



***HYSTRIX***  
*the Italian Journal of Mammalogy*

Volume 33 (suppl.) • 2022

### Editor in Chief

LUCAS A. WAUTERS

Università degli Studi dell'Insubria

Via J.-H. Dunant 3, 21100 Varese, Italy

email: editor@italian-journal-of-mammalogy.it

### Associate Editors

Roberta CHIRICHELLA, Sassari, Italy (*Editorial Committee coordinator*)

Giovanni AMORI, Rome, Italy

Leonardo ANCILLOTTO, Naples, Italy

Francesca BRIVIO, Sassari, Italy

Romolo CANIGLIA, Rome, Italy

Jacopo CERRI, Koper, Slovenia

Paolo CIUCCI, Rome, Italy

Paolo COLANGELO, Rome, Italy

Marcello D'AMICO, Sevilla, Spain

Richard DELAHAY, Exeter, United Kingdom

Mirko DI FEBBRARO, Pesche, Italy

Olivia DONDINA, Milan, Italy

Niccolò FATTORINI, Siena, Italy

Nicola FERRARI, Milan, Italy

Marco FESTA-BIANCHET, Sherbrooke, Canada

Tim FLANNERY, Melbourne, Australia

Stefania GASPERINI, Siena, Italy

Philippe GAUBERT, Toulouse, France

John GURNELL, London, United Kingdom

Fabiola IANNARILLI, Yale, USA

Simona IMPERIO, Ozzano dell'Emilia, Italy

John L. KOPROWSKI, Laramie, USA

Boris KRYŠTUFK, Ljubljana, Slovenia

Maria Vittoria MAZZAMUTO, Laramie, USA

Nick MILNE, Perth, Australia

Alessio MORTELLITI, Orono, USA

Marco MUSIANI, Calgary, Canada

Jorge M. PALMEIRIM, Lisboa, Portugal

Pasquale RAIA, Naples, Italy

F. James ROHLF, New York, United States

Claudia ROMEO, Milan, Italy

Francesco ROVERO, Florence, Italy

Francesca SANTICCHIA, Varese, Italy

Massimo SCANDURA, Sassari, Italy

Clara TATTONI, Trento, Italy

### Assistant Editors

Francesca BRIVIO, Sassari, Italy

Roberta CHIRICHELLA, Sassari, Italy

Stefania GASPERINI, Radicondoli (Siena), Italy

Fabiola IANNARILLI, New Haven, USA

Andrea MARCON, Bologna, Italy

Chiara PANICCIA, Bolzano, Italy

Clara TATTONI, Trento, Italy

### Bibliometrics Advisor

Nicola DE BELLIS, Modena, Italy

### Technical Editor

Damiano PREATONI, Varese, Italy

### Impact Factor (2020) 2.017

**HYSTRIX the Italian Journal of Mammalogy** is an Open Access Journal published twice per year (one volume, consisting of two issues) by Associazione Teriologica Italiana. Printed copies of the journal are sent free of charge to members of the Association who have paid the yearly subscription fee of 30 €. Single issues can be purchased by members at 35 €. All payments must be made to Associazione Teriologica Italiana ETS by bank transfer on c/c n. 001034838399, Bancoposta - Poste Italiane, Italy, banking coordinates IBAN: IT39P0760103200001034838399.

The Association is available to promote exchanges with journals published by other scientific associations, museums, universities, etc.

Associazione Teriologica Italiana secretariat can be contacted at [segreteria.atit@gmail.com](mailto:segreteria.atit@gmail.com).

Information about this journal can be accessed at <http://www.italian-journal-of-mammalogy.it>

The Editorial Office can be contacted at [info@italian-journal-of-mammalogy.it](mailto:info@italian-journal-of-mammalogy.it)

**Associazione Teriologica Italiana Board of Councillors:** Giovanni AMORI (CNR-IRET, Rome) *Honorary President*, Sandro BERTOLINO (Università degli Studi di Torino) *President*, Laura SCILLITANI (MUSE, Trento), *Vicepresident*, Leonardo ANCILLOTTO (Università degli Studi di Napoli Federico II), Paola BARTOLOMMEI (Fondazione Ehoikos, Siena), Dario CAPIZZI (Regione Lazio, Rome), Stefano GRIGNOLIO (Università degli Studi di Sassari), Marco SCALISI (Regione Lazio, Rome), Emiliano MORI (CNR-IRET, Sesto Fiorentino, Italy) *Secretary/Treasurer*, Lucas A. WAUTERS (Università degli Studi dell'Insubria, Varese) *Director of Publications*, Damiano PREATONI (Università degli Studi dell'Insubria, Varese) *Electronic publications*, Chiara PANICCIA (EURAC, Bolzano) *Web sites, social networking*, Andrea BONACCHI (Fondazione Ehoikos, Siena) *Communication Office, Librarian*.



