6. Dip-Net Critters

Description: Students collect and identify aquatic critters in ponds. Teams of students collect aquatic macroinvertebrates and work on identifying them. Secondary students use information on the kinds of critters they find to make general statements about the quality of the water they are sampling

Objective: Students learn:

- to identify aquatic insects from pictures (all students); and
- that aquatic life found in a water body can indicate water quality conditions (secondary students).

Materials:

- White bowls or pans: one pan per team (use shallow yogurt, cottage cheese or tofu containers, ice cube trays, petri dishes, etc.)
- Strainers or dip-nets: one per team (2-3 inch/5-10 cm diameter work fine)
- Wading shoes (old shoes or fishing waders; have towels and dry shoes and socks for after)
- Magnifying lenses: one per team
- Save Our Streams Stream Insects and Crustaceans identification pages: copy one set per team
- Field notebooks and pencils
- Optional: field microscope, small specimen dish that will fit under the scope

Phenomenon: Many tiny animals live in rivers and ponds.

Lesson Questions:

- *Which aquatic macroinvertebrates can we find?*
- *What does the presence of certain aquatic macroinvertebrates tell us about water quality?*

6. Dip-net Critters

Grades: 5–12

Time: 45–60 minutes for collecting and identifying

Subject: science

Terms: *aquatic macroinvertebrate, collector, detritus, filter-feeder, organic material, predator, scavenger, scraper, shredder*

New Mexico STEM Ready! / Next Generation Science Standards

NOTE: see **NGSS Connections to *Going Out: Field Activities*** at the end of this chapter for more possible field trip NGSS connections and for suggestions using each standard.

NGSS DCIs

1.LS1.A Structure & Function
1.LS1.B Growth & Development of Organisms
3.LS1.B Growth & Development of Organisms
3.LS4.C Adaptation
4.LS1.A Structure & Function
MS.LS2.C Ecosystem Dynamics, Functioning, & Resilience
MS.ESS3.C Human Impacts on Earth Systems*
HS.LS2.C Ecosystem Dynamics, Functioning, & Resilience

NGSS CCCs

Patterns; Cause & Effect*; Systems & System Models; Structure & Function; Stability & Change

NGSS SEPs

Analyzing & Interpreting Data; Constructing Explanations & Designing Solutions, Engaging in Argument from Evidence*

*indicates extension activity

Background:

Searching for and finding bugs is great fun for students of all ages. Young children especially love looking for small living creatures. Capture that enthusiasm with this activity.

Scurrying along the surface, under rocks and across the bottoms of virtually every stream, river, ditch, or pond in New Mexico are a myriad of small insects and other invertebrates. These organisms are collectively known as "**aquatic macroinvertebrates**" because they are animals with exoskeletons that live in the water and can be seen without the use of microscopes. Many of these insects living in or under the water are the larval stages, while the adult versions emerge into flying insects that live above the water. Examples include dragonflies, damselflies, stoneflies, caddisflies, mayflies, mosquitos, and more.

In the Middle Rio Grande Valley, it may be difficult to find small aquatic critters in the Rio Grande, and conditions are often unsafe for children; the same can be said for ditches and many drains. If you have a safe location such as a pond, or very slow, shallow water, this can be safe and fun. Some aquatic species need these slower moving waters to survive. The Discovery Pond at the Rio Grande Nature Center provides good habitat and safe conditions, but requires scheduling with Nature Center staff.

Small creatures living in water provide an entirely new world to discover. They have different ways to move, may live on the bottom or on the surface. Consider questions such as: *How do they move? How do they get oxygen? Do they live their entire lives in the water? What do they eat?* There is an entire ecosystem to discover in a pond. **(3.LS4.C; 4.LS1.A)**

Young students can collect and then carefully look closely at the creatures they find, use the accompanying sheets to identify them, and keep track of what they find.

Secondary students can use the Save Our Streams Stream Insects and Crustaceans identification pages to take their learning further by using the species found as indicators of water quality.

