Guides + Science = Citizen Science

Citizen Science (also known as crowd science, crowd-sourced science, or networked science) is scientific research conducted, in whole or in part, by amateur or nonprofessional scientists, often by crowdsourcing. Formally, citizen science has been defined as "the systematic collection and analysis of data; development of technology; testing of natural phenomena; and the dissemination of these activities by researchers on a primarily avocational basis."

—WIKIPEDIA

GUIDES HAVE LONG BEEN involved in Citizen Science initiatives in Grand Canyon; Adopt-A-Beach, recording big horn sheep sightings, participation in invasive plant removal projects, recreational use monitoring, to name a few. In 2012, scientists responsible for studying the dynamics of the

aquatic ecosystem (A.K.A, the aquatic food base) from the United States Geological Survey's (USGS) Grand Canyon Monitoring and Research Center (GCMRC), put out a call requesting guide participation in a project intended to assist researchers gather data on insect populations along the river. Eight river guides, Scott Jernigan (165 samples), Gibney Siemion (148), Walker McKay (142), Kelsey Wogan (124), Bob Dye (109), Eric Baade (66), Derrik Spice (6) and Dave Kashinski (2) responded to the call. These guides, along with a host of volunteers from Grand Canyon Youth, Grand Canyon National Park and other USGS river trips managed to collect nearly 1000 samples yielding a wealth of information currently being analyzed by the food base crew at GCMRC.

Most folks understand that completion of Glen Canyon Dam brought about a host of changes to the river ecosystem including controlled flows that lack seasonal high flood and low flow extremes, consistent cold water temperatures, and a lack of sediment supply. Along with these changes, the river's aquatic food base was also fundamentally altered. The diversity of aquatic insects including caddis flies, mayflies, stoneflies, dragonflies, dobsonflies, and aquatic diving beetles that are still present along Grand Canyon tributaries also once resided in the main stem Colorado River.

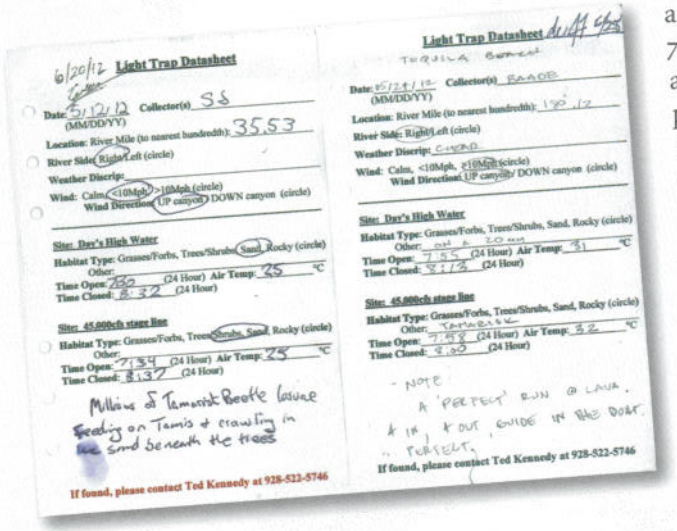
Although fishes like humpback chub are a charismatic and easily identifiable organism, they are only part of a much larger Grand Canyon ecosystem that scientists seek to understand. All fishes of the Colorado River rely upon aquatic insects as an important food resource. In the present clear, cold water aquatic ecosystem, two aquatic insects—non-biting midges and black flies—are the dominant food items consumed by fish. Midges and black flies are famous for their ability to tolerate disturbed and altered aquatic habitats, so it is not surprising they are successful in the mainstem Colorado River whereas other, less tolerant, species like mayflies are now absent.

The abundance of midges and black flies is affected by a variety of factors including food availability (algae is a preferred food), habitat (midges prefer pools whereas black flies prefer areas with swift water such as cobble bars), river flows, and water temperature. Prior insect monitoring projects were never able to fully understand the relative importance of these different factors, and how they varied across years, because these efforts were restricted by scientist's limited river access (i.e., the number of trips is limited).

