Fred M. Benham

Preferred name: Phred M. Benham
(he/him/his)
Postdoctoral Scholar
Museum of Vertebrate Zoology, University of California, Berkeley
3101 Valley Life Sciences Building, Berkeley, CA, 94720-3160
Phone: 603-443-2744 • E-Mail: phbenham@gmail.com
website: http://phredbenham.weebly.com

CURRENT POSITION

Oct. 2018 - present Postdoctoral scholar, Museum of Vertebrate Zoology, University of California Berkeley. Advisor: Dr. Rauri C. K. Bowie. Funding: NSF Postdoctoral Research Fellowship (2018-2020s); California Conservation Genomics Project (2020-present).

EDUCATION

2018 Ph.D. University of Montana, Organismal Biology, Ecology & Evolution
Advisor: Zachary A. Cheviron.

2012-2015 Ph.D. Student, University of Illinois, Urbana-Champaign, Dept. Animal Biology
Moved to University of Montana with the Cheviron lab

2012 M.s. University of New Mexico, Biology.
Advisor: Christopher C. Witt

2006 B.s. Louisiana State University, Biological Sciences

GRANTS & AWARDS

2022 California Department of Fish & Wildlife: "Determination of population structure in mountain quail to facilitate management" ($142,335). Grant awarded to Al Eiden of Pheasant's Forever with Dr. Bowie, myself and others subcontracted to perform funded work. *I performed all preliminary analyses and co-authored this grant proposal.*

2021 American Genetics Association Travel Award, Conservation Genomics Symposium ($400)

2018 NSF Postdoctoral Research Fellowship in Biology, Research Using Biological Collections. "Leveraging museum collections to track population responses to a century of California coastal development in a tidal marsh songbird." ($138,000)

2017 University of Montana, OBE, Drollinger-Dial Travel Award ($950)
AMNH Frank M. Chapman Memorial Fund ($1,700)
American Society of Naturalists' Student Research Award ($2,000)

Bertha Morton Fellowship ($5,000)

2016 University of Montana, OBE, Drollinger-Dial Travel Award ($950)

2015 Society for Integrative & Comparative Biology, Grant-in-aid-of-research ($1,000)
UIUC, School for Integrative Biology, Clark Research Support Grant ($1,000)
UIUC, Department Animal Biology, Odum-Kendeigh Research Grant ($1,000)
Sigma-Xi Grant-in-aid-of-research ($500)
Illinois Ornithological Society Grant ($1,000)

2014 Society for the Study of Evolution, Rosemary Grant Research Award ($2,460)
American Ornithologists' Union Research Award ($2,500)
UIUC Dissertation Travel Grant ($2,916)
UIUC, School for Integrative Biology, Clark Research Support Grant ($1,000)
UIUC, Department Animal Biology, Odum-Kendeigh Research Grant ($1,000)
AMNH Frank M. Chapman Memorial Fund ($2,000)
Systematics Research Fund, Linnean Society and Systematics Association ($1,587)
UIUC, Center for Latin American & Caribbean Studies, Tinker Fellowship ($2,000)

2013 American Genetics Association Travel Award, Speciation Continuum Symposium ($150)

2012 North American Ornithological Conference-V, Student Travel Award ($300)
Illinois Distinguished Fellowship ($25,000 annual stipend).
NSF-IGERT Fellowship ($30,000 annual stipend, $5,000 in research funds).

2011 American Ornithologists' Union Student Travel Award, AOU Meetings ($477)
Frank M. Chapman Memorial Fund, American Museum of Natural History ($3,000)
Graduate Research Allocations Committee Grant, University of New Mexico ($400)

2010 Frank M. Chapman Memorial Fund, American Museum of Natural History ($2,250)
Graduate Research Allocations Committee Grant, University of New Mexico ($400)

2004-2006 Louisiana State University Museum of Natural Science, prepathon ($6,000 over 3 years)

