

Hannah Weller

Research interests: the role of biomechanical constraints in life history evolution; paths of least resistance in the evolution of new traits; image processing in organismal biology, with a focus on methods development for quantifying color and pattern.

Education

- 2019—2023 (expected)** **PhD, Ecology and Evolutionary Biology**
Brown University (Providence, RI)
Thesis: How much does functional morphology matter to the evolution of mouthbrooding?
- 2017—2019** **Transitional M.Sc., Ecology and Evolutionary Biology**
Brown University (Providence, RI)
Thesis: How do feeding adaptations influence the convergent evolution of mouthbrooding?
- 2012—2016** **Honors B.Sc., Biology**
University of Chicago (Chicago, IL)
Thesis: Winnowing in the eartheater cichlids

Awards and Fellowships

- January 2022** **Doctoral Dissertation Enhancement Grant**
\$10,000, Bushnell Fund at Brown University
- April 2019** **Graduate Research Fellowship**
\$138,000, National Science Foundation
- December 2018** **Field Museum Visiting Scientist Scholarship**
\$1,500, Field Museum of Natural History
- May 2017** **Presidential Fellowship**
\$108,000, Brown University
- June 2015** **Jeff Metcalf Undergraduate Research Fellowship**
\$5,000, Marine Biological Laboratory
- March 2015** **Elected to Phi Beta Kappa Society**
- September 2014** **Best Presentation, Undergraduate Research Symposium**
\$150, University of Chicago
- June 2014** **Elliott and Eileen Hinkes Research Fellowship**
\$4,000, University of Chicago

Peer-reviewed publications

- Weller, H.I.**, Hiller, A.E., Van Belleghem, S.M., and Lord, N.P. (2022). Recolorize: flexible color segmentation of biological images. In review at eLife. Preprint DOI: <https://doi.org/10.1101/2022.04.03.486906>.
- Weller, H.I.**, López-Fernández, H., McMahan, C.D., and Brainerd, E.L. (2022). Relaxed feeding constraints facilitate the evolution of mouthbrooding in Neotropical cichlids. *The American Naturalist*. DOI: <https://doi.org/10.1086/719235>.
- Capano, J.G., Boback, S.M., **Weller, H.I.**, Cieri, R.L., Zemer, C.F., and Brainerd, E.L. (2022). Modular lung ventilation in *Boa constrictor*. *Journal of Experimental Biology*. DOI: <https://doi.org/10.1242/jeb.243119>.
- Tumulty, J.P., Miller, S.E., Van Belleghem, S.M., **Weller, H.I.**, Jernigan, C.M., Vincent, S., Staudenraus, R.J., Legan, A.W., Polnaszek, T.J., Uy, F.M.K, Walton, A., and Sheehan, M.J. (2021). Evidence for a selective link between cooperation and individual recognition. In review. Preprint DOI: <https://doi.org/10.1101/2021.09.07.459327>.
- Weller, H.I.**, Olsen, A., Camp, A.L., Hernandez, L.P., Manafzadeh, A.R., and Brainerd, E.L. (2020). An XROMM study of intra-oral transport and swallowing in catfish. *Integrative Organismal Biology*. DOI: <https://doi.org/10.1093/iob/obaa018>.
- Cohen, K.E., **Weller, H.I.**, Westneat, M.W., and Summers, A.P. (2020). The Evolutionary Continuum of Functional Homodonty to Heterodonty in the Dentition of *Halichoeres* Wrasses. *Integrative and Comparative Biology*. <https://doi.org/10.1093/icb/icaa137>.

Weller, H.I.*, Hooper, S.E.*, and Amelon, S.K* (2020). Countcolors, an R package for quantification of the fluorescence emitted by *Pseudogymnoascus destructans* lesions on the wing membranes of hibernating bats. *Journal of Wildlife Diseases*. <https://doi.org/10.7589/2019-09-231>

*These authors contributed equally to this work.

Cohen, K.E., **Weller, H.I.**, and Summers, A.P. (2020). Not your father's homodonty—stress, tooth shape, and the functional homodont. *Journal of Anatomy*. DOI: <https://doi.org/10.1111/joa.13248>

van Meer, N.M., **Weller, H.I.**, Manafzadeh, A.R., Kaczmarek, E.B., Scott, B., Gussekloo, S.W.S., Wilga, C.D., Brainerd, E.B., and Camp, A.L. (2019). Intra-oropharyngeal food transport and swallowing in white-spotted bamboo sharks. *Journal of Experimental Biology*. DOI: [10.1242/jeb.201426](https://doi.org/10.1242/jeb.201426)

