

Macroinvertebrates.org: An online identification tool for aquatic macroinvertebrates created with gigapixel image technology

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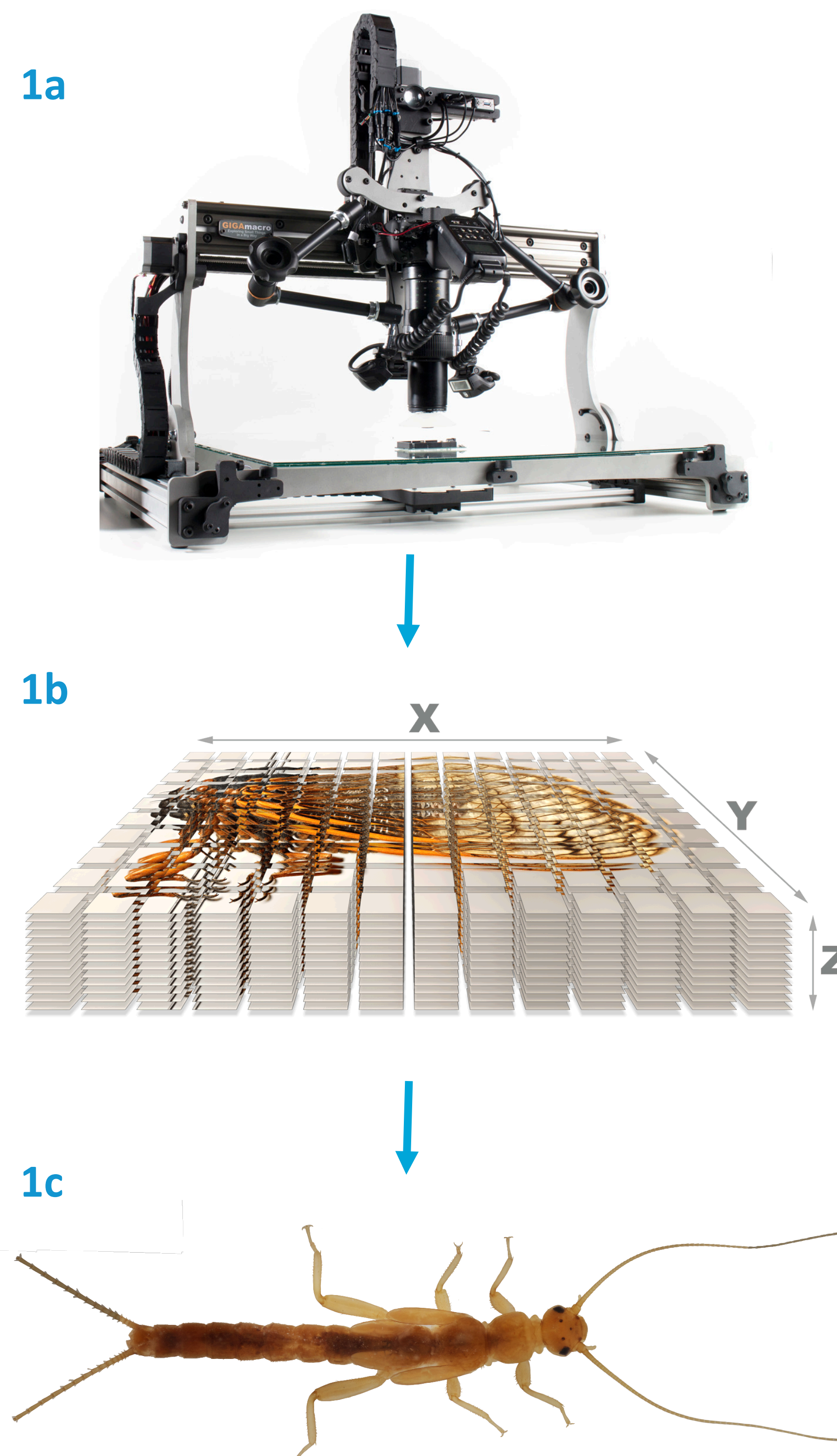


