

ZACHARY M. LAUBACH

Department of Ecology and Evolutionary Biology
University of Colorado, Boulder
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RESEARCH INTERESTS

Behavioral Ecology • Evolutionary Biology • Genomics • Phenotypic Plasticity • Life Course Epidemiology • Developmental Origins of Health and Disease (DOHaD) • Behavioral Endocrinology • Conservation Biology

EDUCATION

University of Colorado, Boulder Postdoctoral Research Fellow in Ecology and Evolutionary Biology 2019 – current
Morris Animal Foundation Postdoctoral Research Fellow
Advisors: Dr. Rebecca Safran (CU Boulder), Dr. Kim Hoke (CSU), and Dr. Kay E. Holekamp (MSU)

Michigan State University Dual Ph. D. Integrative Biology and Interdisciplinary Program in Ecology, Evolution, and Behavioral Biology. 2019
Dissertation topic: *Developmental plasticity: Early life environment, DNA methylation, and later life phenotype in spotted hyenas.*
Primary Advisor: Dr. Kay E. Holekamp
Committee: Dr. Dana C. Dolinoy, Dr. Thomas Getty, Dr. Laura Smale, and Dr. Elise Zipkin

University of Michigan M.S. in Conservation Biology. 2010
Thesis topic: *Functional importance of plumage badges as intraspecific signals in White-crowned sparrows (Zonotrichia leucophrys oriantha).*
Advisors: Dr. Johannes Foufopoulos and Dr. Bobbi Low

Juniata College B.S. in Environmental Science. 2007
Undergraduate Research: *White-tailed deer density, movement and habitat use through GIS and distance sampling.*
Advisors: Dr. Uma Ramakrishnan, Dr. Neil Pelkey, and Dr. Dennis Johnson

GRANTS

- 2021-2023 NSF PRFB DBI 2010607. “Longitudinal and experimental tests of a Rule of Life in animals: Variation in parental care establishes lifelong patterns of DNA methylation associated with physiological stress.” Principal Investigator: **Zachary M. Laubach** - \$138,000.
- 2019-2021 Morris Animal Foundation Postdoctoral Fellowship D19ZO-411. “Pastoralist communities as a potential source of Toxoplasma gondii infection in a wild carnivore and effects on host behavior and survival.” Principal Investigator: **Zachary M. Laubach** - \$100,000.
- 2018-2019 BEACON (Center for the Study of Evolution) NSF DBI 0939454. “Impacts of brain-manipulating parasites on host fitness and social behavior.” Principal Investigator: Chris Adami: CO-PIs: Eben Gering, Thomas Getty, Arend Hintze, and **Zachary M. Laubach** - \$90,132.
- 2017-2019 NSF DDIG 1701384. “DISSERTATION RESEARCH: Early social experience and epigenetic mediation of adult phenotypes.” Principal Investigator: **Zachary M. Laubach** - \$20,151
- 2016 The Society for Integrative and Comparative Biology (SICB), Grants-in-aid of Research (GIAR). “Maternal rank and glucocorticoid receptor methylation in spotted hyenas.” Principal Investigator: **Zachary M. Laubach** - \$1000

- 2015-2016 BEACON (Center for the Study of Evolution) NSF DBI 0939454. “Trans-generational epigenetic inheritance in living and digital hyenas.” Principal Investigator: Kay E. Holekamp; CO-PIs: Risto Miikkulainen, **Zachary M. Laubach**, Arend Hintze, and Elliot Meyerson - \$161,326