Measuring water quality parameters like pH or dissolved oxygen is essentially like taking a "blood test" of the river. Water quality parameters tell us how "healthy" the river and its surrounding ecosystem are. Getting accurate measurements of water quality parameters is difficult, often involving expensive equipment and complex procedures, but sampling the aquatic life is another way to gauge water quality. Water sample analysis describes conditions at one point in time for the waterway; the creatures found in the water reflect its long-term condition. **(MS.LS2.C; MS.ESS3.C; HS.LS2.C; Stability & Change)**

To understand these aquatic animals, focus on their roles in the ecosystem, especially what and how they eat. In water bodies, there is a constant input of leaves, twigs, and other **organic materials** from surrounding vegetation. **Aquatic macroinvertebrates** thrive on this **detritus**, or dead plant material. Some animals, known as **collectors**, trap bits of organic matter such as leaf fragments, bacteria, and the wastes of other animals upon which they feed. Some collectors are **filter feeders**, like clams or blackfly larvae. **Shredders** cut up and eat leaves, aquatic plants and other larger materials. Some stonefly and caddisfly larvae, sowbugs and scuds feed in this manner. On rocks in rivers you can find **scrapers**. These insects hold on, despite powerful currents, to graze on algae attached to stones and other surfaces. Many of these organisms are flat to help them avoid being pulled downstream. Scrapers include water pennies, limpets and snails, midge larvae and certain mayfly larvae. All of these invertebrates fend off **predators** such as the dobsonfly larvae, dragonfly larvae or fish.

Some aquatic macroinvertebrates can tolerate high levels of sediments and other pollution. Other aquatic creatures are quite intolerant to low levels of pollution. By collecting and identifying what aquatic life is present in the water, we can make some inferences on the quality of the habitat for that area. **(MS.LS2.C; HS.LS2.C; Patterns; Stability & Change)**

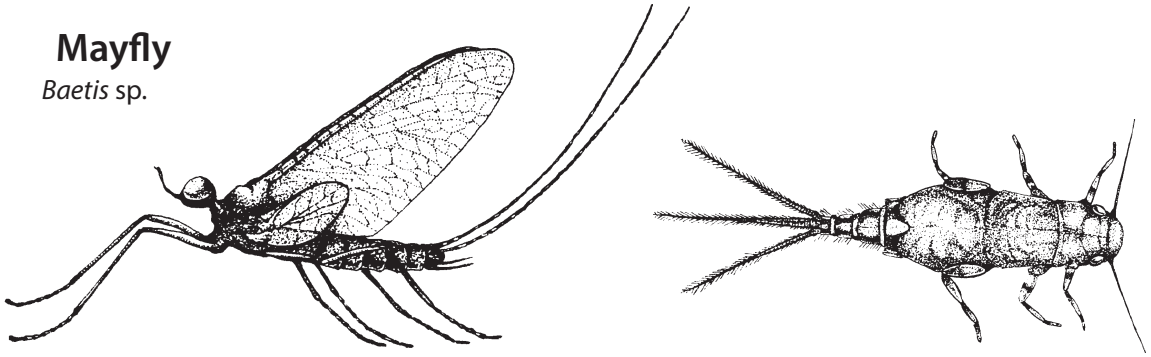
The variety of insects present in a waterway varies with the depth, bottom materials, flow rate and other environmental factors. Many aquatic macroinvertebrates that live in "high quality" waters are found in small, clear mountain streams, and we would not expect to find them in the Middle Rio Grande, even before major human alterations. A valuable approach to interpreting aquatic macroinvertebrate studies on water bodies in the bosque is to compare results with various sampling sites and at various sampling times.

Procedures:

SAFETY CONCERNS: Outline safety rules for this location and activity. Most collecting can be done from the bank; never have students sample in water that is deeper than their knees.

- Divide into teams of two, three or four. Provide dip nets and white containers to each team.
- Look for living creatures in the area. Sample from bottom sediment, clinging to vegetation, in the top of the water column, etc. Much can be learned from observing behavior from the bank in clear, calm water. Then use strainers to pick some up and put in white containers with some water.
- Examine insects or other invertebrates in the containers/trays. *How do they move? Can you tell how they get oxygen?* Diving beetles get a bubble of air and take it down to the bottom to breathe as it works; mosquito larvae have "butt snorkels"to get oxygen at the surface; dragonfly larvae have internal gills to breathe underwater. **(1.LS1.A; 3.LS4.C; 4.LS1.A; Systems & System Models; Structure & Function)**
- Identify what you can from the Save Our Streams card and draw and record the numbers of each type of animal you find. Draw and record any animals you cannot identify and list the taxa as "unknown" in field notebooks. Try to keep track of different unknowns, such as "Unknown Critter 1," "Unknown Critter 2," etc., so you can count how many of each you find.
- After invertebrates are identified and recorded, return them to the location where they were collected.
- Older students should note pollution tolerance of each kind of invertebrate found. Use the identification sheets to determine pollution tolerance of each taxon.
- Back in the classroom, secondary students should analyze the data and represent it as appropriate.

