



MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2023

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

MARE-NOVA, NOVA School of Science and Technology, NOVA University Lisbon

RESEARCH GROUP AND URL

Environmental Risk

Technological Tools for Exploration and Monitoring

<https://www.mare-centre.pt/en/user/25178>

<https://www.ab.mpg.de/person/98273/2736>

SUPERVISOR (NAME AND E-MAIL)

Carlos David Santos

cdsantos@fct.unl.pt

SHORT CV OF THE SUPERVISOR

Carlos David Santos

NOVA School of Science and Technology

Universidade NOVA de Lisboa

Education

PhD, Ecology, University of Lisbon, 2009

BSc, Biology, University of Lisbon, 2001

Academic appointments

2023-present: Assistant Professor. Universidade Nova de Lisboa.

2014-present: Affiliated Scientist. Max Planck Institute of Animal Behavior

2021-2023: Researcher. Faculdade de Ciências, Universidade de Lisboa.

2017-2022: Assistant Professor. NTPC, Federal University of Pará.

2014-2017: Visiting Professor. Biology Dept. Federal University of Maranhão

2010-2014: Post-doctoral fellow. Max Planck Institute for Ornithology

Academic quantitative indicators

Peer-reviewed articles: 41

WOS citations: 689

WOS h-index: 17

Students Supervised: 22

Peer-reviewed journal articles

- Nourani, E., Safi, K., de Grissac, S., Anderson, D.J., Cole, N.C., Fell, A., Grémillet, D., Lerma, M., McKee, J. L., Pichegru, L., Provost, P., Rattenborg, N.C., Ryan, P.G., **Santos, C.D.**, Schoombie, S., Tatayah, V., Weimerskirch, H., Wikelski, M., Shepard, E.L.C. (2023). Seabird morphology determines operational wind speeds, tolerable maxima and responses to extremes. *Current Biology* 33: p1179–1184.e3. <https://doi.org/10.1016/j.cub.2023.01.068>
- Merchant, D., Lathrop, R.G., **Santos, C.D.**, Paludo, D., Niles, L., Smith, J.A.M., Feigin, S., Dey, A. (2023). Distribution Modeling and Gap Analysis of Shorebird Conservation in Northern Brazil. *Remote Sensing*. 15: 452. <https://doi.org/10.3390/rs15020452>
- Santos, C.D.**, Catry, T., Dias, M.P., Granadeiro, JP. (2023). Global changes in coastal wetlands of importance for non-breeding shorebirds. *Science of The Total Environment* 858: 159707. <http://dx.doi.org/10.1016/j.scitotenv.2022.159707>.
- Lathrop, R.G., Merchant, D., Niles, L., Paludo, D., **Santos, C.D.**, Larrain, C.E., Feigin, S., Smith, J., Dey, A. (2022). Multi-Sensor Remote Sensing of Intertidal Flat Habitats for Migratory Shorebird Conservation. *Remote Sensing*. 14: 5016. <https://doi.org/10.3390/rs14195016>
- Visschers, L.L.B., **Santos, C.D.**, Franco, A.M.A. (2022). Accelerated migration of mangroves indicate large-scale saltwater intrusion in Amazon coastal wetlands. *Science of the Total Environment* 836:155679. <https://doi.org/10.1016/j.scitotenv.2022.155679>.
- Santos, C.D.**, Ramesh, H., Ferraz, R., Franco, A.M.A., Wikelski, M. (2022). Factors influencing wind turbine avoidance behaviour of a migrating soaring bird. *Scientific Reports* 12, 6441. <https://doi.org/10.1038/s41598-022-10295-9>.
- Santos, L.H., **Santos, C.D.**, Silva, M.L. (2022) The limits of olfactory perception in black vultures: A field experiment. *Ethology Ecology & Evolution* 35: 340-347. <https://doi.org/10.1080/03949370.2022.2062617>.
- Serra, R.T., **Santos, C.D.**, Rousseau, G.X., Triana, S.P., Gutiérrez, J.A.M., Guerrero, J.E.B. (2021) Fast recovery of soil macrofauna in regenerating forests of the Amazon. *Journal of Animal Ecology* 90: 2094-2108. <https://doi.org/10.1111/1365-2656.13506>.
- Santos, C.D.**, Ferraz, R., Muñoz, A.R., Onrubia, A., Wikelski, M. (2021) Black kites of different age and sex show similar avoidance responses to wind turbines during migration. *Royal Society Open Science*, 8: 201933. <https://doi.org/10.1098/rsos.201933>
- Catry, T., Ventura, F., Dias, M., **Santos, C.D.**, Martins, R., Palmeirim, J., Granadeiro, J.P. (2021) Estimating the conservation cost of the projected new international Lisbon airport for migratory shorebirds of the Tagus estuary, Portugal. *Bird Conservation International*, 1-14. <https://doi.org/10.1017/S0959270921000125>
- Costa, T.D., **Santos, C.D.**, Rainho, A., Abedi-Lartey, M., Fahr, J., Wikelski, M., Dechmann, D.K.N. (2020) Assessing roost disturbance of straw-coloured fruit bats (*Eidolon helvum*) through tri-axial acceleration. *Plos One*. <https://doi.org/10.1371/journal.pone.0242662>.
- Santos, C.D.**, Silva, J.P., Muñoz, A.-R., Onrubia, A., Wikelski, M. (2020) The gateway to Africa: what determines sea crossing performance of a migratory soaring bird at the strait of Gibraltar? *Journal of Animal Ecology*. <https://doi.org/10.1111/1365-2656.13201>
- Santos, C.D.**, Marques, A.T., May, R. (2020) Recovery of raptors from displacement by windfarms – a response. *Frontiers in Ecology and the Environment*. <https://doi.org/10.1002/FEE.2180>

