

## **Jorge P. Rodríguez**

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Staff meteorologist, Balearic Islands Delegation, Spanish Meteorological Agency (AEMET), Palma (Mallorca), Spain

### **1. Keywords**

Big data, complex networks, animal movement, marine megafauna, disease spreading, meteorology

### **2. Professional positions**

**2014-2018** PhD researcher. Formación de Profesorado Universitario (FPU) fellowship, Spanish Ministry of Education, Culture and Sport. Instituto de Física Interdisciplinar y Sistemas Complejos IFISC (CSIC-UIB), Palma (Mallorca), Spain

**2018-2019** Postdoctoral researcher. Funding from project Coupled Animal and Artificial Sensing for Sustainable Ecosystems (CAASE). IFISC (CSIC-UIB), Palma (Mallorca), Spain

**2019-2020** Postdoctoral researcher. Sociopatterns collaboration. ISI Foundation, Turin, Italy

**2020-** Tutoring lecturer. Associated center in Balearic Islands, National Distance University UNED, Palma (Mallorca), Spain

**2020-2021** Postdoctoral researcher. Instituto de Biocomputación y Física de Sistemas Complejos BIFI, Universidad de Zaragoza, Spain

**2021-2023** Postdoctoral fellow. Juan de la Cierva Formación fellowship, Spanish Ministry of Science and Innovation. Instituto Mediterráneo de Estudios Avanzados (CSIC-UIB), Esporles (Mallorca), Spain

**2023-2024** Postdoctoral researcher/fellow. Projects Artificial Intelligence & Animal Movement (AIAM) and Modelling Island Ecological Complexity in the Context of Global Change (MISLAND), and Vicenç Mut fellowship (Govern de les Illes Balears). Instituto de Física Interdisciplinar y Sistemas Complejos IFISC (CSIC-UIB), Palma (Mallorca), Spain

**2024-** Staff meteorologist, Spanish Meteorological Agency (AEMET), Palma (Mallorca), Spain

### **3. Academic qualifications**

**2018** PhD in Physics. University of Balearic Islands (Spain)

**2014** Master's Degree in Physics of Complex Systems (60 ECTS). University of Balearic Islands (Spain)

**2013** 5-year Degree in Physics (300 ECTS). University of Valencia (Spain). Erasmus at Imperial College London (9 months, United Kingdom)

**2018** Degree in Social and Cultural Anthropology (240 ECTS, 2018). National Distance Education University (Spain)

### **4. Funded research projects (PI)**

**2023** "Artificial Intelligence & Animal Movement (AIAM)". Mar 2023-Jan 2024, funded by

Sustainable Ocean Alliance. Amount: 10,000 USD

## 5. Early-career researchers training

**2024-** Master Thesis direction, Carlos Moreno, MsC in Advanced Physics, National Distance University (UNED), Spain

**2023-** PhD co-direction, Jorge Medina, PhD in Physics, University of Balearic Islands, Spain

**2021-2022** Master Thesis co-direction, Lina E. Navarro, Master's Degree in Physics of Complex Systems, University of Balearic Islands, Spain

## 6. Publications

<sup>⋈</sup>: equal contribution

CA: corresponding author

**2025** Rodríguez, J.P. (CA), Aleta, A., Moreno, Y. Multilayer networks describing urban interactions for building the digital twins of five cities in Spain, *Scientific Data* 12, 1227, doi: [10.1038/s41597-025-05551-2](https://doi.org/10.1038/s41597-025-05551-2)

**2025** Sequeira, A.M.M.<sup>⋈</sup>, Rodríguez, J.P.<sup>⋈</sup>, Marley, S.A., Calich, H.J., van der Mheen, M., et al. Global tracking of marine megafauna space use reveals how to achieve conservation targets. *Science* 388, 1086, doi: [10.1126/science.adl0239](https://doi.org/10.1126/science.adl0239)

**2025** VanCompernelle, M., Morris, J., Calich, H.J., Rodríguez, J.P., Marley, S.A., et al. Vulnerability of marine megafauna to global at-sea anthropogenic threats. Accepted for publication in *Conservation Biology*

