

MATTHEW E. GIFFORD, PH.D.

Department of Biology • University of Central Arkansas • 201 Donaghey Ave., Conway, Arkansas 72035

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web: <http://giffordlab.weebly.com>

EDUCATION

- 2008 **Ph.D.** Department of Biology, Washington University, St. Louis (Advisor: Allan Larson)
2002 **M.S.** Department of Biology, University of Texas at Tyler (Advisor: Ronald L. Gutberlet, Jr.)
1999 **B.S.** Department of Biology, Avila University (Undergraduate Thesis Advisor: Robert Powell.)

PROFESSIONAL POSITIONS

- August 2014 **Assistant Professor.** Department of Biology, University of Central Arkansas
Jan. 2010- May 2014 **Assistant Professor.** Department of Biology, University of Arkansas at Little Rock.
2008-09 **Postdoctoral Research Associate.** Bell Museum of Natural History, University of Minnesota, St. Paul, MN. *Salamander ecophysiology.*

HONORS

- Honorable Mention – NSF Graduate Research Fellowship
Honorable Mention – SSAR Seibert competition for oral presentation
Travel Awards – SICB and SSAR

AFFILIATIONS

- Am. Society of Ichthyologists and Herpetologists Society of Integrative & Comparative Biology
Society for the Study of Amphibians and Reptiles Society for the Study of Evolution
Herpetologists League

GRANTS AND AWARDS

FUNDED - \$296,040 SINCE 2010

- NATIONAL GEOGRAPHIC/WAITT FOUNDATION (W316-14): “Staying put in the face of climate change: experimental evolution on islands” \$10,780
- NSF DEB-0949038 “Species delimitation, speciation, and evolution of the niche in slimy salamanders” \$149,249
- NSF REU Supplements to DEB-0949038 \$14,579
- US Fish and Wildlife Service (State Wildlife Grant) “Distribution, health, and status of *Spea bombifrons*, *Gastrophryne olivacea*, *Scaphiophus hurterii*, and *Pseudacris streckeri* in Arkansas” \$51,956

- US Fish and Wildlife Service (State Wildlife Grant) “Climate change in montane environments: assessing salamander risk using physiology and fine-scaled environmental modeling” \$70,117
- Arkansas Department of Higher Education \$1,400
- Minnesota Herpetological Society \$1,422
- American Philosophical Society, Lewis and Clark Fund for Exploration and Field Research \$3,000
- American Society of Ichthyologists and Herpetologists, Gaige Award \$500
- NSF Doctoral Dissertation Improvement Grant \$11,998
- Misc. Student Grants, Awards, and Scholarships \$20,500

PENDING SUBMISSIONS

- NSF IOS – Preproposal, RUI: Can plasticity and/or genetic adaptation buffer ectotherms from the detrimental effects of climate change? (Submitted January 2015)

SUBMITTED - DECLINED

- NSF DEB – Collaborative Research: Comparative analyses on phylogenies and gene networks: Assessing rates of phenotypic evolution at micro- and macroevolutionary scales (FULL PROPOSAL DECLINED – Gifford as Senior Personnel) 2014
- NSF DEB – Preproposal, Multivariate divergence and heritability along a gradient of prey size (NOT INVITED) 2014
- NSF DEB – Preproposal, Staying put in the face of climate change: the roles of plasticity and adaptation (NOT INVITED) 2014
- NSF DDIG (with Timothy Clay, graduate student) - Geographic distributions of species: interactions between physiological and behavioral systems.
- NSF EAGER Collaborative Research: Developing a genotypic index to examine evolutionary responses of amphibians to climate change (DECLINED) 2013
- NSF DEB – Preproposal, Collaborative Research: The role of physiology and species interactions in the origin and maintenance of montane endemism in Appalachian woodland salamanders (NOT INVITED) 2013
- NSF DDIG (with Timothy Clay, graduate student) - Geographic range limits in salamanders: interactions between physiological and behavioral systems (DECLINED) 2012
- NSF IOS – Preproposal, Collaborative Research: Exploring genotypic and phenotypic mechanisms underlying salamander responses to climate change (**PREPROPOSAL INVITED, FULL PROPOSAL DECLINED**) 2012
- NSF DEB – Preproposal, Collaborative Research: The evolutionary ecology of montane endemism in Appalachian woodland salamanders (**PREPROPOSAL INVITED, FULL PROPOSAL DECLINED**) 2012
- NSF Dimensions of Biodiversity, Collaborative Research: How climate change and disease affect species diversity and distribution in Appalachian salamanders (DECLINED) 2012

