

C. DARRIN HULSEY

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Degrees Awarded

Ph.D. Population Biology	University of California-Davis 2004
B.S. Zoology	University of Texas-Austin 1997
B.A. Plan II (Humanities)	University of Texas-Austin 1997

Funded Awards and Honors

€234,200 The Genomic Architecture of Convergent Snail Crushing Jaws in Cichlid Fishes PI: **C.D. Hulsey**, Deutsche Forschungsgemeinschaft (German National Science Foundation). 2017-2020.

€358,750 Species Delimitation in East African Cichlid Fish Adaptive Radiations. PIs: A. Meyer and **C.D. Hulsey**. Deutsche Forschungsgemeinschaft (German National Science Foundation) SPP 1991 Taxon-Omics: New Approaches for Discovering and Naming Biodiversity. 2017-2020.

\$19,250 Swimming Tunnel System. PIs: **C.D. Hulsey** and A. Meyer. University of Konstanz Equipment Grant. 2015-2016.

\$172,000 Evolution of Functional Novelty. PIs: **C.D. Hulsey** and R. Holzman. US-Israel Bi-National Science Foundation. 2012-2016.

\$19,221 Phenotypic Plasticity and Evolution in the Pharyngeal Jaw Apparatus. PIs: **C.D. Hulsey** and S.F. Clemmensen. U.S. National Science Foundation. 2013-2014.

\$161,600 Initiative for Quaternary Paleoclimate Research. PIs: Horn, S., L. Zhenghua, D. Finkelstein, H.D. Grissino-Mayer, L.D. McKay, L. Yingkui, D.G. Anderson, and **C.D. Hulsey**. University of Tennessee Organized Research Unit Funding. 2010-2013.

\$8500 Light Sources for Vertebrate Biology Classes. PI: **Hulsey, C.D.** University of Tennessee ARAA stimulus funds. 2009.

\$166,555 Evolutionary Plasticity: Is Remodeling Key to Cichlid Pharyngeal Jaw Diversification? PI: **C.D. Hulsey**. U.S. National Science Foundation. 2009-2011.

\$15500 Evolution of a Polymorphic Cichlid. PI: **C.D. Hulsey**. National Geographic Research Grant. 2003-2004.

\$11387 Evolution of a Polymorphic Cichlid in Mexico. PI: **C.D. Hulsey**. University of California UCMexus. 2002-2004.

\$110,000 Predoctoral Fellowship. U.S. National Science Foundation. 1998-2001.

