

# Anya Nova Metcalfe

## Ecologist

[ametcalfe@usgs.gov](mailto:ametcalfe@usgs.gov)

Office: (928) 556 7049

Twitter: @anyanovaya

2255 N Gemini Dr, Flagstaff, AZ 86001



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## Education:

### Northern Arizona University

M.S. Biological Sciences

Thesis: Aquatic insect distribution in the Colorado River Basin

Flagstaff, AZ

2018

### Prescott College

B.A. Environmental science with emphasis in aquatic resources

Minor in Adventure Education

Senior thesis: Biogeography of aquatic beetles in springs of the Colorado River Watershed

Prescott, AZ

2012

### Universidad de Guanajuato

Foreign exchange student, Hydrology department

Guanajuato, Mexico

2010

## Work Experience:

### United States Geological Survey

Grand Canyon Monitoring and Research Center & Southwest Biological Science Center

Ecologist GS 9 Series 0408

2012-present

Flagstaff, AZ

- Managed a citizen science project in the Colorado River watershed that spanned 7 states
- Using expert knowledge of Colorado River Basin aquatic insect fauna to identify taxa to species
- Processed more than 1799 light trap samples (979,430 insects) as of 9/3/2019
- Presenting research to and working alongside resource managers
- Spent more than 300 days in remote sections of Grand Canyon and Glen Canyon collecting aquatic and terrestrial invertebrate specimens using a myriad of traps and methods including drift nets, Hess samplers, ponar, light traps, sticky traps, and emergence traps
- Inspiring youth through scientific outreach
- Curating and managing a small in-house entomological collection
- Led a 2 day workshop on Trichoptera identification

### Museum of Northern Arizona

Curatorial Assistant

2012-2013

Flagstaff, AZ

- Handling, sorting, labeling, and identifying entomological specimens for museum collections
- Organizing and maintaining a collection of more than 200,000 specimens
- Collected over 2,000 invertebrate specimens in the field
- Overseeing and organizing museum volunteers

### Grand Canyon Wildlands Council

Lead Technician

2012-2014

Flagstaff, AZ

- Leading collection of interdisciplinary datasets on flora, fauna, hydrology, and human impact
- Wrote technical field reports describing field sites and sampling efforts

### Springs Stewardship Institute

Field Technician

2011-2012

Flagstaff, AZ

- Collected invertebrate specimens from over 40 springs on public lands in AZ and NV
- Gathering interdisciplinary datasets on the biology, geology, hydrology, and archaeology of springs

-Aided in the facilitation of 2 workshops for spring monitoring and restoration.

**US Forest Service/ Americorps**

**2010**

**Interpretation Internship**

Santa Fe National Forest, NM

- Created and delivered 8 educational programs for mixed-age audiences
- Designed and illustrated a field guide to freshwater macroinvertebrates
- Made 2,000+ contacts with forest visitors

**Additional Scientific Research and Field Experience:**

**Field Technician – Monitoring fish populations Glen Canyon/CO River**

2012-present

USGS/GCMRC

- Handling, identifying, sexing, measuring, and tagging fish
- With a team, processing up to 5,000 fish a night (collected by electroshocking)
- Working nocturnally (8 pm – 4 am)

**Trip participant – Sesquicentennial Colorado River Exploratory Expedition**

2019

USGS/UWY

- Selected as a USGS participant in river trip celebrating 150 years since Powell Expedition

**Field Technician**

2012

Seeds of Success/Northern Arizona University

- Identifying and collecting seeds from native plants in Southern Utah
- Using a field press to collect voucher specimens for Flagstaff herbarium and Smithsonian collections

**Field Assistant – Monitoring populations of Humpback Chub in the Colorado River**

Apr 2012, Sept 2012

US Fish and Wildlife Service

- Capturing fish using ring nets and trammel nets
- Handling, identifying, sexing, measuring, and PIT tagging fish

**Bug Camp Instructor**

July 2012, July 2013

Summer Among the Peaks Discovery Camp

- Instructing 10 students during week long bug camps with daily field trips

**Elk calf-mortality study at the Valle Caldera National Wildlife Refuge, NM**

June - July 2011

- Tagging calves with ear tag transmitter, locating wildlife using telemetry, appropriately handling calves

