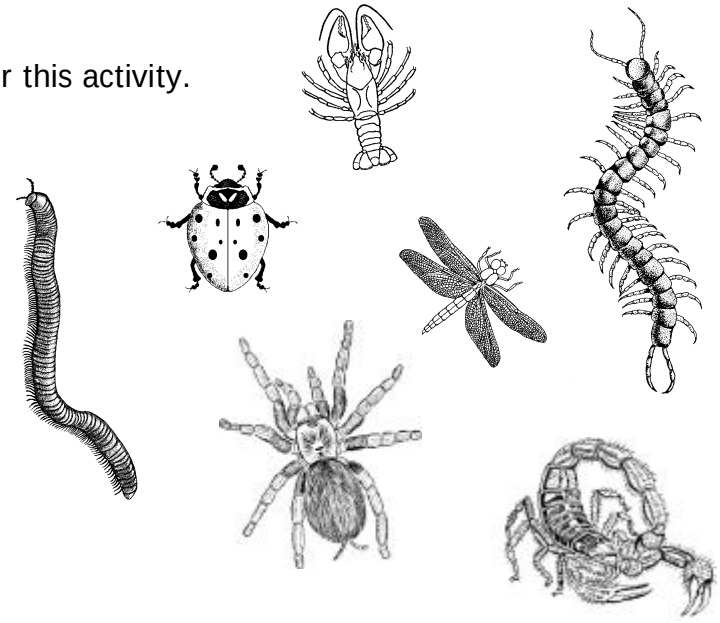
ARTHROPOD ADVENTURE

ACTIVITY:

After a brief review of arthropods...including anatomy, types of arthropods, and types of metamorphosis, the group takes a short walk in the desert discovering arthropods and evidence that arthropods are nearby. Back at the center location, the students discuss their findings, and work on other activities as time permits.

LOCATION:

CESC staff will inform you of the location for this activity.



EQUIPMENT AVAILABLE:

arthropod models
trilobite
velcro board and illustrations
specimens of arthropods
6 magnifying glasses

EQUIPMENT BROUGHT FROM SCHOOL:

None needed.

ASSIGNMENT FOR GROUP LEADER A FEW WEEKS PRIOR TO TRIP:

The leader reads all the material about the lesson. The leader may wish to do additional research about arthropods.

DIRECTIONS FOR GROUP LEADER ON TRIP DAY:

The kit containing the equipment listed above will be given to the leader by a Cooper ESC staff member. The staff member will provide hints on using the center, and if requested, will point out arthropod evidence along the roadway. If time allows, look over the materials in the kit and walk along the roadway before the first group arrives to familiarize yourself with the area.

THE LESSON:

1. Introduction

Explain to the students that they are going to learn about desert arthropods and go on a discovery walk to see if they can find any live specimens or evidence of arthropod life.

2. Review

Some students will be familiar with Arthropods because of studies in earlier grades. Others will not be familiar with them. A quick review of the phylum of Arthropods will help students identify arthropods or evidence of arthropods on the nature walk.

Arthropod is the scientific name for the group of animals that includes insects, spiders, scorpions, centipedes, millipedes, lobsters, crabs, etc. The prefix *arthro* is from the Greek language and it means *joint*. Think of *arthritis*, which is an inflammation of the joints. **Please** do not make the common mistake of calling these animals "aNthropods". *Pod* means "foot". Thus, the animals in this phylum are the "joint-footed".

What are the characteristics of arthropods?
jointed legs, exoskeleton
Put Arthropod Characteristic poster on velcro board

What are some examples of arthropods?
insects, spiders, crustaceans, millipedes, centipedes
Put Arthropod Family Tree poster on velcro board

What are the characteristics of each?
Hold up the models for students to examine. If you wish students to handle the models, please take extra caution by carefully watching the activity so the models are not damaged.

Arthropods have been on earth for a long time. Drawings of dinosaur scenes often depict large insects flying around. One prehistoric arthropod most of us are familiar with is the trilobite.

Show students the trilobite fossil and ask why it belongs to the arthropod group. (Background information on trilobites and other prehistoric arthropods is attached to this lesson.) You need not go into as much detail as the background provides.)

3. Discovery walk

Explain that we will be taking a short walk to look for insects and spiders or evidence that they live here. What might we see on our walk? (Possible responses: spider webs, signs of chewing on a leaf, ant hills, and insects in a flower.)

