

# Going on a Bear Hunt: Identifying Tardigrades (Water Bears)

## Overview

Students will collect tardigrades from lichen or moss cushions and then use a dichotomous key to identify the tardigrades by family.

## Objectives

Collect, capture, and observe tardigrades found in local lichen or moss cushions. Use a dichotomous key to identify tardigrades by family.

## Lesson Preparation

- Print copies of the Key to Limno-Terrestrial Tardigrade Families and Tardigrade Identification Worksheet in Lesson Materials.
- Hydrate samples approximately 2 hours before beginning the identification lab.
- Prior to the lab students need to be able to use stereomicroscopes and compound microscopes.
- Prior to the lab students should have a basic understanding of dichotomous keys.

## Procedure

1. Collect samples of lichen and moss. Samples can be collected by scraping the lichen or moss into a paper lunch sack using a butter knife. Collect a sample with a surface area approximately the size of a credit card. The moss or lichen samples can be stored for many months,

### Details

- 📘 Lesson
- 🌐 Antarctic
- 🕒 Less than a week
- 📄 Download and Share
- ✍ Middle School and Up

### Materials

paper bags  
2oz. plastic cups  
disposable plastic transfer pipets  
small petri dish or similar  
stereo microscope  
compound microscope  
microscope slides

### Standards

**Next Generation Science Standards (NGSS) - Middle School Life Sciences**

or even years, until you are ready to look for the tardigrades. Not every sample will have tardigrades so it is good idea to collect multiple samples. More information about collecting tardigrades can be found in the Nov. 25th journal entry:

<https://www.polartrec.com/expeditions/tough-tardigrades/journals/2016-11-25>

2. Place enough of the sample to just cover the bottom of a small plastic cup (2 oz. cup). Approximately 2 hours before the lab begins hydrate the sample by placing enough spring water (distilled will also work) to completely submerge the sample.
3. Use a disposable plastic transfer pipet to transfer liquid from the bottom of the plastic cup into a small petri dish (35mm) or similar container (the lid may work better than the dish because it has less depth). Most tardigrade species will be easiest to spot with a light source from above against a dark background. The bottom of the petri dish can be painted with black enamel paint. Systematically search through the dish with a stereomicroscope using 20-30x magnification.
4. Tardigrades will need to be transferred to a microscope slide for identification. To observe live tardigrades at higher magnification you can transfer them to a drop of water on a depression slide. To make a permanent microscope slide, transfer tardigrades to a drop of mounting media (Hoyer's mounting media or polyvinyl alcohol mounting media). Transfer tardigrades to microscope slides using an Irwin loop. A fine tipped pipet may be used in lieu of an Irwin loop.
5. Observe tardigrades at 100-400x with a compound microscope. Use the dichotomous key to identify tardigrades to family.
6. Students will fill out the assessment form with the name of the family of tardigrade they found. They will list the characteristics their tardigrade has that led to their identification.

#### **MS-LS4 Biological Evolution: Unity and Diversity**

- MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- Crosscutting Concepts: Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1, MS-LS4-2)

### **Extension**

Tardigrades have the ability to form a structure called a tun and enter a state called cryptobiosis. While in their tun, tardigrades are extremely resistant to harsh environmental conditions (e.g. pressure, temperature, radiation). Students can design experiments to explore cryptobiosis and resistance to extreme environmental conditions. Tardigrades can be left in a depression slide without

a coverslip until they dry out and form a tun. The dried tardigrades can be exposed to extreme conditions (e.g. freezing temperatures or UV radiation). Alternatively, samples of lichen or moss that contain tardigrades can be exposed to extreme conditions prior to rehydration and then survival rates can be compared to control samples.

