CARLOS A. BOTERO
Assistant Professor, Department of Biology, Washington University in Saint Louis,
Campus Box 1137, One Brookings Drive, St. Louis, MO 63130
(314) 935 4711 | cbotero@wustl.edu | https://pages.wustl.edu/botero

RESEARCH INTERESTS

Long-term evolutionary studies across a wide range of wild organisms indicate that the direction and strength of natural selection typically fluctuates over time. However, ecological and evolutionary theories often ignore such fluctuations, leading to an incomplete and potentially misleading understanding of natural processes. I use theoretical modeling, experimental evolution, and large scale comparative analyses to study how organisms adapt to (evolution) and cope with (ecology) repeated environmental change and fluctuating selection. My work has shown that although the process through which organisms adapt to fluctuating selection is stochastic, the resulting adaptations are nevertheless highly predictable. For example, I have shown that phenotypic plasticity, adaptive tracking, diversification bet-hedging and conservative bet-hedging are consistently evolved in different parts of the parameter space determined by the rate and predictability of environmental change. Based on these findings, I have also shown that the likelihood of extinction increases dramatically when climate change results in new parameter combinations that select for a different adaptive response than the one a population originally exhibited. Through comparative analyses, I have also provided evidence of links between the evolution of behavioral strategies, like sociality and flexibility in mate choice, and the ability to occupy harsher and more unpredictable habitats. My team and I are currently exploring the direction of causality in these relationships as well as the potential role of genetic complexity in improving adaptive capacity under fluctuating selection (experimental evolution in yeast), the survival benefits of enhanced cognitive ability in birds that exploit variable environments, the effects of climate oscillations on diversification rates in mammals and birds, and the effects of climate variability on the evolution of human language and culture.

EDUCATION

PhD, Department of Neurobiology and Behavior, Cornell University	2007
BS, Department of Biology, Universidad de los Andes, Colombia	1999

APPOINTMENTS

Assistant Professor, Biology, Washington University in St. Louis	2015 – present
Postdoctoral Fellow. North Carolina State University, Raleigh, NC	2012 – 2015
Postdoctoral Fellow. The National Evolutionary Synthesis Center. Duke University.	2009 – 2011
Postdoctoral Fellow. University of Groningen. The Netherlands.	2008

AWARDS AND HONORS

Distinguished Postdoctoral Fellowship. Initiative for Biological Complexity, NC State University in Raleigh.	2012 – 2015
Rubicon Fellowship. The Netherlands Organization for Scientific Research (NWO). The Netherlands.	2008
Elective member to the American Ornithologists' Union	2013
Excellence Fellowship. Cornell University, Ithaca NY.	2001 – 2002

Magna cum Laude and Valedictorian for the class of 1999. Universidad de los Andes. Bogotá, Colombia. 1999

PUBLICATIONS (* = Wash U affiliation; † = Joint Wash U / NC State affiliation)

24. KR Kirby, DE Blasi, **CA Botero†**, C Bowern, K Cranston, C Ember, W Divale, R Gray, SJ Greenhill, F Jordan, D Leehr, B S Low, J McCarter, S Gomes-Ng, and M Gavin. 2016. D-PLACE: A Global Database of Peoples, Languages, Cultures, and Environment. *PLoS ONE.* 11(7), e0158391. doi:10.1371/journal.pone.0158391

23. Rubenstein DR, **CA Botero***, and EA Lacey. 2016. Discrete but variable structure in animal societies leads to the false perception of a social continuum. *Royal Society Open Science* 3: 160147

22. **Botero CA***, LJ Harmon and Q Atkinson. 2016. The promise and limits of eco-evolutionary studies of human culture: a comment on Sloan Wilson et al. *Religion, Brain and Behavior*. doi: 10.1080/2153599X.2015.1132249.

21. Sheehan MJ, **Botero CA†**, Hendry TA, Sedio BE, Jandt JM, Weiner S, Toth AL, and EA Tibbetts. 2015. Different axes of environmental variation explain the formation versus size of cooperative nest founding associations in Polistes paper wasps. *Ecology Letters* 18 (10): 1057–1067.

20. **Botero CA†**, FJ Weissing, J Wright, and DR Rubenstein. 2015. Evolutionary tipping points in the capacity to adapt to environmental change. *Proceedings of the National Academy of Sciences*, USA. 112 (1): 184-189.