Weller, H.I., and Westneat, M.W. (2019). Quantitative color profiling of digital images with earth mover's distance using the R package colordistance. *PeerJ*. DOI: [10.7717/peerj.6398](https://doi.org/10.7717/peerj.6398)

Weller, H.I., McMahan, C.D., and Westneat, M.W. (2017). Dirt-sifting Devilfish: Winnowing in the geophagine cichlid *Satanoperca daemon* and evolutionary implications. *Zoomorphology*. DOI: [10.1007/s00435-016-0335-6](https://doi.org/10.1007/s00435-016-0335-6)

Software

Weller, H.I. (2020). recolorize: Simplify and Remap Image Colors for Biological Analysis (ver. 0.9.000). CRAN Repository. <https://CRAN.R-project.org/package=recolorize>

O'Sullivan, D., **Weller, H.I.**, and Lord, N.P. Insect Color Database (ICDB). In development. <https://insectcolor.com/>

Weller, H.I. (2019). colordistance: Distance Metrics for Image Color Similarity (ver. 1.1.0). CRAN repository. <https://CRAN.R-project.org/package=colordistance>

Weller, H.I. (2018). countcolors: Locates and Counts Pixels Within Color Range(s) in Images (ver. 0.9.1). CRAN Repository. <https://CRAN.R-project.org/package=countcolors>

Presentations

Weller, H.I., López-Fernández, H., and Brainerd, E.L. Talk: Does feeding mediate life history tradeoffs in mouthbrooding cichlids? *Society for Integrative and Comparative Biology*, virtual conference.

Weller, H.I., (August 2021). Talk: Greater than the sum of their parts? Unpacking the “black box” of perceptual similarity using classical color pattern metrics. *Living Light Early Career Reserachers*, virtual conference.

Weller, H.I., Wham, D., Ezray-Wham, B., and Lord, N.P. (August 2021). Talk: Greater than the sum of their parts? Unpacking the “black box” of perceptual similarity using classical color pattern metrics. *Living Light Early Career Reserachers*, virtual conference.

Weller, H.I., Schwartz, S.T., Karan, E., and Lord, N.P. (Jan. 2021). Talk: Recolorize: a flexible R package for color classification. *Society for Integrative and Comparative Biology*, virtual conference.

Weller, H.I., López-Fernández, H., McMahan, C.D., and Brainerd, E.L. (Jan. 2020). Talk: The spandrels of Satan's perches: evidence for the co-optation of feeding traits in the convergent evolution of mouthbrooding in Neotropical cichlids. *Society for Integrative and Comparative Biology, Austin, TX*.

Weller, H.I., López-Fernández, H., McMahan, C.D., and Brainerd, E.L. (Oct. 2019). Talk: Does mouthbrooding constrain or complement feeding morphology? *Regional Division of Vertebrate Morphology (Northeast), Newton, MA*.

Weller, H.I., Olsen, A., Camp, A.L., Hernandez, L.P., Manafzadeh, A.R., and Brainerd, E.L. (Jan. 2019). Talk: 3D-Intra-oral Prey Trajectories Indicate Distinct Phases in how Channel Catfish (*Ictalurus punctatus*, Siluriformes: Ictaluridae) Swallow Food. *International Congress of Vertebrate Morphology, Prague, CZ*.

Weller, H.I., Cohen, K.E., Gibb, A., and Brainerd, E.L. (Jan. 2019). Poster: Using tethers to measure food transport in a flatfish. *Society for Integrative and Comparative Biology, Tampa, FL*.

Weller, H.I., Olsen, A., Camp, A.L., Hernandez, L.P., Manafzadeh, A.R., and Brainerd, E.L. (Jan. 2019). Talk: An XROMM study of intra-oral transport and swallowing in catfish. *Society for Integrative and Comparative Biology, Tampa, FL*.

Weller, H.I. and Brainerd, E.L. (Oct. 2017). Talk: How do fish swallow food? *Regional Division of Vertebrate Morphology (Northeast), Lowell, MA*.

Weller, H.I., McMahan, C.D., and Westneat, M.W. (July 2016). Poster: Dirt-sifting devilfish: winnowing in eartheater cichlids. *American Society of Ichthyologists and Herpetologists, New Orleans, LA*.

Invited talks, lectures, & workshops

June 2022

Workshop: Statistics for Biologists

University of Washington, Friday Harbor Laboratories (Friday Harbor, WA)

R workshop focusing on practical statistical approaches to messy biological data. Instructors: Matthew Kolmann and Cassandra Donatelli.

May 2022

Podcast: Naturalist Selections

American Society of Naturalists

Podcast interview about 2022 American Naturalist paper on the co-evolution of feeding and mouthbrooding in cichlids.

