Joshua Cullen

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Education

Texas A&M University, College Station, TX — August 2019
Ph.D. Wildlife & Fisheries Sciences

Clemson University, Clemson, SC — May 2013
B.S. Biological Sciences

Research Interests

I am a quantitative ecologist with 9 years of experience using R and a passion for finding novel insights from large datasets. I am broadly interested in the ecological roles and movement patterns of vertebrate organisms to assess how sympatric species partition niche space and interact with their environment, respectively. I have developed an R package (`bayesmove`) for the estimation of latent (unobserved) behavioral states from animal movement data using two different Bayesian models, with ongoing method development for new models to estimate landscape connectivity and habitat selection. I am also interested in data exploration, acquisition, and dissemination via interactive web applications (via Shiny), which may also serve as decision-support tools. I am particularly interested in using quantitative methods (e.g., Bayesian models, state-space models, mixed effects models, multivariate ordinations and clustering) to address complex ecological problems.

Publications

Hardin E, **Cullen J**, Fuentes MMPB. (in review). Comparison of acoustic and satellite telemetry as methods for quantifying space use of marine species.

Valle D, Attias N, **Cullen JA**, Desbiez ALJ, Giroux A, Oliveria-Santos LG, Fletcher R. (in review). Improving the understanding of animal habitat selection and resource use with the time model and the time-explicit step selection function (tSSF).

Cullen JA, Attias N, Desbiez ALJ, Valle D. (2023). Biologging as an important tool to uncover behaviors of cryptic species: An analysis of giant armadillos (*Priodontes maximus*). *PeerJ*, *11*:e14726 https://doi.org/10.7717/peerj.14726.

Cullen JA, Poli CL, Fletcher Jr RJ, Valle D. (2022). Identifying latent behavioral states in animal movement with non-parametric Bayesian methods. *Methods in Ecology and Evolution*. https://doi.org/10.1111/2041-210X.13745.

Valle D, Jameel Y, Betancourt B, Azeria ET, Attias N, **Cullen J**. (2022). Automatic selection of the number of clusters using Bayesian clustering and sparsity-inducing priors. *Ecological Applications*. https://doi.org/10.1002/eap.2524.

Lawson MC, **Cullen JA**, Nunnally CC, Rowe GT, Hala DN. (2021). PAH and PCB body-burdens in epibenthic deep-sea invertebrates from the northern Gulf of Mexico. *Marine Pollution Bulletin*, *162*: 111825.

Marshall CD, **Cullen, JA**, Al-Ansi M, Hamza S, Abdel-Moati MA. (2020). Environmental drivers of habitat use by hawksbill turtles (*Eretmochelys imbricata*) in the Arabian Gulf (Qatar). *Frontiers in Marine Science*, *7*: 961.

Bacosa HP, Kamalanathan M., **Cullen J**, Shi D, Xu C, Schwehr KA, Hala D, Wade TL, Knap AH, Santschi PH, Quigg A. (2020). Marine snow aggregates are enriched in polycyclic aromatic hydrocarbons (PAHs) in oil contaminated waters: Insights from a mesocosm study. *Journal of Marine Science and Engineering, 8*(10): 781.

Cullen JA, Marshall CD. (2019). Do sharks exhibit heterodonty by tooth position and over ontogeny?: A comparison using elliptic Fourier analysis. *Journal of Morphology* 280: 687-700.

Cullen JA, Marshall CD, Hala D. (2019). Integration of multi-tissue PAH and PCB burdens with biomarker activity in three coastal shark species from the northwestern Gulf of Mexico. *Science of the Total Environment* 650: 1158-1172.

Hala D, **Cullen JA**, Hernout B, Ivanov I. (2018). *In silico* predicted transcriptional regulatory control of steroidogenesis in spawning female fathead minnows (*Pimephales promelas*). *Journal of Theoretical Biology* 455: 179-190.

Marshall CD, Al Ansi M, Dupont J, Warren C, Al Shaikh I, **Cullen J**. (2018). Large dugong (*Dugong dugon*) aggregations persist in coastal Qatar. *Marine Mammal Science* 34(4): 1154-1163.

Cullen JA, Maie T, Schoenfuss HL, Blob RW. (2013). Evolutionary Novelty versus Exaptation: Oral Kinematics in Feeding versus Climbing in the Waterfall-Climbing Hawaiian Goby *Sicyopterus stimpsoni*. *PLoS ONE* 8(1): e53274.