**2024** Rodríguez, J.P. (CA), Arola-Fernández, L. Understanding following patterns among high-performance athletes, *Journal of Physics: Complexity* 5, 045007, doi: [10.1088/2632-072X/ad8854](https://doi.org/10.1088/2632-072X/ad8854)

**2024** Rodríguez, J.P. (CA), Klemm, K., Duarte, C.M., Eguíluz, V.M. Shipping traffic through the Arctic Ocean: spatial distribution, temporal evolution and its dependence on the sea ice extent, *iScience* 27, 110236, doi: [10.1016/j.isci.2024.110236](https://doi.org/10.1016/j.isci.2024.110236)

**2024** Rodríguez, J.P. (CA), Irigoien, X., Duarte, C.M., Eguíluz, V.M. Identification of suspicious behaviour through anomalies in the tracking data of fishing vessels. *EPJ Data Science* 13, 23, doi: [10.1140/epjds/s13688-024-00459-0](https://doi.org/10.1140/epjds/s13688-024-00459-0)

**2024** Fernández-Gracia, J., Rodríguez, J.P., Peel, L.R., Klemm, K., Meekan, M.G., et al. Inferring leader-follower behavior from presence data in the marine environment: a case study on reef manta rays, arXiv preprint at [arXiv:2412.03990](https://arxiv.org/abs/2412.03990)

**2023** Belvís, F., Aleta, A., Pericas, J.M., Fernández-Gracia, J., Rodríguez, J.P., et al. Key epidemiological indicators and spatial autocorrelation patterns across five waves of COVID-19 in Catalonia. *Scientific Reports* 13, 9709, doi: [10.1038/s41598-023-36169-2](https://doi.org/10.1038/s41598-023-36169-2)

**2023** Rodríguez, J.P. (CA), Eguíluz, V.M. Coupling between infectious diseases leads to synchronization of their dynamics. *Chaos* 33, 021103, doi: [10.1063/5.0137380](https://doi.org/10.1063/5.0137380)

**2023** Rodríguez, J.P. (CA), Aleta, A., Moreno, Y. Digital cities and the spread of COVID-19: characterizing the impact of non-pharmaceutical interventions in five cities in Spain. *Frontiers in Public Health* 11, 1122230, doi: [10.3389/fpubh.2023.1122230](https://doi.org/10.3389/fpubh.2023.1122230)

**2022** Rodríguez, J.P., Paoluzzi, M., Levis, D., Starnini, M. Epidemic processes on self-propelled particles: Continuum and agent-based modeling. *Physical Review Research* 4, 043160, doi:

**2022** Lacasa, L., [Rodríguez, J.P.](#), Eguíluz, V.M. Correlations of network trajectories. Physical Review Research 4, L042008, doi: [10.1103/PhysRevResearch.4.L042008](https://doi.org/10.1103/PhysRevResearch.4.L042008)

**2021** Bates, A.E., Primack, R.B., Biggar, B.S., Bird, T.J., Clinton, M.E., *et al.* Global COVID-19 lockdown highlights humans as both threats and custodians of the environment. Biological Conservation 263, 109175, doi: [10.1016/j.biocon.2021.109175](https://doi.org/10.1016/j.biocon.2021.109175)

**2021** Calich, H., [Rodríguez, J.P.](#), Eguíluz, V.M., Hammerschlag, N., *et al.* Comprehensive analytical approaches reveal species-specific search strategies in sympatric apex predatory sharks. Ecography 44, 1544, doi: [10.1111/ecog.05953](https://doi.org/10.1111/ecog.05953)

**2021** Ozella, L., Paolotti, D., Lichand, G., [Rodríguez, J.P.](#), Haenni, S., *et al.* Using wearable proximity sensors to characterize contact patterns in a village of rural Malawi. EPJ Data Science 10, 46, doi: [10.1140/epjds/s13688-021-00302-w](https://doi.org/10.1140/epjds/s13688-021-00302-w)

**2021** [Rodríguez, J.P. \(CA\)](#), Fernández-Gracia, J., Duarte, C.M., Irigoien, X., *et al.* The global network of ports supporting high seas fishing. Science Advances 7, eabe3470, doi: [10.1126/sciadv.abe3470](https://doi.org/10.1126/sciadv.abe3470)