**Independent research project on benthic invertebrates of the Colorado River and its tributaries**

2011

- Sampled insects from ten tributaries and 9 sites along the Colorado River during a 21 day river trip
- Authored an unpublished 8 page report and presented at Prescott College Grand Canyon Symposium

**Collecting baseline resource data in remote technical slot canyons of Grand Canyon**

2013

- Collecting data on the ecology, hydrology, geology, and recreation impacts of technical slot canyons
- Rappelling as much as 200 ft/pitch, swimming in cold water, hiking long distances, and packrafting

***Colpomenia tuberculata* as a microhabitat in Estero Santa Rosa, Sonora, Mexico**

2011

- Collecting, identifying, and recording the marine macroinvertebrates that live within a brown alga
- Collection methods required hiking, kayaking, snorkeling, and extensive wading
- Co-wrote a 15 page unpublished report

**Electro-shocking with a backpack unit to remove invasive fish**

Intermittent 2010-2015

- Participated in 14 collective days of fish removal in Prescott National Forest, AZ, Santa Fe National Forest, NM and Bright Angel Creek in Grand Canyon National Park, AZ.

**Monitoring tamarisk beetle populations on the Colorado River**

2011

- Assisting a masters student (CSU) in collecting tamarisk beetles in Grand Canyon

**Surveying beaver population in the Verde River, AZ**

2010

- Three weeks locating, surveying, and monitoring beaver dams for the Nature Conservancy

**Verde River and Butte Creek Restoration Field Technician**

2009

**Volunteer Work:**

**Giving presentations at public schools**

2011-present

- >6 presentations on entomology for Flagstaff Festival of Science (annual)
- 2 hour presentation on Environmental Careers in a rural school district (Dewey, AZ)

**Guest teacher for ecology club “Los delfines juvenes” in Bahia de Kino, Sonora, Mexico**

2011

-Preparing and facilitating lessons on marine biology in Spanish for middle school students	
<b>Founder and president of marine conservation group "Make a Wave" in Pompano Beach, FL</b>	2007-2009
-Initiated and led 64 member club for 3 years	
-Led weekly sampling and analysis of a local inlet for presence of E. Coli for one year	
-Participated in multiple community events, raising awareness of local marine conservation issues	
-Featured in 3 local newspapers and the magazine Teen Vogue	
<b>Instructor and activities coordinator at children's museum "Young @ Art"</b>	2006-2008
-Volunteered 300+ hours	
-Assisted in organization of 3 events and fundraisers	

## Grants & Recognition

### *Federal agencies*

QRP USGS/USFWS grant to continue research on aquatic insects of upper Colorado River Basin, partnership with Upper Colorado Endangered Fish Recovery Program (\$75,000)	2018
Dinosaur National Monument grant to continue Citizen Science efforts in park (\$10,000)	2018
Dinosaur National Monument grant to begin a Citizen Science monitoring project for aquatic insects (\$33,000)	2016
Rhode Island School of Design (RISD) Maharam STEAM fellowship to collaborate with RISD M.F.A. student (\$5,000)	2014

### *Societies & Organizations*

Western Bat Working Group Bob Berry Award (\$2,000 training & new detector)	2015
Aldo Leopold Land Ethic Leader Workshop (Land Steward Fellowship, \$200 training)	2012
Surfrider Foundation (\$2,000 marine water testing equipment and training)	2007

### *Academic*

AmeriCorps Award Recipient, Student Conservation Association (\$1200)	2011
Community Service Education Award (\$1200)	2011
Sustainability Scholar, The North American Mobility Program (\$5000)	2010
Prescott College Designated Class Archivist (\$300 photography award)	2010
John Wesley Powell Scholarship (\$8,000 for academic achievement)	2009
Environmental and Social Justice Scholarship (\$8,000 for community leadership)	2009
George Snow Foundation Scholar (\$12,000 for academic achievement)	2009
Ford Salute to Education Scholar (\$1,000 for academic achievement)	2009
Charles Franklin Parker Scholar (\$4,000 for community leadership)	2009

