

# Long-term trends in the occupancy of ants revealed through use of multi-sourced datasets

Biology Letters

Julie K. Sheard<sup>\*1</sup>, Carsten Rahbek<sup>1,2,3,4,5</sup>, Robert R. Dunn<sup>6</sup>, Nathan J. Sanders<sup>7</sup>, Nick J.B. Isaac<sup>8</sup>

<sup>1</sup>Center for Macroecology, Evolution and Climate, and <sup>2</sup>Center for Global Mountain Biodiversity, GLOBE Institute, University of Copenhagen, Universitetsparken 15, Copenhagen 2100, Denmark

<sup>3</sup>Institute of Ecology, Peking University, Beijing 100871, People's Republic of China

<sup>4</sup>Department of Life Sciences, Imperial College London, Ascot SL5 7PY, UK

<sup>5</sup>Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, Odense M 5230, Denmark

<sup>6</sup>Department of Applied Ecology, North Carolina State University, Raleigh, NC, USA

<sup>7</sup>Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI, USA

<sup>8</sup>UK Centre for Ecology and Hydrology, Crowmarsh Gifford, Maclean Building, Wallingford OX10 8BB, UK

## Table S6: Overview of model results

Overview of all analysed species, including number of iterations needed to reach convergence, Rhat values, Precision, mean occupancy in each time period, directional occupancy change, 95 % equal-tailed credible intervals and confidence of change. Confidence above 80 %, indicating occupancy change, has been highlighted in bold.