Research Experience

Postdoctoral Research: 2021 – present
Dept. of Earth, Ocean, and Atmospheric Sciences, Florida State University
Research Advisors: Dr. Mariana Fuentes (FSU), Dr. Margaret Lamont (USGS), and Dr. Christopher Marshall (TAMU)

- Development of a transferable species distribution model using green sea turtles (*Chelonia mydas*) as the study species by accounting for algorithm and spatial scale used, as well as life stage differences
- Use of Bayesian hierarchical modeling in transferable model
- Method comparison of behavioral state and space-use estimates in migrating green turtles and assessing how method choice impacts ecological inferences
- Developed a Shiny app to collect spatial data from an expert elicitation workshop on invasive species distributions and habitat preferences in the southeast US
- Taught informal lectures covering topics in ecology, GIS, computer programming in R, and species distribution modeling

Postdoctoral Research: 2019 – 2021
School of Forest, Fisheries, and Geomatics Sciences, University of Florida
Research Advisors: Dr. Denis Valle and Dr. Robert Fletcher

- Development of novel Bayesian methods to discern latent behavioral states from animal biotelemetry data
- Estimated behavioral states of endangered snail kites (*Rostrhamus sociabilis plumbeus*) across Florida and conducted population viability analysis with emphasis on climate change impacts in collaboration with USFWS
- Projected changes in snail kite population size via stochastic simulation modeling as part of PVA
- Estimated behavioral states, activity budget, and state-habitat relationships in giant armadillos (*Priodontes maximus*) in the Brazilian Pantanal
- Developed Shiny apps for exploration of animal movement data

Dissertation Research: 2013 – 2019
Department of Wildlife & Fisheries Sciences, Texas A&M University
Research Advisor: Dr. Christopher Marshall

- Integrative study of sharks and their roles in coastal ecosystems over ontogeny by measuring bite force, trophic ecology, and conducting a risk assessment of major organic pollutants (PAHs and PCBs)
- The allometric scaling of bite force was measured over ontogeny and related to ontogenetic dietary shifts (via $\delta^{13}C$ and $\delta^{15}N$ stable isotopes)

- 45 organic pollutants (PAHs/PCBs) were quantified in shark liver and muscle tissue and these burdens were related to feeding ecology (via stable isotopes)
- Shark tooth shape was characterized using elliptic Fourier analysis to evaluate heterodonty over ontogeny and among tooth positions of a given species

Qatar Field and Ecological Modeling Experience: 2014 – 2018
Department of Wildlife & Fisheries Sciences, Texas A&M University
Research Advisor: Dr. Christopher Marshall

- Studied movement patterns of hawksbill (*Eretmochelys imbricata*) and green sea turtles (*Chelonia mydas*) and their environmental drivers in the Arabian Gulf using Bayesian state-space models and species distribution models (GAMMs)
- Remote sensing data were downloaded and extracted for each of the static and dynamic environmental variables included in the species distribution models
- Seasonal utilization distributions were calculated and environmental variables were used to determine drivers of latent states (i.e., transit and area restricted search)

Undergraduate Research: 2010 – 2013
Department of Biological Sciences, Clemson University
Research Advisor: Dr. Richard Blob

- Kinematic analysis of a Hawaiian climbing goby (*Sicyopterus stimpsoni*) comparing cranial movements during feeding and climbing behaviors
- Analyzed kinematic profiles of multiple variables to determine potential evolutionary relationship between superficially similar behaviors
- This research resulted in an oral presentation at a national conference and a publication

Technical Skills

Coding languages: R, JAGS, Stan, Nimble
Software: QGIS, ArcGIS, Google Earth Engine
Other: Git/GitHub, Shiny, Rmarkdown, Quarto, LaTeX, Adobe Illustrator/Photoshop

Software Developed

bayesmove (R package, http://joshcullen.github.io/bayesmove/)

Fellowships and Awards

NSF Ocean Sciences Postdoctoral Research Fellowship (Florida State University)	2021
University of Florida Informatics Institute Postdoctoral Fellowship	2019
Texas A&M University at Galveston Graduate Boost Fellowship	2017
Texas A&M University Doctoral Merit Fellowship	2013
College of Agriculture and Life Sciences Excellence Fellowship (Texas A&M University)	2013
College of Agriculture, Forestry and Life Sciences Senior Award (Clemson University)	2013
NSF Research Experience for Undergraduates (Clemson University)	2012
NSF Research Experience for Undergraduates (Rutgers University)	2011

Grants & Funding

NSF Ocean Sciences Postdoctoral Research Fellowship ($273,561)	2021
US Fish & Wildlife Service Snail Kite Population Viability Analysis ($12,551)	2021
Texas A&M University at Galveston – Department of Marine Biology Mini-Grants ($2500)	2014 – 2018

Erma Lee and Luke Mooney Graduate Student Travel Grant ($1000) 2015, 2017
Texas Sea Grant, Grants-In-Aid of Graduate Research ($1000) 2014

Invited Presentations

"Identifying latent behavioral states in animal movement data" (as part of symposium for The Wildlife Society Annual Conference) 2022
South Coast MA UseR Group March Meeting: Visualization of Data in Space and Time with R Shiny 2022
EFI Shiny Webinar Series: Visualization of Data in Space and Time: An Interactive Framework 2021

Organized Workshops

"Space-use and behavioral state estimation" workshop – Fuentes Lab, Florida State University 2022
Co-organized "Southeast Invasive Species Expert Elicitation" workshop – SECASC grant 2022
Co-organized "Interactive Web-based Visualizations and Decision Support Tools in Shiny/R Workshop" – Northeast Fish and Wildlife Conference 2022
"Using Git and GitHub with RStudio" workshop – Fuentes Lab, Florida State University 2022
Co-organized "Expanding the scope of connectivity" workshop – IALE Conference 2021