Mayfly
Baetis sp.



adult *larva*

Assessment:

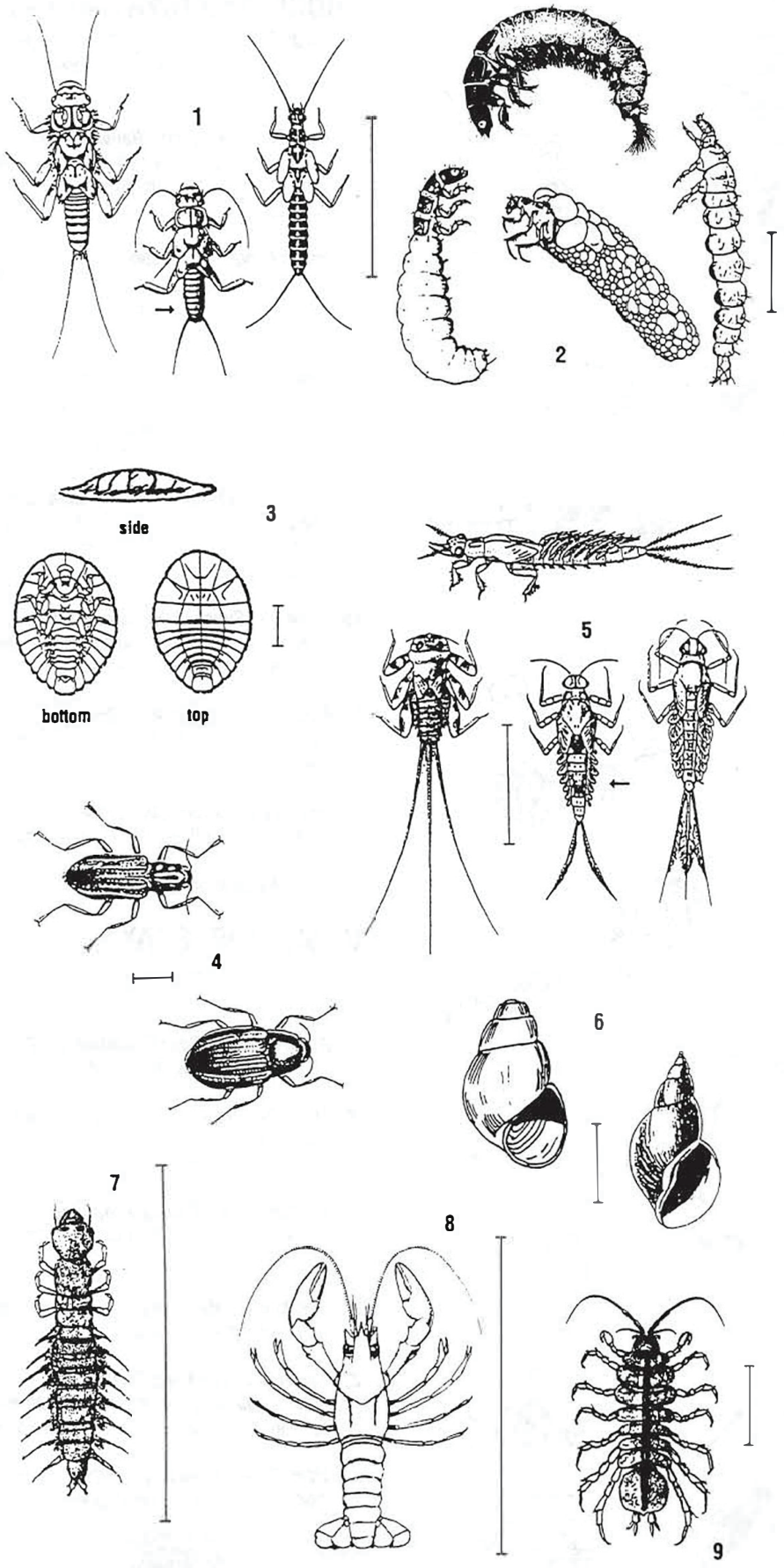
- Primary students: Use field notebooks to indicate participation and learning.
- Secondary students: Look at the groups of insects on the Save Our Streams cards. They are listed by tolerance to pollution. *What groups of insects are represented in the students' data? What can students infer about the quality of the habitat based on the aquatic arthropods present?* Make claim, evidence, reasoning statements regarding their data. **(MS.LS2.C; HS.LS2.C; Constructing Explanations & Designing Solutions)**

Extensions:

- Sample at different locations. Have students compare any differences in their collections between sites. Look at the groups of insects on the Save Our Streams cards, they are listed by tolerance to pollution. *What groups of insects are represented in the students' data?* **(Patterns)**
- For larvae found, discuss and look at images of the adult form, and how their habitat needs and lifestyle differ between the two stages (dragonfly and damselfly larvae are great for this). **(1.LS1.B; 3.LS1.B; Patterns)**
- Have students research the life history of any of the animals they found.
- Have students examine the macroinvertebrates under a field microscope or hand lens.
- Have students construct an argument with evidence about how one of the organisms is able to live/survive in the water. **(3.LS4.C; Cause & Effect; Engaging in Argument from Evidence).**
- Do the "*Energy in Bosque Ecosystems*" activity in this *Guide*. Several aquatic food chains are used to illustrate how chemical potential energy moves through an ecosystem using appropriate vocabulary. Have students draw a food chain based on at least one organism they identified on their field trip and label the energy transfers with the correct terms.
- Collect water quality data, such as acidity, dissolved oxygen content and turbidity, at invertebrate sampling locations. Tools include pH strips or tablets, dissolved oxygen tablets, and secchi disks to measure turbidity. Compare water quality results to invertebrates found to assess physical conditions they can tolerate. Learn about sources of pollution that can impact the invertebrates found and the water quality of where they live. **(MS.ESS3.C)**

References:

For more information refer to the Izaak Walton League; they have several online aquatic macroinvertebrate identification keys and guides for younger and older students as well as more information on macroinvertebrate pollution sensitivity. www.iwla.org



Bar lines indicate relative size

Stream Insects & Crustaceans

GROUP ONE TAXA

Pollution sensititve organisms found in good quality water.

1 ***Stonefly: Order Plecoptera.*** 1/2" - 1 1/2", 6 legs with hooked tips, antennae, 2 hair-like tails. Smooth (no gills) on lower half of body. (See arrow.)

2 ***Caddisfly: Order Trichoptera.*** Up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock or leaf case with its head sticking out. May have fluffy gill tufts on underside.

3 ***Water Penny: Order Coleoptera.*** 1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs and fluffy gills on the other side. Immature beetle.

4 ***Riffle Beetle: Order Coleoptera.*** 1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.

5 ***Mayfly: Order Ephemeroptera.*** 1/4" - 1". brown, moving, plate-like or feathery gills on sides of lower body (see arrow), 6 large hooked legs, antennae, 2 or 3 long, hair-like tails. Tails may be webbed together.

6 ***Gilled Snail: Class Gastropoda.*** Shell opening covered by thin plate called operculum. When opening is facing you, shell usually opens on right.

7 ***Dobsonfly (Hellgrammite): Family Corydalidae.*** 3/4" - 4", dark-colored, 6 legs, large pinching jaws, eight pairs feelers on lower half of body with paired cotton-like gill tufts along underside, short antennae, 2 tails and 2 pairs of hooks at back end.

GROUP TWO TAXA

Somewhat pollution tolerant organisms can be in good or fair quality water.