2003 Louisiana State University Non-resident's Tuition Exemption and Chancellor's work study scholarships.

TEACHING EXPERIENCE

2017 Teaching Assistant, Ornithology, Ecology, University of Montana
2016 Teaching Assistant, Ornithology, Mammalogy, University of Montana
2015 Teaching Assistant, Ecology, University of Montana
2014 Teaching Assistant, Ornithology, University of Illinois, Urbana-Champaign
2012 Teaching Assistant, Human Anatomy and Physiology II, University of New Mexico
2011 Teaching Assistant, Ornithology, University of New Mexico
2010 Teaching Assistant, Human Anatomy and Physiology I, University of New Mexico
2009 Teaching Assistant, Human Anatomy and Physiology I, University of New Mexico

STUDENT MENTORING

- Martha Gomez Mateo: Undergraduate student researcher, University of California Berkeley, ESPM. Working on Senior Honor's thesis research, expected completion May 2023.
- Elisa Yang: Undergraduate and post-bac student researcher, University of California Berkeley, ESPM. Completed Senior Honor's Thesis research May 2022.
- Jenna Krugler: Undergraduate student researcher, University of California Berkeley, ESPM. Completed Senior Honor's Thesis research May 2022.
- Linnea Schaefer: Undergraduate student researcher, University of California Berkeley, IB. Completed Senior Honor's Thesis research May 2021.
- Sahid Martin Robles Bello: undergraduate research assistant, Universidad Nacional Autónoma de México (UNAM). Currently a master's student at UNAM.
- Alfonsina Hernández Cardona: undergraduate research assistant, UNAM.
- Dallas Levey: undergraduate research assistant, University of Illinois. Now a doctoral student Stanford University.
- Daniel Senner: post-baccalaureate research assistant.
- Grace Carlson: undergraduate research assistant, University of Montana.

MUSEUM EXPERIENCE

Curatorial experience:
Senior curatorial assistant, Philip L. Wright Zoological Museum, University of Montana, May-August 2018
Graduate curatorial assistant, Philip L. Wright Zoological Museum, University of Montana, January-May 2018
Graduate curatorial assistant, Museum of Southwestern Biology, University of New Mexico, Spring 2010, 2011

Field experience:
13 international museum expeditions between 2005-2014 to Peru (9 times), Brazil, Malaysia, Mexico, & South Africa.
Field work, application for scientific permits, and collecting of specimens with ancillary data from multiple localities within the United States, including: CA, NM, IL, AK, and WY.
Prepared over 2200 museum specimens with associated tissue and other ancillary data, deposited at several museums in the USA, Peru, Brazil, Malaysia, & Mexico.

PROFESSIONAL ACTIVITIES/SERVICE

Society membership:
- American Ornithological Society: elective member since 2019
- Society for the Study of Evolution
- American Genetics Association

Society service:

2020: Co-organizer of invited symposium, "Leveraging museum collections to track avian population responses to anthropogenic change", at North American Ornithological Conference, virtual meeting.

2019-present American Ornithological Society, Session chair, student presentation judge, Early Professional Committee

2014-2017 American Ornithological Society, Student Affairs Committee

Reviewer: *The Auk, Cotinga, Journal of Biogeography, Revista de Biologia Tropical, Molecular Phylogenetics & Evolution, Ecology & Evolution, PLoSone, Journal of Avian Biology, Ardea, Nature Communications, Proceedings of the Royal Society B, Molecular Ecology, Molecular Ecology Resources, Evolution, Ibis, Molecular Biology & Evolution, Conservation Genetics.*

Ad-hoc grant reviewer: National Science Foundation, Directorate for Biological Sciences (Postdoctoral Research Fellowships in Biology).

Member, Ph.D. Committee: Jonathan Clark (Doctoral student UNH, 2020-present).

2020- present: Member of the Museum of Vertebrate Zoology collections review working group.

PUBLICATIONS

Peer-reviewed publications:

(24) **Benham, P.M.,** Cicero, C., Escalona, M., Beraut, E., Marimuthu, M.P.A., Nguyen, O., Nachman, M.W., & Bowie, R.C.K. A highly contiguous genome assembly for the California quail (*Callipepla californica*). *Accepted: Journal of Heredity.*

(23) **Benham, P.M.** & Bowie, R.C.K. Natural history collections as a resource for conservation genomics: understanding the past to preserve the future. *Invited contribution to Journal of Heredity president's symposium special issue.* Advance access: https://doi.org/10.1093/jhered/esac066

