

Morgan Kain

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Education

McMaster University

PhD: Biology, June 2019

Dissertation supervisor: Benjamin M. Bolker

Dissertation Title: Modeling virus transmission and evolution in mixed communities

CGPA: 4.0

East Carolina University

MS: Biology, July 2015

Thesis supervisor: Michael W. McCoy

Thesis Title: The effects of environmental variation on individual variation

CGPA: 4.0

University of Pittsburgh

BS: Ecology and Evolution, April 2012

BA with honors: Economics, April 2012

Primary Advisor/Lab Association: Walter P. Carson

CGPA: 3.76

Employment

United States Geological Survey & Pennsylvania State University, September 2021—Present
Postdoctoral Scholar with the Amphibian Research and Monitoring Initiative (ARMI) under the supervision of Evan Grant and David Miller — Amphibian disease modeling and conservation

Stanford University, August 2019—August 2021

Postdoctoral Scholar with Biology and the Natural Capital Project under the supervision of Erin Mordecai and Lisa Mandle — Human and wildlife disease modeling

Publications

12. Glidden, C.K., Nova, N., **Kain, M.P.**, Lagerstrom, K.M., Skinner, E.B., Mandle, L., Sokolow, S.H., Plowright, R.K., Dirzo, R., De Leo, G.A., & Mordecai, E.A. **2021**. Human-mediated impacts on biodiversity and the consequences for zoonotic disease spillover. **Current Biology**, 31(19) R1342:R1361. DOI: <https://10.1016/j.cub.2021.08.070>

11. **Kain, M.P.**, Skinner, E., van den Hurk, A.F., McCallum, H., & Mordecai, E.A. **2021**. Physiology and ecology combine to determine host and vector importance of Ross River virus. **eLife**, 10:e67018. DOI: 10.7554/eLife.67018

10. Childs, M.L., **Kain, M.P.**, Harris, M., Kirk, D., Couper, L., Nova, N., Delwel, I., Ritchie, J., Becker, A.D., & Mordecai, E.A. **2021**. The impact of long-term non-pharmaceutical interventions on COVID-19 epidemic dynamics and control: the value and limitations of early models. **Proceedings of the Royal Society B**, 288(1957), 20219811. DOI: 10.1098/rspb.2021.0811

— *Note: This entry contains a portion of the title and most of the same authors as entry #13 but is a distinct publication—a retrospective COVID-19 analysis and comment on early epidemic models*

9. **Kain, M.P.**, Childs, M.L., Becker, A.D., & Mordecai, E.A. **2021**. Chopping the tail: how preventing super spreading can help to maintain COVID-19 control. **Epidemics**, 34,100430. DOI: 10.1016/j.epidem.2020.100430

8. Twomey, E., **Kain, M.P.**, Claeys, M., Summers K., Castroviejo-Fisher S., & VanBocxlaer, I. **2020**. Mechanisms of color convergence in a mimetic radiation of poison frogs. **The American Naturalist**, 195(5), E132-E149.
7. **Kain, M.P.**, & Bolker, B.M. **2019**. Predicting West Nile virus transmission in North American bird communities using phylogenetic mixed effects models and eBird citizen science data. **Parasites & Vectors**, 12.1:1-22.
6. Dushoff, J., **Kain, M.P.**, & Bolker, B.M. **2019**. I can see clearly now: reinterpreting statistical significance. **Methods in Ecology and Evolution**, 00:1-4. <https://doi.org/10.1111/2041-210X.13159>
 * One of Wiley's top 10 most downloaded papers from January 1, 2019—December 31, 2020
5. **Kain, M.P.**, Cattadori, I.M., & Bolker, B.M. **2018**. The evolutionary response of virulence to host heterogeneity: a general model with application to myxomatosis in rabbits co-infected with intestinal pathogens. **Evolutionary Ecology Research**, 19(3):257-278.
4. **Kain, M.P.**, & Bolker, B.M. **2017**. Can existing data on West Nile virus infection in birds and mosquitos explain strain replacement? **Ecosphere**, 8(3).
3. **Kain, M.P.**, & McCoy W.M. **2016**. Anti-predator behavioral variation among *Physa acuta* in response to temporally fluctuating predation risk by *Procambarus*. **Behavioral Processes**, 133:15-23.
2. **Kain, M.P.**, Bolker, M.B., & McCoy W.M. **2015**. A practical guide and power analysis for GLMMs: detecting among treatment variation in random effects. **PeerJ** 3:e1226.
1. **Kain, M.P.**, Battaglia L., Royo A., & Carson, W.P. **2011**. Over-Browsing in Pennsylvania creates a depauperate forest dominated by an understory tree: Results from a 60- year-old deer enclosure. **The Journal of the Torrey Botanical Society**, 138(3):322-326.