Service

Co-organized "Statistical Methods Seminar Series" webinar – Ecological Forecasting Initiative/ Statistical Ecology section of ESA 2021 – present
Co-organized "Taking your R Shiny apps to the next level" webinar – Ecological Forecasting Initiative 2021
Secretary, ESA Statistical Ecology Section 2020 – 2022
Sea Turtle Nesting Responder (Upper Texas Coast) 2016 – 2019

Reviewer for *Journal of Anatomy, Remote Sensing, Science of the Total Environment, Scientific Reports, Sustainability*

Professional Societies

Ecological Society of America
The Wildlife Society

Conference Presentations

Cullen, JA, Attias N, Poli CL, Santos A, Desbiez ALJ, Fletcher Jr RJ, Fuentes MMPB, Valle D. November 2022. Identifying latent behavioral states in animal movement data. The Wildlife Society Meeting, Spokane, WA, USA.

Cullen, JA, Attias N, Desbiez ALJ, Valle D. August 2021. Uncovering behaviors of cryptic species: latent behavioral states, activity budgets, and habitat associations of giant armadillos (*Priodontes maximus*) in the Brazilian Pantanal. Ecological Society of America Meeting, virtual.

Cullen, JA, Poli CL, Fletcher Jr RJ, Valle D. August 2020. Non-parametric Bayesian methods for the identification of latent behavioral states from animal movement. Ecological Society of America Meeting, virtual.

Cullen, JA, Hala, D, Marshall, CD. January 2019. How does feeding ecology impact the accumulation of PAHs and PCBs in sympatric shark species? Southern Division of the American Fisheries Society Meeting, Galveston, TX, USA.

Marshall, CD, **Cullen, JA**, Al-Ansi, M. January 2019. Spatiotemporal Movement Patterns of Hawksbill Sea Turtles (*Eretmochelys imbricata*) in an Extreme Environment: The Arabian Gulf as a Living Laboratory for Investigating Organismal Response to Climate Change. Society for Integrative and Comparative Biology Meeting, Tampa, FL, USA.

Cullen, JA, Hala, D, Marshall, CD. January 2019. Influence of Feeding Ecology on Accumulation of PAHs and PCBs in Three Sympatric Shark Species. Society for Integrative and Comparative Biology Meeting, Tampa, FL, USA.

Burroughs, L, Faulkner, P, **Cullen, J**, Marshall, C, Hala, D. November 2017. Hepatic *in vitro* biotransformation of selected pharmaceuticals in two species of Gulf of Mexico sharks. Society of Environmental Toxicology and Chemistry Meeting, Minneapolis, MN, USA.

Cullen, JA, Marshall, CD, Hala, D. November 2017. Comparative Analysis of Exposure and Physiological Response to PAHs and PCBs in Three Coastal Sharks. Society of Environmental Toxicology and Chemistry Meeting, Minneapolis, MN, USA.

Marshall, CD, **Cullen, JA**, Al Ansi, MA. July 2017. Hawksbill Sea Turtle (*Eretmochelys imbricata*) Spatial Movement in an Extreme Environment: The Arabian Gulf as a Living Laboratory for Investigating Organismal Response to Climate Change. Joint Meeting of Ichthyologists and Herpetologists, Austin, TX, USA.

Cullen, JA, Marshall, CD. July 2017. Morphological Changes in Shark Teeth May Facilitate Ontogenetic Dietary Shifts. Joint Meeting of Ichthyologists and Herpetologists, Austin, TX, USA.

Merrill, ML, **Cullen, JA**, Marshall, CD. April 2016. Tooth Morphology of Three Texas Coastal Sharks. Texas A&M University at Galveston Undergraduate Research Symposium. Galveston, TX, USA.

Cullen, JA, TinHan, T, Plumlee, J, Wells, RJD, Marshall, CD. January 2016. Impact of Allometry and Feeding Biomechanics on Ontogenetic Dietary Shifts in Three Coastal Sharks. Society for Integrative and Comparative Biology Meeting, Portland, OR, USA.

Cullen, JA, Marshall, CD. May 2015. Ontogenetic Scaling of Bite Performance in Three Sympatric Sharks. Canadian Society of Zoologists Meeting, Calgary, AB, CA.

Marshall, CD, **Cullen, JA**, Al Ansi, MA, Dupont, J. January 2015. Iconic Marine Vertebrates of the Qatari Arabian Gulf: Preliminary Data on Sea Turtle and Dugong Morphometrics, Movement, and Strandings. Society for Integrative and Comparative Biology Meeting, West Palm Beach, FL, USA.

Cullen, JA, Marshall, CD. January 2015. A Preliminary Analysis of Ontogenetic Scaling of Bite Performance Within Three Species of Texas Sharks. Society for Integrative and Comparative Biology Meeting, West Palm Beach, FL, USA.

Cullen, JA, Maie, T, Schoenfuss, HL, Blob, RW. January 2013. Can exaptation facilitate terrestrial invasion? Oral kinematics of climbing and feeding in a waterfall-climbing gobiid fish. Society for Integrative and Comparative Biology Meeting, San Francisco, CA, USA.