- Gudka, M., **Santos, C.D.**, Dolman, P.M., Abad-Gómez, J.M., Silva, J.P. (2019) Feeling the heat: Elevated temperature affects male display activity of a lekking grassland bird. *Plos One*, 14, e0221999. <https://doi.org/10.1371/journal.pone.0221999>
- Marques, A.T., **Santos, C.D.**, Hanssen, F., Muñoz, A.-R., Onrubia, A., Wikelski, M., Moreira, F., Palmeirim, J.M., Silva, J.P. (2019) Wind turbines cause functional habitat loss for migratory soaring birds. *Journal of Animal Ecology*, 1-11. <https://doi.org/10.1111/1365-2656.12961>.
- Santos, C.D.**, Campos, L., Efe, M.A. (2019) Foraging habitat choice of White-tailed Tropicbirds revealed by fine-scale GPS tracking and remote sensing. *PeerJ*, 7, e6261. <https://doi.org/10.7717/peerj.6261>.
- Santos, C.D.**, Rocha, T.M.S., Nascimento, A.W.B., Oliveira, V., Martinez, C. (2019) Prey Choice by Declining Atlantic Flyway Semipalmated Sandpipers (*Calidris pusilla*) at a Major Wintering Area in Brazil. *Waterbirds*, 42, 198-204. <https://doi.org/10.1675/063.042.0206>
- Lourenço, P., Alonso, H., Alves, J., Carvalho, A., Catry, T., Costa, H., Costa, J., Dias, M., Encarnação, V., Fernandes, P., Leal, A., Martins, R., Moniz, F., Pardal, S., Rocha, A., **Santos, C.D.** (2018) Monitoring waterbird populations in the Tejo estuary, Portugal: report for the decade 2007-2016. *Airo*, 25, 3-31.
- Veríssimo, A., Gante, H., **Santos, C.D.**, Cheoo, G., Oliveira, J., Cereja, R., Ribeiro, F. (2018) Distribution and demography of the critically endangered Lisbon arched-mouth nase, *Iberochondrostoma olisiponense*. *Fishes in Mediterranean Environments*, 1-13. <https://doi.org/10.29094/FISHMED.2018.002>
- Santos, C.D.**, Hanssen, F., Munoz, A.R., Onrubia, A., Wikelski, M., May, R., Silva, J.P. (2017) Match between soaring modes of black kites and the fine-scale distribution of updrafts. *Scientific Reports*, 7, 6421. <https://doi.org/10.1038/s41598-017-05319-8>
- Santos, C.D.**, Przybyzin, S., Wikelski, M., Dechmann, D.K.N. (2016) Collective Decision-Making in Homing Pigeons: Larger Flocks Take Longer to Decide but Do Not Make Better Decisions. *Plos One*, 11, e0147497. <https://doi.org/10.1371/journal.pone.0147497>
- Santos, C.D.**, Cramer, J.F., Parau, L.G., Miranda, A.C., Wikelski, M., Dechmann, D.K.N. (2015) Personality and morphological traits affect pigeon survival from raptor attacks. *Scientific Reports*, 5, 15490. <https://doi.org/10.1038/srep15490>
- Gagliardo, A., Pollonara, E., Coppola, V.J., **Santos, C.D.**, Wikelski, M., Bingman, V.P. (2014) Evidence for perceptual neglect of environmental features in hippocampal-lesioned pigeons during homing. *European Journal of Neuroscience*, 40, 3102-3110. <https://doi.org/10.1111/ejn.12680>
- Santos, C.D.**, Neupert, S., Lipp, H.-P., Wikelski, M., Dechmann, D.K.N. (2014) Temporal and contextual consistency of leadership in homing pigeon flocks. *Plos One*, 9, e102771. <https://doi.org/10.1371/journal.pone.0102771>
- Marques, J.T., Pereira, M.J.R., Marques, T.A., **Santos, C.D.**, Santana, J., Beja, P., Palmeirim, J.M. (2013) Optimizing Sampling Design to Deal with Mist-Net Avoidance in Amazonian Birds and Bats. *Plos One*, 8, e74505. <https://doi.org/10.1371/journal.pone.0074505>
- Martins, R.C., Catry, T., **Santos, C.D.**, Palmeirim, J.M., Granadeiro, J.P. (2013) Seasonal Variations in the Diet and Foraging Behaviour of Dunlins *Calidris alpina* in a South European Estuary: Improved Feeding Conditions for Northward Migrants. *Plos One*, 8, e81174. <https://doi.org/10.1371/journal.pone.0081174>
- Catry, T., Alves, J.A., Andrade, J., Costa, H., Dias, M.P., Fernandes, P., Leal, A., Lourenco, P.M., Martins, R.C., Moniz, F., Pardal, S., Rocha, A., **Santos, C.D.**, Encarnação, V., Granadeiro, J.P. (2011) Long-term declines of wader populations at the Tagus estuary, Portugal: a response to global or local factors? *Bird Conservation International*, 21, 438-453. <https://doi.org/10.1017/s0959270910000626>
- Beja, P., **Santos, C.D.**, Santana, J., Pereira, M.J., Marques, J.T., Queiroz, H.L., Palmeirim, J.M. (2010) Seasonal patterns of spatial variation in understory bird assemblages across a mosaic of flooded and unflooded