(22) Beckman, E.J., Campos, W.V., **Benham, P.M.**, Schmitt, C.J., Cheviron, Z.A. & Witt, C.C. 2022. Selection on embryonic hemoglobin in an elevational generalist songbird. *Biology Letters,* 18: 20220105. **https://doi.org/10.1098/rsbl.2022.0105**

(21) Linck, E.B., Williamson, J.L., Bautista, E., Beckman, E.J., **Benham, P.M.**, DuBay, S.G., Flores, L.M., Gadek, C.R., Johnson, A.B., Jones, M.R., Núñez-Zapata, J., Quiñonez, A., Schmitt, C.J., Susanibar, D., Tiravanti C., J., Verde-Guerra, K., Wright, N.A., Valqui, T., Storz, J.F., & C.C. Witt. 2022. Blood variation implicates respiratory limits on elevational ranges of Andean birds. *In press. American Naturalist.* bioRxiv preprint DOI: https://doi.org/10.1101/2021.09.30.462673

(20) Clark, J.D., **P.M. Benham**, J.E. Maldonado, D.A. Luther, & H.C. Lim. 2022. Genomic patterns of incipient ecological speciation in a locally adapted songbird subspecies. *Evolution,* 76: 1481-1494.

(19) Walsh, J., A.I. Kovach, **P.M. Benham**, G.V. Clucas, V.L. Winder, & I.J. Lovette. 2021. Genomic data reveal the biogeographic and demographic history of *Ammospiza* sparrows in northeast tidal marshes. *Journal of Biogeography,* 48: 2360-2374. **https://doi.org/10.1111/jbi.14208**

(18) **Benham, P.M.** & Bowie, R.C.K. 2021. The influence of spatially heterogenous anthropogenic change on bill size evolution in a coastal songbird. *Evolutionary Applications,* 14: 607-624. Open access: **https://doi.org/10.1111/eva.13144**.

(17) Mikles, C.S., Walsh, J., Aguillon, S.M., Chan, Y., Arcese, P., **Benham, P.M.** & I.J., Lovette. 2020. Genomic differentiation of threatened song sparrows on a microgeographic scale. *Molecular Ecology,* 29: 4295-4307.

(16) Sweazea, K.L., Tsosie, K., Beckman, E.J., **Benham, P.M.** & C.C. Witt. 2020 Seasonal and elevational variation in glucose and glycogen in two songbird species. *Comparative Biochemistry and Physiology Part A,* 245: 110703.

(15) **Benham, P.M.** & Cheviron, Z.A. 2020. Population history and the selective landscape shape patterns of osmoregulatory trait divergence in tidal marsh Savannah sparrows (*Passerculus sandwichensis*). *Evolution,* 74: 57-72.

(14) Sheldon, F.H., Lim, H.C., **Benham, P.M.,** Brady, M.L., Brown, C.E., Burner, R.C., Chua, V.L., Mittermeier, J.C., Shakya, S.B., Van Els, P., Rahman, M.A., Gawin, D.F., Rahim, Z.A., Setia, L.D., & Moyle, R.G. 2019. Ornithological expeditions to Sarawak, Malaysian Borneo, 2007-2017. *Occasional Papers of the Museum of Natural Science, Louisiana State University*, 90: 1-11.

(13) Walsh, J., **Benham, P.M.,** Deane-Coe, P.E., Arcese, P., Butcher, B.G., Chan, Y.L., Cheviron, Z.A., Elphick, C.S., Kovach, A.I., Olsen, B.J., Shriver, W.G., Winder, V.L., & Lovette, I.J. 2019. Genomics of rapid ecological divergence and parallel adaptation in four tidal marsh sparrows. *Evolution Letters,* 3: 324-338. Open access: https://doi.org/10.1002/evl3.126.

(12) **Benham, P.M.** & Cheviron, Z.A. 2019. Divergent mitochondrial lineages arose within a large, panmictic population of the Savannah Sparrow (*Passerculus sandwichensis*). *Molecular Ecology,* 28: 1765-1783.

(11) Beckman, L., **Benham, P.M.,** Cheviron, Z.A. & Witt, C.C. 2018. Detecting introgression despite persistent phylogenetic uncertainty: the case of the South American siskins. *Molecular Ecology,* 27: 4350-4367.