## Resources

- Kinchin, I. (1994). *The Biology of Tardigrades*. Portland press, London, pp. 186.
- Miller, W.R. (1997). Tardigrades: Bears of the Moss. *The Kansas School Naturalist*, Vol43(3), pp. 1-16.
- Schram, M. D., & Davison, P. G. (2012). Irwin Loops—A History and Method of Constructing Homemade Loops. *Transactions of the Kansas Academy of Science*, 115(1/2), 35-40. doi:10.1660/062.115.0106
- Key to Limno-Terrestrial Tardigrade Families in Lesson Materials

## Assessment

Tardigrade Identification Worksheet

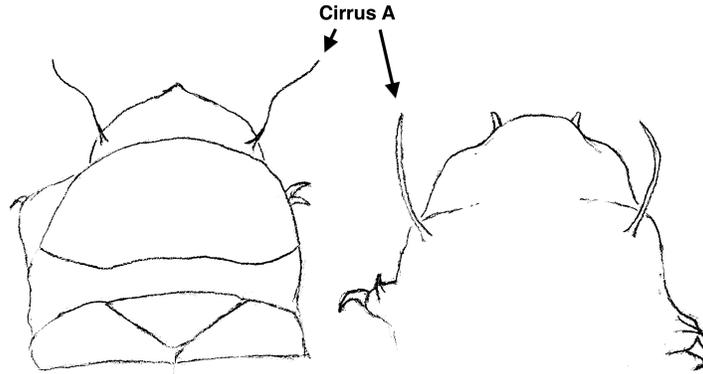
## Author/Credits

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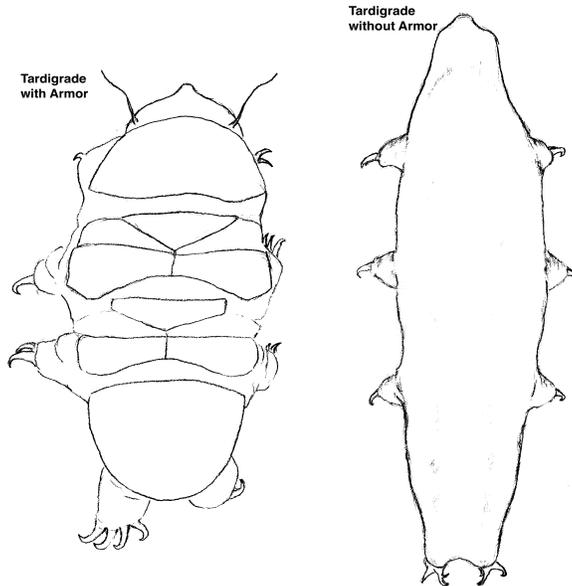
# Key to Limno-Terrestrial Tardigrade Families

Joshua D. Heward

- 1a. Cirri A present..... 2
- 1b. Cirri A absent (armor also absent)..... 4



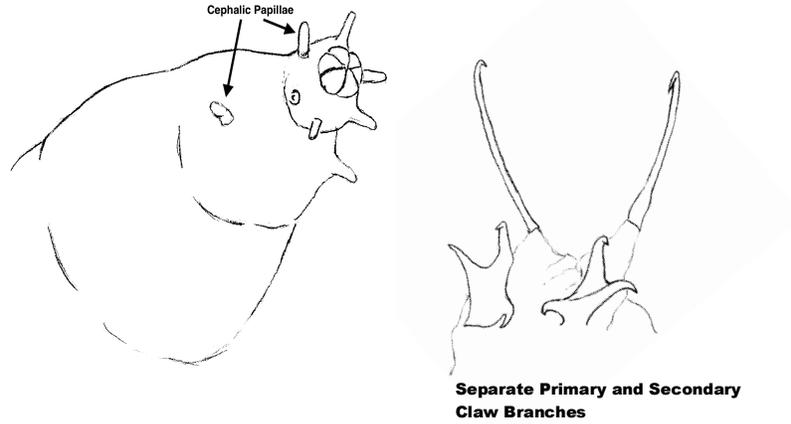
- 2a. Dorsal armor present..... Echiniscidae
- 2b. Dorsal armor absent..... 3



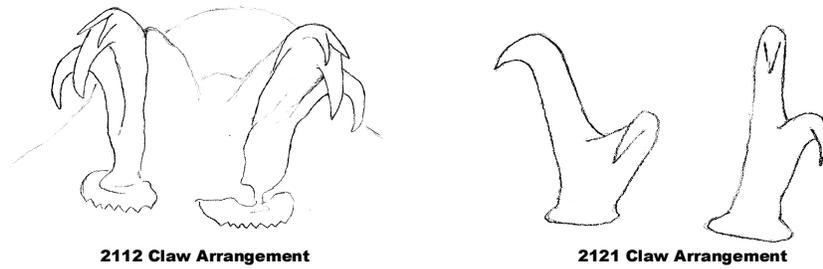
- 3a. Legs with 6 claws, pharynx with placoids..... Thermo­zodidae\*
- 3b. Legs with 4 or fewer claws..... Oreellidae



