlate physical conditions with the types of plants and animals found in each place.

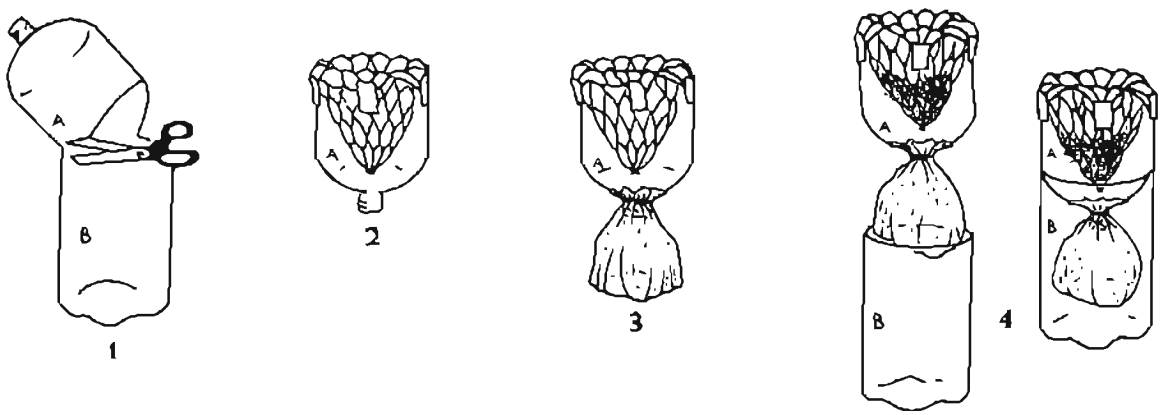
Adopt-a-Site. Return to the study site throughout the year to make observations of how things change over time, such as the life cycles of plants. A photo journal, field guide, or action projects (e.g., a clean-up or wildlife habitat improvements) could result.

Local History. Have students do library research and conduct interviews to find out what the study site looked like at different intervals in the past (e.g., 10, 50, 100, 500 years ago). Trace the causes of change. If the study site is a park, students can find out when it was established, by whom, and why.

Recreated Ecosystems. Visit a zoo and talk with its staff about how and why they try to recreate animals' ecosystems within their displays.

Hidden Critters. Scientists use an apparatus called a Berlese funnel to extract tiny organisms from soil samples. They put a sample of soil and leaf litter in the funnel, then put the funnel beneath a light for a day or two. As the soil gets warm and dry, critters crawl or fall into a container at the bottom of the funnel.

Guide students in collecting a small amount of topsoil, along with the dead leaves on top of the soil, from several locations. Put each sample in a separate plastic bag. Label and number each bag. Then make a Berlese funnel using a 2-liter soda bottles as follows:



1. Cut the bottle in half to make two sections, A and B.
2. Tape a mesh bag to the inside of A so that it hangs suspended about two inches above the mouth of the bottle.
3. Attach a small plastic bag with a rubber band to the outside of the mouth of the bottle.
4. Invert A and rest it inside B. Fill the upper portion of A with soil and leaf litter, and place it under an incandescent light or in sunlight. When critters fall into the plastic bag, transfer them as soon as possible to a small dish or cup with a few drops of water. Also look for critters in the mesh bag among any material that is still moist. Look at the critters with a hand lens. Try to identify them and find out what they eat using the *Who Eats What* guide, especially the "Other Animals Without Backbones" section (pages 371–372). Springtails and mites are two organisms that might be in your sample.