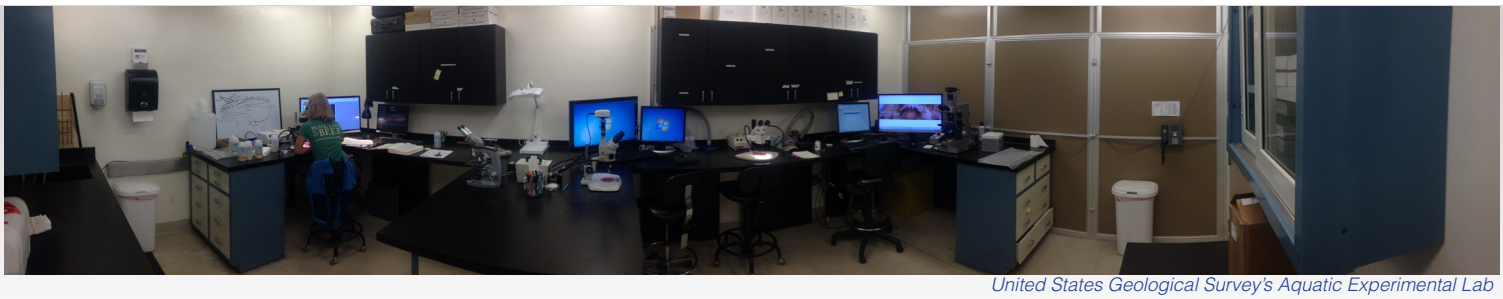
Lumenera's INFINITY cameras chosen by U.S. Geological Survey for North American Macroinvertebrate Digital Reference Collection



United States Geological Survey's Aquatic Experimental Lab

Background: Preserving Macroinvertebrates for Specimen Idenitification

The United States Geological Survey (USGS), a scientific agency of the U.S. government, studies and reports on the health of our ecosystems and the impact of natural hazards on our environment and natural resources. As part of their research, the USGS has a specialized department that studies aquatic macroinvertebrates from across the country. Studying these specimens can reveal a great deal about the health and status of their surrounding ecosystem.

For example, if a certain species can only survive in water with low pollution levels, conclusions can be drawn that the presence of this species indicates that the waterway is healthy and that pollution levels are low. However, in order to make accurate observations, the specimen must be correctly identified. This can be a difficult task that requires training and expertise.

The process of identifying a species is done through the use of a dichotomous key, which presents the observer with two sets of criteria. If the specimen possesses the first set of characteristics, the observer is directed to the next part of the key to continue with the identification process. Conversely, if the specimen meets the second set of characteristics, the observer is directed to a different part of the key. At each step, the observer must select from two sets of characteristics to progress to the following evaluation. This process is repeated until a genus is determined. The observer then compares their specimen to a physical reference specimen to make a positive identification.

Ephemeroptera Heptageniidae Epeorus longimanus (Photo Credit: USGS)

HIGHLIGHTS

- The United States Geological Survey (USGS) needed to preserve aquatic macroinvertebrate specimens for reference purposes in order to study and report on their ecosystems
- Lumenera's INFINITY *2-1*R and INFINITY*3-3*UR cameras provided the high quality and accuracy needed for imaging the specimens
- USGS now has over 5000 images of over 400 macroinvertebrate specimens taken with Lumenera's INFINITY cameras and believed to be the largest digital collection in existence

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Reference specimens, however, are subject to deterioration over time. Furthermore, their removal from storage to be observed can lead to the wear and damage of the specimens. They are also quite costly as they require expert resources to collect, identify, verify, and curate. Consequently, researchers at the USGS sought to improve the identification process by obtaining new specimens and finding a way to preserve them.

Dytiscus head (Photo Credit: USGS)

Solution: Imaging Reference Specimens

Initially, USGS researchers took photos of their existing stock of reference specimens to use when training new analysts. They imaged these specimens with Lumenera's INFINITY microscope cameras and ANALYZE software. The images quickly became valuable teaching tools to compare to specimens under evaluation or to show the students on a monitor or screen.

