

Joshua Cullen

Education

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

August 2019

Clemson University, Clemson, SC
B.S. Biological Sciences

May 2013

Research Experience

ORISE Postdoctoral Fellow:

2023 – present

Eastern Ecological Science Center, US Geological Survey

- Investigated spatiotemporal overlap of GPS tagged mallards (*Anas platyrhynchos*) with confirmed outbreaks of highly pathogenic avian influenza (HPAI) H5N1 in poultry farms
- Segmented tracks into periods of restricted movement and estimated mallard range distributions via AKDE
- Fit a Bayesian hierarchical occupancy model in Stan to estimate the impact of mallard overlap and farm type on H5N1 outbreak probability at poultry farms while accounting for imperfect reporting
- Developed reproducible documents and dashboards in Quarto for sharing results

NSF Postdoctoral Fellow:

2021 – 2023

Dept. of Earth, Ocean, and Atmospheric Sciences, Florida State University

- Developed frequentist and Bayesian hierarchical methods (e.g., GLM, GAM, BRT, Gaussian Process) to generate transferable habitat selection models using green sea turtles (*Chelonia mydas*) as a focal species
- Comparison of numerous statistical methods to estimate behavioral states and space-use in migrating green turtles and assessing how method choice impacts ecological inferences
- Downloaded remotely sensed environmental data as NetCDF files from NOAA's ERDDAP server, which I subsequently wrangled and extracted for habitat selection modeling
- Developed workshops on statistical methods for movement ecology and version control in RStudio with GitHub
- Workshop [recordings](#) hosted on YouTube have received ~3000 views and the [website](#) hosting workshop resources and R scripts has been accessed by 1200 visitors from 76 countries
- Wrote proposal and developed budget for funded NSF postdoctoral fellowship

Postdoctoral Fellow:

2019 – 2021

School of Forest, Fisheries, and Geomatics Sciences, University of Florida

- Developed novel Bayesian statistical methods to identify behavioral states from animal biotelemetry data and developed [{baysmove}](#) R package to apply these methods
- Applied flexible Bayesian models to the analysis of spatial and temporal patterns of endangered snail kite (*Rostrhamus sociabilis plumbeus*) and giant armadillo (*Prionomys maximus*) movement with respect to remotely sensed environmental variables
- Remote sensing data downloaded and extracted to calculate different spectral indices using a variety of remote sensing imagery (Landsat 8, Sentinel-2) via Google Earth Engine
- Conducted population viability analysis of snail kites across Florida using a CJS multi-state mark-resight model to project future changes in population size as part of a USFWS Species Status Assessment
- Managed and completed 4 separate projects on novel statistical method development related to animal movement ecology and their application towards conservation efforts

Dissertation Research:

2013 – 2019

Department of Wildlife & Fisheries Sciences, Texas A&M University

- 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 $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ 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
- Applied frequentist and Bayesian GLMs, hierarchical models, multivariate ordinations, and clustering to address study objectives

Qatar Field and Ecological Modeling Experience:

2014 – 2018

Department of Wildlife & Fisheries Sciences, Texas A&M University

- The movement ecology of hawksbill (*Eretmochelys imbricata*) and green sea turtles (*Chelonia mydas*) was studied in relation to biophysical variables 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 biophysical variables were used to determine drivers of latent states (i.e., transit and area restricted search)

Publications

- Cullen JA**, Santos AJB, White JW, Komoroske LM, Stahelin G, Fuentes MMPB. (in review). Method selection and temporal scale greatly impact ecological inferences on animal behavior and space use.
- Cullen JA**, Domit C, Lamont MM, Marshall CD, Santos AJB, Sasso CR, Al Ansi M, Fuentes MMPB. (in review). A transferable modeling approach to predict species distributions from animal telemetry data.
- Valle D, Attias N, **Cullen JA**, Hooten M, Desbiez ALJ, Giroux A, Oliveria-Santos LG, Fletcher R. (in review). Bridging the gap between movement data and connectivity analysis using the time-explicit Step Selection Function (tSSF).
- 14)** Hardin EE, **Cullen JA**, Fuentes MMPB. (2024). Comparing acoustic and satellite telemetry: an analysis quantifying the space use of *Chelonia mydas* in Bimini, Bahamas. *Royal Society Open Science*, 11:231152.
- 13)** Weber S, **Cullen JA**, Fuentes MMPB. (2023). Isotopic niche overlap among foraging marine turtle species in the Gulf of Mexico. *Ecology and Evolution*, 13:e10741.
- 12)** Santos AJB, **Cullen J**, Vieira DHG, Lima EHSM, Quennessen V, Santos EAPd, Bellini C, Ramos R, Fuentes MMPB. (2023). Decoding the interesting movements of marine turtles using a fine-scale behavioral state approach. *Frontiers in Ecology and Evolution*, 11:1229144.
- 11)** **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>.
- 10)** **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>.
- 9)** 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>.
- 8)** 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.
- 7)** 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.

- 6) 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.
- 5) **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.
- 4) **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.
- 3) 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.
- 2) 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.
- 1) **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.

Teaching Experience

- Teaching Assistant, Natural History of Vertebrates (MARB 315) 2014 – 2019
Texas A&M University at Galveston, Galveston, TX
- Undergraduate Teaching Assistant, Vertebrate Biology (BioSci 307) 2012
Clemson University, Clemson, SC

Technical Skills & Professional Development

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

- Participant in Leadership Academy and Network for Diversity and Inclusion in the Geosciences (LANDInG) Program hosted by the American Geophysical Union (AGU) 2022 – 2023

Software Developed

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

Fellowships and Awards

- ORISE Postdoctoral Fellowship (USGS, Eastern Ecological Science Center) 2023
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 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 – 2022
Co-organized “ Taking your R Shiny apps to the next level ” webinar – Ecological Forecasting Initiative Secretary, ESA Statistical Ecology Section	2021 2020 – 2022
Sea Turtle Nesting Responder (Upper Texas Coast)	2016 – 2019

Reviewer for: *Ecology*, *Journal of Anatomy*, *Journal of Experimental Marine Biology and Ecology*, *Remote Sensing*, *Science of the Total Environment*, *Scientific Reports*, *Sustainability*, *USGS Internal Review*

Professional Societies

Ecological Society of America

Conference Presentations

Blob RW, Diamond KM, Sepa EB, **Cullen J**, Maie T, Schoenfuss HL. January 2024. Grazing kinematics and the evolution of waterfall-climbing in goby fishes. Society for Integrative and Comparative Biology, Seattle, WA, USA.

- Blob RW, Diamond KM, **Cullen J**, Maie T, Schoenfuss HL. July 2023. Feeding kinematics of algal grazing in the gobiid fish *Sicydium punctatum*: A missing link in the evolution of goby climbing mechanics? International Congress of Vertebrate Morphology, Cairns, Queensland, Australia.
- Cullen JA**, Fletcher Jr RJ, Jeffrey B. April 2023. Population Viability of the Everglade Snail Kite Under Future Climate Change Scenarios. Greater Everglades Ecosystem Restoration Meeting, Coral Springs, FL, USA.
- Cullen JA**, Lamont M, Marshall C, Domit C, Sasso C, Fuentes MMPB. March 2023. A transferable modeling approach to predict habitat selection of green turtles (*Chelonia mydas*). Southeast Regional Sea Turtle Meeting, Orange Beach, AL, USA.
- 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.
- Hardin EE, Fuentes MMPB, **Cullen JA**. March 2022. Comparison of acoustic and satellite telemetry as methods for quantifying space use of marine turtles within foraging grounds. International Sea Turtle Symposium, Perth, Australia.
- 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.