\$1,320,187 Total

Publications

- 52) **Hulsey, C.D.**, G. Machado-Schiaffino, L. Keicher, D. Ellis-Soto, F. Henning, and A. Meyer. 2017. The integrated genomic architecture and evolution of dental divergence in East African cichlid fishes (*Haplochromis chilotes* x *H. nyererei*). *G3: Genes, Genomes, Genetics*. (in press).
- 51) **Hulsey, C.D.**, J. Zheng, B.C. Faircloth, A. Meyer, and M.E. Alfaro. 2017. Phylogenomic analysis of Lake Malawi cichlid fishes: further evidence that the three-stage model of diversification does not fit. *Molecular Phylogenetics and Evolution*. 114: 44-48.
- 50) Holzman, R. and **C.D. Hulsey**. 2017. Mechanical transgressive segregation and the rapid origin of trophic novelty. *Scientific Reports*. 7: 40306.
- 49) **Hulsey, C.D.**, G.F. Fraser, and A. Meyer. 2016. Biting into the genome to phenome map: developmental genetic modularity of cichlid fish dentitions. *Integrative and Comparative Biology*. 56: 373-388.
- 48) **Hulsey, C.D.**, K. Bell, F.J. García de Leon, C. Nice, and A. Meyer. 2016. Do relaxed selection and habitat temperature facilitate biased mitogenomic introgression in a narrowly endemic fish? *Ecology and Evolution*. 6: 3684-3698.
- 47) McGee, M.D., B.C. Faircloth, S.R. Borstein, J. Zheng, **C.D. Hulsey**, P.C. Wainwright, and M.E. Alfaro. 2016. Replicated divergence in cichlid radiations mirrors a major vertebrate innovation. *Proceedings of the Royal Society Series B*. 283: 20151413.
- 46) **Hulsey, C.D.**, F.J. García de León, and A. Meyer. 2015. Sexual dimorphism in a trophically polymorphic cichlid fish? *Journal of Morphology*. 276: 1448-1454.
- 45) Higham, T.E., A. Birn-Jeffery, C.E. Collins, **C.D. Hulsey**, and A.P. Russell. 2015. Adaptive simplification and the evolution of gecko locomotion: Morphological and biomechanical consequences of losing adhesion. *Proceedings of the National Academy of Sciences USA*. 112: 809-814.
- 44) York R.A., C. Patil, **C.D. Hulsey**, J.T. Streebman and R.D. Fernald. 2015. Evolution of bower building in Lake Malawi cichlid fish: Phylogeny, morphology, and behavior. *Frontiers in Ecology and Evolution*. 3: 18.
- 43) Rupp, M.F. and **C.D. Hulsey**. 2014. Influence of substrate orientation on feeding kinematics and performance of algae grazing Lake Malawi cichlid fishes. *Journal of Experimental Biology*. 217: 3057-3066.
- 42) Coghill, L.M., **C.D. Hulsey**, J. Chaves-Campos, F.J. García de Leon, and S.G. Johnson. 2014. Next generation phylogeography of cave and surface *Astyanax mexicanus*. *Molecular Phylogenetics and Evolution*. 79: 368-374.
- 41) Keck, B.P. and **C.D. Hulsey**. 2014. Continental monophyly of cichlid fishes and the phylogenetic position of *Heterochromis multidentis*. *Molecular Phylogenetics and Evolution*. 73: 53-59.
- 40) Hollingsworth, P.R. Jr., A.M. Simons, J.A. Fordyce, and **C.D. Hulsey**. 2013. Explosive diversification following a benthic to pelagic shift in freshwater fishes. *BMC Evolutionary Biology*. 13: 272.

- 39) Douglas, M., B.P. Keck, C. Ruble, M. Petty, J.R. Shute, P. Rakes, and **C.D. Hulsey**. 2013. Pelagic larval duration predicts extinction risk in a freshwater fish clade. *Biology Letters*. 9: 20130672.
- 38) **Hulsey, C.D.** and F.J. García de León. 2013. Introgressive hybridization in a trophically polymorphic cichlid. *Ecology and Evolution*. 3: 4536-4547.
- 37) Coghill, L.M., **C.D. Hulsey**, J. Chaves-Campos, F.J. García de León, and S.G. Johnson. 2013. Phylogeography and conservation genetics of a distinct lineage of sunfish in the Cuatro Ciénegas valley of Mexico. *PLoS One*. 8: e77013.
- 36) Friedman M., B.P. Keck, A. Dornburg, R.I. Eytan, C.H. Martin, **C.D. Hulsey**, P.C. Wainwright, and T.J. Near. 2013. Molecular and fossil evidence place the origin of cichlid fishes long after Gondwanan rifting. *Proceedings of the Royal Society Series B*. 280: 20131733.
- 35) **Hulsey, C.D.**, R.J. Roberts, Y.H.E. Loh, M.F. Rupp, and J.T. Streelman. 2013. Lake Malawi cichlid evolution along a benthic/limnetic axis. *Ecology and Evolution*. 3: 2262-2272.
- 34) **Hulsey C.D.**, B.P. Keck, H. Alamillo, and B.C. O'Meara. 2013. Mitochondrial genome primers for Lake Malawi cichlids. *Molecular Ecology Resources*. 13: 347-353.
- 33) Parnell, N.F., **C.D. Hulsey**, and J.T. Streelman. 2012. The genetic basis of a complex functional system. *Evolution*. 66: 3352-3366.
- 32) Holzman, R., D.C. Collar, S.A. Price, **C.D. Hulsey**, R.C. Thomson, and P.C. Wainwright. 2012. Biomechanical trade-offs bias rates of evolution in the feeding apparatus of fishes. *Proceedings of the Royal Society Series B*. 279: 1287-1292.
- 31) Chaves-Campos, J., S.G. Johnson, and **C.D. Hulsey**. 2011. Spatial geographic mosaic in an aquatic predator-prey network. *PLoS One*. 6: e22472.
- 30) Hollingsworth, P.R. Jr. and **C.D. Hulsey**. 2011. Reconciling gene trees of eastern North American minnows. *Molecular Phylogenetics and Evolution*. 61: 149-156.
- 29) **Hulsey, C.D.** and P.R. Jr. Hollingsworth. 2011. Do constructional constraints influence cyprinid (Leuciscine: Cyprinidae) craniofacial coevolution? *Biological Journal of the Linnean Society*. 103: 136-146.
- 28) **Hulsey, C.D.** and H. López-Fernández. 2011. Chapter 17: Historical biogeography of the fishes of Nuclear Central America. in *Historical Biogeography of Neotropical Freshwater Fishes* (eds. James Albert and Roberto Reis). University of California Press.
- 27) Chaves-Campos, J., S.G. Johnson, F.J. García de León, and **C.D. Hulsey**. 2011. Phylogeography, genetic structure, and gene flow in the endemic freshwater shrimp *Palaemonetes suttkusi* from Cuatro Ciénegas, Mexico. *Conservation Genetics*. 557-567.
- 26) **Hulsey, C.D.**, B.P. Keck, and P.R. Jr. Hollingsworth. 2011. Species tree estimation and the historical biogeography of heroine cichlids. *Molecular Phylogenetics and Evolution*. 58: 124-131.

