

Curriculum Vitae

EDUARDO HENRIQUE COLOMBO

PERSONAL INFORMATION

NAME: Eduardo Henrique Filizzola Colombo
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I'm a physicist interested in the macroscopic phenomena that emerge in biological populations. My research focuses on providing a theoretical foundation to understand ecosystems across scales, specifically how individual-level interactions drive species spatial organization and determine key macroecological outcomes. Currently, I am a Postdoctoral Research at Center for Advanced Systems Understanding (CASUS/HZDR) under the supervision of Prof. Justin Calabrese.

PROFESSIONAL ACTIVITY

- 2023 - Postdoctoral Researcher at Center for Advanced Systems Understanding (Görlitz, Germany).
- 2020 - 2022 Postdoctoral Research Associate at Department of Ecology and Evolutionary Biology, Princeton University (New Jersey, USA) and Department of Ecology, Evolution, and Natural Resources, Rutgers University (New Jersey, USA).
- 2019 - 2020 Postdoctoral researcher at Institute for Cross-Disciplinary Physics and Complex Systems (Palma de Mallorca, Spain).

EDUCATION

- 2014 - 2018 | Doctoral degree in Physics, PUC-RIO, March 2018.
Advisor: Prof. Celia Anteneodo. Awarded with FAPERJ-Nota10 fellowship for outstanding students.
- 2012 - 2014 | Master's degree in Physics, PUC-RIO, February 2014.
Advisor: Prof. Celia Anteneodo. Awarded with FAPERJ-Nota10 fellowship for outstanding students.
- 2007 - 2011 | Bachelor's degree in Physics, PUC-RIO, December 2011.

FELLOWSHIPS AND GRANTS

- 2017 - 2017 CAPES visiting student fellowship/PDSE. Ministry of Science and Technology.
- 2016 - 2018 Nota10 fellowship. Research Foundation of Rio de Janeiro State.
- 2014 - 2016 CNPq-GD fellowship and grant. Ministry of Science and Technology.
- 2013 - 2014 Nota10 fellowship. Research Foundation of Rio de Janeiro State.
- 2012 - 2013 CAPES fellowship. Ministry of Education of Brazil.
- 2009 - 2011 Scientific initiation fellowship. Ministry of Education of Brazil.
- 2007 - 2009 Scientific initiation fellowship. Research Foundation of Rio de Janeiro State.

LIST OF PUBLICATIONS

- IN PREPARATION *Pulsed interactions unify reaction-diffusion and spatial nonlocal models for biological pattern formation* E.H. Colombo, R. Martinez-Garcia, J. M Calabrese, C. López, E. Hernández-García. Accepted at JSTAT.
- The morphology of phytoplankton blooms reveals zooplankton grazer behavioral signatures* E.H. Colombo, J.A. Bonachela, C.E. Tarnita. Under review at PNAS.
- 1 *Pulsed signaling as a route to pattern formation.* E.H. Colombo, C. López, E. Hernández-García. Physical Review Letters 130 (5), 058401
- 2 *Interplay between scales in the nonlocal FKPP equation.* G.G. Piva, E.H. Colombo, C. Anteneodo. Chaos, Solitons & Fractals 153, 111609 (2021).

- 3 *Random diffusivity scenarios behind anomalous non-Gaussian diffusion.* M.A.F. dos Santos, E.H. Colombo, C. Anteneodo. *Chaos, Solitons & Fractals*, 152, 111422 (2021).
- 4 *Landscape-induced spatial oscillations in population dynamics.* V. Dornelas, E.H. Colombo, C. López, E. Hernández-García. *Scientific reports* 11, 3470 (2021).
- 5 *Critical patch size reduction by heterogeneous diffusion.* M.A.F. dos Santos, V. Dornelas, E.H. Colombo, C. Anteneodo. *Phys. Rev. E* v. 102, p. 042139 (2020).
- 6 *Connecting metapopulation heterogeneity to aggregated lifetime statistics.* E.H. Colombo. *Ecological Complexity* 39, 100777 (2019).
- 7 *Heat flux direction controlled by power-law oscillators under non-Gaussian fluctuations.* E.H. Colombo, L. Defaveri, C. Anteneodo. *Phys. Rev. E*, v. 100, p. 032118 (2019).
- 8 *Single-species fragmentation: The role of density-dependent feedbacks.* V. Dornelas, E. H. Colombo and C. Anteneodo. *Phys. Rev. E*, v. 99, p. 062225 (2019).
- 9 *Spatial eco-evolutionary feedbacks mediate coexistence in prey-predator systems.* E.H. Colombo, R. Martínez-García, C. López, E. Hernández-García. *Scientific Reports* 9, 18161 (2019).
- 10 *Nonlinear population dynamics in a bounded habitat.* E. H. Colombo and C. Anteneodo. *J. Theor. Biol.*, v. 446, 11 (2018).
- 11 *Population dynamics in an intermittent refuge.* E. H. Colombo and C. Anteneodo. *Phys. Rev. E*, v. 94, p. 042413 (2016).
- 12 *Metapopulation dynamics in a complex ecological landscape.* E. H. Colombo and C. Anteneodo. *Phys. Rev. E*, v. 92, p. 022714 (2015).
- 13 *Effect of environment fluctuations on pattern formation of single species.* L. A. da Silva, E. H. Colombo, and C. Anteneodo. *Phys. Rev. E*, v. 90, p. 012813 (2014).
- 14 *Nonlinear diffusion effects on biological population spatial patterns.* E. H. Colombo and C. Anteneodo. *Phys. Rev. E*, v. 86, p. 036215 (2012).