Volume 33 (suppl.) • 2022

## **XII Congresso Italiano di Teriologia**

**Cogne, 8–11 Giugno 2022**

edited by

Roberta Chirichella and Damiano G. Preatoni

This Journal as well as the individual articles contained in this issue are protected under copyright and Creative Commons license by Associazione Teriologica Italiana. The following terms and conditions apply: all on-line documents and web pages as well as their parts are protected by copyright, and it is permissible to copy and print them only for private, scientific and noncommercial use. Copyright for articles published in this journal is retained by the authors, with first publication rights granted to the journal. By virtue of their appearance in this Open Access journal, articles are free to be used, with proper attribution, in educational and other non-commercial settings. This Journal is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 Italy License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-sa/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, California, 94042, USA.

**Publication information:** *Hystrix* the Italian Journal of Mammalogy is published as a printed edition (ISSN 0394-1914) twice per year. A single copy of the printed edition is sent to all members of Associazione Teriologica Italiana. The electronic edition (ISSN 1825-5272), in Adobe® Acrobat® format is published “online first” on the Journal web site (<http://italian-journal-of-mammalogy.it>). Articles accepted for publication will be available in electronic format prior to the printed edition, for a prompt access to the latest peer-reviewed research.

### Best Paper Award

Associazione Teriologica Italiana established a Best Paper Award for young researchers. Eligible researchers are leading authors less than 35 years old, and within 7 years from their PhD (but young researcher at an even earlier stage of their career, i.e. without a PhD, are also eligible), who have expressed interest in the award in the Communications to the Editor (step 1 of the online submission procedure; for details, see the Electronic Publication Guide; <http://www.italian-journal-of-mammalogy.it/public/journals/3/authguide.pdf>).

If the eligible leading researcher is not the corresponding author, the latter should express interest on the leading researcher's behalf. Criteria are innovation, excellence and impact on the scientific community (e.g., number of citations).

The award will be assigned yearly, in the second semester of the year following that of reference (i.e., Best Paper Award for 2013 will be assigned in the second semester of 2014). The Editorial Committee is responsible to assign the award. A written motivation will be made public on the journal website.



**Parco Nazionale del Gran Paradiso**  
**Centro Congressi "Maison de la Grivola"**  
**Piazza E. Chanoux, Cogne**  
**8-11 Giugno 2022**

## **Riassunti: Comunicazioni e Poster**

edited by  
Roberta Chirichella and Damiano G. Preatoni

**Organizzato da**  
Associazione Teriologica Italiana ONLUS

**In collaborazione con**



Parco Nazionale del  
Gran Paradiso



Comune di Cogne



#### COMITATO ORGANIZZATORE

LEONARDO ANCILLOTTO, Università degli Studi di Napoli Federico II  
PAOLA BARTOLOMMEI, Fondazione Ethoikos  
BRUNO BASSANO, Parco Nazionale del Gran Paradiso  
SANDRO BERTOLINO, Università degli Studi di Torino  
ANDREA BONACCHI, Fondazione Ethoikos  
FRANCESCA BRIVIO, Università degli Studi di Sassari  
DARIO CAPIZZI, Regione Lazio  
STEFANO GRIGNOLIO, Università degli Studi di Ferrara  
EMILIANO MORI, CNR – Istituto di Ricerca sugli Ecosistemi Terrestri  
CHIARA PANICCIA, EURAC – Institute for Alpine Environment  
DAMIANO G. PREATONI, Università degli Studi dell'Insubria  
MARCO SCALISI, ISPRA  
LAURA SCILLITANI, MUSE – Museo delle Scienze di Trento  
DAVIDE SOGLIANI, Università degli Studi di Pavia  
LUCAS A. WAUTERS, Università degli Studi dell'Insubria

#### COMITATO SCIENTIFICO

GIOVANNI AMORI, CNR – Istituto di Ricerca sugli Ecosistemi Terrestri  
LEONARDO ANCILLOTTO, Università degli Studi di Napoli Federico II  
PAOLA BARTOLOMMEI, Fondazione Ethoikos  
BRUNO BASSANO, Parco Nazionale del Gran Paradiso  
SANDRO BERTOLINO, Università degli Studi di Torino  
DARIO CAPIZZI, Regione Lazio  
ROMINA FUSILLO, LUTRIA Wildlife Research and Consulting  
STEFANIA GASPERINI, Fondazione Ethoikos  
STEFANO GRIGNOLIO, Università degli Studi di Ferrara  
EMILIANO MORI, CNR – Istituto di Ricerca sugli Ecosistemi Terrestri  
DAMIANO G. PREATONI, Università degli Studi dell'Insubria  
FEDERICA ROSCIONI, Ecomodel  
MARCO SCALISI, ISPRA  
MASSIMO SCANDURA, Università degli Studi di Sassari  
LAURA SCILLITANI, MUSE – Museo delle Scienze di Trento  
LUCAS A. WAUTERS, Università degli Studi dell'Insubria

