

Final Report

CNHA Discovery Pool Grant #25-02-USFS: *Surveying for the rare stonefly, Gaufinia cristata, to inform management*

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Executive Summary:

***Gaufinia cristata* is one of the rarest stoneflies in Utah. It is only known from small streams, high in the Abajo and Henry Mountains. As grazing pressures rise, snowpack declines, and there is increasing pressure on mountain aquatic habitat in Utah, there is a concern that a species like *G. cristata* may be negatively impacted. In partnership with the Manti-La Sal National Forest, we conducted a study to better understand the contemporary distribution of *G. cristata* by re-surveying historical localities, integrating genetic data into species identification, and exploring new places where the species may reside. We confirmed healthy populations of *G. cristata* across many sites where it was previously recorded and discovered a new population in the La Sal Mountains, the first for the entire mountain range. In addition, we produced the first ever genetic data for *G. cristata*, including the first association between larval nymphs and adults which will empower future monitoring and conservation. Finally, we detected *G. cristata* living in a stream emanating from a rock glacier—a large mass of debris-covered ice. This is important because rock glaciers are common in Utah, support key coldwater habitat for aquatic biodiversity, and are resistant to climate change. Looking ahead, while *G. cristata* still has a robust presence across its historical distribution, there are valuable steps that can be taken to ensure it continues to thrive in Utah. These include: continued monitoring of known populations, habitat protection where possible, particularly from grazing. This protection could include fencing of mountain springs near their source to limit grazing cattle from degrading the stream directly. And, finally, continuing to explore and identify new populations of *G. cristata*, and the environmental conditions associated with them, will provide important broader context to the status and future of this unique stonefly.**

Project overview:

In summer 2024, with support from the CNHA, we initiated a project in collaboration with the Manti-La Sal National Forest to establish contemporary understanding of the distribution of the rare stonefly, *Gaufinia cristata* in the La Sal and Abajo Mountains. In addition, we planned to perform genetic work to bolster future conservation efforts by making identification easier and more definitive and, hopefully, to link the winged terrestrial adults of the species to the larval nymphs. During our field surveys, we also sought to better understand the conditions associated with healthy *G. cristata* populations and to potentially inform management decisions (e.g., informing the value of fencing of headwater springs that contain *G. cristata* to limit impacts from grazing).