## Specialized Training:

-Spatial Statistical Network Modeling (Boise, ID)	2019
-Bayesian Modeling (Flagstaff, AZ)	2019
-Swiftwater certified (NOLS)	2017
-Titley ANABAT software training (Raleigh, NC)	2015
-Trichoptera of the Southwest Workshop (Flagstaff, AZ)	2014
-Springs Restoration Workshop (Las Vegas, NV)	2012
-Wilderness First Responder	Current, Since 2011
-Grand Canyon Semester selected participant (Prescott College, AZ)	2011
-Aldo Leopold Land Ethic Leader Workshop (Albuquerque, NM)	2011
-Completed B-3 Combination Helicopter/Airplane Safety Course (DOI)	2010

## Scientific Publications

Metcalfe, A., Muehlbauer, J., Kennedy, T., Yackulic, C., Dibble, K., & Marks, C. (In press) Net-spinning caddisfly distribution in large regulated river. Freshwater Biology.

Metcalfe, A., Kennedy, T., Marks, C., Smith, A., & Muehlbauer, J. 2020. Spatial genetic structuring of a widespread aquatic insect in the Colorado River Basin: evidence for *Hydropsyche oslari* species complex.

Metcalfe, A., Muehlbauer, J., Ford, Morgan, & Kennedy, T. 2020. Bug Flows: Don't count your midges until they hatch. The Boatman's Quarterly Review 32(4): 8-11.

Metcalfe, A. 2019. Adult net-spinning caddisfly (*Hydropsyche* spp.) catch rates and morphology from large rivers of the southwestern United States, 2015-2016: U.S. Geological Survey data release. Available from <https://doi.org/10.5066/P94N7GI9>.

Metcalfe, A. 2019. Locality based caddisfly (*Hydropsyche oslari*) sampling data and CO1 sequences from the southwestern United States, 2013-2016: U.S. Geological Survey data release. Available from <https://doi.org/10.5066/P93GMB1Y>.

Nathan, L., Mamoozadeh, N., Tumas, H., Gunselman, S., Klass, K., Metcalfe, A., Edge, C., Waits, L., Spruell, P., Lowery, E. & Connor, E. 2019. A spatially-explicit, individual-based demogenetic simulation framework for evaluating hybridization dynamics. *Ecological Modelling* 401: 40-51.

Metcalfe, A. 2018. Aquatic insect distribution in the Colorado River Basin. Masters Thesis. Northern Arizona University. Available from Proquest (<<https://search.proquest.com/docview/2051910485>)

Eitzel, M., Cappadonna, J., Santos-Lang, C., Duerr, R., West, S., Virapongse, A., Kyba, C., Bowser, A., Cooper, C., Sforzi, A., Metcalfe, A., Harris, E., Thiel, M., Haklay, M., Ponciano, L., Roche, J., Ceccaroni, L., Shilling, F., Dörler, D., Heigl, F., Kiessling, T., Davis, B., & Jiang, Q. 2017. Citizen science terminology matters: Exploring key terms. *Citizen Science: Theory and Practice* 2: 1-20. DOI: 10.5334/cstp.96.

Metcalfe, A., Kennedy, T., & Fritzinger, C. 2016. Moth Mystery Hour. The Boatman's Quarterly Review 27(4): 15-16.

Metcalfe, A., Kennedy, T., & Muehlbauer, J. 2016. Phenology of the adult angel lichen moth (*Cisthene angelus*) in Grand Canyon, USA. The Southwestern Naturalist 61: 233–240. DOI: 10.1894/0038-4909-61.3.233

Metcalfe, A., Kennedy, T. & Muehlbauer, J. 2016. Angel lichen moth abundance and morphology data, Grand Canyon, AZ, 2012. US Geological Survey Data Release. DOI: 10.5066/F7154F5S

Kennedy, T., Muehlbauer, J., Yackulic, C., Lytle, D., Miller, S., Dibble, K., Kortenhoeven, E., Metcalfe, A., & Baxter, C. 2016. Flow management for hydropower extirpates aquatic insects, undermining river food webs. *BioScience* 77: 561–575. DOI: 10.1093/biosci/biw059. **BioScience Editor's Choice and featured in Press Releases by USGS, Oregon State U., Conservation Magazine, and others.**

## **Manuscripts in review**

Patrick, C., Anderson, K., Brown, B., Hawkins, C., Metcalfe, A., Saffarinia, P., Siqueira, T., Swan, C., Tonkin, J., & Yuan, L. (In review) The application of metacommunity theory to the management of running waters. Submitted to *Freshwater Biology* January 2020.