| Species               | Iterations | Rhat <sub>mean</sub> | Rhat <sub>min</sub> | Rhat <sub>max</sub> | Precision | Time Period             | Change | 95% ETI      | Confidence | Mean occupancy |           |           |           |           |           |           |           |           |           |           |           |
|-----------------------|------------|----------------------|---------------------|---------------------|-----------|-------------------------|--------|--------------|------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                       |            |                      |                     |                     |           |                         |        |              |            | 1900-1909      | 1910-1919 | 1920-1929 | 1930-1939 | 1940-1949 | 1950-1959 | 1960-1969 | 1970-1979 | 1980-1989 | 1990-1999 | 2000-2009 | 2010-2019 |
| Increasing species    |            |                      |                     |                     |           |                         |        |              |            |                |           |           |           |           |           |           |           |           |           |           |           |
| <i>C. herculeanus</i> | 50000      | 1.006                | 1.002               | 1.016               | 0.057     | 1900-1909 to 1940-1949  | 0.03   | -0.06, 0.12  | 82         | 0.044          | 0.045     | 0.045     | 0.047     | 0.078     |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1940-1949 to 1950-1959  | -0.01  | -0.09, 0.05  | 64         |                |           |           |           | 0.065     |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1950-1959 to 2010-2019  | 0.18   | 0.00, 0.52   | 97         |                |           |           |           |           | 0.086     | 0.094     | 0.130     | 0.199     | 0.220     | 0.242     |           |
| <i>F. picea</i>       | 200000     | 1.003                | 1.002               | 1.004               | 0.034     | 1900-1909 to 1970-1979  | 0.16   | -0.06, 0.52  | 83         | 0.251          | 0.252     | 0.260     | 0.286     | 0.296     | 0.339     | 0.388     | 0.410     |           |           |           |           |
|                       |            |                      |                     |                     |           | 1970-1979 to 1980-1989  | -0.05  | -0.30, 0.07  | 68         |                |           |           |           |           |           |           |           | 0.360     |           |           |           |
|                       |            |                      |                     |                     |           | 1980-1989 to 2010-2019  | 0.05   | -0.16, 0.40  | 61         |                |           |           |           |           |           |           |           |           | 0.365     | 0.387     | 0.408     |
| <i>F. rufa</i>        | 50000      | 1.061                | 1.021               | 1.100               | 0.300     | 1900-1909 to 1970-1979  | 0.17   | -0.05, 0.65  | 83         | 0.665          | 0.686     | 0.729     | 0.730     | 0.744     | 0.771     | 0.807     | 0.836     |           |           |           |           |
|                       |            |                      |                     |                     |           | 1970-1979 to 2010-2019  | -0.12  | -0.57, 0.06  | 73         |                |           |           |           |           |           |           |           | 0.811     | 0.786     | 0.754     | 0.721     |
| <i>F. uralensis</i>   | 50000      | 1.007                | 1.001               | 1.024               | 0.056     | 1900-1909 to 1920-1929  | -0.01  | -0.16, 0.08  | 45         | 0.055          | 0.049     | 0.045     |           |           |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1920-1929 to 1970-1979  | 0.22   | 0.03, 0.38   | 99         |                |           |           | 0.045     | 0.056     | 0.075     | 0.202     | 0.267     |           |           |           |           |
|                       |            |                      |                     |                     |           | 1970-1979 to 1980-1989  | -0.08  | -0.28, 0.13  | 79         |                |           |           |           |           |           |           |           | 0.187     |           |           |           |
|                       |            |                      |                     |                     |           | 1980-1989 to 2010-2019  | 0.16   | -0.12, 0.51  | 87         |                |           |           |           |           |           |           |           |           | 0.198     | 0.273     | 0.349     |