RESEARCH INTERESTS

My research examines the influence of biotic and abiotic factors on ecological and physiological differentiation at varying levels of biological organization. I approach questions from an integrative perspective, combining field observation and experimentation with laboratory physiology, biochemistry, and modeling. I focus primarily on ectotherms (salamanders, snakes, lizards, and more recently terrestrial arthropods). Current major projects include: 1) causes and consequences of individual variation in morphology, physiology, behavior, and performance; 2) physiological mechanisms driving life history divergence among populations; 3) the role of population-level variation in physiology in structuring species distributions and determining range limits; 4) the role of physiological constraints in species responses to climate change.

REFEREED PUBLICATIONS (mentored undergraduate co-authors are underlined, mentored graduate co-authors are italicized, * = supervising/anchor author)

28. Verble-Pearson, R., **M.E. Gifford**, S.P. Yanoviak. (In Press) A phylogenetic analysis of thermal tolerance and body size in ants. *Journal of Thermal Biology*.
27. *Brewster, C.L.*, R.S. Sikes, **M.E. Gifford**. (In Press) Body size and growth of the Eastern Collared Lizard (*Crotaphytus collaris*) in central Arkansas. *Herpetological Review*.
26. Diamond, K., D. Trovillion, K.E. Allen, K.M. Malela, D.A. Noble, R. Powell, D. Eifler, **M.E. Gifford***. (In Press) Individual (co)variation of field behavior and locomotor performance in curly-tailed lizards. *Journal of Zoology*.
25. Careau, V., **M.E. Gifford**, P. Biro. 2014. Individual (co)variation in thermal reaction norms: standard and maximal metabolic rates in wild-caught salamanders. *Functional Ecology* 28:1175-1186.
24. **Gifford, M.E.**, T.A. Clay, and V. Careau. 2014. Individual (co)variation in standard metabolic rate, feeding rate, and exploratory behavior in wild-caught semi-aquatic salamanders. *Physiological and Biochemical Zoology* 87(3):384-396.
23. Les, A.M., **M.E. Gifford**, J.S. Parmerlee, Jr., & R. Powell. 2014. Do polymorphic female Cuban brown anoles (*Anolis sagrei*) differ in sprint speed or escape behavior? *Herpetologica* 70:47-55.
22. Winters, A. & **M.E. Gifford***. 2013. Geographic variation in the water economy of a lungless salamander *Herpetological Conservation and Biology* 8(3):741-747.
21. **Gifford, M.E.**, T.A. Clay & W.E. Peterman. 2013. Temperature and activity influence metabolic scaling in a lungless salamander. *Journal of Experimental Zoology, Part A* 319:230-236
20. *Brewster, C.L.*, R.S. Sikes, & **M.E. Gifford***. 2013. Quantifying the cost of thermoregulation: thermal and energetic constraints on growth rates in hatchling lizards. *Functional Ecology* 27:490-497.
19. *Young, V.K.H.*, **M.E., Gifford**. 2013. Limited capacity for thermal acclimation in a lungless salamander, *Desmognathus brimleyorum*. *Journal of Comparative Physiology, B* 183:409-418.
18. Langerhans, R.B., **M.E. Gifford**, O. Domínguez-Domínguez, D. García-Bedoya & T.J. DeWitt. 2012. A new species of *Gambusia* (Cyprinodontiformes: Poeciliidae) from east-central Mexico. *Journal of Fish Biology* 81: 1514-1539.
17. **Gifford, M.E.** and K.H. Kozak. 2012. Islands in the sky or squeezed at the top? Ecological