## **Major conference presentations (as lead author only)**

Metcalfe, A., Muehlbauer, J., Kennedy, T., Yackulic, C., Dibble, K., & Marks, C. 2020. (Poster). Net-spinning caddisfly distribution in a large regulated river. Ecological Society of America annual meeting. Virtual.

Metcalfe, A., Kennedy, T., Muehlbauer, J., Marks, J. 2019. Gene flow among net-spinning caddisfly populations in the Colorado River Basin. Biennial Conference of Science and Management on the Colorado Plateau. Invited speaker for special session "Evaluating the effects of flow and connectivity on river ecosystems." Flagstaff, AZ.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2019. Genetic diversity of a widespread net-spinning caddisfly (Hydropsyche oslari). Society Freshwater Science annual meeting. Salt Lake City, UT.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2019. Genetic diversity of a widespread net-spinning caddisfly (Hydropsyche oslari). (Poster). Glen Canyon Dam Adaptive Management Program annual reporting meeting. Phoenix, AZ.

Metcalfe, A. 2018. Shedding light on aquatic insects of the Colorado River Basin with citizen science. The 39<sup>th</sup> annual researchers meeting for the Upper Colorado River Endangered Fish & Recovery Program. Vernal, UT.

Metcalfe, A. 2018. Shedding light on aquatic insects of the Colorado River Basin with citizen science. Glen Canyon Dam Adaptive Management Program annual reporting meeting. Phoenix, AZ.

Metcalfe, A. Mixon, R. 2017. Do dams affect bat diets? Western Bat Working Group annual meeting. Fort Collins, CO.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2017. The Grand Beyond: Aquatic foodbase of the Upper Colorado River Basin (Poster). Glen Canyon Dam Adaptive Management Program annual reporting meeting. Phoenix, AZ.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2017. The Colorado River Basin: Aquatic insect diversity and distribution in a fragmented riverscape. Society for Freshwater Science annual meeting. Raleigh, NC.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2016. Compounding Impoundments: aquatic insect distribution and emergence in a fragmented riverscape. Society for Freshwater Science annual meeting. Sacramento, CA.

## **Other, invited, scientific presentations**

Metcalfe, A. 2019. What are Bug Flows? Field presentation to the Coconino County Watershed Partnership. Page, AZ.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2019. Colorado River ecosystem response to the 2018 Bug Flow Experiment released from Glen Canyon Dam. Grand Canyon River Guides Training Seminar. Marble Canyon, AZ.

Metcalfe, A. 2017. What is Citizen Science? Consultative Group for Biological Diversity annual meeting. Flagstaff, AZ.

Metcalfe, A., Kennedy, T., Muehlbauer, J. 2017. Comparative emergence studies in the upper basin using citizen science light traps. Western Area Power Administration webinar. Remote.

Metcalfe, A. 2016. Big River Bugs: A Citizen Science Approach. Moab Festival of Science. Moab, UT.

Metcalfe, A. 2016. Aquatic insect diversity and distribution in the Colorado River Basin. Center for Ecosystem Science and Society seminar. Flagstaff, AZ.

## **External media coverage**

USGS (2019) Guest for podcast about Citizen Science. "Outstanding in the Field: Citizen Science – Your Data in Action" <<https://www.usgs.gov/media/audio/outstanding-field-ep-2-citizen-science-your-data-action>>

Arizona PBS (2019) Interviewed for documentary about the future of Grand Canyon National Park. <<https://azpbs.org/2019/02/beyond-the-rim-the-next-100-years-of-grand-canyon-national-park/>>

National Geographic (2016) Interviewed for "At 17 million years old, Grand Canyon still has lessons to teach." <<https://video.nationalgeographic.com/video/short-film-showcase/00000156-e673-dbd5-add6-fff3e6d30000>>