| <i>M. ruginodis</i>   | 50000      | 1.011                | 1.001               | 1.037               | 5.750     | 1900-19009 to 1920-1929 | 0.01   | -0.17, 0.27  | 48         | 0.836          | 0.847     | 0.848     |           |           |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1920-1929 to 1930-1939  | -0.03  | -0.32, 0.12  | 57         |                |           |           | 0.818     |           |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1930-1939 to 1940-1949  | 0.01   | -0.15, 0.30  | 48         |                |           |           |           | 0.831     |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1940-1949 to 1950-1959  | -0.03  | -0.24, 0.13  | 62         |                |           |           |           |           | 0.802     |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1950-1959 to 1970-1979  | 0.07   | -0.05, 0.27  | 83         |                |           |           |           |           |           | 0.851     | 0.877     |           |           |           |           |
|                       |            |                      |                     |                     |           | 1970-1979 to 1990-1999  | -0.1   | -0.90, 0.09  | 63         |                |           |           |           |           |           |           |           | 0.818     | 0.775     |           |           |
|                       |            |                      |                     |                     |           | 1990-1999 to 2010-2019  | 0.1    | -0.08, 0.83  | 71         |                |           |           |           |           |           |           |           |           |           |           | 0.826     |
| Declining species     |            |                      |                     |                     |           |                         |        |              |            |                |           |           |           |           |           |           |           |           |           |           |           |
| <i>L. fuliginosus</i> | 50000      | 1.005                | 1.002               | 1.008               | 1.168     | 1900-1909 to 1920-1929  | 0.03   | -0.20, 0.37  | 55         | 0.681          | 0.704     | 0.714     |           |           |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1920-1929 to 1970-1979  | -0.28  | -0.65, 0.04  | 94         |                |           |           | 0.682     | 0.635     | 0.589     | 0.485     | 0.430     |           |           |           |           |
|                       |            |                      |                     |                     |           | 1970-1979 to 1980-1989  | 0.05   | -0.14, 0.32  | 65         |                |           |           |           |           |           |           |           | 0.480     |           |           |           |
|                       |            |                      |                     |                     |           | 1980-1989 to 2010-2019  | -0.03  | -0.31, 0.23  | 60         |                |           |           |           |           |           |           |           |           | 0.463     | 0.455     | 0.446     |
| <i>M. rubra</i>       | 50000      | 1.015                | 1.005               | 1.035               | 46.178    | 1900-1909 to 1920-1929  | 0.006  | -0.16, 0.23  | 45         | 0.863          | 0.864     | 0.869     |           |           |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1920-1929 to 1930-1939  | -0.01  | -0.17, 0.12  | 57         |                |           |           | 0.855     |           |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1930-1939 to 1940-1949  | 0.01   | -0.11, 0.18  | 53         |                |           |           |           | 0.868     |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1940-1949 to 1990-1999  | -0.25  | -0.79, 0.06  | 88         |                |           |           |           |           | 0.832     | 0.827     | 0.715     | 0.680     | 0.618     |           |           |
|                       |            |                      |                     |                     |           | 1990-1999 to 2010-2019  | 0.1    | -0.17, 0.57  | 67         |                |           |           |           |           |           |           |           |           |           |           | 0.668     |
| <i>M. sabuleti</i>    | 50000      | 1.006                | 1.001               | 1.021               | 29.110    | 1900-1909 to 1940-1949  | 0.24   | -0.33, 0.82  | 72         | 0.456          | 0.511     | 0.516     | 0.546     | 0.697     |           |           |           |           |           |           |           |
|                       |            |                      |                     |                     |           | 1940-1949 to 2010-2019  | -0.64  | -0.92, -0.37 | 100        |                |           |           |           |           | 0.611     | 0.512     | 0.489     | 0.161     | 0.136     | 0.104     | 0.053     |