- July 2020** **Workshop: Phylogenetic Comparative Methods in R**
University of Washington, Friday Harbor Laboratories (Friday Harbor, WA)
R workshop focusing on phylogenetic and comparative methods. Instructors: Matthew Kolmann and Cassandra Donatelli.
- July 2020** **A field guide to statistics in organismal biology**
University of Washington, Friday Harbor Laboratories (Friday Harbor, WA)
Guest lecture. Instructors: Matthew Kolmann and Cassandra Donatelli.
- July 2020** **Mouthbrooding morphologies in Neotropical cichlids**
University of California Davis, Dept. of Ecology and Evolutionary Biology (Davis, CA)
Virtual seminar. Host: Peter Wainwright.
- April 2020** **Special Topics: Light, Color, and Vision in Biology (BIOL 7901/ENTM 7008)**
Louisiana State University, Dept. of Entomology and Dept. of Biology (Baton Rouge, LA)
Guest lecturer (3 classes). Instructors: Nathan Lord (ENTM) & Brant Faircloth (BIOL).
- December 2019** **Workshop: R for Biologists**
Louisiana State University, Dept. of Entomology (Baton Rouge, LA)
Organizer. Day-long workshop on data analysis and visualization in R.

Research experience

- 2017—Present** **PhD Candidate, Brainerd Lab**; advisor: Elizabeth Brainerd
Brown University, Dept. of Ecology & Evolutionary Biology
Comparative morphology, kinematics, and biomechanics of mouthbrooding fishes; XROMM fish feeding and transport.
- September 2013—July 2017** **Research assistant**; advisor: Mark Westneat
University of Chicago, Dept. of Organismal Biology & Anatomy
Quantitative color analysis; geometric morphometrics; high-speed video kinematics.
- June 2015—September 2015** **Jeff Metcalf Summer Research Fellow**; advisor: Roger Hanlon
Brown University, Dept. of Ecology & Evolutionary Biology
Hyperspectral imaging; image analysis pipelines; camouflage analyses.
- June 2014—September 2014** **Summer Research Fellow, Westneat Lab**; advisor: Mark Westneat
University of Chicago, Dept. of Organismal Biology & Anatomy
Ontogenetic scaling; biomechanical modeling; geometric morphometrics.

Teaching and outreach

- June 2021 & July 2022** **Instructor**, *Brown University, Summer@Brown Program* (Providence, RI)
Anatomy, Behavior, and Evolution: Fishy Solutions to Life Underwater
Intensive high school course including labs, assignments, and mentoring of final project (preparation of research proposals and presentations). 12 (2021) and 22 (2022) students.
- August 2020 – Present** **Teaching assistant**, *Brown University, Alpert Medical School* (Providence, RI)
COVID-modified Human Anatomy (lecture and lab)
Restructuring the traditional gross anatomy curriculum, including remote/small group work and prosection-based staggered labs.
- September 2019 – Present** **R User Group**, *Brown University, Dept. of Ecology and Evolutionary Biology* (Providence, RI)
Organizing and running monthly R workshops for graduate and undergraduate students, focusing on techniques for biological analysis (e.g., data organization, statistics, and visualization).
- August 2019 – April 2020** **Teaching assistant**, *Brown University, Alpert Medical School* (Providence, RI)
Human Anatomy (lecture and lab)
Guiding medical students through cadaver-based human anatomy labs.
- September 2018 – Present** **Marine Science Club**, *Paul Cuffee High School* (Providence, RI)
Collaborating with high school teachers for weekly science activities with high school students.
- September 2017 – Dec. 2017** **Teaching assistant**, *Brown University, Dept. of Ecology & Evolutionary Biology* (Providence, RI)
Diversity of Life (lecture)

**January 2015
– April 2017**

Teaching assistant, *University of Chicago, Dept. of Biological Sciences* (Chicago, IL)
Presenting and supervising lab experiments; writing and grading assignments; lecturing; leading paper discussions and review sessions; guiding dissection-based anatomy labs.

Genetic and Developmental Biology (lab & lecture)
Multiscale Modeling of Biological Systems (lecture)
Molecular Biology of the Cell (lab)
Comparative Vertebrate Anatomy (lab & lecture)

June 2013 – September 2013

Animal care intern, *New England Aquarium* (Boston, MA)
Daily animal care and maintenance; visitor outreach; collection trips.

Skills

Coding

R, Python (esp. OpenCV, Scrapy, & BioPython libraries), MATLAB, UNIX, MEL

Software

Latex, Maya, FIJI/ImageJ, Horos, 3DSlicer, XMALab, Mesquite, Pandoc, Microsoft Office

Languages

English (native), French (intermediate)

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