AWARDS

- 2019 Animal Behavior Society Student Research Grant - \$1500
- 2019 BEACON Travel Award, Michigan State University - \$500
- 2019 College of Natural Science Dissertation Completion Fellowship - \$6000
- 2018 BEACON Travel Award, Michigan State University - \$700
- 2018 Dr. Marvin Hensley Endowed Scholarship in Zoology, Michigan State University - \$8700
- 2018 Michigan State University Graduate School Research and Travel Fellowship - \$1500
- 2018 Ecology, Evolutionary Biology and Behavior Program Travel Fellowship - \$1000
- 2014-2017 Ecology, Evolutionary Biology and Behavior Program Summer Fellowship, Michigan State University - \$1800
- 2014 BEACON Travel Award, Michigan State University - \$500
- 2014 Dr. Marvin Hensley Endowed Scholarship in Zoology, Michigan State University - \$9165
- 2013-2018 BEACON Science and Technology Center Top Up Fellowship, Michigan State University - \$3000/yr
- 2010 School of Natural Resources Conference Travel Grant, University of Michigan - \$200
- 2010 MEEC Conference Travel Grant, University of Michigan - \$200
- 2010 Rackham Conference Travel Grant (received twice), University of Michigan - \$600
- 2009 Dr. Lee R. G. Snyder Memorial Research Fellowship, Rocky Mountain Biological Laboratory - \$1,440
- 2009 Harold and Vivian Shapiro/John Malik Awards, University of Michigan - \$600
- 2008-2009 Robbins/Shuman Award, Fulton Financial Advisors - \$4,500
- 2008 Rackham Graduate Student Research Grant, University of Michigan - \$1,500
- 2008 SNRE Practicum/Thesis Research Award, University of Michigan - \$1,000
- 2003 - 2007 Calvert Ellis Award, Juniata College - \$40,000

PUBLICATIONS (* Indicates authors contributed equally)

- Laubach Z. M.**, Greenberg J. R., Turner J. W., Montgomery T. M., Pioon M. O., Smale L., Cavalcante R., Padmanabhan K. R., Lalancette C., vonHoldt B., Faulk C. D., Dolinoy D. C., Holekamp K. E., Perng, W. (in review) Associations of early social experience with offspring DNA methylation and later life stress phenotype. *Nature Communications*.
- Gering, E. *, **Laubach, Z. M.***, Weber, P., Hussey, G. S., Lehmann, K. D. S., Montgomery, T. M., Turner, J. W., Perng, W., Pioon, M. O., Holekamp, K. E., and Getty, T. (in review). *Toxoplasma gondii* infections are associated with boldness towards lions in wild hyena hosts. *Science Advances*.
- Spagnuolo, O. S. B., Jarvey, J. C., Battaglia, M. J., **Laubach, Z. M.**, Miller, M. E., Holekamp, K. E., Bourgeau-Chavez, L. L. 2020. Mapping Kenyan grassland heights across large spatial scales with combined optical and radar satellite imagery. *Remote Sensing*. DOI: 10.3390/rs12071086
- Gering, E. *, Laubach, **Z. M.***, Weber, P., Hussey, G. S., Turner, J., Holekamp, K. E., and Getty, T. 2020. Time makes you older, parasites make you bolder: *Toxoplasma gondii* infections predict hyena boldness toward definitive lion hosts in a human-altered landscape. In *Evolution in action: Past, present and future: A Festschrift in honor of Erik D. Goodman*. Wolfgang Banzhaf, Betty Cheng, Kalyanmoy Deb, Kay Holekamp, Richard Lenski, Charles Ofria, Robert Pennock, Bill Punch, Danielle Whittaker, Editors. Springer International Publishing. DOI: 10.1007/978-3-030-39831-6
- Laubach, Z. M.***, Perng, W. *, Cardenas, A., Rifas-Shiman, S. L., Oken, E., DeMeo, D., Litonjua, A. A., Duca, R. C., Godderis, L., Baccarelli, A., Hivert, M. F. 2019. Socioeconomic status and DNA methylation from birth through mid-childhood: A prospective study in Project Viva. *Epigenomics*. DOI: 10.2217/epi-2019-0040