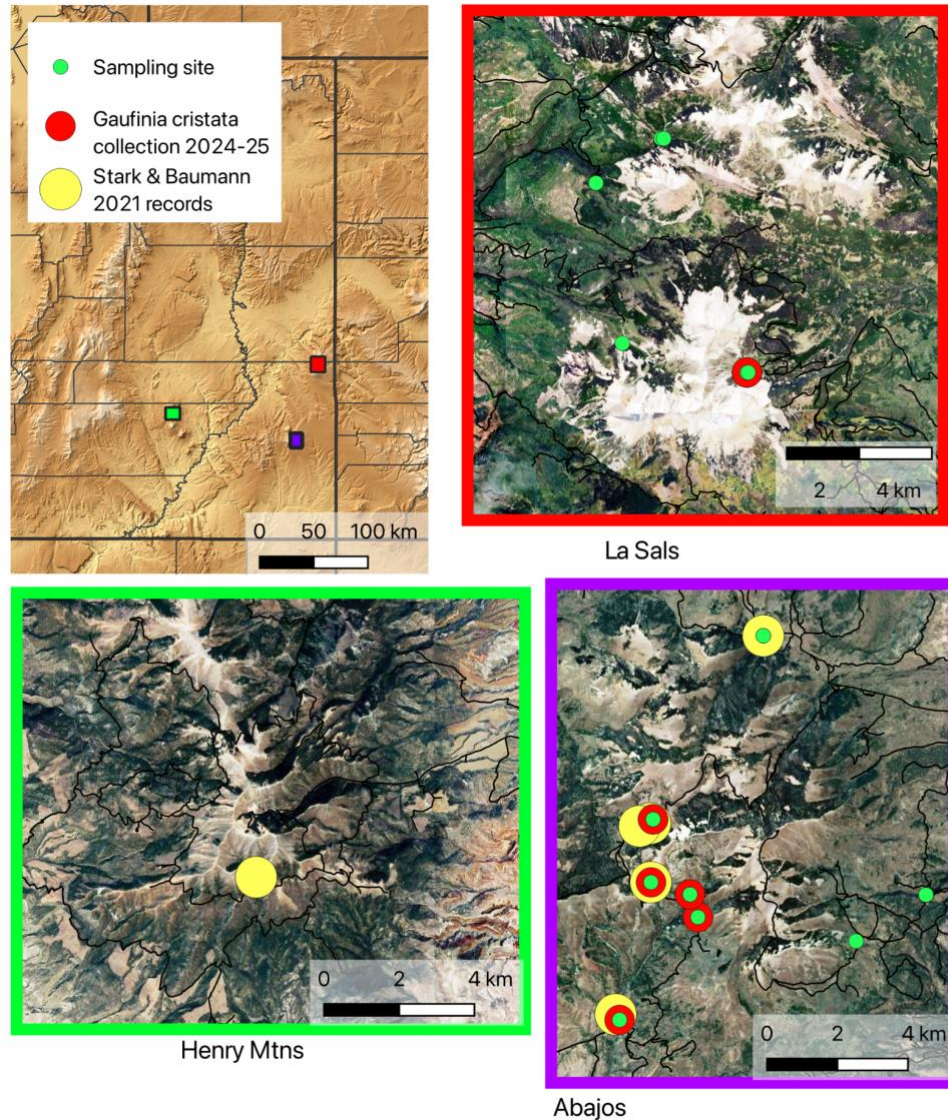


Figure 1. Areas where we sampled for *Gaufinia cristata* as part of this study. Note: We did not sample the Henry Mountains due to funding limitations and our focus on the La Sals and Abajo Ranges.

History of *Gaufinia cristata* taxonomy:

Gaufinia cristata was first described in 1995 from museum records (Surdick 1995) as *Sweltsa cristata*. This initial description of *S. cristata* was based on two males and a female from “Utah, San Juan Co., Johnson Crk., Tunnel 19 mi. N. of Blanding” (Surdick 1995). Previously only known from the Abajo Mountains, Call and Baumann (2002) reported a collection of 40 male and 20 female *Sweltsa cristata* near Oowah Lake, a northern extension of the species’ range by 75 km, in the La Sal Mountains. In 2021, *S. cristata* and several species in the same group were reclassified to a new genus, *Gaufinia* (Stark and Baumann 2021), and *S. cristata* received its current species name: *Gaufinia cristata*. The same study also determined that the individuals reported as *S. cristata* in Call and Baumann (2002) were actually *Gaufinia hondo*. Additionally, the 2021 confirmed the presence of *G. cristata* in the Henry Mountains to the west. Thus, as of 2021, *G. cristata* only known from the Abajo and Henry Mountains.

Notably, *G. cristata* has only been described based on morphology. The application of well-established modern methods (i.e., genetic barcoding) have greatly improved resolution of species boundaries by identifying cases where one previously described species is not actually distinct from a relative and the opposite, when a single species actually consists of one or more independent lineages (“cryptic biodiversity”). At present, there is no reason to not bolster morphological species assignments with appropriate molecular data. In addition to baseline knowledge of distributions and habitat requirements, *Gaufinia cristata* needed genetic confirmation of its species status.

Results:

Survey effort

Over two summers (2024 and 2025), we visited 28 streams that were likely to harbor populations of *G. cristata* based upon previous surveys, reports, and satellite imagery (Figure 1). Of these, only 19 streams had flowing water when visited. We sampled streams in July and August as we expected this to be the time when we were most likely to find nymphs still in the streams and adults that had emerged. By collecting both nymphs and adults, we would be able to perform the first genetic association between *G. cristata* life stages, an important step for future management and monitoring. In total, we spent roughly 20 days surveying for *G. cristata* over two summers. One of the locations that we targeted for sampling was the Blanding Tunnel in the Abajo Mountains, the type locality for *G. cristata*.



Figure 2. Left: *Gaufinia cristata* mature nymph (Process ID GAUF003-25) and right: *G. cristata* adult female (Process ID GAUFB024-25).

Taxonomic analysis and new genetic associations

In total, we performed genetic barcoding on 148 nymph and adult stoneflies as part of this study. In general, we targeted specimens that could potentially be *G. cristata*—with a near equal mix of both nymphs and adults. We identified 24 *G. cristata* specimens during the course of our study. And, we successfully collected both male and female nymphs which will be important

reference material for future studies (Figure 2). We also barcoded other stonefly species in the same streams to be sure that *G. cristata* was not simply another phenotype of an existing species (i.e., that it was truly genetically distinct and should be considered its own species).