Scientific American (2019) Article about conducting aquatic ecology research in Grand Canyon. <<https://www.scientificamerican.com/article/re-engineering-the-colorado-riverto-save-the-grand-canyon>>

Associated Press, picked up by The New York Times, The Washington Post, US News and World Report, and others (2018) Story describing the Bug Flows experiment <<https://apnews.com/accec230d442406fa7bedf4af219c5d1>>

Bureau of Reclamation (2018) Official press release describing Bug Flows experiment  
<<https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=62133>>

Undark Magazine (2018) Essay about conducting aquatic ecology research in Grand Canyon  
<https://undark.org/article/wilo-doyle-colorado-river-insects/>

NAU (2017) Featured on Center for Ecosystem Science and Society page < <http://ecoss.nau.edu/team/anya-metcalfe/>>

National Public Radio KNAU (2017) Story about *Cisthene angelus* paper. <<https://www.knau.org/post/earth-notes-angel-lichen-moths>>

Science Magazine (2016) Scientific reinterpretation of the BioScience hydropeaking paper.  
<<http://science.sciencemag.org/content/353/6304/1099>>

Arizona Daily Sun (2016) Story about BioScience hydropeaking paper. <[http://azdailysun.com/news/local/dam-management-plan-aims-to-boost-native-fishbugs/article\\_8f2a949c-03ee-5f96-86b4-eda52fd0ffbf.html](http://azdailysun.com/news/local/dam-management-plan-aims-to-boost-native-fishbugs/article_8f2a949c-03ee-5f96-86b4-eda52fd0ffbf.html)>

National Public Radio KNAU (2016) Story about BioScience hydropeaking paper. <<http://knau.org/post/study-hydropower-decimates-aquatic-insects-coloradoriver#stream/0>>

High Country News (2016) Reinterpretation of BioScience hydropeaking paper.  
<<https://www.hcn.org/issues/48.12/new-measures-could-reduce-glen-canyon-dams-impact-on-the-grand-canyon-a-bit>>

Columbia Basin Fish & Wildlife News Bulletin (2016) Summary of BioScience hydropeaking paper.  
<<http://www.cbbulletin.com/436660.aspx>>

American Fisheries Society (2016) Summary of BioScience hydropeaking paper. <<https://fisheries.org/2016/05/citizen-science-reveals-how-river-food-webs-are-affected-by-hydropower-practices/>>

Conservation Magazine (2016) Summary of BioScience hydropeaking paper.  
<<http://conservationmagazine.org/2016/05/simple-trick-make-dams-less-damaging-river-ecosystems/>>

USGS (2016) Official press release for BioScience hydropeaking paper. <<https://www.usgs.gov/news/river-food-webs-threatened-widespread-hydropower-practice>>

Oregon State University (2016) Official press releases for BioScience hydropeaking paper.  
<<https://today.oregonstate.edu/archives/2016/may/hydropoaking-river-waterlevels-disrupting-insect-survival-river-ecosystems>>

BioScience (2016) Editor's choice selection for BioScience hydropeaking paper.  
<<http://bioscienceaibs.libsyn.com/hydroelectric-dams-kill-insects-wreak-havoc-with-food-webs>>

## Students & Technicians Mentored

*Emilio Saladino*. B.S. candidate. Northern Arizona University, Environmental Sciences. 2019 – present.

-Internship supervisor for ENV 408 and mentor in Science outreach

*Breche Hendrix*. B.S. Northern Arizona University, Forestry., Biological technician 2015-2018.

-Supervisor and mentor in aquatic entomology

*Kate Aitchison*. M.F.A. Rhode Island School of Design. 2015-2016.

-Collaborator in science communication for Maharam STEAM Fellowship

## Professional Service

-Peer reviewer for Environmental Entomology, Journal of Environmental Management, and Journal of Applied Ecology

-Flagstaff Science Center Outreach Committee since 2013

-Classroom speaker for Flagstaff Festival of Science since 2012



## **Additional Skills and Interests:**

- Trilingual (Russian, Spanish, English)
- Outdoor enthusiast: experienced river runner, hiker, canyoneer, and rock climber
- Certified Wilderness First Responder since May 2011
- Proficient with R, GIS, Inkscape, Github, Microsoft Office, and a suite of genetic analysis tools

