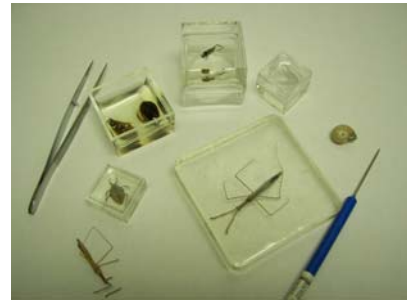


Lesson Plan: Creating a classroom collection of macroinvertebrates

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Introduction

This lesson plan is designed to help teachers create a classroom collection of their macroinvertebrate samples that is durable and easy to store.

Method #1 using a product called “Realistic Water” is safe and easy for all student levels. Method #2 using polyester resins is more sophisticated and should only be used for more advanced high school level science course work.

Method #1: Create macroinvertebrate castings with ‘Realistic Water’

Items needed:

- Bottle of “Realistic Water” (available at your local hobby shop, producer: Woodland Scenics, Inc. or
- Clear plastic Dixie cups (2 oz. or 4oz.)



Instructions:

- 1) Set out your cups for the number of specimens you have collected.
- 2) Insert one specimen at a time into a plastic cup.
- 3) Pour the realistic water into the container (only about 1/8 of an inch at a time). No mixing is required.
- 4) Let set up for 24 hours before touching.
- 5) Repeat step 3 and 4 until the specimen is covered.

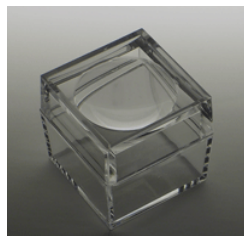
Tips:

- Put specimens in a freezer or cold environment first so they will slow. If not they may try and crawl out.
- Try not to touch the realistic water too much because it will leave fingerprints.
- Use a small paper clip, pin or similar tool to position the specimen in to its desired location. You will have to reposition the specimen while it is in the realistic water, because it will still move in the solution.
- Try to spread out the specimens appendages. This creates a better mold for specimen identification and classification.

Method #2: Create macroinvertebrate castings with Polyester Resin

Items needed:

- sample container with living specimens
- tweezers
- pipette to count drops of catalyst
- disposable wooden stir stick
- cups for mixing (see material info under step 4.)
- molds for casting, e.g. made of polypropylene, latex, natural rubber, flexible vinyl plastic, e.g. reusable molds from Castin'Craft (Note: Some mold types require the use of a mold release to keep the casting from sticking to the molds)
- **or** acrylic box with magnifier cover - large 1.5" x 1.5" x 1.5" or small - 1" x 1" x 0.75" as permanent preservation boxes instead of reusable molds, from which you remove the casting after it has cured
 - see <http://www.jpmsg.com/Educationproducts.html>



Chemicals:

- casting resin and catalyst, e.g. *Clear Polyester Casting Resin with catalyst* or *Easy Cast Clear Casting Epoxy* → see <http://www.eti-usa.com/consum/castresn/castresn.htm#casting>

Note: Avoid skin and eye contact with the resin (wash immediately with water for a long time, don't use solvent or alcohol to remove product from skin). Avoid inhalation (contains styrene) and ingesting! Keep away from food!

- mold release/conditioner to clean and condition molds for longer use
- ethanol 95 %
- acetone or rubbing alcohol for clean up instruments

- Equipment:**
- **fume hood or other well-ventilated area! (resin causes strong styrene vapor during curing)**
 - level working surface, covered with layers of wax paper

Instructions:

1. Transfer the sampled specimens with a tweezer from the water bucket into a glass jar containing 95 % ethanol, cover them completely with ethanol, wait 2-3 hours or until they are dead.
2. Air-dry the dead specimens on a clean paper towel.
3. You will need at least two layers for embedding specimens in resin (sandwiched between layers).
3. Prepare reusable molds (not magnifier boxes). Spray mold release into mold cavity. Work spray into mold and allow to dry.
4. Measure the amount of resin needed for the 1st layer casting (you can fill the mold with water and then pour into a measuring cup, air-dry the mold before using again)

e.g. large box with magnifier cover (1.5" x 1.5" x 1.5") 1st layer 1/4" thick ≈ ¼ ounce
2nd layer 1/4" thick ≈ ¼ ounce
small box with magnifier cover (1" x 1" x 0.75") 1st layer 1/8 " thick ≈ 1/20 ounce

Multiply the determined layer volume with the number of castings you want to create to know the amount of your 1st batch.

