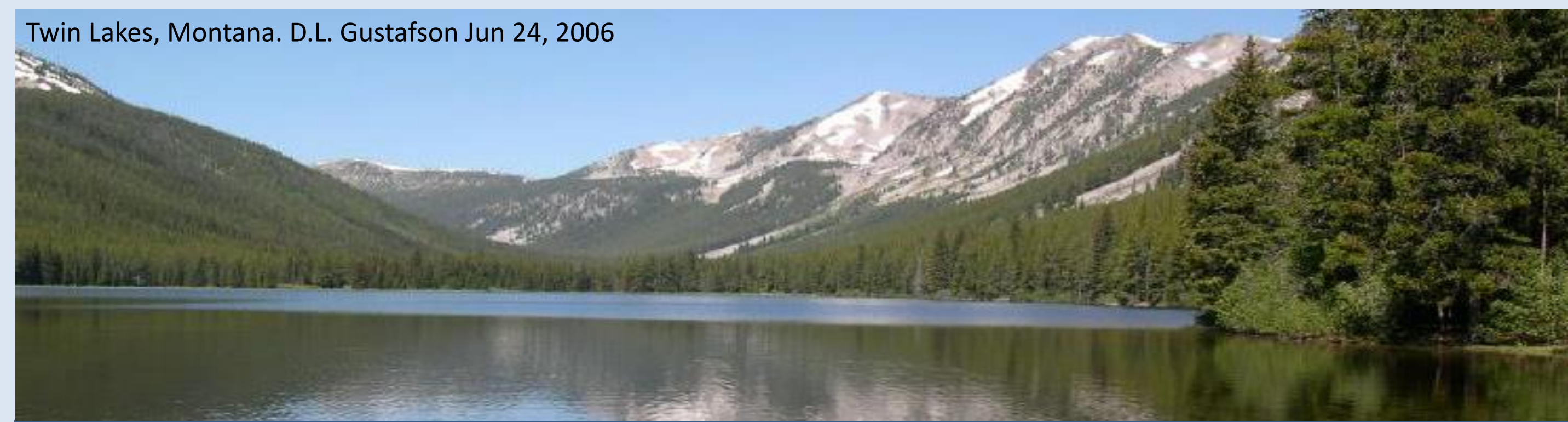


Digitizing the Daniel L. Gustafson Aquatic Invertebrates Collection in the Montana Entomology Collection at Montana State University



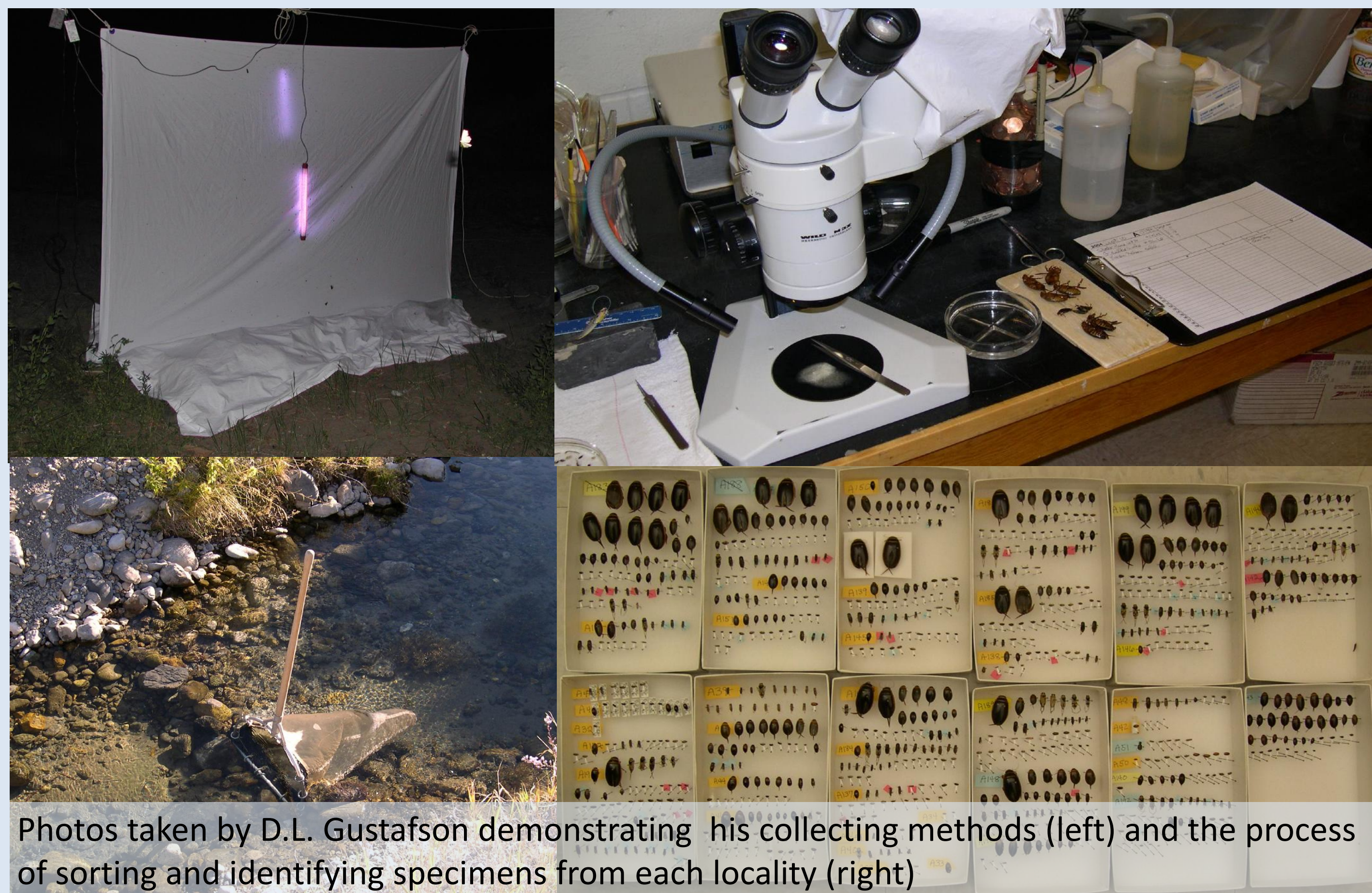
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Twin Lakes, Montana. D.L. Gustafson Jun 24, 2006