- Laubach, Z. M.**, Faulk, C. D., Dolinoy, D. C., Montrose, L., Jones, T. R., Ray, D., Pioon, M. O., Holekamp, K. E. 2019. Early life social and ecological determinants of global DNA methylation in wild spotted hyenas. *Molecular Ecology*. DOI: 10.1111/mec.15174
- Laubach, Z. M.**, Perng, W., Dolinoy, D. C., Faulk, C. D., Holekamp, K. E., Getty, T. 2018. Epigenetics and the maintenance of developmental plasticity: extending the signaling theory framework. *Biological Reviews*. DOI: 10.1111/brv.12396
- Laubach, Z. M.**, Faulk, C. D., Cardenas, A., Perng, W. 2017. Nutrition, DNA methylation, and developmental origins of cardiometabolic disease: A signal systems approach. Chapter 6 in *Handbook of Nutrition, Diet and Epigenetics*. Vinood Patel and Victor Preedy, Editors. Springer Publishers. DOI: 10.1007/978-3-319-31143-2_107-1
- Bourgeau-Chavez, L., Lee, Y. M., Battaglia, M., Endres, S., **Laubach, Z. M.**, Scarbrough, K. 2016. Identification of woodland vernal pools with seasonal change PALSAR data for habitat conservation. *Remote Sensing* 8 (6): 490. DOI: 10.3390/rs8060490
- Laubach, Z. M.**, Perng, W., Lombardo, M., Murdock, C. C., & Foufopoulos, J. 2015. Determinants of parental care in Mountain white-crowned sparrows (*Zonotrichia oriantha*). *The Auk: Ornithological Advances* 132: 893-902. DOI: 10.1642/AUK-15-9.1
- Bourgeau-Chavez, L., Endres, S., Battaglia, M., Miller, M., Banda E., **Laubach, Z. M.**, Higman, P., Chow-Fraser, P., and Marcaccio, J. 2015. Development of a bi-national Great Lakes coastal wetland and land use map using three-season PALSAR and Landsat imagery. *Remote Sensing* 7: 8655-8682. DOI: 10.3390/rs70708655
- Bourgeau-Chavez, L. L., **Laubach, Z. M.**, Battaglia, M. J., Landon, A. J., Banda E. C., Endres, S. L., Macleod, R., Miller, M. E., and Brooks, C. N. 2015. Great Lakes Coastal Wetland Mapping. Chapter 15 in *Remote Sensing of Wetlands: Applications and Advances*. R. Tiner, V. Klemas and M. Lang, Editors. Taylor and Francis Publishers. DOI: 10.1201/b18210-19
- Laubach, Z. M.**, Sampson, G., Blumstein, D. T., Romero, L. M., & Foufopoulos, J. 2013 Are white-crowned sparrow badges reliable signals? *Behavioral Ecology and Sociobiology* 67: 481-492. DOI: 10.1007/s00265-012-1468-3.
- Bourgeau-Chavez, L. L., Kowalski, K. P., Carlson Mazur, M. L., Scarbrough, K. A., Powell, R. B., Brooks, C. N., Huberty, B., Jenkins, L. K., Banda, E. C., Galbraith, D. M., **Laubach, Z.M.**, and Riordan, K. 2013 Mapping invasive *Phragmites Australis* in the coastal Great Lakes with ALOS Palsar satellite imagery for decision support. *Journal of Great Lakes Research* 39: 65-77. DOI: 10.1016/j.jglr.2012.11.001
- Forster, L., Hassel, H., & **Laubach, Z. M.** 2005. Are algae indicators of nitrogen levels in springs? *Journal of Ecological Research* 7: 51-56.

PRESENTATIONS

Platform presentations

- Laubach, Z. M.**, Cavalcante, R., Dolinoy, D. C., Faulk, C., Greenberg, J., Lalancette, C., Montgomery, T., Padmanabhan, K., Perng, W., Pioon, M., Smale, L., Turner, J., vonHoldt, B., & Holekamp, K. E. 2020. Early social experiences contribute to DNA methylation and development of future stress phenotype. *Animal Behavior Society, Virtual Conference*.
- Gering, E., **Laubach, Z. M.**, Holekamp, K. E., Getty, T. 2020. Behavioral and demographic covariates of coccidian infection in free-living spotted hyenas. *Animal Behavior Society, Virtual Conference*.
- Laubach, Z. M.**, Faulk, C., Dolinoy, D. C., Montrose, L., & Holekamp, K. E. 2019. Associations of early life environment and DNA methylation in wild spotted hyenas. *Animal Behavior Society*. Chicago, IL.
- Laubach, Z. M.**, Faulk, C., Montrose, L., Greenberg, J., Dolinoy, D. C., & Holekamp, K. E. 2017. Associations of early-life social experience with DNA methylation in free-living spotted hyenas. U.S. *DOHaD*. Detroit, MI.