19. **Botero CA†**, Gardner B, Kirby KR, Bulbulia J, Gavin MC and R Gray. 2014. The ecology of religious beliefs. *Proceedings of the National Academy of Sciences*, USA. 111 (47): 16784-16789.

18. **Botero CA**, R Dor, C McCain, and RJ Safran. 2014. Environmental harshness is positively correlated with intraspecific divergence in mammals and birds. *Molecular Ecology* 23: 259-268.

17. **Seddon, N.*, C. A. Botero*,** J. A. Tobias, P. O. Dunn, H. E. A. MacGregor, D. R. Rubenstein, J. A. C. Uy, J. T. Weir, L. A. Whittingham, and R. J. Safran. 2013. Sexual selection accelerates signal evolution during speciation in birds. *Proceedings of the Royal Society B*. 280 (1766): 20131085 . doi:10.1098/rspb.2013.1065 **[*Equal contribution co-first authors]**

16. Gavin MC, **CA Botero**, C Bowern, RK Colwell, M Dunn, RR Dunn, RD Gray, KR Kirby, J McCarter, A Powell, T Rangel, J Stepp, M Trautwein, JL Verdolin, and G Yanega. 2013. Towards a mechanistic understanding of linguistic diversity. *Bioscience* 63 (7): 524-535.

15. **Botero CA** and SR de Kort. *2013*. Learned signals and consistency of delivery: a case against receiver manipulation in animal communication. In: Stegmann, U. (ed) *Animal Communication Theory: Information and Influence*. Cambridge University Press, Cambridge, UK. Pp. 281-286.

14. **Botero CA** and DR Rubenstein. 2012. Fluctuating environments, sexual selection and the evolution of flexible mate choice in birds. PLoS One 7 (2): e32311. doi:10.1371/journal.pone.0032311

13. Lovette IJ, BS Arbogast, RL Curry, RM Zink, **CA Botero**, JP Sullivan, AL Talaba, RB Harris, DR Rubenstein, RE Ricklefs, and E Bermingham. 2011. Phylogenetic Relationships of the Mockingbirds and Thrashers (Aves: Mimidae). *Molecular Phylogenetics and Evolution*. doi:10.1016/j.ympev.2011.07.009

12. **Botero CA**, I. Pen, J Komdeur, and FJ Weissing. 2010. The evolution of individual variation in communication strategies. *Evolution.* 64: 3123-3133.
Faculty of 1000 article recommendation at: http://f1000.com/prime/6132956

11. Elias DO, **CA Botero**, MCB Andrade, AC Mason and MM Kasumovic. 2010. High resource valuation fuels "desperado" fighting tactics in female jumping spiders. *Behavioral Ecology* 21 (4): 868-875.

10. **Botero, CA**, N Boogert, IJ Lovette, and SL Vehrencamp. 2009. Climatic patterns predict the elaboration of song displays in mockingbirds. *Current Biology*. 19: 1-5.

9. **Botero CA**, RJ Rossman, LM Caro, LM Stenzler, IJ Lovette, SR de Kort, and SL Vehrencamp. 2009. Syllable type consistency is related to age, social status and reproductive success in the tropical mockingbird. *Animal Behaviour*. 77 (3): 701-706.

8. De Kort SR, ERB Eldermire, S Valderrama, **CA Botero**, and SL Vehrencamp. 2009. Trill consistency is an age-related assessment signal in banded wrens. *Proc. R. Soc. B*. 276: 2315-2321.

7. **Botero CA**, AE Mudge, AM Koltz, WM Hochachka, and SL Vehrencamp. 2008. How Reliable are the Methods for Estimating Repertoire Size? *Ethology*. 114 (12): 1227-1238.

6. Amat E, J Olano, F Forero, and **CA Botero**. 2007. Notes on *Philornis vulgaris* (Couri, 1984) (Diptera: Muscidae) in a nest of tropical mockingbird *Mimus gilvus* (Viellot, 1808) in the Colombian Andes. *Acta Zoologica Mexicana*. 23 (2): 205-207.

5. **Botero CA**, JM Riveros, and SL Vehrencamp. 2007. Relative threat and recognition ability in the responses of tropical mockingbirds to song playback. *Animal Behaviour*. 73: 661-669.

4. **Botero CA** and Vehrencamp, SL. 2007. Responses of tropical mockingbirds to variation in within-song and between-song versatility. *The Auk*. 124 (1): 185-196.

3. **Botero CA**. 2002. Is the White-Flanked Antwren (Formicariidae: *Myrmotherula axillaris*) A Nuclear Species in Mixed-Species Flocks? A Field Experiment. The *Journal of Field Ornithology*.73 (1): 74-81.

