

Théo Michelot

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EDUCATION

- PhD in Statistics** 2016-2019
University of Sheffield, UK
Thesis: Stochastic models of animal movement and habitat selection
- MSc in Mathematical and Software Engineering** 2010-2015
INSA de Rouen, France

EMPLOYMENT

- Lecturer in statistics** Since January 2022
University of St Andrews, UK
- Postdoctoral research fellow** 2019-2021
University of St Andrews, UK
Development of flexible continuous-time stochastic processes with applications in ecology

OTHER RESEARCH EXPERIENCE

- Research placement** July-December 2015
University of St Andrews, UK
Development of an R package for the analysis of ecological data with hidden Markov models
- Research placement** June-September 2013
University of St Andrews, UK
Analysis of ecological and financial data with hidden Markov models

PUBLICATIONS

19. Klapstein, N.J., Potts, J.R., **Michelot, T.**, Pilfold, N.W., Börger, L., Lewis, M.A., Derocher, A.E. (in press) Energy-based step selection analysis: modelling the energetic drivers of animal movement and habitat use. *Journal of Animal Ecology*.
18. Glennie, R., Adam, T., Leos-Barajas, V., **Michelot, T.**, Photopoulou, T., & McClintock, B.T. (in press). Hidden Markov models: pitfalls and opportunities in ecology. *Methods in Ecology and Evolution*. DOI: 10.1111/2041-210X.13801.
17. **Michelot, T.**, Glennie, R., Harris, C., Thomas, L. (2021). Varying-coefficient stochastic differential equations with applications in ecology. *Journal of Agricultural, Biological and Environmental Statistics*, 26 (3), pp. 446-463.
Selected for invited session at the Joint Statistical Meetings 2022.
16. Connors, M., **Michelot, T.**, Heywood, E., Orben, R.A., Phillips, R., Vyssotski, A., Shaffer, S.A., Thorne, L. (2021). Hidden Markov models reveal major animal movement modes from multi-sensor tags: a case study of four albatross species. *Movement Ecology*, 9 (7), DOI: 10.1186/s40462-021-00243-z.
15. Runde, B.J., **Michelot, T.**, Bacheler, N.M., Shertzer, K.W. and Buckel, J.A. (2020). Assigning fates in telemetry studies using hidden Markov models: an application to deepwater groupers released with descender devices. *North American Journal of Fisheries Management*, 40, pp. 1417–1434.

14. **Michélot, T.**, Blackwell, P.G., Chamaillé-Jammes, S., Matthiopoulos, J. (2020). Inference in MCMC step selection models. *Biometrics*, 76, pp. 438-447.
Selected for Young Biometrician Award 2021 (honourable mention).
13. Farhadinia, M.S., **Michélot, T.**, Johnson, P.J., Hunter, L.T.B., MacDonald, D.W. (2020). Understanding decision making in a food-caching predator using hidden Markov models. *Movement Ecology*, 8 (9), DOI: 10.1186/s40462-020-0195-z.
12. Spangenberg, M., Serrouya, R., Dickie, M., DeMars, C., **Michélot, T.**, Boutin, S., Wittmann, M.J. (2019). Slowing down wolves to protect boreal caribou populations: a spatial simulation model of linear feature restoration. *Ecosphere*, 10 (10), DOI: 10.1002/ecs2.2904.
11. **Michélot, T.**, Gloaguen, P., Blackwell, P.G., Étienne, M.P. (2019). The Langevin diffusion as a continuous-time model of animal movement and habitat selection. *Methods in Ecology and Evolution*, 10 (11), pp. 1894-1907.
10. Bacheler, N. M., **Michélot, T.**, Cheshire, R. T., Shertzer, K. W. (2019). Fine-scale movement patterns and behavioral states of gray triggerfish *Balistes capriscus* determined from acoustic telemetry and hidden Markov models. *Fisheries Research*, 215, pp. 76-89.
9. **Michélot, T.**, Blackwell, P.G. (2019). State-switching continuous-time correlated random walks. *Methods in Ecology and Evolution*, 10 (5), pp. 637-649.
8. **Michélot, T.**, Blackwell, P.G., Matthiopoulos, J. (2019). Linking resource selection and step selection models for habitat preferences in animals. *Ecology*, 100 (1), DOI: 10.1002/ecy.2452.
7. Grecian, W.J., Lane, J., **Michélot, T.**, Wade, H., Hamer, K.C. (2018). Understanding the ontogeny of foraging behaviour: insights from combining marine predator bio-logging with satellite-derived oceanography in hidden Markov models. *Journal of the Royal Society Interface*, 15 (143), DOI: 10.1098/rsif.2018.0084.
6. McClintock, B., **Michélot, T.** (2018). momentuHMM: R package for generalized hidden Markov models of animal movement. *Methods in Ecology and Evolution*, 9 (6), pp. 1518-1530.
5. **Michélot, T.**, Langrock, R., Bestley, S., Jonsen, I.D., Photopoulou, T., Patterson, T.A. (2017). Estimation and simulation of foraging trips in land-based marine predators. *Ecology*. 98 (7), pp. 1932-1944.
4. Langrock, R., Kneib, T., Glennie, R., **Michélot, T.** (2017). Markov-switching generalized additive models. *Statistics and Computing*. 27 (1), pp. 259-270.
3. **Michélot, T.**, Langrock, R., Patterson, T.A. (2016). moveHMM: An R package for analysing animal movement data using hidden Markov models. *Methods in Ecology and Evolution*, 7 (11), pp. 1308-1315.
2. **Michélot, T.**, Langrock, R., Kneib, T., King, R. (2016). Maximum penalized likelihood estimation in semiparametric capture-recapture models. *Biometrical Journal*, 58, pp. 223-239.
1. Langrock, R., **Michélot, T.**, Sohn, A., Kneib, T. (2015). Semiparametric stochastic volatility modelling using penalized splines. *Computational Statistics*, 30, pp. 517-537.