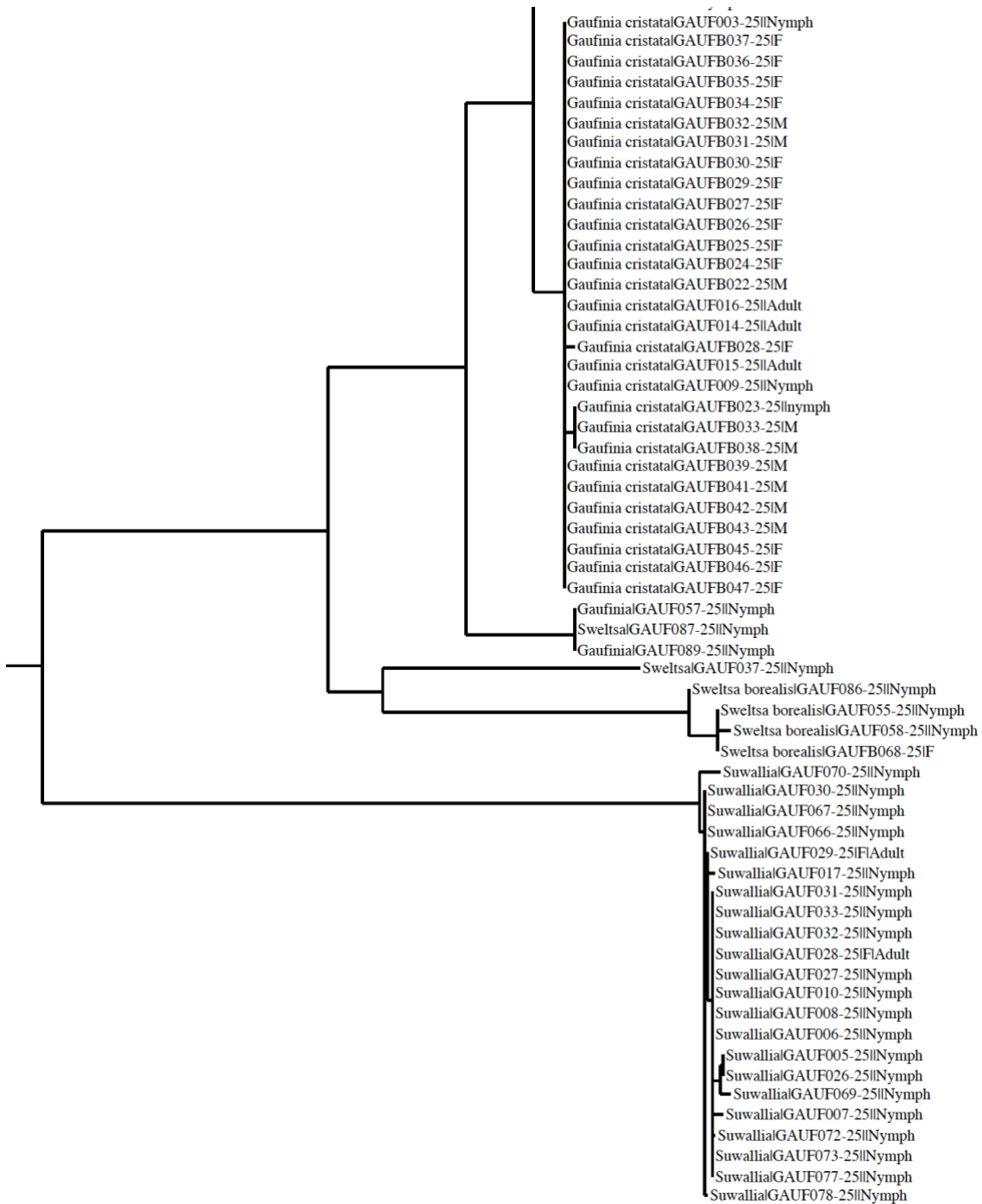


Figure 3. A subset of a genetic phylogeny of *Gaufinia* and other closely related stoneflies based on the COI gene. *Gaufinia cristata* forms its own monophyletic clade.

We successfully identified multiple adult *G. cristata* using the same morphological characters described by Stark and Baumann (2021). We then barcoded these specimens which provided

the first link between morphology and genetic identity for *G. cristata* (and likely any *Gaufinia* species for that matter). With this, we were able to compare all of our barcoded specimens against these newly generated reference barcodes for *G. cristata* (Figure 3).



A mating pair of *Gaufinia* stoneflies in the moss next to an Oowah Lake inlet spring in July 2025. These specimens turned out to be *G. hondo* and not *G. cristata*. But both species look very similar as adults. Photograph by Scott Hotaling.

Contemporary distribution of *G. cristata*

Of the 19 streams we sampled, we confirmed *G. cristata* in 6 of them—5 in the Abajos and 1 in the La Sals. We sampled 7 streams that were reported by Stark and Baumann (2021) to contain *G. cristata*. Of these, we confirmed contemporary populations at 5 sites. Our identification of a population in the La Sals was particularly notable as it was *not* at Oowah Lake—the putative population of *G. cristata* that was already morphologically debunked by Stark and Baumann (2021). We further confirmed that *G. hondo* lives in the springs that feed Oowah Lake—not *G. cristata*—with new genetic data.