- causes of elevational range limits in montane salamanders. *Ecography* 35:193-203.
16. Muniz Pagan, D.H., R. Powell, J.S. Parmerlee, Jr., & **M.E. Gifford***. 2012. Ecological performance in an actively foraging teiid lizard, *Ameiva ameiva*. *Journal of Herpetology* 46: 253-256.
 15. **Gifford, M.E.**, T.A. Clay & R. Powell. 2012. Habitat use and activity influence thermoregulation in a tropical lizard, *Ameiva exsul*. *Journal of Thermal Biology* 37:496-501.
 14. Langerhans, R.B., **M.E. Gifford** & E.O. Joseph. 2010. Ecological speciation among blue holes in mosquitofish. In M. Uribe and H. Grier, eds. *Viviparous Fishes II*. Homestead, FL, New Life Publications.
 13. Langerhans, R.B. & **M.E. Gifford**. 2009. Divergent selection, not life history plasticity via food limitation, drives morphological divergence between predator regimes in *Gambusia hubbsi*. *Evolution* 63:561-567.
 12. **Gifford, M.E.**, A. Larson. 2008. *In situ* genetic differentiation in a Hispaniolan lizard (*Ameiva chrysolema*): A multilocus perspective. *Molecular Phylogenetics and Evolution* 49:277-291.
 11. Wittenberg, R.D. & **M.E. Gifford**. 2008. Funnel traps may be inappropriate for many studies of semi-aquatic snakes. *Journal of Freshwater Ecology* 23:213-218.
 10. **Gifford, M.E.** 2008. Divergent character clines across a recent secondary contact zone in a Hispaniolan lizard. *Journal of Zoology* 274:292-300.
 9. **Gifford, M.E.**, D.L. Mahler, & A. Herrel. 2008. The evolution of locomotor morphology, performance, and antipredator behaviour among populations of *Leiocephalus* lizards from the Dominican Republic. *Biological Journal of the Linnean Society* 93:445-456.
 8. **Gifford, M.E.** & R. Powell. 2007. Sexual dimorphism and reproductive characteristics in five species of *Leiocephalus* lizards from the Dominican Republic. *Journal of Herpetology* 41:521-527.
 7. Langerhans, R.B., **M.E. Gifford**, & E.O. Joseph. 2007. Ecological speciation in *Gambusia* fishes. *Evolution* 61:2056-2074.
*FACULTY OF 1000 RATING OF 'EXCEPTIONAL' (TOP 1% OF PUBLICATIONS), AND FEATURED IN EDITORS' CHOICE SECTION OF *SCIENCE*.
 6. **Gifford, M.E.**, R. Powell, A. Larson, & R.L. Gutberlet, Jr. 2004. Population structure and history of a phenotypically variable teiid lizard (*Ameiva chrysolema*) from Hispaniola: The influence of a geologically complex island. *Molecular Phylogenetics and Evolution*, 32:735-748.
 5. Glor, R.E., **M.E. Gifford**, A. Larson, J.B. Losos, L. Rodriguez-Schettino, A. Chamizo-Lara, & T.R. Jackman. 2004. Partial island submergence and speciation in an adaptive radiation: a multilocus analysis of the Cuban green anoles. *Proceedings of the Royal Society of London, B. Biological Sciences* 271:2257-2265.
*FEATURED IN FACULTY OF 1000
 4. Fontenot, B.E., **M.E. Gifford** & R. Powell. 2003. Seasonal variation in dietary preferences of a Hispaniolan anole, *Anolis longitibialis*. *Herpetological Bulletin*, 86:2-4
 3. **Gifford, M.E.**, Y.M., Ramos, R. Powell & J.S. Parmerlee, Jr. 2002. Natural History of a saxicolous anole, *Anolis longitibialis*: from Hispaniola. *Herpetological Natural History*

- 9(1): 15–20.
2. Cast, E.E., **M.E. Gifford**, K.R. Schneider, A.J. Hardwick, J.S. Parmerlee, Jr., & R. Powell. 2000. Natural history of an anoline lizard community in the Sierra de Baoruco, Republica Dominicana. *Caribbean Journal of Science* 36:258-266.
 1. **Gifford, M.E.**, R. Powell, & W.E. Stiener. 2000. Relationship of diet and prey availability in *Aristelliger cochranae*, a gecko from Navassa Island, West Indies. *Caribbean Journal of Science* 36:323-326.