(10) Stager, M., Pollock, H.S., **Benham, P.M.,** Sly, N.D., Brawn, J.D. & Cheviron, Z.A. 2016. Disentangling environmental drivers of metabolic flexibility in birds: the importance of temperature extremes versus temperature variability. *Ecography,* 39: 787-795.

(9) **Benham, P.M** & Witt, C.C. 2016 The dual role of Andean topography in primary divergence: functional and neutral variation among populations of the hummingbird, *Metallura tyrianthina. BMC Evolutionary Biology*, 16:22. Open access: https://doi.org/10.1186/s12862-016-0595-2.

(8) Galen, S.C., Natarajan, C., Moriyama, H., Weber, R.E., Fago, A., **Benham, P.M.**, Chavez, A.N., Cheviron, Z.A., Storz, J.F. & Witt, C.C. 2015 Contribution of a mutational hot spot to hemoglobin adaptation in high-altitude Andean house wrens. *Proceedings of the National Academy of Sciences,* 112: 13958-13963.

(7) **Benham, P.M.**, A.M. Cuervo, J.A. McGuire & C.C. Witt. 2015. Biogeography of the Andean metaltail hummingbirds: contrasting evolutionary histories of treeline-specialist and habitat-generalist clades. *Journal of Biogeography,* 42: 763-777.

(6) Lim, H.C., Chua, V.L., **Benham, P.M.,** Oliveros, C.H., Rahman, M.A., Moyle, R.G. & Sheldon, F.H. 2014. Divergence history of the Rufous-tailed Tailorbird (*Orthotomus sericeus*) in eastern Sundaland: Implications for the biogeography of Palawan and the taxonomy of island species in general. *The Auk,* 131: 629-642.

(5) Sanchez, C., J. Saucier, **P.M. Benham,** D.F. Lane, R.E. Gibbons, T. Valqui, S. Figueroa, C.J. Schmitt, C. Sánchez, C.M. Milenski, A.G. Bravo, D.G. Olaechaea. 2012. New and noteworthy records from northwestern Peru, Dpto. Tumbes. *El boletín de la Unión de Ornitólogos del Perú,* 7: 18-36.

(4) Gibbons, R.E., **P.M. Benham** & J. M Maley. 2011. Notes on birds of the high Andes of Peru. *Ornitología Colombiana,* 11: 76-86.

(3) **Benham, P.M.**, E.J. Beckman, S.G. DuBay, M. Flores, A.B. Johnson, M.J. Lelevier, C.J. Schmitt, N.A. Wright & C.C. Witt. 2011. Satellite imagery reveals new critical habitat for endangered bird species in the high Andes of Peru. *Endangered Species Research,* 13: 145-157.

(2) Hallworth, M.T., **P.M. Benham**, J.D. Lambert & L.R. Reitsma. 2008. Canada Warbler (*Wilsonia canadensis*) breeding ecology in young forest stands compared to a Red Maple (*Acer rubrum*) swamp. *Forest Ecology and Management,* 255, 1353-1358.

(1) Reitsma, L.R, M.T. Hallworth & **P.M. Benham.** 2008. Does age influence territory size, habitat selection, and reproductive success of male Canada Warblers in Central New Hampshire? *Wilson Journal of Ornithology,* 120, 446-454.

Manuscripts in review/revision/prep:

Mikles, C.S., Arcese, P., I.J., Lovette, Aguillon, S.M., Chan, Y.L., , **Benham, P.M.**, Carbeck, K., & Walsh, J. Evolutionary divergence and adaptive capacity in morphologically distinct Song Sparrow subspecies. *In review. Conservation Genetics.*

Benham, P.M., Walsh, J. & Bowie, R.C.K. Spatial variation in population genomic responses to 125 years of anthropogenic change within a tidal marsh songbird. *In revision.* Preprint on bioRxiv: https://doi.org/10.1101/2022.06.10.495648.