- Amazonian forests. *Biodiversity and Conservation*, 19, 129-152. <https://doi.org/10.1007/s10531-009-9711-6>
- Gante, H.F., **Santos, C.D.**, Alves, M.J. (2010) Phylogenetic relationships of the newly described species *Chondrostoma olisiponensis* (Teleostei: Cyprinidae). *Journal of Fish Biology*, 76, 965-974. <https://doi.org/10.1111/j.1095-8649.2010.02536.x>
- Santos, C.D.**, Miranda, A.C., Granadeiro, J.P., Lourenco, P.M., Saraiva, S., Palmeirim, J.M. (2010) Effects of artificial illumination on the nocturnal foraging of waders. *Acta Oecologica*, 36, 166-172. <https://doi.org/10.1016/j.actao.2009.11.008>
- Santos, C.D.**, Palmeirim, J.M., Granadeiro, J.P. (2010) Choosing the best foraging microhabitats: individual skills constrain the choices of dunlins *Calidris alpina*. *Journal of Avian Biology*, 41, 18-24. <https://doi.org/10.1111/j.1600-048X.2009.04860.x>
- Pereira, M.J.R., Marques, J.T., Santana, J., **Santos, C.D.**, Valsecchi, J., de Queiroz, H.L., Beja, P., Palmeirim, J.M. (2009) Structuring of Amazonian bat assemblages: the roles of flooding patterns and floodwater nutrient load. *Journal of Animal Ecology*, 78, 1163-1171. <https://doi.org/10.1111/j.1365-2656.2009.01591.x>
- Santos, C.D.**, Saraiva, S., Palmeirim, J.M., Granadeiro, J.P. (2009) How do waders perceive buried prey with patchy distributions? The role of prey density and size of patch. *Journal of Experimental Marine Biology and Ecology*, 372, 43-48. <https://doi.org/10.1016/j.jembe.2009.02.005>
- Lourenco, P.M., Silva, A., **Santos, C.D.**, Miranda, A.C., Granadeiro, J.P., Palmeirim, J.M. (2008) The energetic importance of night foraging for waders wintering in a temperate estuary. *Acta Oecologica*, 34, 122-129. <https://doi.org/10.1016/j.actao.2008.04.005>
- Santos, C.D.**, Lourenco, P.M., Miranda, A.C., Granadeiro, J.P., Palmeirim, J.M. (2008) Birds after dark: an efficient and inexpensive system for making long-range observations at night. *Journal of Field Ornithology*, 79, 329-335. <https://doi.org/10.1111/j.1557-9263.2008.00168.x>
- Gante, H.F., **Santos, C.D.**, Alves, M.J. (2007) A new species of *Chondrostoma* Agassiz, 1832 (Cypriniformes: Cyprinidae) with sexual dimorphism from the lower Rio Tejo Basin, Portugal. *Zootaxa*, 23-35.
- Granadeiro, J.P., **Santos, C.D.**, Dias, M.P., Palmeirim, J.M. (2007) Environmental factors drive habitat partitioning in birds feeding in intertidal flats: implications for conservation. *Hydrobiologia*, 587, 291-302. <https://doi.org/10.1007/s10750-007-0692-8>
- Dias, M.P., Granadeiro, J.P., Lecoq, M., **Santos, C.D.**, Palmeirim, J.M. (2006) Distance to high-tide roosts constrains the use of foraging areas by dunlins: Implications for the management of estuarine wetlands. *Biological Conservation*, 131, 446-452. <https://doi.org/10.1016/j.biocon.2006.02.020>
- Granadeiro, J.P., Dias, M.P., Rebelo, R., **Santos, C.D.**, Catry, P. (2006) Numbers and population trends of Cory's Shearwater *Calonectris diomedea* at Selvagem Grande, Northeast Atlantic. *Waterbirds*, 29, 56-60. [https://doi.org/10.1675/1524-4695\(2006\)29\[56:naptoc\]2.0.co;2](https://doi.org/10.1675/1524-4695(2006)29[56:naptoc]2.0.co;2)
- Santos, C.D.**, Granadeiro, J.P., Palmeirim, J.M. (2005) Feeding ecology of Dunlin *Calidris alpina* in a southern European estuary. *Ardeola*, 52, 235-252.
- Gante, H.F., **Santos, C.D.** (2002) First records of the North American catfish *Ameiurus melas* in Portugal. *Journal of Fish Biology*, 61, 1643-1646. <https://doi.org/10.1006/jfbi.2002.2166>