- 25) **Hulsey, C.D.**, P.R. Jr. Hollingsworth, and J.A. Fordyce. 2010. Temporal diversification of Central American cichlids. *BMC Evolutionary Biology*. 10: 279.
- 24) **Hulsey, C.D.**, P.R. Jr. Hollingsworth, and R. Holzman. 2010. Co-evolution of the premaxilla and jaw protrusion in cichlid fishes (Heroinae: Cichlidae). *Biological Journal of the Linnean Society*. 100: 619-629.
- 23) **Hulsey, C.D.**, M.C. Mims, N.F. Parnell, and J.T. Streebman. 2010. Comparative rates of lower jaw diversification in cichlid adaptive radiations. *Journal of Evolutionary Biology*. 23: 1456-1467.
- 22) Mims, M.C., **C.D. Hulsey**, B.M. Fitzpatrick, and J.T. Streebman. 2010. Geography disentangles introgression from ancestral polymorphism in Lake Malawi cichlids. *Molecular Ecology*. 19: 940-951.
- 21) **Hulsey, C.D.** 2009. Cichlid genomics and phenotypic diversity in a comparative context. *Integrative and Comparative Biology*. 49: 618-629.
- 20) **Hulsey, C.D.** and S.C.P. Renn. 2009. Genomics and vertebrate adaptive radiation: a celebration of the first cichlid genome. *Integrative and Comparative Biology*. 49: 613-617.
- 19) Fraser, G.J., **C.D. Hulsey**, R.F. Bloomquist, K. Uyesugi, N.R. Manley, and J.T. Streebman. 2009. An ancient gene network is co-opted for teeth on old and new jaws. *PLoS Biology*. 7: 2 e1000031.
- 18) **Hulsey C.D.**, R.J. Roberts, A.S.P Lin, R. Guldberg, and J.T. Streebman. 2008. Convergence in mechanically complex phenotype: Detecting structural adaptations for crushing in cichlid fish. *Evolution*. 62: 1587-1599.
- 17) Parnell, N.F., **C.D. Hulsey**, and J.T. Streebman. 2008. Hybridization produces novelty when the mapping of form to function is many to one. *BMC Evolutionary Biology*. 8: 122.
- 16) **Hulsey, C.D.**, M.C. Mims, and J.T. Streebman. 2007. Do constructional constraints influence cichlid craniofacial diversification? *Proceedings of the Royal Society Series B*. 274: 1867-1875.
- 15) Johnson, S.G., **C.D. Hulsey**, and F.J. García de León. 2007. Spatial mosaic evolution of snail defensive traits. *BMC Evolutionary Biology*. 7: 50.
- 14) Higham, T.E., **C.D. Hulsey**, O. Rican, and A.M. Carroll. 2007. Feeding with speed: prey capture evolution in cichlids. *Journal of Evolutionary Biology*. 20: 70-78.
- 13) **Hulsey, C.D.**, F.J. García de León, and R. Rodiles-Hernández. 2006. Micro- and macroevolutionary decoupling of cichlid jaws: a test of Liem's key innovation hypothesis. *Evolution*. 60: 2096-2109.
- 12) **Hulsey, C.D.** 2006. Function of a key morphological innovation: fusion of the cichlid pharyngeal jaw. *Proceedings of the Royal Society Series B*. 273: 669-675.
- 11) **Hulsey, C.D.**, J. Marks, D.A. Hendrickson, C.A. Williamson, A.E. Cohen, and M.J. Stephens. 2006. Feeding specialization in *Herichthys minckleyi*: a trophically polymorphic fish. *Journal of Fish Biology*. 68: 1-12.
- 10) **Hulsey, C.D.**, G.J. Fraser, and J.T. Streebman. 2005. Evolution and development of complex biomechanical systems: 300 million years of fish jaws. *Zebrafish*. 2: 243-257.