- Laubach, Z. M.** 2017. Epigenetics and phenotypic plasticity: An extension of a signal detection problem. MSU, EEBC Colloquium, East Lansing, MI.
- Laubach, Z. M.,** Faulk, C., Dolinoy, D. & Holekamp, K. E. 2015. Measuring glucocorticoid receptor DNA methylation in Spotted Hyenas. *BEACON Congress*. Michigan State University, East Lansing, MI.
- Laubach, Z. M.,** Faulk, C., Dolinoy, D., Sant, K., & Holekamp, K. E. 2014. Social environment, epigenetics and stress response: an ethological extension in Spotted Hyenas. *Animal Behavior Society (51st Anniversary Meeting)*. Princeton University, Princeton, NJ.
- Laubach, Z. M.,** Faulk, C., Dolinoy, D., & Holekamp, K. E. 2014. Social environment, epigenetics and stress physiology in Spotted Hyenas. *Fish and Wildlife Graduated Student Organization Research Symposium*. Michigan State University, Lansing, MI.
- Laubach, Z. M.,** Blumstein, D. T., Romero, L. M., & Foutopoulos, J. 2013. A test of status badge reliability in Mountain white-crowned sparrows. *Animal Behavior Society (50th Anniversary Meeting)*. University of Colorado Boulder, CO.
- Bourgeau-Chavez, L. L., Scarbrough, K., Miller, M. E., **Laubach, Z. M.,** Endres, S., Banda, E., Battaglia, M., Landon, A., Jenkins, L., Powell, R., and Brooks, C. 2012. Mapping coastal Great Lakes wetlands and adjacent land use through hybrid optical-infrared and radar image classification techniques. Intecol Wetlands Conference. Orlando, FL.
- Bourgeau-Chavez, L. L., Powell, R., Jenkins, L., Brooks, C., Scarbrough, K., Riordan, K., **Laubach, Z. M.,** Mazur, M. C., & Kowalski, K. 2011. Mapping Monotypic Stand of Invasive *Phragmites* in the Coastal Great Lakes. *Phragmites Invasions in Michigan: A Symposium to Build Capacity for Management*. East Lansing, MI.
- Laubach, Z. M.,** Sampson, G., Blumstein, D. T., Romero, L. M., & Foutopoulos, J. 2010. Functional importance of a plumage badge in intraspecific signaling in white-crowned sparrows. *Ecological Society of America Conference (95th ESA Annual Meeting)*. Pittsburgh, PA.
- Laubach, Z. M.,** Sampson, G., Blumstein, D. T., Romero, L. M., & Foutopoulos, J. 2010. Functional importance of plumage characteristics (design and costs) as intraspecific signals in mountain white-crowned sparrows (*Zonotrichia leucophrys oriantha*). *Midwest Ecology and Evolution Conference*. Ames, IA.
- Laubach, Z. M.,** Blattenberg, C., Pelkey, N. & Ramakrishan, U. 2007. An Evaluation of Nocturnal and Diurnal Behavior by Male White-tailed Deer using GPS Collar Data. *Northeast Fish and Wildlife Conference*. Mystic, CT.
- Laubach, Z. M.,** Blattenberg, C., Pelkey, N. & Ramakrishan, U. 2007. An Evaluation of Nocturnal and Diurnal Behavior by Male White-tailed Deer using GPS Collar Data. *Juniata Liberal Arts Symposium*. Huntingdon, PA.
- Laubach, Z. M.** & Ramakrishan, U. 2005. Applications in Wildlife Research: Deer Density and Habitat Monitoring. *Appalachian GIS Convention*. California University of Pennsylvania. California, PA.
- Poster presentations
- Laubach, Z. M.,** Perng, W., Holekamp, K., Faulk, C., Dolinoy, D. C., Getty, T. 2017. The role of epigenetics in phenotypic plasticity: an extension of signal detection theory. *1st Annual Research Symposium (Ecology, Evolutionary Biology and Behavior Program)*. Michigan State University, East Lansing, MI
- Laubach, Z. M.,** Perng, W., Holekamp, K., Faulk, C., Dolinoy, D. C., Getty, T. 2017. The role of epigenetics in phenotypic plasticity: an extension of signal detection theory. *13th Annual Early Career Scientists Symposium (Ecology and Evolutionary Biology of Phenotypic Plasticity)*. University of Michigan, Ann Arbor, MI
- Laubach, Z. M.,** Walker, A. & Ramakrishan, U. 2007. GIS Application in Wildlife Research: A Comparison between Home Range Extension and Hawth's Analysis Tools. *Pennsylvania Wildlife Society Conference*. State College, PA.
- Walker, A., **Laubach, Z. M.** & Ramakrishan, U. 2007. GIS Application in Wildlife Research: A Comparison between Home Range Extension and Hawth's Analysis Tools. *Juniata Liberal Arts Symposium*. Huntingdon, PA.