Research grants

2020-present: Applying new bio-logging and analytical tools to study the movement ecology and conservation of birds in the Caatinga biome, Fundação de Amparo à Pesquisa do Estado de São Paulo (Brasil) grant 2018/19389-9. Role: Co-I. Funding: R\$300,632 + \$229,796



2019-present: Bird telemetry monitoring to evaluate loss of habitat in mining area in the northeastern Amazon, Norsk Hydro Brasil Role: Co-I. Funding: R\$390,225

2018-2022: ENVMETAGENOMICS - eDNA: from rare species detection to whole-community diversity using high-throughput sequencing, Fundação para a Ciência e a Tecnologia (Portugal) grant 031644-02/SAICT/2017. Role: Co-I. Funding: €239,955.

2018-2019: Optimizing conservation outcomes and investments for semipalmated sandpiper using full life cycle migratory network models, U.S Fish and Wildlife Service, and National Fish and Wildlife Foundation. Role: Co-I. Funding: \$207,000

2015-2017: The mechanisms of social navigation in Scarlet Ibis *Eudocimus ruber*, FAPEMA (Brazil) grant 00060/15. Role: PI. Funding: R\$38,599.

2015-2016: Evaluation of population trends and genetic diversity of the critically endangered Lisbon Arched-mouth Nase *Iberochondrostoma olisiponensis*, Mohamed Bin Zayed - Species Conservation Fund. Role: Co-I. Funding: \$12,000.

2012-2016: The gateway to Africa: How do soaring birds overcome the Strait of Gibraltar? Max Planck Institute for Ornithology (Germany). Role: PI. Funding: €10,000.