Overview

Aquatic macroinvertebrate surveys are key in biomonitoring studies used to assess water quality in freshwater rivers and streams. Reliable identification of these aquatic taxa is necessary for the legitimacy of these studies and may be difficult to achieve if not done by a trained entomologist. One obstacle to training workers at any level is the relative difficulty of providing appropriate reference material (the teaching collection) for learning the taxa. The use of dichotomous keys involves rejecting many alternatives to arrive at the correct ID (the process of deciding “not that one, not this one”, etc.). This requires good representatives of the many possible taxa. We are composing a web-based tool to complement pictorial or descriptive keys, ultimately serving both the beginner and the expert. The invertebrates are photographed using gigapixel image technology, which combines hundreds or thousands of individual photos into one very high-resolution image. The images are annotated to direct the learner to diagnostic characters needed for various levels of identification (order, family, and genus). A 12-taxa prototype demonstrates functionality, and the site is currently being expanded to include 150 total taxa found across the eastern United States. This tool is available now at Macroinvertebrates.org.

What is Gigapixel Imaging?

Gigapixel images are created by combining many photographs into one very high-quality image. This can be done on a large scale with sweeping landscape panoramas or on a very small scale using a GIGAmacro machine (Fig. 1a).

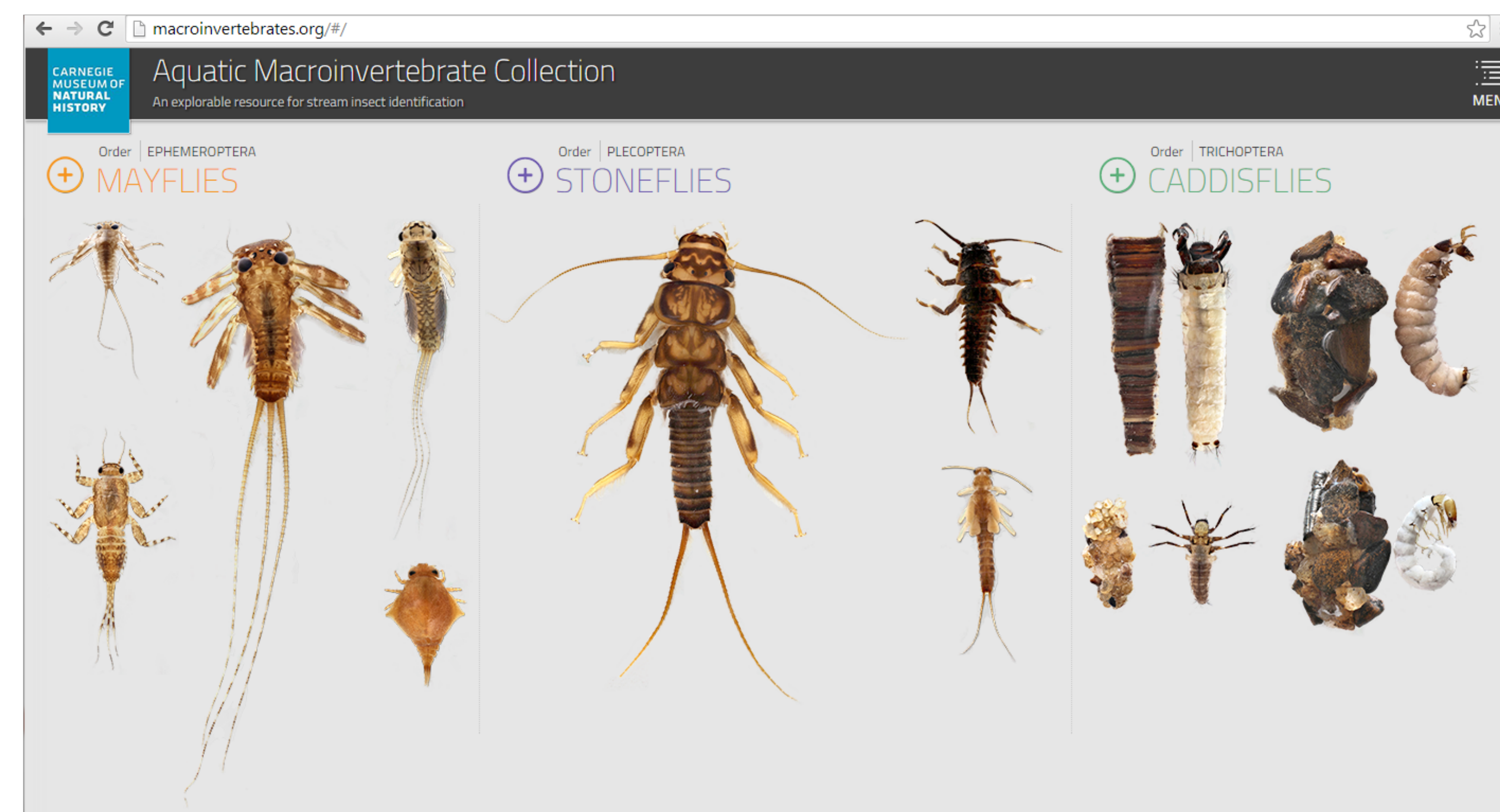


Step 1: The camera is mounted onto a rig that systematically moves up-and-down and side-to-side, capturing the image in three dimensions (Fig. 1b). By taking layers of photographs across the entire XY grid, every part of the specimen is brought into focus.

Step 2: Software is then used to “stack” the layered photographs from each grid square into one image.

Step 3: The stacked photos are “stitched” together like a quilt, resulting in a composite photograph containing billions of pixels (Fig. 1c), hence the term gigapixel.