2. **Botero CA**. 2001. First specimen of the Ecuadorian Cacique (Icterinae: *Cacicus sclateri*) from Colombia with notes on its nesting behavior. *The Wilson Bulletin*. 113 (3): 327-328.

1. Cadena CD, M Alvarez, JL Parra, I Jimenez, CA Mejia, M Santamaria, AM Franco, **CA Botero**, GD Mejia, AM Umaña, A Calixto, J Aldana and GA Londoño. 2000. The birds of CIEM, Tinigua National Park, Colombia: an overview of 13 years of ornithological research. *Cotinga* 13: 46-54.

TEACHING

Washington University

BIO373 – Laboratory on the evolution of animal behavior (Fall 2015; 11 students, 10 hours lecture, 80 hours laboratory)

Other Institutions

Methods in Animal Behavior, Department of Neurobiology and Behavior, *Cornell University*. FL07

Bioacoustics. *Instituto de Investigación en Recursos Biológicos Alexander von Humboldt, Colombia*. SM05

Field Techniques in Biology. *Universidad de los Andes, Colombia*. SM00

UNIVERSITY SERVICE

Student dinner with Dean J. Smith (co-hosted a discussion on evolution and human nature for 10 undergraduate students from Arts and Sciences) SP16

EEPB admissions committee AY15-16

EEPB steering committee FL15 – present

Environmental studies steering committee FL15 – present

EEPB qualifying exam committees (Holly Bernardo and Tyler Larsen)

PUBLIC SERVICE

Outreach talk for fifth graders at The Evergreen School, Shoreline WA 2016

NSF Panel Member 2012, 2015

NSF Ad hoc reviewer 2009, 2013, 2014

Postdoctoral representative to the Operations Committee for the *National Evolutionary Synthesis Center* 2009 – 2011

Associate Faculty Member for *Faculty of 1000* (Biology: Theoretical ecology) 2010-2014

After-school mentor for African American and Latino kids. SALSA: Seeing and Learning Science after school. Chapel Hill, North Carolina 2011

Career options panelist for undergraduate diversity programs at the joint meeting for the *Society for the Study of Evolution* & the *American Society of Naturalists* 2011

Career options panelist at the meeting for the *Society for the Advancement of Hispanics, Chicanos, & Native Americans in Science* (SACNAS) 2011

Referee for the following scientific journals (13 reviews in 2015 indicated in parentheses): *American Naturalist (2), American Midland Naturalist, Animal Behaviour (1), Auk (1), Behavioral Ecology, Behaviour, Biology Letters, Caldasia, Condor, Current Biology, Current Zoology, Ecology (1), Ecography, Evolution (1), Ethology, Frontiers in Ecology and Evolution, Herpetological Journal, Ibis (1), Journal of Avian Biology (1), Journal of Comparative Physiology, Journal of Field Ornithology, Journal of Molecular Evolution and Biodiversity (1), Journal of Ornithology, Journal of Theoretical Biology (1), Molecular Ecology, Naturwissenschaften, PLoS one, Proceedings of the National Academy of Sciences (1), Proceedings of the Royal Society of London B (2), Turkish Journal of Zoology, The Wilson Journal of Ornithology*.

MENTORING ACTIVITIES

Postdoctoral Associates (* = 3 current)

Trevor Fristoe* (PhD U of New Mexico) FL15 – present

Ty Tuff* (PhD UC Boulder) SP16 – present

Bruno Vilela* (PhD Federal University of Goias, Goiânia, Goiás, Brazil) SP16 – present

Research Associates

Ping Liu (Senior Lab Technician) FL15 – present

Graduate Students (* = 1 current)

Vincent Fasanello* (EEPB) SP16 – present

Graduate Student Rotations (* = 1 current)
James Weagley* (GENETICS) FL15 – SP16

Graduate Student Thesis Committees (* = 6 current)
Kimberly Sukhum* (WUSLT - EEPB, PhD), Dilys Vega* (WUSTL - EEPB, PhD), Cassondra Vernier* (WUSTL - EEPB, PhD), Kathleen Mortland* (WUSTL, PhD), Meghann Humphries* (UMSL, PhD), Kara Anders* (SLU, Masters).

Undergraduate students (* = 4 current)
Annie Marggraff* (FL15, SP16), Iris Seto* (SP16), Harkjoon Lee* (SP16), and Laura McLaughlin* (SP16)