Background

The Montana Entomology Collection (MTEC) is two years through digitizing the Daniel L. Gustafson Aquatic Invertebrates Collection (DLGAIC), which is the largest aquatic invertebrate collection housed in the MTEC. The DLGAIC contains invertebrates collected primarily from the freshwaters of Montana by Daniel L. Gustafson and his colleagues. In addition to specimens, the DLGAIC includes logbooks containing field notes, photographs of the sites taken at the time of collecting, and digital databases containing localities with coordinates and their associated logbook numbers.



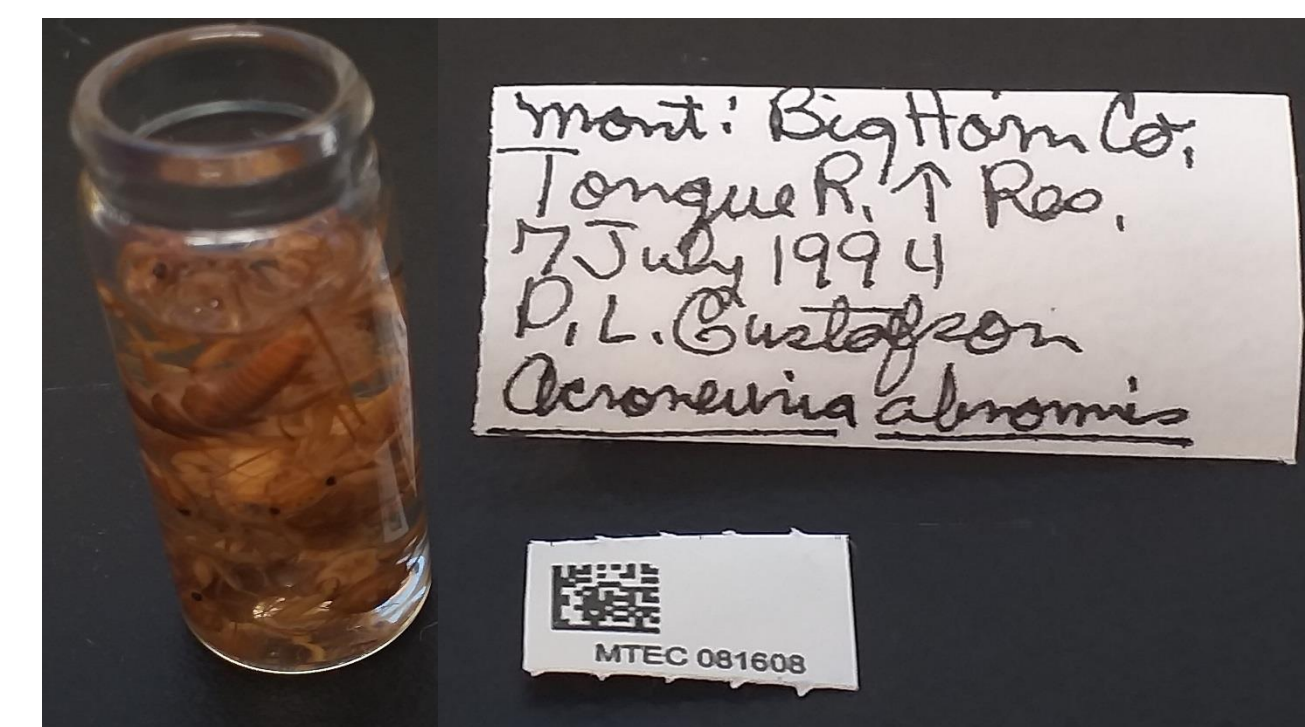
Photos taken by D.L. Gustafson demonstrating his collecting methods (left) and the process of sorting and identifying specimens from each locality (right)