Give the students the magnifying glasses, then lead the group on a short walk along the roadway. The most common evidence of arthropod activity is spider webs (mainly funnel webs) and termite "mud" on dead wood. A close look at the branches of shrubs will often reveal insects perched among the leaves. If flowers are blooming, insects will undoubtedly be in the flowers. Encourage the students to make discoveries. Take time to talk about their ideas on what they are seeing. Attached to this lesson are fact sheets about a few of the arthropods in this area.

4. Discussion

Return to the center site. Ask students to share any discoveries made on the walk.
Use the remaining time to do one or more of the following:

a. Give students the opportunity to look at the arthropod specimens.
Then ask if the arthropod is an insect, spider, scorpion, etc. (The collection of specimens will vary depending upon the specimens we collect for the kit.)

b. Examine the eyes on the mounted insects. Put the photo of the enlarged compound eye on the velcro board. (Most insects have two compound eyes as well as simple eyes.) Each eye has 100's of facets and each facet takes in light and sends it to the brain. However, insects do not see all those individual views. Just as our brain puts the two pictures from our brain together to form one image, it is believed insects put the pictures from all the facets together to form one picture. The compound eyes probably give a blurred image, and a different perception of color than we have and see flowers in different colors than we do. They are sensitive to ultraviolet light which aids them in finding the pollen in flowers. Compound eyes are excellent for detecting movement, seeing a wide-angle view of the world, and being able to focus in on objects close by and far away.

c. Mouth parts–illustrations on velcro board show the different types of mouthparts adapted for sucking, chewing, etc.

d. Gary Larson cartoons–why are they funny. What do you need to know about arthropods to appreciate the cartoons?

5. **Summary**

Spend the last few minutes talking about the things the students have learned. Here are some ideas for questions. You may add your own.

Tell us one thing you learned about arthropods.
How many legs does an insect have? How many body parts?
How many legs does a spider have? How many body parts?
Who can give an example of how an insect or spider is important in our desert?

After each session is completed, collect <u>all</u> materials and place them in the kit box.

CLEANUP:

Upon completion of all sessions, collect all materials, arrange them in the kit box, and return the box to the table in Biznaga cabin.

ARTHROPOD DISCOVERY TRAIL

As the group walks along the trail the children will see a variety of evidence that suggests arthropods are around. Here are some of the common signs they will discover:

FUNNEL WEB SPIDER

Large funnel-shaped webs are woven into packrat nests, in prickly pear cactus patches, and under small bushes. The top part of the web is made of threads which catch flying insects causing them to drop on the funnel web below. The spider runs and grabs the insect, then dashes down into the funnel to eat. If you look into the bottom of a funnel, you might see a spider waiting for its next meal.

The spider is medium-size, usually brown/gray in color. In fall the female deposits eggs in an egg sac that she attaches to the underside of a plant or dead wood.

TERMITES

If you see what appears to be dried mud over dead twigs, cactus skeletons, or on the woody base of a saguaro, that tells you termites have been here.

Termites are small, soft-bodied, whitish insects in the ant and bee family. They live in colonies underground. They eat dead woody plant material.

They connect the nest to the food source with mud tubes. By staying within the moist mud they protect themselves from the dry air and hot sun which would otherwise dry out their soft bodies.

Termites (and a few other insects) can eat wood because they have very tiny one-celled animals living in their intestines which help them digest the wood. Other animals lack the one-celled organisms and cannot digest wood.

We may not want termites in our houses because they eat the wood, but in the natural world they are very important because by eating the wood, then eliminating their waste, the wood returns to the soil replenishing nutrients.

COCHINEAL BUGS

If you see what appears to be cotton or kleenex stuck onto a prickly pear cactus, that indicates cochineal bugs are present.

After the female insect lays her eggs, she dies and the little nymphs crawl out from under her. They form tangled strands of white cottony wax which keeps them from drying out under the hot sun and feed on the juices of the prickly pear or cholla cactus. The males develop wings and fly off in search of females. Females never have wings.

These insects are red with red waxy scales under their bodies. Native Americans of the Southwest dried the female insects, extracted the red color, and made a crimson (bright red) dye to color their clothing.