Figure 4. Top: A researcher collecting a stonefly from a mountain stream in the Abajo Mountains. Bottom: A small stream fed by a rock glacier in the La Sal Mountains. This stream is the only known location where *G. cristata* lives in the La Sal Mountains. Both images were taken in July 2024 by Scott Hotaling.

Rather, we confirmed *G. cristata* in the La Sals in a stream that is fed by a rock glacier in the Dark Canyon area of the mountain range. This is notable for two reasons: (1) it confirms the presence of *G. cristata* in the La Sal mountain range and expands the known range of the species significantly to the north. And, (2) this stream is fed by a rock glacier (Figure 4)—a large mass of debris-covered ice. Rock glaciers have been shown to be resilient to climate warming and may serve as critical refugia for mountain aquatic biodiversity in the western United States (Brighenti et al. 2021).

Management implications:

With relatively limited survey effort over two summers, we found populations of *G. cristata* persisting at 5 of 7 sites where they had been previously reported. This suggests that a healthy regional population of *G. cristata* still exists in the Manti-La Sal National Forest. Moreover, our finding that at least one population of *G. cristata* exists in the La Sal mountains highlights the strong potential for *G. cristata* to continue to exist in the Forest for the foreseeable future.

However, during the course of our study, we noted limited water supply and tremendous grazing pressure over much of *G. cristata*'s range. As winter snowpack declines and summers become hotter and drier (e.g., Hotaling et al. 2024), there will be ever increasing pressure on water supplies in the region, particularly at mountain springs. This pressure will no doubt degrade *G. cristata* habitat. As such, continued monitoring of known populations in both mountain ranges will be critical for tracking and identifying any changes before they put the species at risk of extinction.

We will be working with Barb Smith, Wildlife Biologist for the Manti-La Sal National Forest, and other Forest personnel to integrate our findings into their forest management plans. Notably, due in large part to the efforts of PI Hotaling and the results of this project, *G. cristata* is now listed as a Species of Greatest Conservation Need in Utah under the state's new Wildlife Action Plan (Utah Wildlife Action Plan, 2025).

Future directions:

Despite sampling at the same time as historical records, we potentially sampled a bit too late in the season and earlier trips (e.g., late June) may have yielded more nymphs and more specimens from the La Sals or other areas. The reason for this conclusion is that across both sampling years, we only collected a small number of nymphs of *G. cristata*—all other specimens were adults. This suggests that the streams containing *G. cristata* but we may have missed their aquatic life stage. Many aquatic species are shifting their life history timing due to factors like climate change. In Utah, the decline in peak snowpack paired with earlier melt may be driving similar changes for *G. cristata*. Future studies focused on contemporary understanding of their life history timing would empower their conservation and monitoring.

In addition, the *Gaufinia* taxonomy remains incomplete. While our efforts confirmed with genetic data for the first time that *G. cristata* should be considered its own species, the extent to which other cryptic biodiversity within the genus may exist warrants investigation. A major first step toward this integrated perspective would be to perform the same genetic analyses performed in this study on the *Gaufinia* specimens that were the subject of the taxonomic revision by Stark and Baumann (2021). The specimens are housed at the Monte L. Bean Life Science Museum at BYU.

Finally, due to limited sampling and delays in the timing of our genetic analyses, we were unable to fully investigate the environmental conditions that support *G. cristata* populations. With changing hydrologic conditions, increasing temperatures, and seemingly growing intensity of grazing in the Abajo and La Sal mountains, this ecological piece of *G. cristata*'s status is critical.

Outreach and education:

Throughout this project, we made considerable efforts to connect with the public and educate about *G. cristata*, aquatic biodiversity in Utah, and how mountain ecosystems are changing. We primarily have done this through presentations and podcasts as well as PI Hotaling's lab YouTube channel. Below, we detail these efforts in more detail:

Presentations:

- Moab Information Center (June 19, 2025): "The Future of Utah's Mountains"
- Moab Information Center (June 13, 2024): "Climate Change in Utah's Mountains"

Podcasts:

- Science Moab Podcast (September 3, 2024): "Rock Glaciers and Water Sustainability" -- <https://sciencemoab.org/rock-glaciers-and-water-sustainability/>

YouTube videos:

PI Hotaling's "Climate Change in Mountains" research lab has a YouTube channel ([@MountainFutures](#)) where we've published two videos about our CNHA funded work. We are planning to publish at least one more video about *G. cristata* specifically.



“Ice in the Desert: Stream Ecology in Utah’s Alpine Zone” (180 views):
<https://youtu.be/VCRVBi9nHU>



“Researchers Collecting Stoneflies in a Mountain Stream” (105 views):
<https://youtu.be/5dEbz4qyTYM>

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