MANUSCRIPTS UNDER REVIEW OR IN REVISION

- Aviles, K., B. LaFloe, K. Diamond, R. Powell, **M.E. Gifford**, & D. Eifler. Effects of endurance and morphology on search behavior in *Ameiva auberi* (Squamata: Teiidae). *Herpetologica* (In Review)
- Korfel, C., J.D. Chamberlain, **M.E. Gifford**. A test of energetic trade-offs between growth and immune function in watersnakes.

MANUSCRIPTS NEAR SUBMISSION

- Chamberlain, J.D., **M.E. Gifford**. Locomotor cost of gestation in watersnakes. For Journal of Experimental Zoology, Part A.
- Gifford, M.E.**, W.E. Peterman, & T.A. Clay. Physiological and fitness consequences of embryonic rearing environment in post-metamorphic wood frogs.

OTHER PUBLICATIONS

- Gifford, M.E.** 2013. Advice for new faculty. Book review: You're hired! Now what?: a guide for new science faculty. *Ecology*.
- John, R.R., E.J. Bentz, M.J. Rivera Rodriguez, R.R. John, **M.E. Gifford**, & R. Powell. 2010. *Bachia heteropa alleni* (Earless Worm Lizard). Escape and digging behaviors. *Herpetological Review*.
- Leininger, P.D., R. Powell, & **M.E. Gifford**. 2010. Hanging on for dear life: A study of *Anolis* claws in arboreal and aquatic species. The Anolis Newsletter VI: 104–107.
- Powell, R. & **M.E. Gifford**. 2010. *Leiocephalus lunatus*. *Catalogue of American Amphibians and Reptiles* (874): 1–5.
- Gifford, M.E.** 2005. Ecotones and hybrid zones: implications for conservation illustrated by ground-dwelling lizards from Hispaniola. *IGUANA*, 12:1519.
- Gifford, M.E.**, & R. Powell. 2004. The Ground Lizards (*Ameiva*) of the Lower Barahona Peninsula. *IGUANA* 11:14–15.
- Gifford, M.E.** & B.E. Fontenot. 2003. Geographic distribution: *Bufo nebulifer*. *Herpetological Review* 34(3).
- Gifford, M.E.** & R. Powell. 2002. *Anolis sheplani*. *Catalogue of American Amphibians and Reptiles*: 750.
- Gifford, M.E.** & R. Powell. 2002. *Anolis longitibialis*. *Catalogue of American Amphibians Reptiles*: 749.

- Gifford, M.E.**, B.E. Fontenot, & D. Nieves. 2002. Geographic distribution extension of *Anolis porcatus* in the Dominican Republic. *Herpetological Review* 33(3): 223.
- Powell, R., D.M. Nieves, **M.E. Gifford**, & B.E. Fontenot. 2002. The “Rhino Factory” at Manati Park. *Iguana Times* 9:75–81.

INVITED PRESENTATIONS (past 5 years only)

- 2015 Scheduled, April: Department of Biology, Arkansas Tech University
- 2015 Scheduled, April: Department of Biology, University of Louisville
- 2014 *Evolution, ecology, and physiology of responses to climate change*, Senior Seminar Talk, Hendrix College
- 2014 *The influence of prey size on morphology, physiology, and life history of watersnakes*, Department of Biology, Salisbury University
- 2014 *Physiological variation at the individual, population, and species levels*, Department of Biology, University of Texas at Tyler
- 2014 *Physiological variation of salamanders at the individual, population, and species levels*, Department of Biological Sciences, Clemson University.
- 2014 *Physiological variation at the individual, population, and species levels*, Department of Biology, University of Central Arkansas
- 2012 *Physiological and behavioral perspectives on range limits and montane endemism in plethodontid salamanders*. Division of Biological Sciences, University of Missouri
- 2011 *Physiology and ecology of salamander range limits*. Department of Biology, Missouri State University
- 2011 *Islands in the sky or squeezed at the top? Ecological causes of elevational range limits in montane salamanders*. Department of Biological Sciences, University of Tulsa
- 2011 Kozak, K.H., **Gifford, M.E.**, Fridley, J. *Shrinking Islands in the sky? Trait- and microclimate-based forecasts of the range dynamics of montane species under climate change*. Society of Integrative and Comparative Biology, Symposium (“A synthetic approach to the response of organisms to climate change: the role of thermal adaptation”)
- 2010 *Physiological and ecological determinants of salamander distributions in GSMNP and the potential impact of climate change*. Great Smoky Mountains National Park Science Colloquium
- 2009 *Understanding the origin and maintenance of species’ range limits: integrating thermal physiology and bioenergetic modeling in montane salamanders*. Department of Biology, University of Arkansas at Little Rock