INVITED RESEARCH SEMINAR

- The Developmental Origins of Health and Disease (DOHaD) hypothesis: A step into the wild. 16 Oct. 2018
Laubach, Z. M.
Biology Seminar, Eastern Michigan University, Ypsilanti, MI.
- Random Forests: An Overview of What, Why, How, and When* 14 Nov. 2012
Shriver, J., Miller, M.E., Endres, S. & **Laubach, Z. M.**
Research Seminar, Michigan Tech Research Institute, Ann Arbor, MI.
- MSU Hyena Research Project: A Slice from a Long Term Study in the Masai Mara Kenya* 3 April 2012
Laubach, Z. M.
Research Seminar, Michigan Tech Research Institute, Ann Arbor, MI.

TEACHING EXPERIENCE

Michigan State University, Department of Biology. East Lansing, MI

Teaching

- Introduction to Data Management and Analysis for Biologists and Behavioral Scientists January 2018 – April 2018
- Coordinated a lecture series at Michigan State University in conjunction with the African Graduate Students Association for advanced master's and PhD students
 - Bi-weekly lectures covered basics of R, fundamentals of data management, regression analysis, and causal inference
- IBIO 490: Behavioral Ecology of African Mammals May 2017 – June 2017; May 2018 – June 2018
- Co-lead Instructor for 6 credit study abroad course in East Africa, Kenya on animal behavior, field ecology and evolution
 - Presented lectures, advised field based research projects, and graded writing, quizzes, final reports and presentations

Graduate Teaching Assistant (GTA)

- IBIO 445 Evolution (3 semesters) January 2017 – May 2018
- Taught two sections (approximately 50 undergraduate students).
 - Graded exams, papers, and presentations; lead discussion section that reviewed concepts of evolutionary biology.
- IBIO 415: Ecological Aspects of Animal Behavior September 2016 – December 2016
- Taught two sections (approximately 40 undergraduate students).
 - Graded papers and presentations, gave guest lecture, lead discussion of primary literature on animal behavior and ecology.
- BIOLOGY 172: Organismal and Population Biology Laboratory September 2013 - June 2014
- Taught two sections (approximately 40 undergraduate students).
 - Graded papers and presentations, gave weekly mini-lectures, demonstrated/assisted with the lab protocol, guided students through design and execution of research projects on animal behavior and ecology.

University of Michigan, Department of Biology. Ann Arbor, MI

Graduate Student Instructor (GSI)

- BIOLOGY 226: Animal Physiology Laboratory September 2008 - December 2009
- Taught two 4-hour sections (approximately 36 undergraduate students).
 - Graded papers and presentations, gave weekly mini-lectures, demonstrated/assisted with the lab protocol, created quizzes.

Guest Lectures

- Evolutionary perspectives in public health. 28 April 2020
Laubach, Z. M.
Advanced Epidemiology, University of Colorado, Anschutz, School of Public Health, Aurora, CO.