- 9) **Hulsey, C.D.** and F.J. García de León. 2005. Cichlid jaw mechanics: linking morphology to feeding specialization. *Functional Ecology*. 19: 487-494.
- 8) Wainwright, P.C., M.E. Alfaro, D.I. Bolnick, and **C.D. Hulsey**. 2005. Many-to-one mapping of form to function: a general principle in organismal design. *Integrative and Comparative Biology*. 45: 256-262.
- 7) **Hulsey, C.D.**, D.A. Hendrickson, and F.J. García de León. 2005. Trophic morphology, feeding performance, and prey use in the polymorphic fish *Herichthys minckleyi*. *Evolutionary Ecology Research*. 7: 303-324.
- 6) **Hulsey, C.D.**, F.J. García de León, Y. Sanchez-Johnson, D.A. Hendrickson, and T.J. Near. 2004. Temporal diversification of Mesoamerican cichlid fishes across a major biogeographic boundary. *Molecular Phylogenetics and Evolution*. 31: 754-764.
- 5) Bolnick, D.I., R. Svanbäck, J.A. Fordyce, L.H. Yang, J.M. Davis, **C.D. Hulsey**, and M.L. Forister. 2003. The ecology of individuals: incidence and implications of individual specialization. *American Naturalist*. 161: 1-28.
(***Mercer Award)
- 4) **Hulsey, C.D.** and P.C. Wainwright. 2002. Projecting mechanics into morphospace: disparity in the feeding system of Labrid Fish. *Proceedings of the Royal Society Series B*. 269: 317-326.
- 3) Wainwright, P.C., L.A. Ferry-Graham, T.B. Waltzek, A.M. Carroll, **C.D. Hulsey**, and J.R. Grubich. 2001. Examination of ram and suction feeding performance in cichlid fishes. *Journal of Experimental Biology*. 204: 3039-3051.
- 2) Ferry-Graham, L.A., P.C. Wainwright, **C.D. Hulsey**, and D.R. Bellwood. 2001. Evolution and mechanics of long jaws in Butterflyfishes (Family Chaetodontidae). *Journal of Morphology*. 248: 120-143.
- 1) Vargo, E.L. and **C.D. Hulsey**. 2000. Multiple glandular origins of queen pheromones in the fire ant *Solenopsis invicta*. *Journal of Insect Physiology*. 46: 1151-1159.

***Mercer Award-Ecological Society of America for best ecological research paper by young researchers. 2005.

Papers Submitted

Hulsey, C.D., J. Zheng, R. Holzman, M.E. Alfaro, and A. Meyer. Phylogenomics of a putatively convergent novelty: Did hypertrophied lips evolve repeatedly in Lake Malawi cichlid fishes? *Molecular Phylogenetics and Evolution*. (in review).