CONTRIBUTED PRESENTATIONS AT CONFERENCES (past 5 years only)

- 2014 **Gifford, M.E.** & T.A. Clay. Individual (co)variation of physiology and behavior in stream salamanders (SICB2014, Austin, TX)
- 2013 Clay, T.A. & **Gifford, M.E.** Thermal constraints on energy assimilation in salamanders. 2013 JMIH, Albuquerque, NM.
- 2013 Chamberlain, J.D. & **Gifford, M.E.** Variation among populations in maternal provisioning of offspring in watersnakes. 2013 JMIH, Albuquerque, NM.

- 2013 Brewster, C.L., Sikes R.S., & **Gifford, M.E.** Quantifying the cost of thermoregulation in hatchling lizards. 2013 JMIH, Albuquerque, NM.
- 2012 **Gifford, M.E.**, Peterman, W.E., & Clay, T.A. Does activity and temperature influence ontogenetic scaling of metabolic rates in a salamander. 2012 JMIH/World Congress of Herpetology, Vancouver, British Columbia.
- 2012 Clay, T.A. & **Gifford, M.E.** Thermal dependence of aggression in lungless salamanders. 2012 JMIH/World Congress of Herpetology, Vancouver, British Columbia.
- 2012 **Gifford, M.E.**, & Clay, T.A. (POSTER) Repeatability of standard metabolic rate, feeding performance, and behavior in a lungless salamander. 2012 JMIH/World Congress of Herpetology, Vancouver, British Columbia.
- 2012 Barnes, C.L. & **Gifford, M.E.** (POSTER) Digestive energetics in montane and lowland salamanders (*Plethodon*). 2012 JMIH/World Congress of Herpetology, Vancouver, British Columbia.
- 2011 **Gifford, M.E.** & Kozak, K.H. (POSTER) Thermal sensitivity of locomotor performance in montane salamanders. 2011 JMIH, Minneapolis, MN.
- 2011 **Gifford, M.E.** & Kozak, K.H. Potential impact of climate change on competing salamander species in the southern Appalachian Mountains. 2011 JMIH, Minneapolis, MN.
- 2009 **Gifford, M.E.** and Kozak, K.H. Competition, physiological limitation, and the impact of climate change on the distribution and abundance of montane salamanders. Joint Meeting of Ichthyologists and Herpetologists 2009, Portland, OR.
- 2009 Lowe, B., **Gifford, M.E.**, Markle, T., Kozak, K.H. (POSTER) Speciation, species delimitation, and the systematics of slimy salamanders (Plethodontidae: *Plethodon glutinosus* Group). Joint Meeting of Ichthyologists and Herpetologists 2009, Portland, OR.
- 2008 **Gifford, M.E.** A test of Pleistocene climate-induced diversification in island lizards from Hispaniola. Evolution 2008, Minneapolis, MN.

TEACHING EXPERIENCE

Courses Taught at UALR

Comparative Animal Physiology, Animal Physiological Ecology, Structure and Function I

Courses Taught at UALR

Comparative Animal Physiology, Ecological Genetics, Herpetology, Science and Society, Thermal Adaptation, Zoology, Undergraduate Independent Research

REU Mentor

Program through Avila University (*Ecology of a West Indian Herpetofauna*). 2010-12.

Responsibilities: Mentor undergraduate students and assist in the development, execution, and completion of field and laboratory research projects.