| Species              | Iterations | Rhat <sub>mean</sub> | Rhat <sub>min</sub> | Rhat <sub>max</sub> | Precision | Time Period            | Change  | 95% ETI      | Confidence | Mean occupancy |           |           |           |           |           |           |           |           |           |           |           |       |
|----------------------|------------|----------------------|---------------------|---------------------|-----------|------------------------|---------|--------------|------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|
|                      |            |                      |                     |                     |           |                        |         |              |            | 1900-1909      | 1910-1919 | 1920-1929 | 1930-1939 | 1940-1949 | 1950-1959 | 1960-1969 | 1970-1979 | 1980-1989 | 1990-1999 | 2000-2009 | 2010-2019 |       |
| <i>M. schencki</i>   | 50000      | 1.030                | 1.018               | 1.053               | 0.037     | 1900-1909 to 1910-1919 | -0.0002 | -0.17, 0.16  | 46         | 0.302          | 0.302     |           |           |           |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1910-1919 to 1940-1949 | 0.06    | -0.21, 0.44  | 64         |                |           | 0.309     | 0.339     | 0.366     |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1940-1949 to 1970-1979 | -0.12   | -0.43, 0.05  | 81         |                |           |           |           |           | 0.276     | 0.262     | 0.247     |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1970-1979 to 1980-1989 | 0.0007  | -0.12, 0.14  | 46         |                |           |           |           |           |           |           |           | 0.247     |           |           |           |       |
|                      |            |                      |                     |                     |           | 1980-1989 to 2010-2019 | -0.01   | -0.25, 0.20  | 54         |                |           |           |           |           |           |           |           |           |           | 0.240     | 0.239     | 0.235 |
| Fluctuating species  |            |                      |                     |                     |           |                        |         |              |            |                |           |           |           |           |           |           |           |           |           |           |           |       |
| <i>F. polycheta</i>  | 50000      | 1.003                | 1.001               | 1.005               | 16.222    | 1900-1909 to 1940-1949 | 0.46    | -0.23, 0.96  | 88         | 0.294          | 0.457     | 0.464     | 0.673     | 0.750     |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1940-1949 to 1960-1969 | -0.57   | -0.89, -0.11 | 99         |                |           |           |           | 0.347     | 0.175     | 0.192     |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1960-1969 to 1990-1999 | 0.54    | 0.05, 0.88   | 99         |                |           |           |           |           |           |           |           | 0.708     | 0.710     |           |           |       |
|                      |            |                      |                     |                     |           | 1990-1999 to 2010-2019 | -0.17   | -0.52, 0.21  | 80         |                |           |           |           |           |           |           |           |           |           | 0.610     | 0.539     |       |
| <i>F. rufibarbis</i> | 50000      | 1.008                | 1.001               | 1.017               | 0.016     | 1900-1909 to 1930-1939 | 0.11    | -0.17, 0.50  | 73         | 0.474          | 0.479     | 0.508     | 0.583     |           |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1930-1939 to 1970-1979 | -0.23   | -0.57, 0.02  | 95         |                |           |           |           | 0.578     | 0.433     | 0.369     | 0.352     |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1970-1979 to 2010-2019 | 0.17    | -0.08, 0.51  | 85         |                |           |           |           |           |           |           |           | 0.368     | 0.397     | 0.455     | 0.519     |       |
| <i>F. sanguinea</i>  | 50000      | 1.023                | 1.004               | 1.047               | 0.019     | 1900-1909 to 1940-1949 | 0.22    | -0.03, 0.50  | 91         | 0.197          | 0.203     | 0.245     | 0.364     | 0.420     |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1940-1949 to 1950-1959 | -0.01   | -0.18, 0.14  | 55         |                |           |           |           |           | 0.410     |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1950-1959 to 1960-1969 | 0.02    | -0.10, 0.19  | 60         |                |           |           |           |           |           | 0.434     |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1960-1969 to 2010-2019 | -0.21   | -0.48, 0.02  | 93         |                |           |           |           |           |           |           |           | 0.419     | 0.347     | 0.313     | 0.267     | 0.224 |
| <i>L. umbratus</i>   | 50000      | 1.002                | 1.001               | 1.005               | 51.108    | 1900-1909 to 1970-1979 | -0.28   | -0.76, 0.06  | 92         | 0.489          | 0.473     | 0.436     | 0.384     | 0.335     | 0.335     | 0.281     | 0.212     |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1970-1979 to 2010-2019 | 0.27    | -0.03, 0.72  | 94         |                |           |           |           |           |           |           |           |           | 0.242     | 0.305     | 0.391     | 0.483 |
| <i>M. rugulosa</i>   | 50000      | 1.003                | 1.002               | 1.007               | 300.545   | 1900-1909 to 1910-1919 | 0.05    | -0.16, 0.38  | 65         | 0.402          | 0.455     |           |           |           |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1910-1919 to 1930-1939 | -0.07   | -0.39, 0.15  | 68         |                |           | 0.397     | 0.388     |           |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1930-1939 to 1940-1949 | 0.003   | -0.21, 0.20  | 52         |                |           |           |           | 0.391     |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1940-1949 to 1970-1979 | -0.11   | -0.35, 0.06  | 86         |                |           |           |           |           | 0.387     | 0.286     | 0.282     |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1970-1979 to 2010-2019 | 0.16    | -0.09, 0.63  | 83         |                |           |           |           |           |           |           |           |           | 0.344     | 0.363     | 0.403     | 0.444 |
| <i>T. caespitum</i>  | 100000     | 1.008                | 1.001               | 1.017               | 6.600     | 1900-1909 to 1930-1939 | 0.08    | -0.25, 0.62  | 61         | 0.616          | 0.664     | 0.692     | 0.695     |           |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1930-1939 to 1940-1949 | -0.04   | -0.34, 0.15  | 58         |                |           |           |           | 0.656     |           |           |           |           |           |           |           |       |
|                      |            |                      |                     |                     |           | 1940-1949 to 1980-1989 | 0.15    | -0.09, 0.51  | 83         |                |           |           |           |           | 0.688     | 0.788     | 0.790     | 0.803     |           |           |           |       |
|                      |            |                      |                     |                     |           | 1980-1989 to 2010-2019 | -0.14   | -0.44, 0.07  | 86         |                |           |           |           |           |           |           |           |           |           | 0.757     | 0.712     | 0.662 |

