Project Runway: Capturing the Better Side of Macros!

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ABSTRACT

Aquatic macroinvertebrates are commonly used by state agencies, including the Connecticut Department of Energy and Environmental Protection (CT DEEP) to assess water quality. Despite its small size, the state of Connecticut has over 6,000 miles of rivers and streams that it is responsible for monitoring. To do this efficiently, the CT DEEP relies on a citizen science program developed by the Bureau of Water Protection & Land Reuse called *Riffle Bioassessment by Volunteers (RBV)* to collect data.(1) In recent years, there has been a surge in participants of all ages wanting to partake in this popular RBV program in their communities. Unfortunately the resources currently available, primarily the field identification cards, to help in this endeavor, have remained unchanged for 15 years and have been a source of frustration for participants. Marvelwood School has a long history of photographing various organisms using the "*Meet Your Neighbours"* (MYN) style of photography to create detailed educational resources of biological communities for use by the school, town conservation commission and Kent Land Trust. The school approached the CT DEEP to offer assistance in updating their field identification cards as part of a student NRCA project, which the CT DEEP gladly accepted. Identification cards were improved and reorganized, utilizing high resolution photographs of key features. We anticipate the new cards will result in easier and more accurate identifications, which will improve the quality of date submitted to the state while simultaneously helping to minimize volunteer identification frustration at all age levels.

INTRODUCTION

Benthic macroinvertebrates are organisms that lack a backbone; are large enough to be seen with the naked eye and usually found living in lotic bodies of water under rocks and/or on the bottom of the stream substrate. "Macroinvertebrates are often referred to as "canaries of the stream" because they function as living barometers that indicate changes in water quality."(1) Monitoring programs, utilizing benthic macroinvertebrates as indicators ("organisms whose presence, absence or abundance reflects a specific environmental condition") (2) of stream health are important screening tools for the following four reasons: 1) require minimal training, equipment and time; 2) organisms are widespread and fairly sedentary; 3) exhibit varying tolerances to changes in water and sediment quality;(3) and 4) they spend much of their life cycle in a stream/river and are affected by local changes in water quality.(4)

Governmental monitoring agencies often lack adequate resources to monitor lotic bodies of water, and citizen scientists play a critical role in helping these agencies quickly assess water quality based on the presence of pollution sensitive macroinvertebrates (i.e. stoneflies). Citizen scientists can easily identify these organisms if they have the proper resources. The current CT RBV program is using a set of outdated field identification cards with black and white illustrations, which have remain unchanged for 15 years. These crude identification cards have frustrated volunteers in the past and lack the visualization of key details often needed to distinguish between organisms.
NRCA student Jacob Renket and Marvelwood School offered to bring their experience using the MYN style of photography to help the CT DEEP update their field identification cards. By providing detailed photographs, that visually highlight key identification characteristics, to upgrade the state's identification resources, this project fulfills a critical role in enhancing future identification success by RBV volunteers in the field (see Figs 1, 2 & 4b). Improved identification skills will result in the generation of better quality data and hopefully verification of more high quality streams in their state

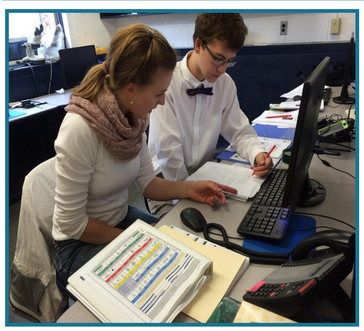

Figure 1. (left) Jacob Renkert and Meghan Lally, State RBV Coordinator for CT DEEP, working on the modified field guide highlighting key identification features. Example photos of (middle) crane fly larvae (Order: Diptera Family: Tipulidae), (top right) fishfly larvae (Order: Corydalidae Family: Nigronia, Order: Megaloptera, Family: Nigronia) and (bottom right) water penny beetle (Genus: *Psephenus,* Order: Coloptera, Family: Psephenidae) photographed in the *Meet your Neighbours* style of macro-photography.

Figure 2. Common stonefly (Family: Perlidae, Order:Plecoptera) photographed in the MYN style.