IN PREPARATION

Michélot, T., Glennie, R., Quick, N., Harris, C., Thomas, L. Continuous-time modelling of behavioural responses in animal movement.

Michélot, T., Glennie, R. hmmTMB: an R package for flexible hidden Markov models with non-parametric and random effects.

Invernizzi, E., **Michelot, T.**, Ng, N., Macqueen, E., Rouviere, A. and Sasaki, T. Using hidden Markov models to study ant collective behaviour: self-organised building activity regulated through a feedback loop.

Chance, A.M., Demarais, S., Strickland, B.K., Street, G.M., **Michelot, T.**, McKinley, W. Danger or does: what drives male white-tailed deer movements?

SOFTWARE

I have developed several software packages for the R programming language, including:

- **moveHMM**: Analysis of animal movement data with hidden Markov models. Available on CRAN: cran.r-project.org/package=moveHMM. Lead developer and maintainer.
- **momentuHMM**: Analysis of multivariate ecological data with hidden Markov models (extension of moveHMM). Available on CRAN: cran.r-project.org/package=momentuHMM. Co-developer.
- **hmmTMB**: Hidden Markov models with non-parametric and random effects. Available on Github: github.com/TheoMichelot/hmmTMB. Joint lead developer and maintainer.
- **smoothSDE**: Varying-coefficient stochastic differential equations. Available on Github: github.com/TheoMichelot/smoothSDE. Lead developer and maintainer.

BOOK CHAPTERS

Antinori P., **Michelot T.**, Lescuyer P., Müller M., Acosta-Martin A.E. (2019)
Detection of unknown chemical adduct modifications on proteins: from wet to dry laboratory
In: Evans C., Wright P., Noirel J. (eds), Mass Spectrometry of Proteins
Methods in Molecular Biology, vol 1977. Humana Press, New York, NY.

TEACHING

Module coordinator

- MT5758 Multivariate Analysis, University of St Andrews *Spring 2022*

Guest lecturer

- MT4113 Computing in Statistics, University of St Andrews *Fall 2019*
- Ecological Modelling, University of Lisbon *Fall 2019*

Teaching training

Academic Staff Development Programme, University of St Andrews

- Assessment and feedback (half-day workshop)
- Effective lecturing (half-day workshop)

Fall 2019

Workshop lecturer and demonstrator

Hidden Markov models for animal movement and other ecological data

- Two-day workshop in St Andrews, UK. *August 2017*
- Three-day workshop in Mossel Bay, South Africa. *March 2016*

Tutorial demonstrator and marker

University of Sheffield

- MAS113 Introduction to Probability and Statistics (first year)
- MAS275 Probability Modelling (second year)
- MAS223 Statistical Inference and Modelling (second year)
- MAS6002 Statistical Laboratory (MSc)

2016-2018

STUDENT SUPERVISION

MSc research placements

Carlina Feldmann (U. of St Andrews, with Theoni Photopoulou) *October-November 2019*
Topic: *Spatially-explicit models of animal movement for acoustic detection data*

Hugo Hervé (U. of St Andrews, with Len Thomas and Richard Glennie) *June-August 2019*
Topic: *Simulation study of multiple imputation techniques for the application of hidden Markov models to irregular and noisy telemetry data*

Honours projects

Mairi McHale (U. of St Andrews, with David Borchers) *2019-2020*
Topic: *Analysis of snow leopard movement data using hidden Markov models*

Student examination

Bantu Halam (U. of Cape Town, Department of Statistical Sciences) *September 2019*
External examiner for MSc thesis: *Mining a large shopping database to predict where, when, and what consumers will buy next*

AWARDS

Young Biometrician Award – honourable mention *2021*
For “*Inference in MCMC step selection models*” (Michelot et al., 2020)
International Biometric Society (British and Irish Region) and Fisher Memorial Trust

Best student talk award *2016*
International Statistical Ecology Conference

PRESENTATIONS

Multiscale models of animal movement and space use
Seminar at Dalhousie University, Halifax, Canada. February 2022.