2008-2012: Migra-Tagis - Wintering and migrating shorebirds as indicators of the quality of estuarine environments, Fundação para a Ciência e Tecnologia (Portugal) grant PTDC/MAR/66319/2006. Role: Co-I. Funding: €163,000

2007-2009: Spatial variation in Amazonian bat and bird assemblages under contrasting flooding regimes: implications for nature reserve management, Fundação para a Ciência e Tecnologia (Portugal) grant POCI/BIA-BDE/60710/2004. Role: Co-I. Funding: €50,000

2003-2006: Pred-Tagis - Birds as predators of invertebrates in intertidal habitats: role in estuarine environments and scale-dependent processes, Fundação para a Ciência e Tecnologia (Portugal) grant POCTI/BSE/47569/2002. Role: Co-I. Funding: €63,000

2000-2004: Sat-Tagis - Modelling the habitats of primary producers, invertebrates and birds in intertidal flats of the Tagus estuary, using satellite images and GIS, Fundação para a Ciência e Tecnologia (Portugal) grant POCTI/BSE/47569/2002. Role: Co-I. Funding: €360,000

5 SELECTED PUBLICATIONS

Santos, C.D., Ramesh, H., Ferraz, R., Franco, A.M.A., Wikelski, M. (2022). Factors influencing wind turbine avoidance behaviour of a migrating soaring bird. *Scientific Reports* 12, 6441. <https://doi.org/10.1038/s41598-022-10295-9>.

Santos, C.D., Ferraz, R., Muñoz, A.R., Onrubia, A., Wikelski, M. (2021) Black kites of different age and sex show similar avoidance responses to wind turbines during migration. *Royal Society Open Science*, 8: 201933. <https://doi.org/10.1098/rsos.201933>

Marques, A.T., **Santos, C.D.**, Hanssen, F., Muñoz, A.-R., Onrubia, A., Wikelski, M., Moreira, F., Palmeirim, J.M., Silva, J.P. (2019) Wind turbines cause functional habitat loss for migratory soaring birds. *Journal of Animal Ecology*, 1-11. <https://doi.org/10.1111/1365-2656.12961>.

Santos, C.D., Hanssen, F., Munoz, A.R., Onrubia, A., Wikelski, M., May, R., Silva, J.P. (2017) Match between soaring modes of black kites and the fine-scale distribution of updrafts. *Scientific Reports*, 7, 6421. <https://doi.org/10.1038/s41598-017-05319-8>

PROJECT TITLE AND SHORT DESCRIPTION

Mapping sensitivity of soaring birds to wind energy development

Wind energy production has expanded globally in order to reduce the dependence of carbon emitting fossil fuels and mitigate climate change. However, such expansion came at the cost of considerable impacts on wildlife, arising from collisions with turbines and loss of habitat, raising concerns on its sustainability. This paradox has brought together conservationists and wind energy developers seeking for solutions to minimize conflicts between wind power development and wildlife. Soaring birds are among the groups suffering the highest impacts because their flight behaviour makes them prone to collide with turbines and their low fecundity limits their capacity to out-balance this additional source of mortality. These birds rely on uplift (raising air currents) to travel across long distances at low energetic costs. Recent advances in research have made possible to map uplift and predict the movement of soaring birds across the landscape. However, studies developed so far did not try to upscale predictive models of soaring birds' movement to a global range, although the information needed to map uplift globally is already available. Mapping the movement of soaring birds in a global scale and with high spatial discrimination would be key to support the development of wind energy with reduced conservation costs for this group of birds. This project will integrate methods of Movement Ecology, Remote Sensing and Computer Science, and will ensemble large collections of satellite imagery, animal tracking data and atmospheric data to deliver empirically supported algorithms to predict movement corridors of soaring birds in a global scale. We will deliver those results to wind energy developers and conservationists through a web platform designed for non-academic users. We expect this tool to become part of a standard protocol in environmental impact assessments for new wind energy developments across the world, particularly in critical areas for soaring bird migration.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Life Sciences (LIF)

***Scientific Area where the project fits best** – Please select/indicate the scientific area according to the panel evaluation areas: Chemistry (CHE) • Social Sciences and Humanities (SOC) • Economic Sciences (ECO) • Information Science and Engineering (ENG) • Environment and Geosciences (ENV) • Life Sciences (LIF) • Mathematics (MAT) • Physics (PHY)