Invited Seminars

2016 A Bigger Picture: Organismal Function at the Nexus of Development, Ecology, and Evolution. Society for Integrative and Comparative Biology Symposium. Portland, Oregon, USA

2015 Department of Animal and Plant Sciences Seminar Series. Sheffield, United Kingdom
Aquatic Research Institute Seminar Series (EAWAG). Lucerne, Switzerland

- Department of Biology Seminar Series. University of Konstanz, Germany
- 2013** Inter-University Institute for Marine Sciences Eilat, Israel
Ecology and Evolution Seminar Series. University of Tennessee-Knoxville, USA
- 2012** Fish and Wildlife Seminar Series. University of Tennessee-Knoxville, USA
- 2011** Fishhead seminar series. Oak Ridge National Laboratories, USA
- 2010** Evolutionary Morphology Seminar Series. University of Chicago, USA
- 2009** Young Investigators in Aquatic and Fisheries Science. University of Washington, USA
Ecology and Evolutionary Biology Department Seminar Series. Brown University, USA
Biology Department Seminar Series Case Western University, USA
- 2007** Ecology and Evolution Seminar Series. Yale University, USA
Department of Biology. Florida State University, USA
Department of Zoology. University of Florida, USA
Ecology and Evolution Seminar Series. University of Tennessee-Knoxville, USA
- 2006** Evolutionary Biology Series. Konstanz University, Germany
- 2005** Department of Biology Seminar Series. Clemson University, USA
- 2004** Ecology and Evolution Seminar Series. University of New Orleans, USA
Ecology and Evolution Seminar Series. University of Tennessee-Knoxville, USA
Population Biology Seminar Series. University of California – Davis, USA
Biology Departmental Seminar. Texas State University-San Marcos, USA
- 2003** Museum of Vertebrate Zoology and Evolutionary Biology Seminar Series. University of California-Berkeley, USA

Presentations at Professional Meetings (2013-2017)

- Hulsey, C.D.** and A. Meyer. 2016. Evolutionary consequences of modularity in vertebrate dentitions at multiple levels of biological design. Society for Integrative and Comparative Biology. Portland, OR.
- Hulsey, C.D.**, Bell, K.L, C.C. Nice, F.J. García de Leon, and A. Meyer. 2015. Genetics of jaw divergence in a trophically polymorphic cichlid fish. Society for Molecular Biology and Evolution. Vienna, Austria.
- Hulsey, C.D.** and A. Meyer. 2015. Biomechanical and Kinematic Evolution of the Feeding Apparatus in Nicaraguan Crater Lake Cichlids. Society for Experimental Biology. Prague, Czech Republic.
- Bell, K.L, C.C. Nice, and **C.D. Hulsey**. 2014. Population genomics of a trophically polymorphic Cuatro Ciénegas cichlid, *Herichthys minckleyi*. Evolution. Raleigh, NC.
- Clemmensen, S.F. and **C.D. Hulsey**. 2014. Dynamic gene expression and rates of gene evolution underlying divergence in a cichlid key innovation. Evolution. Raleigh, NC.
- Hulsey, C.D.** and R. Holzman. 2014. Mechanical transgressive segregation and the rapid origin of trophic novelty. Society for Integrative and Comparative Biology. Austin, TX.

- Bell, K.L., C.C. Nice, and **C.D. Hulsey**. 2014. Population genomics of a trophically polymorphic Cuatro Ciénegas cichlid, *Herichthys minckleyi*. Society for Integrative and Comparative Biology. Austin, TX.
- Higham, T.E., A. Birn-Jeffery, C.E. Collins, **C.D. Hulsey**, and A.P. Russell. 2014. Use it or lose it: locomotor evolution associated with the loss of adhesion in geckos. Society for Integrative and Comparative Biology. Austin, TX.
- Clemmensen, S.F. and **C.D. Hulsey**. 2014. Dynamic gene expression and rates of gene evolution underlying divergence in a cichlid key innovation. Society for Integrative and Comparative Biology. Austin, TX.
- Rupp, M.F. and **C.D. Hulsey**. 2014. Pectoral Fin and Feeding Kinematics in Rock Dwelling Malawi Cichlids. Society for Integrative and Comparative Biology. Austin, TX.
- Hulsey, C.D.**, Douglas, M., B.P. Keck, C. Ruble, M. Petty, J.R. Shute, and P. Rakes. 2013. Pelagic larval duration predicts extinction risk in a freshwater fish clade. Southeastern Fishes Council. Guntersville, AL.
- Hulsey, C.D.** and R. Holzman. 2013. Mechanical transgressive segregation and the rapid origin of trophic novelty. International Conference of Vertebrate Morphology. Barcelona, Spain.
- Hollingsworth, P.R. Jr., A.M. Simons, J.A. Fordyce, and **C.D. Hulsey**. 2013. Explosive diversification following a benthic to pelagic shift in freshwater fishes. American Society for Ichthyology and Herpetology. Albuquerque, NM.
- Bell, K., C. Nice, and **C.D. Hulsey**. 2013. Population genomics of the trophically polymorphic Cuatro Ciénegas cichlid *Herichthys minckleyi*. Evolution. Snowbird, UT.
- Rupp, M.F. and **C.D. Hulsey**. 2013. Evolution and kinematics of pectoral fins in Malawi cichlids. Society for Integrative and Comparative Biology. San Francisco, CA.