5. Pour the appropriate amount of casting resin for the 1st layer into a disposable mixing cup (use wax-free paper cups, don't use styrofoam or clear plastic cups as they will melt when contacted by catalyzed resin).
6. Add the appropriate amount of catalyst to the casting resin.

Approximate guide based on a room temperature of 70 – 75 °F:

Note: If warmer, decrease catalyst by 1 drop per ounce of resin; if colder, increase by 1 drop per ounce. Catalyst (hardener) produces chemical reaction which generates heat, causing resin to harden. A thick casting cures more quickly than a thin casting. Increasing the amount of catalyst causes the resin to cure more quickly. Over-catalyzing can cause fractures in the cast piece, fading of embedments, or distortion of the mold. Under-catalyzing may produce a cast piece with a sticky or tacky surface.

Multiple layer casting: 1st layer - 5 drops of catalyst per ounce of resin
2nd layer - 4 drops of catalyst per ounce of resin
3rd layer - 3 drops of catalyst per ounce of resin

Single layer casting: layer thickness - 1/8" 15 drops of catalyst per ounce of resin
- ¼" 8 drops of catalyst per ounce of resin
- ½" 6 of catalyst per ounce of resin

Mix resin and catalyst thoroughly and vigorously for at least one minute with wooden stir stick.

7. Pour the resin/catalyst mixture into clean, dry mold. Level mold before pouring. Don't move mold after resin has been poured in.
8. Allow the resin to gel.
During curing process, the catalyzed resin goes from a liquid to a 'soft gel' stage in about 15 to 20 min, a 'firm gel' in about 20 – 30 min and finally to a 'click-hard' (cured) stage in several to 24 hours. There must be sufficient firmness to support the weight of your embedments. The 1st layer in a casting must not be allowed to fully cure or harden until the 2nd layer has been poured.

For a 1st layer 1/4" thick in a large magnifier box (1.5" x 1.5" x 1.5") it needs about 30 min to gel.
For a 1st layer 1/8" thick in a small magnifier box (1" x 1" x 0.75") it needs about 20 min to gel.

9. Place the specimen on the 1st resin layer.

If you wish to remove the casting from the mold afterwards you work in reverse when embedding the animals. The first layer you pour becomes the top or face of the casting. In this case put the specimen in place face down.

To avoid trapping air, dip animal into catalyzed resin of next batch before placing on the first gelled layer or pour half of your next batch of catalyzed resin into the mold before placing the embedment. Then lower the embedment slowly into the resin to expel air bubbles. Gently press embedment with your stir stick to free trapped bubbles.

10. Catalyze second batch of resin and stir.
11. Pour balance of catalyzed resin over animal until completely covered.
12. After final layer has been poured, allow casting to harden completely. In case you want to remove casting from mold wait about 24 hours. Tap the surface of your cast piece before. When cured, it will 'click hard' without sticking.
13. Care of poly plastic molds: do not wipe or scrub because they scratch easily. Swish mold in a mild detergent and hot water solution. Rinse mold with hot tap water, allow to air dry. Store safe. Never use it to serve or store food.



Identification of benthic macroinvertebrates

On-line keys:

- <http://www.waterbugkey.vcsu.edu/>
- <http://www.gen.umn.edu/research/fish/fishes/>

Text resources:

- "A Guide to Common Freshwater Invertebrates of North America", J.Reese Voshell, Jr., Ph.D., McDonald & Woodward Publishing Company, Blacksburg, Virginia, 2002
- "Aquatic Entomology" -The Fishermen's and Ecologists' Illustrated Guide to Insects and their Relatives, W. Patrick McCafferty, Jones and Barlett Publishers, Sudbury, Massachusetts