**2021** Kazimierski, L.D., [Rodríguez, J.P.](#), Eguíluz, V.M. Design of deployment strategies to monitor the movement of animals with passive electronic devices. Sensors 21, 236, doi: [10.3390/s21020326](https://doi.org/10.3390/s21020326)

**2020** Eguíluz, V.M., Fernández-Gracia, J., [Rodríguez, J.P.](#), Pericas, J.M., Melián, C.M. Risk of secondary infection waves of COVID-19 in an insular region: the case of the Balearic Islands, Spain. Frontiers in Medicine 7, 563455, doi: [10.3389/fmed.2020.563455](https://doi.org/10.3389/fmed.2020.563455)

**2019** Sequeira, A.M.M., Hays, G.C., Sims, D.W., Eguíluz, V.M., [Rodríguez, J.P.](#), *et al.* Overhauling ocean spatial planning to improve marine megafauna conservation. Frontiers in Marine Science 6, 639, doi: [10.3389/fmars.2019.00639](https://doi.org/10.3389/fmars.2019.00639)

**2019** [Rodríguez, J.P. \(CA\)](#), Ghanbarnejad, F., Eguíluz, V.M. Particle velocity controls phase transitions in contagion dynamics. Scientific Reports 9, 6463, doi: [10.1038/s41598-019-42871-x](https://doi.org/10.1038/s41598-019-42871-x)

**2018** Melián, C.J., Matthews, B., de Andreazzi, C.S., [Rodríguez, J.P.](#), Harmon, L.J., *et al.* Deciphering the interdependence between ecological and evolutionary networks. Trends in Ecology & Evolution 33, 504, doi: [10.1016/j.tree.2018.04.009](https://doi.org/10.1016/j.tree.2018.04.009)

**2018** Sequeira, A.M.M.<sup>\*,</sup> [Rodríguez, J.P.<sup>\\*</sup>](#), Eguíluz, V.M., Harcourt, R.G., *et al.* Convergence of marine megafauna movement patterns in coastal and open oceans. Proceedings of the National Academy of Sciences 115, 3072, doi: [10.1073/pnas.1716137115](https://doi.org/10.1073/pnas.1716137115)

**2018** [Rodríguez, J.P.](#), Liang, Y.H., Huang, Y.J., Juang, J. Diversity of hysteresis in a fully cooperative coinfection model. Chaos 28, 023107, doi: [10.1063/1.4996807](https://doi.org/10.1063/1.4996807)

**2017** [Rodríguez, J.P.](#), Ghanbarnejad, F., Eguíluz, V.M. Risk of coinfection outbreaks in temporal networks: a case study of a hospital contact network. Frontiers in Physics 5, 46, doi: [10.3389/fphy.2017.00046](https://doi.org/10.3389/fphy.2017.00046)

**2017** [Rodríguez, J.P. \(CA\)](#), Fernández-Gracia, J., Thums, M., Hindell, M.A., *et al.* Big data analyses reveal patterns and drivers of the movements of southern elephant seals. Scientific Reports 7, 112, doi: [10.1038/s41598-017-00165-0](https://doi.org/10.1038/s41598-017-00165-0)

## **7. Citation Statistics**

Number of citations: 761 (Google Scholar)

h-index: 12 (Google Scholar)

## **8. Awards**

- 2<sup>nd</sup> National End-Of-Degree Award. Degree in Physics. Spanish Ministry of Education, Culture and Sport
- Selected photography “El árbol pendular” (The pendular tree) for national scientific photography exhibition, Fotciencia 14 (2017)

## **9. Conference presentations (oral communications)**

**2024** “Leveraging acoustic telemetry data to understand spreading processes on marine animal populations”, European Tracking Network Symposium, Palma (Spain)

**2022** “Epidemic processes on self-propelled particles”. Conference on Complex Systems, CCS22, Palma (Spain)

**2022** “Digital cities and COVID-19: modeling the impact of non pharmaceutical interventions”. International Conference BIFI (online)

**2021** “Fishing at the High Seas: the Global Network Connecting Ports to Fishing Areas”. Conference on Complex Systems, CCS21, Lyon (France)