Introduction to analysing animal movement data in R
Webinar of Ecological Forecasting Initiative & Ecological Society of America. February 2022.
Recording available online.

hmmTMB: hidden Markov models with non-parametric and random effects
Talk at the meeting of the National Centre for Statistical Ecology, online. June 2021.

Time-varying diffusion processes in movement ecology
Talk at the virtual International Statistical Ecology Conference, online. June 2020.

Linking scales of animal movement using statistical samplers
Invited seminar at the University of Alberta, Edmonton, Canada. March 2020.

Behavioural response studies of beaked whales using accelerometer data and diffusion models
Talk at the British Ecological Society conference, Belfast, UK. December 2019.

Spline-based diffusion models and application to accelerometer data
Invited seminar at the University of Glasgow, UK. November 2019.
Seminar at the University of St Andrews, UK. November 2019.

Hidden Markov models of animal movement and behaviour
Invited seminar at the University of Lisbon, Portugal. November 2019.
Invited talk at the congress of Soc. Portuguesa de Estatística, Amarante, Portugal. November 2019.

Modelling animal movement and habitat selection across scales
Invited talk at the annual meeting of the BES movement ecology group, Sheffield, UK. July 2019.

The Langevin diffusion as a model of animal movement and habitat selection

Talk at the meeting of the National Centre for Statistical Ecology, Edinburgh, UK. June 2019.

Modelling animal movement and habitat selection across scales

Invited seminar at the School of Biosciences of the University of Cardiff, UK. March 2019.

Analysing telemetry data with hidden Markov models

Invited seminar at the Duke University Marine Lab, Beaufort, USA. March 2019.

Do animals move like statistical samplers?

Talk at the Research Students' Conference in Statistics and Probability, Sheffield, UK. July 2018.

Markov chain Monte Carlo as a model of animal movement and space use

Talk at the International Statistical Ecology Conference, St Andrews, UK. July 2018.

moveHMM and momentuHMM – Analysing animal movement in R

Invited tutorial at the moving2gather meeting, Montpellier, France. December 2017.

Can animals do MCMC? Linking resource selection and step selection models

Poster at the Bio-logging symposium, Konstanz, Germany. September 2017.

From movement to space use

Flash talk at the BES movement ecology group meeting, London, UK. July 2017.

momentuHMM: an R package for the analysis of general telemetry data using hidden Markov models

Talk at the EURING meeting, Barcelona, Spain. July 2017.

Can animals do MCMC? Integrating resource selection and step selection

Talk at the meeting of the National Centre for Statistical Ecology, Canterbury, UK. June 2017.

Analysing animal movement data with moveHMM – Conservation action plan for the wild haggis

Talk at the International Statistical Ecology Conference, Seattle, USA. June 2016.

Best student talk award

Multistate Ornstein-Uhlenbeck processes for modelling animal movement

Talk at the Research Students' Conference in Probability and Statistics, Dublin, Ireland. June 2016.

moveHMM: an R package for modelling animal movement with hidden Markov models

Seminar at the Australian Antarctic Division, Hobart, Australia. June 2016.

Seminar at the Sea Mammal Research Unit, St Andrews, UK. November 2015.

A statistical introduction to animal movement modelling

Talk at the German Statistical Week, Hamburg, Germany. September 2015.

COMMUNITY INVOLVEMENT

Associate Editor

Since 2021

Journal of Statistical Theory and Practice

Reviewer

Advances in Statistical Analysis (2020), *Animals* (2019), *Ecography* (2018), *Ecological Applications* (2017), *Ecological Monographs* (2019), *Ecology and Evolution* (2016, 2017), *Ecology Letters* (2019), *Emu - Austral Ornithology* (2018), *Fish and Fisheries* (2021), *Journal of Agricultural, Biological, and Ecological Statistics* (2017, 2018), *Journal of Animal Ecology* (2019), *Journal of Mammalogy* (2018), *Journal of Statistical Theory and Practice* (2022), *Journal of Zoology* (2019), *Methods in Ecology and Evolution* (2016, 2017×3, 2018, 2021), *Movement Ecology* (2016×3, 2019, 2020×3), *Nature Ecology & Evolution* (2020), *Plos One* (2018), *Scientific Reports* (2018, 2019), *Sensors* (2021).

Early career researcher representative

Since 2019

Executive committee of the National Centre for Statistical Ecology, UK

Seminar organiser*Since 2021*

National Centre for Statistical Ecology seminar series

OTHER SKILLS

Programming

R (including Rcpp, Stan, TMB), C++, Python

Tools

git, Latex, R development tools (devtools, unit testing, profiling, documentation)

Languages

French, English