Current Graduate and Undergraduate Student Advising

- Jeremy Chamberlain (PhD) – Evolution of Reproductive Life History in Watersnakes Along a Gradient of Resource Availability
- Timothy Clay (PhD) – The Ecology and Evolution of Montane Endemism in Salamanders: Interactions Between Physiological and Behavioral Systems
- Ian Clifton (BS, MS) – Heritability and Divergence in Cranial Shape of Watersnakes Along a Gradient of Prey Size
- Samantha Pike (MS) – prey preferences in watersnakes: innate patterns and the influence of early-life prey exposure
- Marcia Polett (MS) - TBD

Past Graduate and Undergraduate Research Advising

- Cody Barnes (MS) – Foraging and Digestive Energetics in Montane and Lowland Salamanders (Completed, 2012; in PhD program – Oklahoma State Univ.)
- Casey Brewster (MS) – Energetic Costs of Thermoregulation and Population Life History Characterization in Eastern Collared Lizards (Completed, 2012; in PhD program – Univ. Arkansas)
- Vanessa Young (MS) – Physiological and Morphological Variation in a Stream Salamander, *Desmognathus brimleyorum* (Completed, 2012; in PhD program – Clemson Univ.)
- Amber Anderson (BS) – 1) Among-family Variation in Anti-predator Behavior in Watersnakes; 2) Morphological Correlates of Long-Distance Dispersal and Survival in a Lungless Salamander (in MS program – Univ. Central Arkansas)
- Nicholas Goforth (BS, REU student) – Physiological Variation Among Salamander Species Inhabiting Different Environments (in MS program – Texas Tech Univ.)
- Amanda Winters (BS, REU student) – 1) Variation in Evaporative Water Loss in Salamanders Along an Elevation Gradient (*Manuscript Published*); 2) Can Water Time Limits Predict Range Limits in Terrestrial Salamanders?

UNIVERSITY AND PROFESSIONAL SERVICE

Associate Editor – *Copeia*, American Society of Ichthyologists and Herpetologists

UALR Campus-wide: Honors College Task Force 2014, Academic Restructuring Faculty Task Force (College Representative) 2013, Academic Restructuring Steering Committee 2013, Institutional Animal Care and Use Committee (IACUC) 2012-2014, Athletics Committee 2010-2012, Graduate Council 2013, Donaghey Scholars Policy Committee 2013-2014.

UALR College of Science Honors and Awards Committee 2012-2014.

UALR Department of Biology Graduate Committee 2011-2014.

Co-organizer for the sixth Conference on the Biology of Plethodontid Salamanders – to convene May, 2014.

Nominations Committee – Society for the Study of Amphibians and Reptiles (SSAR) 2013-2014.

Graduate Research Awards Committee – Herpetologists' League 2013-2014.

Advisory Board – The Ouachita Mountains Biological Station (OMBS) 2011-pres.

Best Student Poster Judge – SSAR 2011

Stoye Award Judge (Physiology and Physiological Ecology) – ASIH 2009

Manuscript Reviews:

Animal Behaviour (2x), *Annals of the New York Academy of Sciences*, *Applied Herpetology*, *Proc. AR Academy of Science*, *Behavioral Ecology*, *Biology Letters*, *Biological Conservation*, *Canadian Journal of Zoology*, *Caribbean Journal of Science* (4x), *Conservation Genetics*, *Ecography* (6x), *Functional Ecology*, *Herpetologica*, *Herpetological Journal* (2x), *Journal of Applied Meteorology and Climatology* (2x), *Journal of Biogeography*, *Journal of Experimental Zoology, Part A*, *Journal of Herpetology* (7x), *Journal of Thermal Biology*, *Journal of Zoology* (2x), *Molecular Ecology*, *Molecular Phylogenetics and Evolution* (11x), *Northwestern Naturalist*, *Southeastern Naturalist*

Research Proposal Reviews or Panel Service:

National Science Foundation: IOS-Animal Preproposal Panel

Sigma Delta Epsilon, Graduate Women in Science Fellowship

University of Central Oklahoma, On-Campus Grant external reviewer (X2)

Arkansas State Wildlife Grants

Student Research Committee Service (in addition to those I directly mentored)

Lori Monday (MS) - UCA

Derek Filipek (MS) - UCA

Amber Anderson (MS) - UCA

Stephen Robertson (MS) - UALR

Dana Frederick (MS) - UALR

Theodore Sumnicht (MS) - UALR

Petrus Moreira (BS, MS) - UALR

Sophie King (BS) - UALR

Krista Mougey (PhD – Texas Tech University)

Casey Brewster (PhD – University of Arkansas)

REFERENCES

Dr. Kenneth Kozak

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Dr. Robert Powell

Professor of Biology

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