Preprints, Publications In Revision, Review, or Preparation

19. **Kain, M.P.**, USGS AMRI Scientists*, Grant, E.H.C. **In prep**. Chytrid fungus and methyl mercury contamination jointly lower amphibian survival: results from US-wide multi-year capture-mark-recapture monitoring.
 * *Authors and Author Order TBD*
18. **Kain, M.P.**, Grant, E.G.C., Miller, D.A. **In prep**. Validation of management-focused applied ecological models.
17. Holcomb, K.M., Mathis, S., Staples, J.E., Fischer, M., Barker, C.M., Beard, C.B., Nett, R.J., Keyel, A.C., Marcantonio, M., Childs, M.L., Gorris, M.E., Rochlin, I., Hamins-Puertolas, M., Ray, E.L., Uelman, J.A., Freedman, A.S., Hollingsworth, B.D., Das, P., Osthus, D., Humphreys, J.M., Nova, N., Mordecai, E.A., Cohnstaedt, L.W., Kirk, D., Kramer, L.D., Harris, M.J., **Kain, M.P.**, Reed, E.M.X., Johansson, M.A. **In Review (R1)**. Evaluation of an open forecasting challenge to assess skill of West Nile virus neuroinvasive disease prediction. **Parasites & Vectors**.
16. **Kain, M.P.**, Skinner, E.B., Athni, T.S.*, Mordecai, E.A., & van den Hurk, A.F. **In Review (R2)**. Not all mosquitoes are created equal: incriminating mosquitoes as vectors of arboviruses. **PLoS Neglected Tropical Diseases**.
 * *Undergraduate Author*
15. Anderson, C.B., Mordecai, E.A., Howard, M.E., Fernandez, L.E., Gaitán, M.S., Guevara, M., **Kain, M.P.**, Lescano, A.G., Mandle, L., Trujillo, S.M., Smith, J.R., Vogl, A., & Daily, G.C. **In revision**. Quantifying human-vector-environment relationships to map mosquito-borne disease risk.
14. **Kain, M.P.**, MacDonald, A.J., Mordecai, E.A., & Mandle, L. **2021**. Land-use planning for health: Tradeoffs and nonlinearities govern how land-use change impacts vector-borne disease risk. **medRxiv**. <https://www.biorxiv.org/content/10.1101/2021.06.09.447801v1>
13. Childs, M.L., **Kain, M.P.**, Kirk, D., Harris, M., Couper, L., Nova, N., Delwel, I., Ritchie, J., & Mordecai, E.A. **2020**. The impact of long-term non-pharmaceutical interventions on COVID-19 epidemic dynamics and control. **medRxiv**. <https://doi.org/10.1101/2020.05.03.20089078>

Book Chapters

1. Shocket, M.S, Anderson, C.B., Caldwell, J.M., Childs, M.L., Couper, L.I., Han, S., Harris, M.J., Howard, M.E., **Kain, M.P.**, MacDonald, A.J., Nova, N. Mordecai, E.A. **2021**. Environmental drivers of vector-borne diseases. In: *Population Biology of Vector-borne Diseases*, Ed. Drake, J.M., Bonsall, M., Strand, M. Oxford University Press.

Technical Reports

1. **Kain, M.P.**, Anderson, C.B., Mandle, L. **2020**. Modeling dengue risk in Madre de Dios, Peru
1A. Technical report for the government of Peru
1B. Model details and extended results with R and Stan code. <https://osf.io/t58wg/>

Advising

- Jason Starr - Briarcliff High School (NYC) Science Research Program. 2021. Project title: COVID-19 transmission dynamics and intervention strategies: an agent-based model.
- Megan Hall - Stanford undergraduate summer research project. 2020. Project title: Pathogen host- and vector-range: understanding the evolution of pathogen plasticity and predicting spillover.

Teaching and Other Work Experience

Graduate Teaching Assistant, McMaster University, September 2015–April 2019

- Population Biology (McMaster BIOLOGY 3SS3), Winter 2016, 2017, 2018, 2019
 - Guest full-class lecture given on species competition, Winter 2018
- Bioinformatics (McMaster BIOLOGY 3S03), Fall 2017
- Communities and Ecosystems (McMaster BIOLOGY 3DD3), Fall 2016, 2018
- Biodiversity, Evolution, and Humanity (McMaster BIOLOGY 1M03), Fall 2015

Graduate Teaching Assistant, East Carolina University, August 2013–July 2015

- Introductory Biology Wet Laboratory (East Carolina BIOL 1101), Fall and Spring Semesters 2013–2015