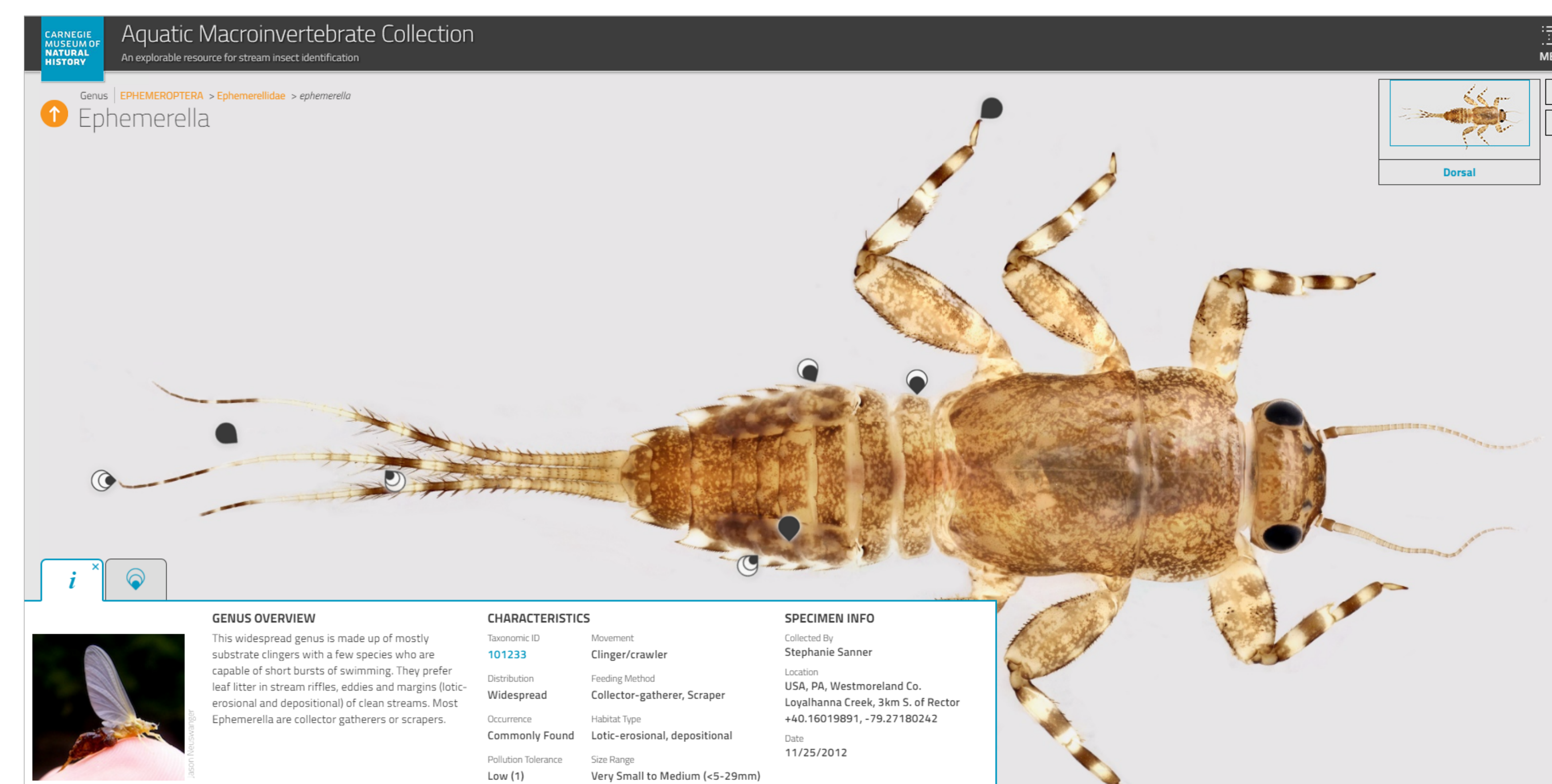
Website Features



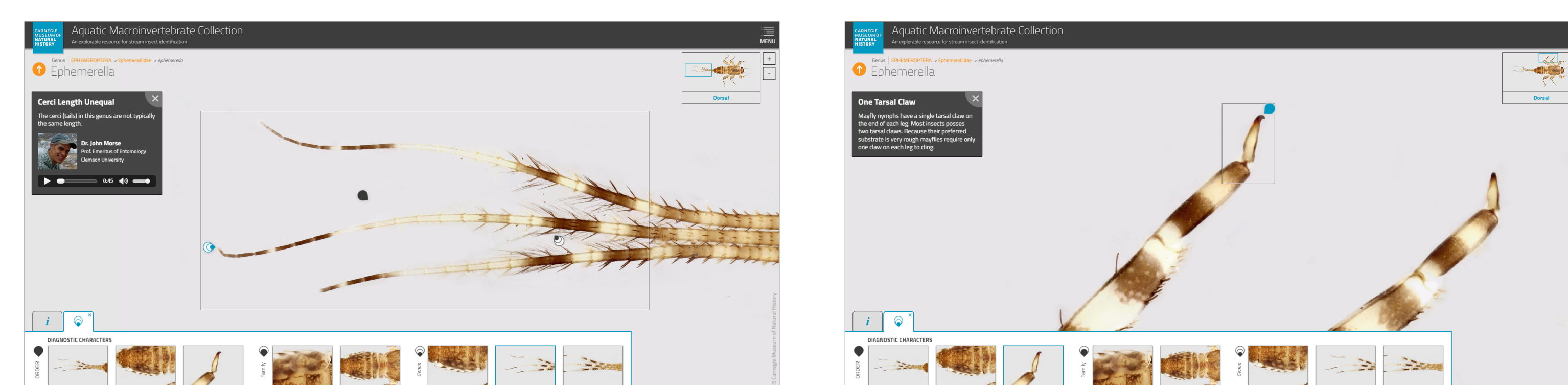
- The home page (above) groups specimens by order; clicking on the order name takes you to a list of families within that order and an order overview (below).



- Clicking on a family takes you to a family overview and clicking on a specimen takes you to the zoom-able image (below); in some cases more than one image is available from different perspectives (e.g. dorsal, ventral, lateral).



- Diagnostic characters for the order, family, and genus of the specimen are indicated with pointers and described when you click on them (below).



- Other features include a glossary of entomological and anatomical terms, sound and video clips, line drawings, photos of the adult stage, and additional identification resources.

Users

- This site was created to serve both the beginner and expert. Short videos, expert interviews, supplemental drawings, and common language all are used to facilitate use by non-entomologists.
- Few people have access to a complete teaching collection of aquatic macroinvertebrates, and this site was created to serve as such. It is meant to be used in conjunction with keys for identification.
- Learning researchers are involved with the project who will assess the functionality of the website with a variety of different target audiences (e.g. citizen scientists, environmental consultants, children, college students, etc.) and help to optimize effectiveness.



Above: Stream monitoring lessons with a variety of audiences at Powdermill Nature Reserve in Rector, PA

- The prototype contains 12 taxa, and we are now working to expand this to a total of ~150 taxa, which cover macroinvertebrates found in watersheds across eastern North America.
- We have started with EPT (Ephemeroptera, Trichoptera, and Plecoptera) taxa as these are most valuable in water quality assessment, but the final product will also include other aquatic insects, as well as mollusks, crustaceans, annelids, and arachnids

Visit the site right now on your smart phone, tablet , or computer and explore for yourself! We are interested in your opinions; email the author (kautza@carnegiemnh.org) with any feedback you may have.

Acknowledgements

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