PARTICIPATION IN RESEARCH PROJECTS

- Maria de Maeztu Program for units of Excellence in R&D (2019 -).
- Emergent social, technical and ecological complex systems project. Coordinator: Pere Colet. ESOTECOS FIS2015-63628-C2-2-R (AEI/FEDER,EU) (2018-2019).
- Dinâmica de sistemas complexos. Coordinator: Prof. Celia Anteneodo. APQ1- FAPERJ - E110.369/2014 (2014-2016).
- Dinâmica estocástica em sistemas complexos. Coordinator: Prof. Celia Anteneodo. Ed. Universal, MCT/CNPq 14/2013, 480392/2013-7 (2013-2016)
- Mecânica Estatística, fundamentos, aspectos teóricos e aplicações. Coordinator: Prof. Celia Anteneodo. APQ1 - FAPERJ E26/111.646/08 (2008-2010)
- Problemas em Física Granular. Coordinator: Prof. Welles Morgado. APQ1 -FAPERJ - E26/111.455/2008 (2008-2010).

RESEARCH VISITS

APRIL-SEPTEMBER 2017 – Institute for Cross-Disciplinary Physics and Complex systems (exchange doctoral program - advisor: Prof. Emilio Hernández-García).

Invited lectures

- 2023 *Biodiversity shearing in river ecosystems.* Workshop on the CASUS/UFZ river networks open project.
- 2022 *Grazers leave behavior signatures in phytoplankton blooms.* ICTP-SAIFR lecture for the Quantitative Biology program.
- 2022 *A multiscale approach to population dynamics.* Blackboard-style lecture for ICTP-SAIFR lecture for the Quantitative Biology program (available at <https://youtu.be/w5i6LuB9nfE?si=dDVR8Xjj9lmws54S>).

Invited seminars

- 2021 *A multiscale approach to plankton patterns.* E&E GP Seminar Series at Rutgers University.
- 2021 *A multiscale approach to plankton patterns.* LabTea at EEB-Princeton.
- 2020 *Biology from Images.* Complex Systems & Statistical Mechanics ICTP-SAIFR Seminars (São Paulo, Brazil).
- 2019 *Spatial eco-evolutionary feedbacks mediate coexistence in prey-predator systems.* IFISC (Palma, Spain).
- 2018 *Population survival in spatiotemporal environments.* IFISC (Palma, Spain).
- 2015 *Impact of environment spatial structure in population dynamics.* Bio-Rio meeting (Niterói, Brazil).
- 2015 *Metapopulation dynamics: complex habitats and dispersal strategy.* Seminar at Applied Mathematics School at Getúlio Vargas Foundation (Rio de Janeiro, RJ).

Conference participation

Talks

- 2021 *Taxis-induced mesoscale patchiness in plankton communities.* (contributed talk). SMB 2021 Annual Meeting.
- 2021 *Taxis-induced mesoscale patchiness in plankton communities.* (contributed talk). ASLO 2021 Aquatic Sciences Meeting on session “Modelling the ecology & evolution of plankton”.
- 2019 *Spatial eco-evolutionary feedbacks mediate coexistence in prey-predator systems.* (contributed talk). Fluctuations, tipping points and emergence in eco-evolutionary dynamics (Leeds, UK).
- 2018 *Species mixing determines predators’ optimal perception range and coexistence times in predator-prey dynamics* (contributed talk). Physics and Ecology: Challenges at the frontier (Menorca, Spain).
- 2016 *Metapopulation dynamics and self-organization* (invited talk). International Conference on Structural Nonlinear Dynamics and Diagnosis (Marrakesh, Marroco).
- 2015 *Role of habitat spatial structure and dispersal strategy* (contributed talk). National Meeting of Statistical Physics (Vitória, Brazil).
- 2015 *Metapopulation dynamics in a complex habitat* (contributed talk). Models in Population Dynamics and Ecology (Niterói, Brazil).
- 2014 *The effects of nonlinear diffusion and environment fluctuations in the self-organization of biological populations* (invited talk). III Dynamics days South America (Valparaiso, Chile).
- 2014 *Nonlocality, nonlinear diffusion and environment fluctuations in biological population patterns* (contributed talk). XXXVII Brazilian Meeting on Condensed Matter Physics (Sauipe, Brazil).

Posters

- 2023 *Bridging scales to understand species spatial organization.* (contributed poster). Big data analytical methods for complex systems at Wroclaw University.
- 2018 *Nonlinear population dynamics in a bounded habitat* (Poster). XXII Congreso de Física Estadística (Madrid, Spain).
- 2017 *Population dynamics in a intermittent refuge* (Poster). Crossroads in Complex Systems (Palma, Spain).
- 2016 *Population dynamics in a intermittent refuge* (Poster). Encontro de Física 2016 (Natal, Brazil).
- 2013 *Nonlinear subdiffusion induces population fragmentation* (Poster). XIII Latin American Workshop on Nonlinear Phenomena (Córdoba, Argentina).
- 2013 *Nonlinear diffusion in biological population* (Poster). Mathematical Methods and Modeling of Biophysical Phenomena (Cabo Frio, Brazil).

FURTHER EDUCATION

- 2020 ICTP Winter School on Quantitative Systems Biology: Quantitative Approaches in Ecosystem Ecology. (30 November - 17 December 2020)
- 2018 School on Physics Applications in Biology, 40hrs (ICTP – SAI FR, São Paulo, Brazil).
- 2017 VII GEFENOL Summer School on Statistical Physics of Complex Systems, 60hrs (IFISC, Palma, Spain).
- 2017 VI Southern-Summer School on Mathematical Biology, 40hrs (ICTP – SAI FR, São Paulo, Brazil).

LANGUAGES

English-fluent; Spanish-fluent; Portuguese-first language.