Benham, P.M., Cicero, C., Escalona, M., Beraut, E., Fairbairn, C., Marimuthu, M.P.A., Nguyen, O., Sahasrabudhe, R., Nachman, M.W. & Bowie, R.C.K. High repeat content in the genomes of sparrows: the importance of genome assembly completeness for transposable element discovery. *In prep. Target journal: Genome Biology and Evolution.*

Benham, P.M., Cicero, C., DeRaad, D., McCormack, J., Wayne, R., Escalona, M., Beraut, E., Marimuthu, M.P.A., Nguyen, O., Nachman, M.W., & Bowie, R.C.K. A highly contiguous genome assembly for the Steller's Jay (*Cyanocitta stelleri*). *In prep. Target journal: Journal of Heredity.*

Benham, P.M. & Cheviron, Z.A. Genetic accommodation of ancestral plasticity aided the colonization of tidal marshes in Savannah sparrows (*Passerculus sandwichensis*). *In prep.*

Jiménez, R.A., **Benham, P.M.,** Cerca, J., & Bowie, R.C.K. Elucidation of the phylogeography and genetic basis of phenotype-genotype discordance in the White-naped Brushfinch (*Atlapetes albinucha*) across its geographic range. *In prep.*

Schaefer, L.N., Cicero, C., **Benham, P.M.**, Benedict, L., Bowie, R.C.K. Relating song to morphology, ecology, and phylogeny in the avian genus *Vireo* (Aves: Vireonidae). *In prep.*

Technical reports:

Benham, P.M. The influence of history, gene flow, and effective population size on local adaptation to saltmarshes in the Savannah Sparrow (*Passerculus sandwichensis).* 2015 Annual Report to the California Department of Fish & Wildlife, Sacramento, CA. 24 pp.

Benham, P. M., E. Bautista O., E.J. Beckman, J.A. Clark, L.M. Flores, S.C. Galen, A.B. Johnson, M. Combe, J. Huaroto, K.S. Verde G., & C.C. Witt. 2013. Survey of the Birds of Cloud Forest and Páramo Habitats above Agua Azul, Northwest Peru. Technical Report to Dirección General Forestal y de Fauna Silvestre (DGFFS), Lima, Peru. 13 pp.

Book chapters:

Benham, P.M. 2022. Plain Xenops (*Xenops minutus*). In: *Elusive birds of the tropical understory.* Edited by J.P. Whitelaw, J.D. Brawn, H.S. Pollock & J.W. Fitzpatrick. Cornell University Press, Ithaca, NY.

Benham, P.M. 2022. Russet Antshrike (*Thamnistes anabatinus*). In: *Elusive birds of the tropical understory.* Edited by J.P. Whitelaw, J.D. Brawn, H.S. Pollock & J.W. Fitzpatrick. Cornell University Press, Ithaca, NY.

SCIENTIFIC PRESENTATIONS

Contributed talks:

P.M. Benham, J. Walsh, & R.C.K. Bowie. 2022. The genetic basis of adaptation in an ecologically widespread songbird, the Savannah sparrow. American Ornithological Society & Birds Caribbean joint meeting. 27 June-2 July 2022, San Juan, Puerto Rico.

P.M. Benham, J. Walsh, & R.C.K. Bowie. 2021. Spatial variation in population genomic responses to 125 years of anthropogenic change within a tidal marsh songbird. American Genetics Association, President's Symposium. Conservation Genomics: Current Applications and Future Directions. 10-13 October 2021, Snowbird, UT.

P.M. Benham, J. Walsh, & R.C.K. Bowie. 2021. Spatial variation in population genomic responses to anthropogenic change within tidal marsh populations of the Savannah Sparrow. American Ornithologists' Society & Society of Canadian Ornithologists Joint Meeting, August 9-14 2021. Virtual conference.

P.M. Benham, J. Walsh, & R.C.K. Bowie. 2020. Genomic data from museum specimens illuminate population responses in a tidal marsh songbird to a century of anthropogenic change. North American Ornithological Conference. August 10-14 2020. Virtual conference.

Benham, P.M. & R.C.K. Bowie. 2019. Bill size evolution in response to human-mediated ecological change. American Ornithologists' Society, Anchorage, AK.

Benham, P.M. & R.C.K. Bowie. 2019. Bill size evolution in response to human-mediated ecological change. Evolution, Providence, RI.

Benham, P.M. & Z.A. Cheviron. 2017. Ancestral plasticity and colonization of salt marsh habitats by the Savannah Sparrow. Evolution, Portland, OR.