Digitization Workflow

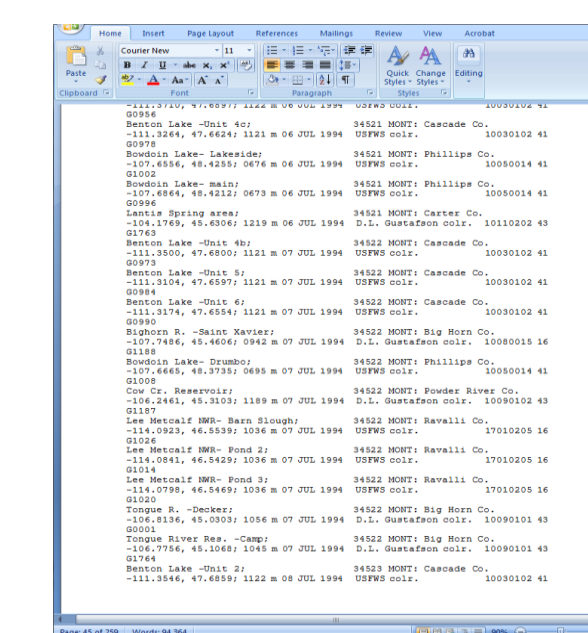
Each lot was assigned a unique machine-readable barcode label, with its locality label and determination typed out in compliance with Darwin Core terminology. D.L. Gustafson's digital databases were used to find latitudes, longitudes, elevations, and logbook numbers for each lot. D.L. Gustafson was consulted regarding suspected synonymous locality names. For specimens without coordinates, Google Earth was used to georeference by locality name.

Logbook numbers were used to link specimens to field notes. Digitization of the logbooks was outsourced to Backstage Library Works, producing PDF scans of the pages. Specimen records were linked to photographs taken by D.L. Gustafson at the collecting sites using logbook numbers. The specimen metadata, along with the PDF logbook scans and site photos which will be made publicly available online.

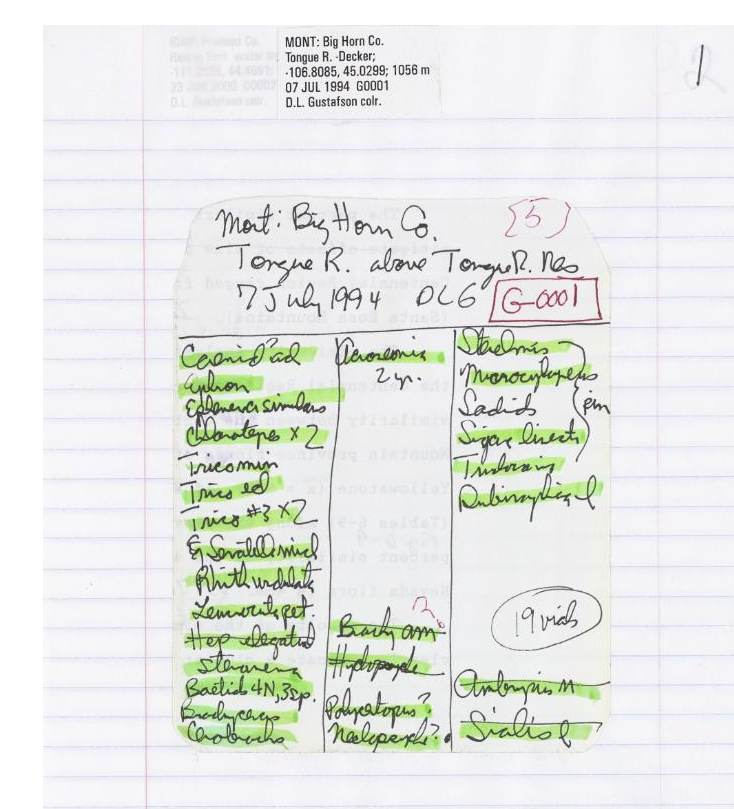
The flowchart below demonstrates, with an example specimen, the process of inputting information to create a metadata record and the digital objects which can be linked directly to the record using its logbook number.