MATERIALS AND METHODS

Study Area and Organisms

- We surveyed five streams in the towns of Kent, Hartford, and Cornwall, Connecticut (Emery Park, Macedonia Brook, Deep Brook, Gully Brook, and Furnace Brook) for riffle dwelling benthic macroinvertebrates (see Fig. 5)

Specimen Collection and Photographic Protocol

- Focused on capturing organisms found on the outdated field identification cards.
- When possible, macroinvertebrate samples were collected from riffles using the standard kick-stop method used by the RBV volunteers (Fig. 4c). An EPA approved watermark bottom aquatic kicknet was used to capture specimens.
- Organisms were either photographed in the field or were placed in containers and photographed on campus and then released back into the stream (Fig. 4a).
- A Canon 60D camera with a 100 mm Canon Macro lens was used to take photographs.
- Sampling occurred between late August to mid-December, 2015.
- MYN photography consisted of placing organism on white background and using macrophotography and flash to take close, detailed images of the macroinvertebrates.
- If we were not able to photograph a living specimen, then photos previously taken by past Marvelwood School students/CT DEEP technicians and/or photographs of reference collections were utilized.

Development of Field Cards

Step 1 – Modified the layout of the cards to better illustrate the key features by isolating them in cropped photos and adding key characteristics often used in dichotomous keys.
Step 2 – Emphasized the headers using a consistent block shaping throughout all cards.
Step 3 – Added size references and pollution sensitive color boxes.
Step 4 – Focused on taking photos that best illustrated features that would be most likely encountered by collectors in the field.

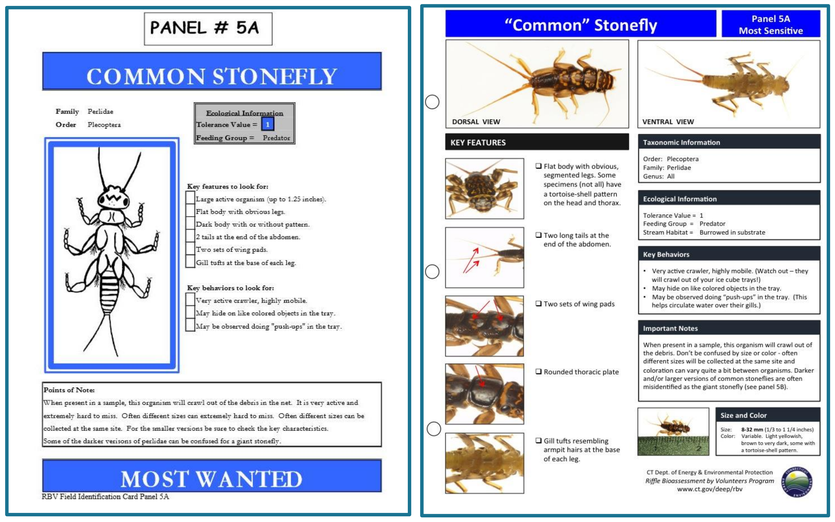

Figure 3. Comparison of old vs. new designed RBV field cards for the common stonefly.

RESULTS

A total of 32 organisms were photographed. Most photographs were primarily of live specimens, but due to drought conditions we had to resort to several preserved specimens from reference collections and/or photos from previous years sampling efforts. The addition of headers, size and color reference boxes and isolation of key characteristics resulted in a more user friendly field identification card for volunteers of all ages (Fig. 3).

Figure 4. (left) Photographing macoinverebrates. (middle) Example photos of macroinvertebrates (dragonfly larvae Family: Libellulidae and Family: Cordulergastridae). (right) Searching for a riffle to sample for macroinvertebrates in December after the rains once again filled the streams.

CONCLUSION

The impact this project will have on CT DEEP's RBV program will be significant because it will increase the accuracy of volunteers in their monitoring efforts of streams and rivers in Connecticut. More importantly, this project will also create interest in volunteers as they will now be able to better visualize many of the details in the field cards via the *Meet Your Neighbours* style of photography, that effectively showcases the key features of all the organisms. Photographs from future sampling efforts, under better water flow conditions and of actual live organisms will be used to replace current photographs of preserved subjects. This will lead to the further improvement of the State's RBV field identification cards in the near future and will be previewed during the 2016 sampling season.

ACKNOWLEDGEMENTS

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Figure 5. (left) Flat-head mayfly (*Heptageniidae Stenonema*). (right) An example of a riffle in a stream, the habitat preferred by most sensitive indicator species used for water bioassessment.