Benham, P.M. & Z.A. Cheviron. 2016. Genetic divergence predicts the degree of divergence in renal traits of salt marsh Savannah Sparrows (*Passerculus sandwichensis*). Society of Integrative & Comparitive Biology, Portland, OR.

Benham, P.M. & Z.A. Cheviron. 2016. Genetic divergence predicts the degree of divergence in renal traits of salt marsh Savannah Sparrows (*Passerculus sandwichensis*). Evolution, Austin, TX.

Benham, P.M. & Z.A. Cheviron. 2016. Genetic divergence predicts the degree of divergence in renal traits of salt marsh Savannah Sparrows (*Passerculus sandwichensis*). North American Ornithological Council, Washington, DC.

Benham, P.M. & Z.A. Cheviron. 2014. Historical and ecological correlates of population structure in the Savannah Sparrow (*Passerculus sandwichensis*). American Ornithologists' Union, Estes Park, CO.

Benham, P.M., A.M. Cuervo, R.T. Brumfield & C.C. Witt. 2012. Topographic complexity in the Andes shapes diversification patterns in the hummingbird genus *Metallura*. North American Ornithological Conference, University of British Columbia, Vancouver, BC.

Benham, P.M. & C.C.Witt. 2011 Climate explains the discordance between morphological and genetic variation in the hummingbird *Metallura tyrianthina*. American Ornithologists' Union Meeting, Jacksonville, FL.

Posters:

Benham, P.M. & C.C. Witt. 2013 Andean topography promotes genetic and ecological divergence in the hummingbird *Metallura tyrianthina.* American Genetics Association: Symposium on the Speciation Continuum, Cornell University, Ithaca, NY.

Benham, P.M., M.T. Hallworth & L.R. Reitsma. 2009. Habitat and mixed-species flock use by boreal migrants in eastern Ecuador with emphasis on Canada Warbler (*Wilsonia canadensis*). American Ornithologists' Union Meeting, Philadelphia, PA.

Invited talks:

Benham, P.M. 2015. Adaptive genomics of Neotropical birds. Talk presented for the Smithsonian Tropical Research Institute IGERT-NEO tropical biology field course, Panama.

PUBLIC OUTREACH

2022 Berkeley Bird Festival, Sponsored by Golden Gate Audubon.
2021 Berkeley Bird Festival, Sponsored by Golden Gate Audubon.

Life on the Edge: The Unique Evolutionary History of Salt Marsh Sparrows in the San Francisco Bay Area and Their Persistence in a Human-dominated Environment. Invited talk for the San Francisco Bay Bird Observatory, Birdy Hour. Link: https://www.youtube.com/watch?v=EhtP7HzwIcc

2019 CalDay presentation on physiology in tidal marsh birds. Museum of Vertebrate Zoology, Berkeley, CA

2018 Presentation on birding and ornithology in Peru, Mascoma Chapter Audubon Society, Hanover, NH

2016 Birds, Museums, and Evolution. Talk presented to University of Montana, Wildlife Society Chapter.

2015 Leading spring bird walks for the Urbana Park District.

2013 Presented unit on Birds for the Girls Do Science Summer Camp, Orpheum Children's Science Museum, Champaign, IL.

2012 Presentation on ornithological fieldwork to classes at Kenwood Elementary School, Champaign, IL.
Tour of the Museum of Southwestern Biology for members of the Central New Mexico Audubon Society.

2011 Migration Presentation, Santa Fe Audubon Society: April 2011

2010 Sponsored an ornithology merit badge for two Boy Scouts from Albuquerque with aid of Museum of Southwestern Biology collections
Migration Presentation, Rio Grande Nature Center Herbfest
Migration Presentation, Central New Mexico Audubon Society

REFERENCES:

Rauri C. K. Bowie
University of California, Berkeley
Museum of Vertebrate Zoology
email: bowie@berkeley.edu
phone: 510-643-1617

Zachary A. Cheviron
University of Montana
Division of Biological Sciences
email: zac.cheviron@mso.umt.edu
phone: 406-243-4496

Christopher C. Witt
University of New Mexico
Museum of Southwestern Biology
email: cwitt@unm.edu
phone: 505-918-7199