**2021** “Big Data analytics for marine movement tracking data: a global picture”. I Annual Meeting of the Spanish Tracking Network, Palma (Spain)

**2021** “The global network of ports supporting high seas fishing”. FisEs Joven ‘21 (online)

**2019** “Structure and dynamics of contact patterns among structured populations in South Africa”. Conference on Complex Systems, CCS19, Singapore

**2019** “Genome networks and the stability of diversification”. Conference on Complex Systems, CCS19, Singapore

**2018** “Cooperative disease spreading in networks of mobile particles: how mobility can speed up, slow down and change the nature of the epidemic phase transition”. Conference on Complex Systems, CCS18, Thessaloniki (Greece)

**2018** “Inferring intraspecific tracing behaviour in animal movement”. Conference on Complex Systems, CCS18, Thessaloniki (Greece)

**2017** “Coinfection in the space: cooperative disease spreading in geometric and contact networks”. COSTNET17 (Palma de Mallorca)

**2017** “Cooperative spreading diseases in temporal networks”. 8<sup>th</sup> Conference on Complex Networks, CompleNet’17, Dubrovnik (Croatia)

## **10. Service to scientific community**

**2023** Organizer of a training workshop on the analysis of movement data, Palma de Mallorca, Spain

**2021** Member of the organizing of the V Symposium on Ecological Networks, ECONET2021,

Palma de Mallorca (Spain)

**2020-2023** Elected member for the Council of the Complex Systems Society

**2017** Member of the organizing team of the COSTNET 17 conference, Palma de Mallorca (Spain)

Reviewing activity for peer-review journals: Communications Physics, PLOS Computational Biology, Physical Review Research, PRX Life, PLOS ONE, JSTAT, Physical Review E, Journal of Physics: Complexity, Scientific Reports, PeerJ, Chaos, Complexity, Entropy, Frontiers in Marine Science, Science Progress, Social Science Computer Review, Frontiers in Physics, Chaos, Solitons and Fractals, Frontiers in Public Health, Ecological Complexity

Review editor of Frontiers in Marine Science

## **11. Stays in research centers**

**2018** Indian Ocean Marine Research Centre, University of Western Australia (Australia). Research stay with Dr. Ana Sequeira.

**2018** Department of Engineering Mathematics, University of Bristol (United Kingdom). Research stay with Dr. Naoki Masuda. Funding: COSTNET (EU COST Action)

**2016-2017** Eawag (Switzerland). Research stays with Dr. Carlos Melián. Funding (2016): Obra Social la Caixa

**2016** National Chiao-Tung University (Taiwan). Research stay with Prof. Jonq Juang. Funding: Ministry of Science and Technology of Taiwan

**2016** University of Western Australia (Australia). Research stay with Dr. Ana Sequeira

## **12. Invited seminars and talks**

**2024** “New questions on epidemic spreading suggested by the COVID-19 pandemic”, Department of Applied Mathematics, National Kaohsiung University (Kaohsiung, Taiwan)

**2024** “Understanding following patterns among Olympic medallists”, Institute for Cross-Disciplinary Physics and Complex Systems (IFISC, Palma de Mallorca, Spain)

**2024** “Analysis of marine fishing using vessels trajectories: global structure, suspicious behavior and emergent pathways”, Institute for Cross-Disciplinary Physics and Complex Systems (IFISC, Palma de Mallorca, Spain)

**2023** “Oceanic big data for marine megafauna conservation”, Institute for Cross-Disciplinary Physics and Complex Systems (IFISC, Palma de Mallorca, Spain)

**2019** “Animal movement in the Big Data era”, ISI Foundation (Turin, Italy)

**2019** “Velocity-controlled phase transitions in contagion dynamics: single vs cooperative infections”, Department of Applied Mathematics, National Chiao-Tung University (Hsinchu, Taiwan)

**2018** “Animal movement in the Big Data era: from data analysis to forecast and control”, The UWA Oceans Institute (Perth, Australia)

**2016** “Movement patterns at aggregated, collective and individual scales”, Swiss Federal Institute of Aquatic Science and Technology (EAWAG, Kastanienbaum, Switzerland)