Plant Ecology Field & Lab Research Tech, University of Alaska Fairbanks, June 2012–September 2012

Ecology Lab Tech, University of Pittsburgh, August 2010–November 2010, August 2011–November 2011

Conference Presentations

- Starr, J.*[^], & Kain, M.P. **2022. Paper and Oral** presentation. An agent-based model for localized COVID-19 transmission dynamics and intervention impacts. *Newtech Congress 2023*.
[^]*Awarded one of the best 10 submitted papers.* **High School Author*
- Starr, J.,* & Kain, M.P. **2021. Poster** presentation. Local COVID-19 Transmission Dynamics and Intervention Impacts: an Agent Based Model. *Sigma Xi Student Research Conference*.
**High School Author*
- Kain, M.P., Skinner, E., van den Hurk, A., McCallum, H., & Mordecai, E.A. **2021. Oral** presentation. Physiology and ecology combine to determine host and vector importance for Ross River virus and other vector-borne diseases. *MIDAS Network Annual Meeting*.

- Hall, M.*, & Kain, M.P. **2020. Poster** presentation. Vector and Host Range of Vector-borne Viruses. *Stanford Undergraduate Summer Research Symposium*.
*Undergraduate Author
- Kain, M.P., Mandle, L., Mordecai, E.A., & MacDonald, A.J. **2020. Oral** presentation. Incorporating infectious disease transmission into land-use planning. *Ecological Society of America*.
- Kain, M.P., & Bolker, B.M. **2019. Poster** presentation. Stochastic mutation-selection-drift models of parasite virulence evolution. *Ecology and Evolution of Infectious Diseases*.
- Kain, M.P., & Bolker, B.M. **2019. Oral** presentation. Predicting West Nile virus transmission in North American bird communities using phylogenetic mixed effects models and eBird citizen science data. *Ontario Ecology, Ethology, and Evolution Colloquium*.
- Kain, M.P., & Bolker, B.M. **2018. Oral** presentation. Predicting bird community reservoir competence for West Nile virus using phylogenetic mixed effects models. *International Statistical Ecology Conference*.
- Kain, M.P., & Bolker, B.M. **2018. Oral** presentation. Predicting bird community reservoir competence for West Nile virus using phylogenetic mixed effects models. *McMaster Biology Graduate Student Research Day*.
- Kain, M.P., & Bolker, B.M. **2017. Oral** presentation. Virulence evolution given host heterogeneity. *McMaster Biology Graduate Student Research Day*.
- Kain, M.P., & Bolker, B.M. **2016. Poster** presentation. A synthesis of West Nile Virus experimental infections in birds and mosquitos. *Ecology and Evolution of Infectious Diseases*.
- Kain, M.P., & McCoy, W.M. **2015. Oral** presentation. Variability in anti-predator behavior in response to a variable predator environment: Quantifying a novel form of behavioral plasticity. *Society of Integrative and Comparative Biology*.
- Kain, M.P., Bolker, B.M., & McCoy, W.M. **2014. Poster** presentation. Quantifying variation in individual reaction norms: a practical guide and power analysis for GLMM. *Ecological Society of America*.
- Kain, M.P., & Carson, W.P. **2011. Oral** presentation. Does a rare climatic event cause invasion? *University of Pittsburgh Honors College Interdisciplinary Meeting of Brackenridge Fellows*.

Honors and Awards

- Second Place Overall Oral Presentation. Awarded at: Ontario Ecology, Ethology, and Evolution Colloquium, 2019.
- First Place Oral Presentation in Ecology and Evolution. Awarded at: McMaster Graduate Student Research Day, 2018.
- First Place Publication in Ecology and Evolution within McMaster University's Biology department for 2017. Awarded at: McMaster Graduate Student Research Day, 2018.
- East Carolina University Life Sciences Master's Thesis Award, 2017: Masters thesis awarded as the best thesis in the school of Life Sciences at East Caroline University that was completed in 2015.

Scholarships and Funding

McMaster University

- International Excellence Award, September 2016-August 2017 (\$5,000)
- Graduate Research Scholarship, September 2015-August 2016 (\$1,800)
- Travel Scholarships, 2016, 2017, 2018, 2019 (\$500)

East Carolina University

- Graduate Scholar Award, August 2013-July 2015 (\$2,000 Per Semester)
- Travel Scholarship, August 2014 (\$650)

University of Pittsburgh

- Honors College Brackenridge Undergraduate Fellowship, May 2011 (\$3,500)

Non-Academic Interests and Personal Achievements

- Birding: Enthusiastic amateur birder, currently at 453 ABA birds, 2016—Present
- Go: Rank of 1 Dan amateur in the ancient board game Go (aka igo, weiqi), 2012—2013