Epigenetics and behavioral ecology of spotted hyenas. Laubach, Z. M. Biology, Nova Southeastern University, Davie, FL.	16 April 2020
Evolutionary perspectives in public health. Laubach, Z. M. Advanced Epidemiology, University of Colorado, Anschutz, School of Public Health, Aurora, CO.	25 April 2019
<i>Evolution of social behavior and group living</i> Laubach, Z. M. Evolution, Michigan State University, East Lansing, MI.	19 April 2018
<i>Evolution of social behavior and group living</i> Laubach, Z. M. Evolution, Michigan State University, East Lansing, MI.	4 Dec. 2017
<i>Associations of early-life social experience with DNA methylation in free-living spotted hyenas</i> Laubach, Z. M. Ecological Aspects of Animal Behavior, Michigan State University, East Lansing, MI.	27 Nov. 2017
<i>How to read a scientific paper</i> Laubach, Z. M. : BRInC Group (Computer Science Club), Michigan State University, East Lansing, MI.	17 April 2017
<i>Social Environment, Epigenetics, and Spotted Hyenas</i> Laubach, Z. M. Ecological Aspects of Animal Behavior, Michigan State University, East Lansing, MI.	14 Sept. 2016
<i>The Evolution of Spotted Hyena Sociality: Lessons from a Long Term Field Study</i> Laubach, Z. M. Animal Behavior, Juniata College, Huntingdon, PA.	29 April 2013
<i>MSU Hyena Research Project: A Slice from a Long Term Study in the Masai Mara Kenya</i> Laubach, Z. M. Field Mammology, University of Michigan Biological Station, Pellston, MI.	14 July 2012

Mentorship

Michigan State University

Undergraduate Student Mentorship

- Trained and mentored 19 undergraduate research assistants in behavioral ecology data collection and molecular laboratory work 2016 - current

Master Student Mentorship

Olivia Spagnuolo, Thesis Title: TBD 2015 – 2016

- Assisted with experimental design and statistical consulting for data analyses

Timothy Ikime, Thesis Title: Diurnal movement patterns, habitat use and energy cost of locomotion by spotted hyenas (*Crocuta crocuta*) in the Masai Mara National Reserve, Kenya 2014 - 2015

- Trained and provided analytic support for remote sensing to create a land use, land cover map

University of Michigan

Undergraduate Student Mentorship

- Trained and mentored 3 technicians to collect behavioral data and handle live birds in the field 2008 - 2009

RESEARCH EXPERIENCE

Michigan Technological Research Institute. Ann Arbor, MI

Consultant

September 2013 - 2014

Assistant Research Scientist

September 2012 - August 2013

Intern and Field Technician

January 2012 - August 2012; May 2010 - March 2011

- GIS and remote sensing image analyst.
- Used optical-thermal and radar sensor fusion to map coastal wetlands of the Great Lakes Basin as part of EPA and NASA grants.
- Spatial analysis in R, field data collection in emergent wetlands across Great Lakes, processing LandSat TM satellite and SAR radar imagery using ESRI Arc GIS, ERDAS Imagine, and ENVI software packages.

Michigan State University Hyena Research Project. Masai Mara National Reserve, Kenya

Research Assistant and Field Camp Manager

March 2011 - January 2012

- Conducted daily behavioral monitoring and data collection on spotted hyenas (*Crocuta crocuta*) by recording spatial distributions, demography, critical incident behaviors, and census prey and other carnivore populations in the park.
- Collected fecal samples and morphological and physiological data; trained in darting and blood collection.
- Managed camp employees, finances, data records, photo ID books, and fieldwork vehicles.

University of Michigan and Rocky Mountain Biological Laboratory. Ann Arbor, MI and Gothic, CO

Master's Student

September 2007 - August 2010

- Independent research for Masters of Science thesis on status badge signaling and stress physiology in free-living mountain white-crowned sparrows.
- Developed experimental design and implemented laboratory and field data collection; created behavioral ethogram, conducted focal animal samples, collected and assayed blood, and quantified reproductive success.

University of Michigan Natural History Museum. Ann Arbor, MI

Independent Study Student

September 2010 - December 2010

- Conducted museum grade curation; prepared mammal skins, skulls, skeletons, tissue and fluid samples.
- Maintained records and inventory of specimens.

United States Geological Survey (U.S.G.S). Ann Arbor, MI

Work Study Student

September 2007 - April 2008

- Conducted experiments on cat-ion exchange related to pH buffering of different *Sphagnum sp.*
- Managed data files and digitized imagery.