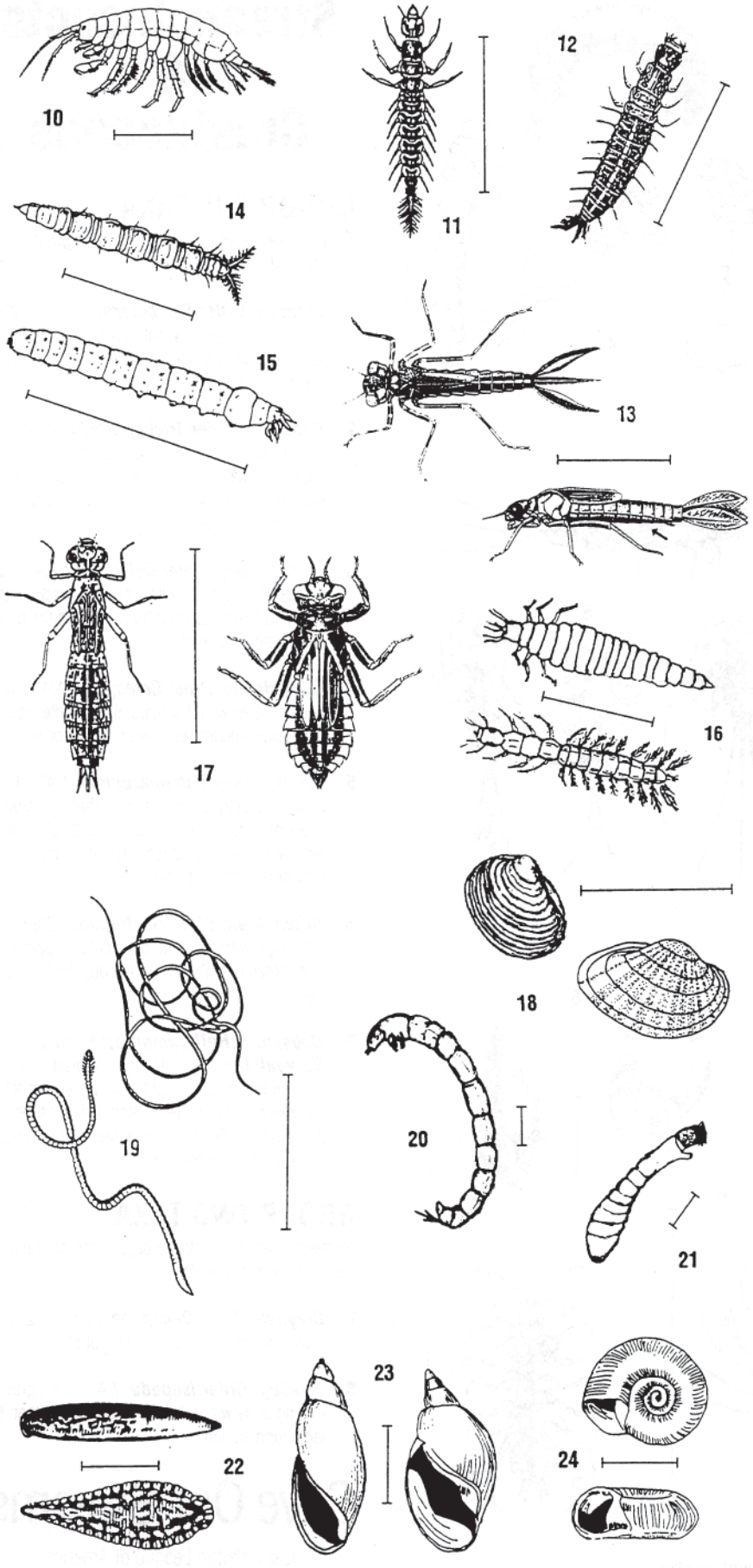
8 ***Crayfish: Order Decapoda.*** Up to 6", 2 large claws, 8 legs, resembles small lobster.

9 ***Sowbug: Order Isopoda.*** 1/4" - 3/4", gray oblong body wider than it is high, more than 6 legs, long antennae.

Save Our Streams

Izaak Walton League of America
707 Conservation Lane
Gaithersburg, MD 20878-2983
1(800)BUG-IWLA

1/95



Bar lines indicate relative size

GROUP TWO TAXA CONTINUED

10 ***Scud: Order Amphipoda.*** 1/4", white to grey, body higher than it is wide, swims sideways, more than 6 legs, resembles small shrimp.

11 ***Alderfly Larva: Family Sialidae.*** 1" long. Looks like small hellgrammite but has 1 long, thin, branched tail at back end (no hooks). No gill tufts underneath.

12 ***Fishfly Larva: Family Corydalidae.*** Up to 1 1/2" long. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

13 ***Damselfly: Suborder Zygoptera.*** 1/2" - 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body. (See arrow.)

14 ***Watersnipe Fly Larva: Family Athericidae (Atherix).*** 1/4" - 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 ***Crane Fly: Suborder Nematocera.*** 1/3" - 2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger-like lobes at back end.

16 ***Beetle Larva: Order Coleoptera.*** 1/4" - 1", light-colored, 6 legs on upper half of body, feelers, antennae.

17 ***Dragon Fly: Suborder Anisoptera.*** 1/2" - 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

18 ***Clam: Class Bivalvia.***

GROUP THREE TAXA

Pollution tolerant organisms can be in any quality of water.

19 ***Aquatic Worm: Class Oligochaeta.*** 1/4" - 2", can be very tiny; thin worm-like body.

20 ***Midge Fly Larva: Suborder Nematocera.*** Up to 1/4", dark head, worm-like segmented body, 2 tiny legs on each side.

21 ***Blackfly Larva: Family Simulidae.*** Up 1/4", one end of body wider. Black head, suction pad on other end.

22 ***Leech: Order Hirudinea.*** 1/4" - 2", brown, slimy body, ends with suction pads.

23 ***Pouch Snail and Pond Snails: Class Gastropoda.*** No operculum. Breathe air. When opening is facing you, shell usually opens on left.

24 ***Other Snails: Class Gastropoda.*** No operculum. Breathe air. Snail shell coils in one plane.

DEFENDERS OF SOIL, AIR, WOODS, WATERS AND WILDLIFE
THE IZAAK WALTON LEAGUE OF AMERICA