#### SEGRETERIA

EMILIANO MORI, CNR – Istituto di Ricerca sugli Ecosistemi Terrestri  
[segreteria@mammiferi.org](mailto:segreteria@mammiferi.org)

Citazione consigliata / Recommended citation

## Seasonal and environmental determinants of small mammals and their zoonotic potential across a wide latitudinal and altitudinal gradient

Ferrari G.<sup>1,2</sup>, Cagnacci F.<sup>2,\*</sup>, Tagliapietra V.<sup>2,\*</sup>, Devineau O.<sup>1,\*</sup>

<sup>1</sup> Faculty of Applied Ecology and Agricultural Science and Biotechnology, Campus Evenstad, Inland Norway University of Applied Sciences, 2480 Koppang, Norway

<sup>2</sup> Fondazione Edmund Mach, Research and Innovation Centre, Via Edmund Mach 1, 38010 San Michele all'Adige (Trento), Italy

\*These co-authors equally contributed and co-supervised the work



EO04

The functional role and position of a species within the environment is strongly governed by the interplay between species internal state, abiotic and biotic environmental conditions, as well as by multi-species interactions (predation, competition and parasitism). In this work we have implemented a multi-factorial niche-based approach to evaluate the consequences and patterns of environmental, climate and anthropic changes on small mammal populations and assemblages, considering also the cascading effects on parasite loads and thus on emergence of zoonotic and non-zoonotic diseases.

To achieve this goal, we carried out a treatment-control experiment with supplemental *ad libitum* food accessible all-year-round to woodland rodents at two latitudinal extremes i.e. Norway (from 2013 to 2015) and Italy (from 2019 to 2021). Secondly, we assessed the composition of small mammal assemblages across a wide altitudinal gradient (from 500 to 2500 m a.s.l.) in the Italian Alps (2019–2020). In both studies, we live-trapped small mammal species using a capture-mark-recapture approach. In Italy only, we counted the tick burden on rodents and collected biological samples (ear biopsy, blood sample) and molecular and serological screenings were subsequently performed for rodent- and vector-borne pathogens assessment. Within this work, we captured a total of 917 small mammals in Norway and 830 in Italy. In the latitudinal comparison, only bank vole (*Myodes glareolus*) was sampled in Norway, while two mice species (*Apodemus sylvaticus* and *A. flavicollis*) and bank vole in Italy. Within this comparison, we found that individual rodent survivorship seemed to be governed by seasonal cycles and overridden by food availability only when unfavourable conditions occurred. Conversely, local population size generally increased with supplemental food availability, unless when both mice and voles were sympatric (in Italy only). In this case, the dominant species (i.e., *Apodemus* spp.) performed better both on survival and population size respect to the subordinate one (i.e., *M. glareolus*). In Italy, rodent abundance and spatial aggregation registered at sites provided with supplemental food favoured

also tick burden on rodent hosts, especially on heavier animals. Beyond exploitation of rodent hosts, ticks were also favoured by less-limiting climatic conditions, indeed we sampled them at 2000–2500 m a.s.l., the highest altitude at which ticks were recorded in central Europe. At those altitudes, representing the cold and remote edges of small mammal distribution, we monitored the distributional overlap of snow vole (*Chionomys nivalis*), field voles (*Microtus* spp.) and unexpectedly of bank vole, which occupied also woodland habitats in sympatry with mice. Further, we also detected an altitudinal pattern among vector-borne pathogens, with *Borrelia* spp. infection at low altitudes, while *Anaplasma phagocytophilum* and *Babesia microti* mainly occurred at high altitudes. Beyond these common vector-borne pathogens, we also found *Hepatozoon* spp. along the entire altitudinal gradient and on snow voles for the first time.

These findings suggest that modifications in rodent demography and community structure, as well as host-parasite association, were favoured by homogeneous and human-disrupted areas such as at ungulate feeding stations. In these areas, if tick density in the environment is supportive, the presence of both rodents and deer may favour the completion of tick life cycle and enhance pathogens circulation among hosts. Moreover, the generalist species (e.g. *M. glareolus*), that occurred along a wide altitudinal range in sympatry with more specialist (e.g. *Apodemus* spp.) and climate-sensitive ones (e.g. *C. nivalis*), may be prone to upward distributional shifts and further promote the geographic expansion of arthropod vectors. This may also facilitate the spread and transmission of zoonotic pathogens under a climate change context. Overall, this study suggests that the multiple extrinsic and intrinsic environmental facets and biotic interspecific forces governing small mammal demography and communities should be considered ensemble using a multi-factorial approach, especially in perturbed ecosystems. Further, changes in small mammal populations and communities seem to alter host-vector-pathogen interactions, increasing the risk of transmission of infectious diseases both on wildlife and humans.