Juniata College and Pennsylvania Game Commission. Huntingdon, Pennsylvania

Undergraduate Research Student

September 2006 - August 2007

- Independent undergraduate research on patterns of white-tailed deer home range size, movement, and habitat use.
- Developed experimental design and implemented GIS analysis.
- Conducted literature searches, cleaned data, analyzed data, and prepared reports.

Juniata College and Foundation for Ecological Research, Advocacy, and Learning. India

Study Abroad Research Student

January 2006 - April 2006

- Conducted coral reef sampling and monitored vegetation response to tsunamis.
- Interviewed local artisan fisherman and sampled catch and bi-catch.
- Sampled dispersal of grassland invasive species (i.e. *Prosopis sp.*).

Juniata College and U.S. Corp of Army Engineers. Raystown Field Station, PA

Undergraduate Research Student

January 2005 - May 2005

- Independent undergraduate research on density distribution of white-tailed deer.
- Conducted a distance sampling survey and compared density estimation to infrared fly-over results.
- Cleaned and analyzed data for reports and presentations.

TECHNICAL SKILLS

Lab Training

- LUMA (LUMinometric Methylation Assay) for measuring genome wide DNA methylation
- Sodium Bisulfite treatment of DNA for measuring DNA methylation
- Polymerase chain reaction (PCR)
- Pyrosequencing
- DNA extraction
- Hormone Radio Immune Assay
- Enzyme-Linked Immunosorbent Assay (ELISA)

Field Training

- General: animal behavior data collection and designing observational and experimental field studies
- Hyenas: critical incident behavior sampling, fecal hormone collection, immobilization, blood collection, morphometric measurements, necropsy, and photo identification
- Birds: focal animal sampling, simulated territory intrusions, Potter trapping, morphometric measurements, banding, and blood collection

Bioinformatics Training

- Primer Design and Multiple Species Alignment for *de novo* gene sequencing of non-model organisms

Programming / Software

- R • Unix shell • AWK • Bash • SAS • SPSS • J-Watcher (for behavioral analysis) • UCSC Genome Browser • NCBI Blast • Genious • Primer3 • QGIS

PROFESSIONAL SOCIETY MEMBERSHIPS

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| • Animal Behavior Society (ABS) | 2013 – current |
| • Society for Integrative and Comparative Biology (SICB) | 2014 – current |
| • American Society of Naturalists (ASN) | 2020 – current |
| • U.S. Developmental Origins of Health and Disease (DOHaD) | 2017 – 2018 |

Service

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| • Moderator for Animal Behavior Society annual meeting, Development session | 2019 |
| • Peer Review Service, <i>Evolutionary Ecology</i> | 2018 – current |
| • Peer Review Service, <i>The Northeastern Naturalist</i> | 2018 – current |
| • Peer Review Service, <i>The Wilson Journal of Ornithology</i> | 2018 – current |
| • Poster Evaluator for 2018 Spring University Undergraduate Research and Arts Forum (UURAF) | 2018 |
| • Reviewer for MSU, Integrative Biology undergraduate award applications | 2018 |
| • Coordinated a lecture series in collaboration with the MSU African Graduate Student Association, titled: Introduction to Data Management and Analysis for Biologists and Behavioral Scientists | 2018 |
| • Peer Review Service, <i>Ethology</i> | 2015 - current |
| • Blog Authorship for <i>BEACON: An NSF Center for the Study of Evolution in Action</i> | 2017 |
| • Guest Speaker for MSU undergraduate club BrInC about reading scientific literature | 2017 |
| • Poster Evaluator for 2017 Spring University Undergraduate Research and Arts Forum (UURAF) | 2017 |
| • Moderator BEACON Congress Behavior Session | 2015 |
| • Evaluator for 2015 Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE) | 2015 |
| • Participant of Career Panel Discussion for Integrative Biology of Social Behaviors (IBSB) REU Students | 2015 |
| • Graduate Student representative MSU Zoology Graduate Affairs Committee | 2013 - 2014 |
| • Public Outreach Volunteer at Darwin Day at MSU Museum | 2014 |
| • Blog Authorship for <i>Notes From Kenya: MSU Hyena Research</i> | 2011 |