Multiple Diptera (Photo Credit: USGS)

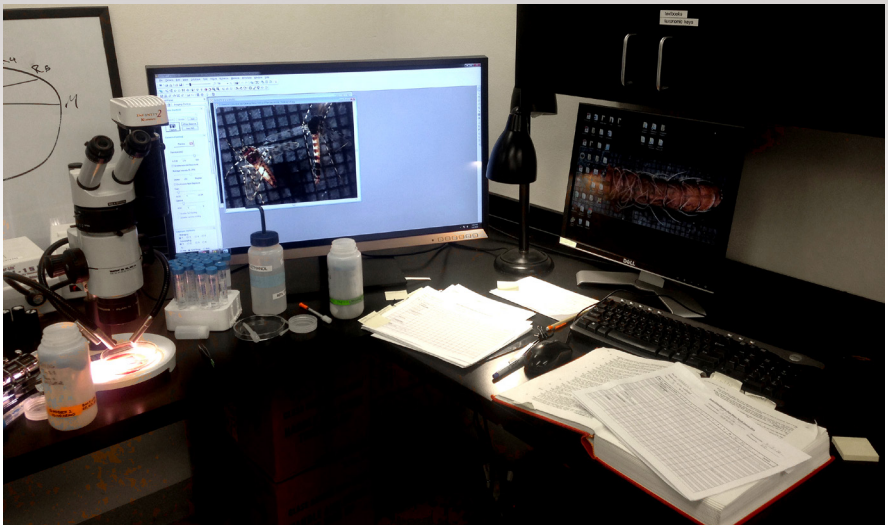
The staff at the USGS found this method of using images as reference specimens to be successful and decided to advance their project into imaging reference specimens for the purpose of their research and specimen identification. New specimens were collected from across the United States, with the help of Colorado State University and the C.P. Gillette Museum of Arthropod Diversity. This allowed for the preservation of expensive reference specimens to use in their research, while also making them available to a wider range of researchers and organizations.

The imaging of the insects takes place on both stereo and compound microscopes ranging from 10x to 500x magnification. As image quality and accuracy is highly important for this project, USGS selected Lumenera's high performance, research-grade INFINITY*2-1*RC and INFINITY*3-3*URC cameras. Morgan Ford, a contractor for the project explains how the plug-and-play nature of the cameras, along with their user-friendly INFINITY ANALYZE software, makes them very easy to use:

> **"Lumenera INFINITY cameras and INFINITY ANALYZE software provide an imaging solution for our lab that lets us easily capture high quality images for use in our research. Using multiple Lumenera cameras, we are able to effectively photograph several specimen types without having to grapple with connectivity issues and/or formatting concerns."**

Compound Microscope with INFINITY2-1RC (Photo Credit: USGS)

The images collected are either composite images comprised by stitching a number of images with varying depths of field together or single images displaying a small section of the specimen in focus at one time. This depends mostly on what will best illustrate the portion of the specimen being examined under the dichotomous key.



Imaging Specimens with the INFINITY2-1RC (Photo Credit: USGS)

At the time of this publication, the USGS group has collected roughly five thousand images of approximately four hundred different specimens. The high quality digitized references of aquatic macroinvertebrates, believed to be the largest digital collection in existence, will be made available on the web for users to search and download. If you would like to learn more about the cameras that the USGS used for their project or the wide range of microscope cameras that Lumenera has to offer, please contact info@lumenera.com.*

Lumenera's INFINITY Cameras

Lumenera's INFINITY cameras are known for superior color reproduction and high resolution. The INFINITY*2-1*R and INFINITY*3-3*UR cameras have provided the image quality and accuracy needed for imaging specimens for the purpose of genus identification and geological research.

INFINITY*2-1*R Product Highlights

- USB 2.0 high-speed interface camera for ease of installation on any computer
- Low noise characteristic 1.4 MP CCD image sensor
- High dynamic range of 64 dB
- Full color sub-windowing allows for rapid focus and scanning of samples
- 30 fps at full 1392 x 1040 resolution
- Select 8 and 14-bit pixel data modes

INFINITY*3-3*UR Product Highlights

- High-speed USB 3.0 interface for fastest image delivery and simplified connectivity
- Industry leading Sony EXview HAD II 2.8 MP CCD sensor
- High frame rate of 53 fps at full 1936 x 1456 resolution
- Designed for applications requiring optimal color reproduction, extreme sensitivity, increased resolution and high speed
- Select 8 and 14-bit pixel data modes

About Lumenera

Lumenera Corporation, a division of Roper Technologies, headquartered in Ottawa, Canada, is a leading developer and manufacturer of high performance digital cameras and custom imaging solutions. Lumenera cameras are used worldwide in a diverse range of industrial, scientific and security applications.

Lumenera solutions provide unique combinations of speed, resolution and sensitivity in order to satisfy the most demanding digital imaging requirements. Lumenera customers achieve the benefit of superior price to performance ratios and faster time to market with the company's commitment to high quality, cost effective product solutions.

For further information about Lumenera, please visit www.lumenera.com or call 613-736-4077.

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