The power of citizen science in Grand Canyon has enabled researchers to ask questions that are beyond their reach by tapping into guides' season-long access to the river environment. The method guides used to sample insects was fairly simple. Each evening around dusk, amidst the multitude of other guidely tasks,

guides placed a small "light trap" at river's edge and a second trap was placed at the historic high water level of approximately 45,000 cubic feet per second (CFS). Traps consisted of a small plastic tray filled with an inch or so of ethanol and a small battery powered black fluorescent light placed on one edge of the container to attract insects. Traps were left in place for about an hour, and then the contents of the containers were poured into sample bottles and labeled with collection information. Data describing the habitat where traps were placed, weather conditions, river mile and date were also recorded in a small notebook.

Preliminary results indicate midges and black flies were the most common insects captured by the light traps deployed by guides. These results suggest citizen science light trapping is a useful tool for monitoring the aquatic food base response to ongoing adaptive management experimentation including experimental floods. Light traps also caught a variety of other aquatic and terrestrial insects, thereby documenting the abundance and diversity of the insect community present in today's Colorado River ecosystem downsteam of Glen Canyon Dam. It is worth noting that fish aren't the only animals that feed on midges and black flies—bats, spiders and birds also eat them in great numbers. Thus, citizen science light trapping provides a platform that can be used to ask fresh questions, such as how changes in the aquatic ecosystem affect terrestrial wildlife such as bats. An additional benefit of this project has been the development of a reference collection of invertebrate specimens from light trap sampling that will be a resource to inform future research projects. This collection will be at the 2013 GTS so all guides have a chance to see some of the fascinating insects that inhabit Grand Canyon.


Light Trap Datasheet

Date: 5/12/12 (MM/DD/YY) Collector(s): SS

Location: River Mile (to nearest hundredth): 35.53

River Side: Right/Left (circle)

Weather Discrip:

Wind: Calm, <10Mph, >10Mph (circle) Wind Direction: UP canyon/ DOWN canyon (circle)

Site: Day's High Water

Habitat Type: Grasses/Forbs, Trees/Shrubs, Sand, Rocky (circle)

Other:

Time Open: 7:30 (24 Hour) Air Temp: 25 °C

Time Closed: 8:32 (24 Hour)

Site: 45,000cfs stage line

Habitat Type: Grasses/Forbs, Trees/Shrubs, Sand, Rocky (circle)

Other:

Time Open: 7:34 (24 Hour) Air Temp: 25 °C

Time Closed: 8:37 (24 Hour)

Millions of Tamarisk Beetle larvae feeding on Tamis & crawling in the sand beneath the trees

If found, please contact Ted Kennedy at 928-522-5746

Light Trap Datasheet

Date: 5/24/12 (MM/DD/YY) Collector(s): BAADE

Location: River Mile (to nearest hundredth): 190.12

River Side: Right/Left (circle)

Weather Discrip: CLOUDY

Wind: Calm, <10Mph, >10Mph (circle) Wind Direction: UP canyon/ DOWN canyon (circle)

Site: Day's High Water

Habitat Type: Grasses/Forbs, Trees/Shrubs, Sand, Rocky (circle)

Other:

Time Open: 7:45 (24 Hour) Air Temp: 51 °C

Time Closed: 8:15 (24 Hour)

Site: 45,000cfs stage line

Habitat Type: Grasses/Forbs, Trees/Shrubs, Sand, Rocky (circle)

Other:

Time Open: 7:45 (24 Hour) Air Temp: 32 °C

Time Closed: 8:05 (24 Hour)

- NOTE A 'PERFECT' RUN @ LAVA. A IR, & OUR GUIDE IN THE BOAT. = PERFECT.

If found, please contact Ted Kennedy at 928-522-5746

The value and importance of this specific Citizen Science effort goes far beyond the new scientific insights into Grand Canyon insects that will arise once all the nearly 1000 samples are processed (261 down, 700 to go!). Guides' natural ability to engage with the public through outreach serves to strengthen the ever important bridge between science's mission to gain understanding about the environment and informing and including the public in that mission.

Cheers and thanks to everyone that participated in this project. Hopefully this is just a springboard for more Citizen Science in the future.

For more information about this project or to inquire about future participation in GCMRC Citizen Science projects please feel free to contact any of the authors.

Ted Kennedy (tkennedy@usgs.gov)
Eric Kortenhoeven (ekortenhoeven@usgs.gov)
Carol "Fritz" Fritzinger (cfritz@usgs.gov)