One lot of *Acroneuria abnormis* (Newman, 1838) specimens with their label and barcode MTEC 081608



D.L. Gustafson's database used to find the logbook number, latitude, longitude, and elevation. This specimen's logbook number is G0001.



Logbook entry for the collecting event G0001, containing field notes



Photo taken at time of collecting the lot MTEC 081608 by D.L. Gustafson at Tongue River, Bighorn Co., Montana (logbook number G0001)

Results

Of the 13,000 lots from the DLGAIC digitized so far:

Collectors:

- 75% of lots collected by D.L. Gustafson
- 130 collectors in total contributed specimens over a time span of five decades

Taxonomic Scope:

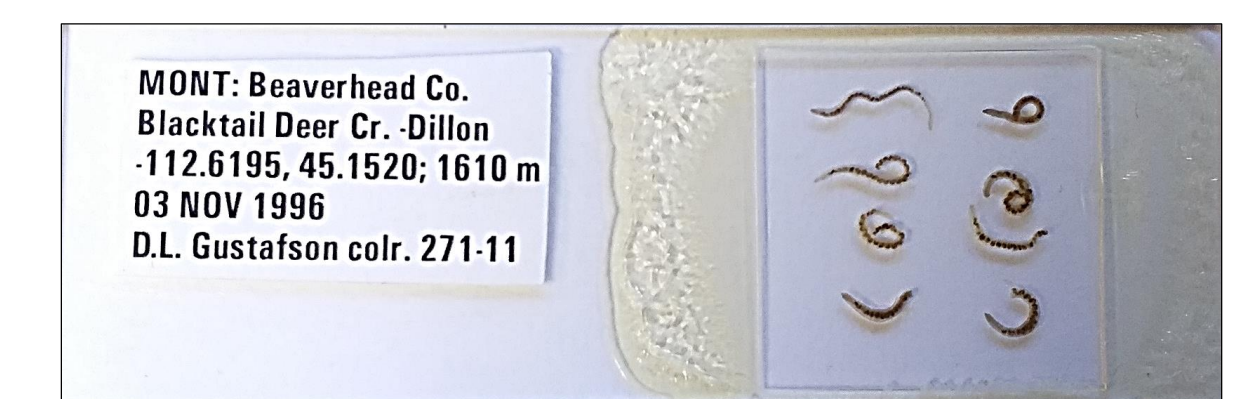
- 84,000 individual specimens across 350 species.
- Astacoidea, Corixidae, Plecoptera, Ephemeroptera and Odonata have been fully digitized.

Geographic Scope:

- A majority of specimens were collected from Montana, with all 56 counties represented.
- Habitats range from prairie streams in Eastern Montana to lakes in the Rocky Mountains
- A minority of specimens were collected from 28 states outside of Montana.

Remaining work:

- An estimated 51,000 DLGAIC lots remain to be digitized, which are mainly coleopterans, trichopterans, gastropods and slide-mounted worms
- Gastropoda will be the most specimen-rich group, with an estimated 1,000,000 specimens.
- 12,000 lots from the other aquatic invertebrate collections at MTEC.



A slide with specimens collected and mounted by D.L. Gustafson

Discussion

The long-term goal is to completely digitize the DLGAIC and the rest of the AIC. Combined, the data will represent a complex web of interspecific relationships, currently unavailable to scientists visiting the collections. This will open opportunities for scientists to conduct temporal and geographic studies on the biodiversity of Montana's freshwater systems, such as detecting changes in community composition over time and the investigating human impacts on aquatic environments. The dataset could also be used in conjunction with Montana State University's fish collections, which have recently been digitized and which share many of the same sampling sites.

Acknowledgements

The Council on Library and Information Resources provided funding through a CLIR Digitizing Hidden Collections grant. We are deeply indebted to Daniel L. Gustafson, whose lifetime of collecting, along with his phenomenal expertise and dedication, has provided the museum with an outstanding aquatic invertebrate collection.

Collecting and Recording Methods

D.L. Gustafson used a variety of collecting techniques including, but not restricted to, hand nets, kick nets, drift nets, emergence nets, black light traps, bottle traps, pitfall traps, and Lindgren funnels. Each collecting event was assigned a unique number and field notes from the event were handwritten under this number in logbooks. Once specimens were identified, these too were written up in the logbooks.

To accompany the logbooks, D.L. Gustafson created two digital databases. One contained a list of all locality names organized by the date he visited, with latitudes, longitudes, elevations, and synonymous locality names. The other database contained a list of localities with coordinates and elevations, along with collector names and logbook numbers. Digital copies of photos taken at sites were saved with their logbook numbers as their file names.