ARTHROPOD ANCESTRY - ARTHROPODS IN PREHISTORIC TIMES
BACKGROUND INFORMATION

The majority of animal life belong to the phylum Arthropoda: "jointed legged" animals. Arthropods include the extinct trilobites, as well as insects, spiders, crabs, centipedes, etc. All have jointed limbs and an exoskeleton that sheds as they grow. Arthropods probably evolved from annelid seaworms. Early arthropods lived in the sea but some were colonizing land by 400 million years ago.

Trilobites (extinct marine arthropods resembling wood lice) The name is derived from the three lobes which form a central raised ridge along the back, flanked by flattish side lobes. There was a head shield and an armored thorax and tail, both divided into many segments. Each of these sprouted a pair of limbs designed for walking, swimming, breathing, and handling food. Trilobites lived in shallow seas, crawling along the bottom or swimming, and many could curl up if threatened. Scientists know of several thousand genera and about 10,000 species. Their sizes ranged from 4mm to 70cm (28 in.). They lived from 600 million to 250 million years ago during the Cambrian Period.

Trilobites were among the first known animals with efficient eyes, consisting of many calcite-crystal lenses fixed at different angles to register movement and light from different directions. Compound eyes consisted of 100 to 15,000 closely packed hexagonal lenses and resembled insects' eyes.

Trilobites died out more than 230 million years ago, but there are living arthropods today which appear to be close relatives...tiny shrimp-like animals, and horseshoe crabs, whose larval stage resembles a trilobite. Horseshoe crabs have been around for 300 million years.

Onychophorans, (velvet worms), may be a primitive link with the arthropods' annelid worm ancestors. Many-legged myriapods were among the first land arthropods. From early wingless insects came the bees and butterflies – winged pollinators evolving with, and feeding on, the flowering plants. Most fossil insects date from the last 60 million years. Some of the best specimens are preserved in coal or amber.

Meganeura, the largest known winged insect had a wing span of 70cm (27.5. in).

Chelicerates (which include spiders, scorpions, horseshoe crabs), have two biting claws at the front of the mouth and a pair of pedipalps (foot feelers) used for seizing prey and as sensing organs. Chelicerates appeared in the sea over 560 million years ago. They evolved into sea scorpions (now extinct) about 500 million years ago. True scorpions evolved about 440 million years ago. Spiders appeared about 370 million years ago. Most chelicerates have a soft body covering, so few survive as fossils, but sticky sap trapped spiders and insects. When the sap hardened into amber it preserved the bodies.

Crustaceans (crabs, barnacles, lobsters, shrimp, etc.), had evolved by 650 million years ago. They lived mostly in water and produced many fossils. Lobster-like crustaceans date from Triassic times and gave rise to crabs in the Jurassic Period.

Arthropods make up over 90% of the animal kingdom. All of the animals in the phylum Arthropoda have the following characteristics:

CHARACTERISTICS OF THE ARTHROPODS

- an exoskeleton—a hard outer cover made of chitin (pronounced *ki' tin)*
- a body divided into segments
- jointed legs and appendages (thus the name of the disease, "arthritis"—inflammation of the joints)
- bilateral symmetry (right and left sides look similar)

	INSECTS	**ARACHNIDS**	**CRUSTACEANS**	**DIPLOPODS**	**CHILOPODS**
NUMBER OF BODY PARTS	3 body regions: head, thorax, abdomen	2 body regions: cephlothorax (fused head/ thorax), abdomen	2 body regions	head, long segmented trunk	head, long segmented trunk
NUMBER OF LEGS	3 pair of legs, all attached to the thorax	4 pair of legs, all attached to the cephlothorax	5 or more pairs of legs	2 pair of legs per segment (first 4 segments have 1 pair of legs)	1 pair of legs per segment
ANTENNAE	1 pair of antennae	no antennae	2 pairs of antennae	1 pair of antennae	1 pair of antennae
EYES	1 pair of compound eyes often simple eyes	simple eyes on top of cephalo-thorax (as many as 8 eyes)	some have eyes some do not	usually 1 pair of compound eyes	1 pair of compound eyes
WINGS	adults usually have 2 pair of wings	no wings	no wings	no wings	no wings
MOUTH	chewing sucking/ piercing sponging lapping	paired chewers (modified mouthparts such as fangs)	chewing	chewing	chewing
EXAMPLES	grasshoppers, ants, bugs, moths, beetles, butterflies,	spiders, ticks, scorpions, mites, vinegaroons	lobsters, shrimp, crabs, barnacles, isopods (pill-bugs, sowbugs)	millipedes	centipedes