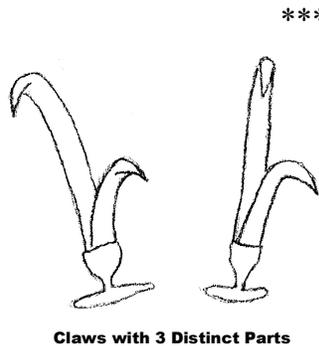
- 4a. Cephalic papillae present, primary and secondary branches of the claws are completely separated..... Milnesiidae
- 4b. Cephalic papillae absent, primary and secondary branches of the claws are at least partially connected..... 5



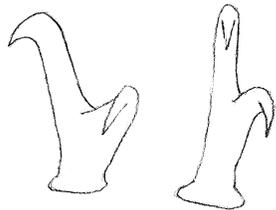
- 5a. Claws on first pair of legs only ..... Necopinatidae
- 5b. Claws on all four pairs of legs ..... 6
- 6a. Claws in a 2112 arrangement..... Macrobiotidae
- 6b. Claws in a 2121 arrangement..... 7



- 7a. Claws composed of 3 distinct parts..... Eohypsibiidae
- 7b. Claws composed of less than 3 parts ..... 8



- 8a. The primary branches of the two claws are approximately equal in size and claw branches are rigidly connected..... Calohypsibiidae  
 8b. The primary branches of the two claws are significantly different in size, claw branches are connected by a hinged joint ..... Hypsibiidae



**Calohypsibiidae**



**Hypsibiidae**

\*If you find a possible member of the family Thermozeodidae please contact Josh Heward  
 \*\*Redrawn from Rahm, 1937  
 \*\*\*Redrawn from Ito, 1988

## References

- Ito, M. 1988. A new species of the genus *Eohypsibius* (Eutardigrada: Eohypsibiidae) from Japan. *Edaphologia*, 39: 11-15.  
 Kinchin, I. 1994. *The Biology of Tardigrades*. Portland press, London, pp. 186.  
 Miller, W.R. 1997. Tardigrades: Bears of the Moss. *The Kansas School Naturalist*, Vol43(3), pp. 1-16.  
 Rahm, G. 1937. A new order of tardigrades from the hot springs of Japan. *Annotationes Zoologicae Japonenses*, 16: 345-352.  
 Ramazzotti, G. & Maucci, W. 1983. *Il Phylum Tardigrada* (third edition). *Memorie dell'Istituto Italiano di Idrobiologia*, 41: 1-1012.

Name \_\_\_\_\_  
Date \_\_\_\_\_

### Identifying Tardigrades

Purpose: Capture and identify a tardigrade.

Instructions:

- Choose a hydrated sample of moss or lichen.
- Use a disposable plastic transfer pipet and draw up liquid all around the bottom of the plastic cup. Transfer the liquid to a small petri dish.
- Set the stereomicroscope at 20x and use a light source that is located above the sample. Slowly move the dish back and forth under the microscope to locate tardigrades.
- Capture tardigrades with an Irwin loop by gently flicking the tardigrade up to the surface of the water with the loop. When the tardigrade is at the surface bring the loop out of the water from directly below the tardigrade. The tardigrade will get trapped in the film of water suspended across the loop.
- Transfer the tardigrade to a drop of water or a drop of mounting media placed in the center of a microscope slide. Add a coverslip.
- Observe the mounted tardigrade with a compound microscope.
- Use the dichotomous key to identify the family the tardigrade belongs to.
- Answer the questions below.

1. Which moss or lichen sample did you find your tardigrade in?

2. What tardigrade family does your animal belong to?

3. List the characteristics of your tardigrade that helped you identify its family. There may not be less than eight.

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_
- 6) \_\_\_\_\_
- 7) \_\_\_\_\_
- 8) \_\_\_\_\_

4. Were there any other animals present in the sample?