Synergistic Activities

Organized the Symposium "Genomics and vertebrate adaptive radiation: a celebration of the first cichlid genome": I co-organized (with Suzy Renn) a symposium of speakers at the Society for Comparative and Integrative Biology meeting in Boston that addressed the promise and utility of the first fully sequenced cichlid genome.

Etnier Ichthyological Collection: As curator of this collection, I contributed to the growth and maintenance of this natural history collection that governmental and non-governmental groups in the Southeastern United States utilize extensively. During this time, we completed the digitization of the collection and made it web-accessible. Additionally, I oversaw the creation and building of a \$50,000 endowment for this collection to contribute to its long-term maintenance and improvement.

Nimbios Suction Feeding Working Group: In collaboration with Peter Wainwright and Steven Day, I helped to organize a working group at the U.S. National Institute of Mathematical and Biological Sciences that examined the biomechanics of the suction feeding apparatus in vertebrates.

Spoken Languages

English (Native), German (Functional), French (Functional), Spanish (Advanced)

Programming Languages

R (Advanced), Perl (Functional)

Appointments

Assistant Professor, University of Konstanz, 2014-current

Ichthyology Curator/Group Leader, University of Tennessee, 2008-2014

Postdoctoral Researcher, Georgia Tech, 2005-2007

Postdoctoral Researcher, University of Tennessee, 2004-2005

Undergraduate Student Advisees

Current: Denise Jansen

Past: Laurentz Schuhknecht, Katie Watson, Callie Grabenstein, Meredith Leigh, Benjamin Allen, Denise Kendall, Barry Hedgespeth, Donnie Pickel, Bradley Pruitt, Iman Ferdjallah, Chauntelle Williams, Ryan Umphenour, Meryl Mims, Yara Sanchez-Johnson

Graduate Student Advisees

Jan Gerwin (M.S. current) Masters topic: "Color evolution in East African cichlids"

Phillip Hollingsworth (Ph.D 2014) Dissertation Topic: "Evolution of North American minnows along a benthic/limnetic axis"

Maxwell Rupp (M.S. 2014) Masters topic: "Pectoral fin locomotion in Lake Malawi cichlid fishes"

Morgan Douglas (M.S. 2013) Masters topic: "Evolution of pelagic larval duration in freshwater darter fishes"

Postdoctoral Advisees

Ryan Martin (2012-2013) Current Position: Assistant Professor at Case Western University

Benjamin Keck (2011-2013) Current Position: Lecturer at the University of Tennessee, Department of Ecology and Evolutionary Biology

Hugo Alamillo (2010-2011) Current Position: Assistant Professor at North Seattle Community College

Classes Taught

Undergraduate

Lab and Lecture in Ichthyology - 4 Semesters

Lab and Lecture in Vertebrate Biology – 3 Semesters

Freshman Seminar in Biology of the Hunger Games– 1 Semester

Graduate

Lecture Macroevolution and Comparative Methods – 3 Semesters

Lab and Lecture in Evolutionary Molecular Biology – 3 Semesters

Evolution/Development Journal Club – 6 Semesters

Seminar in Speciation and Adaptation – 3 Semesters

Seminar in Evolution and Development – 1 Semester

Seminar in Transformations in Vertebrate Evolution – 1 Semesters

Seminar in Evolution of Genomic Architecture – 1 Semester

Seminar in Human Evolutionary Genomics – 1 Semester