| Species         | Iterations | Rhat <sub>mean</sub> | Rhat <sub>min</sub> | Rhat <sub>max</sub> | Precision | Time Period            | Change  | 95% ETI     | Confidence | Mean occupancy |           |           |           |           |           |           |           |           |           |           |           |
|-----------------|------------|----------------------|---------------------|---------------------|-----------|------------------------|---------|-------------|------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                 |            |                      |                     |                     |           |                        |         |             |            | 1900-1909      | 1910-1919 | 1920-1929 | 1930-1939 | 1940-1949 | 1950-1959 | 1960-1969 | 1970-1979 | 1980-1989 | 1990-1999 | 2000-2009 | 2010-2019 |
| Stable species  |            |                      |                     |                     |           |                        |         |             |            |                |           |           |           |           |           |           |           |           |           |           |           |
| F. cinerea      | 50000      | 1.016                | 1.003               | 1.029               | 0.034     | 1900-1909 to 1950-1959 | -0.04   | -0.22, 0.04 | 73         | 0.190          | 0.178     | 0.172     | 0.164     | 0.162     | 0.151     |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1950-1959 to 2010-2019 | 0.03    | -0.05, 0.18 | 68         |                |           |           |           |           |           | 0.160     | 0.160     | 0.169     | 0.169     | 0.175     | 0.181     |
| F. cunicularia  | 50000      | 1.066                | 1.038               | 1.100               | 0.009     | 1900-1909 to 1940-1949 | -0.006  | -0.08, 0.03 | 45         | 0.060          | 0.058     | 0.057     | 0.055     | 0.054     |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1940-1949 to 1990-1999 | 0.008   | -0.05, 0.08 | 59         |                |           |           |           |           | 0.055     | 0.058     | 0.061     | 0.062     | 0.063     |           |           |
|                 |            |                      |                     |                     |           | 1990-1999 to 2010-2019 | -0.002  | -0.06, 0.05 | 48         |                |           |           |           |           |           |           |           |           |           | 0.062     | 0.061     |
| F. exsecta      | 200000     | 1.015                | 1.008               | 1.020               | 0.026     | 1900-1909 to 1910-1919 | -0.009  | -0.15, 0.09 | 51         | 0.316          | 0.307     |           |           |           |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1910-1919 to 1970-1979 | 0.11    | -0.04, 0.47 | 77         |                |           | 0.309     | 0.325     | 0.327     | 0.350     | 0.383     | 0.414     |           |           |           |           |
|                 |            |                      |                     |                     |           | 1970-1979 to 1990-1999 | -0.05   | -0.36, 0.07 | 65         |                |           |           |           |           |           |           |           | 0.377     | 0.364     |           |           |
|                 |            |                      |                     |                     |           | 1990-1999 to 2000-2009 | 0.0004  | -0.13, 0.14 | 47         |                |           |           |           |           |           |           |           |           |           | 0.365     |           |
|                 |            |                      |                     |                     |           | 2000-2009 to 2010-2019 | -0.0009 | -0.14, 0.14 | 47         |                |           |           |           |           |           |           |           |           |           |           | 0.364     |
| F. fusca        | 100000     | 1.006                | 1.002               | 1.010               | 8.634     | 1900-1909 to 1930-1939 | 0.02    | -0.07, 0.22 | 49         | 0.921          | 0.932     | 0.934     | 0.937     |           |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1930-1939 to 1950-1959 | -0.008  | -0.12, 0.07 | 51         |                |           |           |           | 0.934     | 0.929     |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1950-1959 to 1970-1979 | 0.02    | -0.04, 0.15 | 62         |                |           |           |           |           |           | 0.936     | 0.948     |           |           |           |           |
|                 |            |                      |                     |                     |           | 1970-1979 to 2010-2019 | -0.03   | -0.20, 0.05 | 66         |                |           |           |           |           |           |           |           | 0.927     | 0.926     | 0.918     | 0.917     |
| F. pratensis    | 100000     | 1.020                | 1.007               | 1.032               | 0.009     | 1900-1909 to 1910-1919 | 0.005   | -0.08, 0.11 | 52         | 0.256          | 0.261     |           |           |           |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1910-1919 to 1960-1969 | -0.04   | -0.25, 0.04 | 73         |                |           | 0.251     | 0.247     | 0.244     | 0.218     | 0.215     |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1960-1969 to 1970-1979 | 0.007   | -0.04, 0.08 | 54         |                |           |           |           |           |           |           | 0.222     |           |           |           |           |
|                 |            |                      |                     |                     |           | 1970-1979 to 2010-2019 | -0.02   | -0.17, 0.09 | 58         |                |           |           |           |           |           |           |           | 0.219     | 0.214     | 0.210     | 0.206     |
| F. pressilabris | 50000      | 1.013                | 1.001               | 1.035               | 0.013     | 1900-1909 to 1910-1919 | -0.001  | -0.09, 0.08 | 46         | 0.243          | 0.242     |           |           |           |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1910-1919 to 1950-1959 | 0.04    | -0.10, 0.27 | 63         |                |           | 0.245     | 0.252     | 0.270     | 0.281     |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1950-1959 to 1960-1969 | -0.005  | -0.12, 0.08 | 50         |                |           |           |           |           |           | 0.276     |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1960-1969 to 1980-1989 | 0.04    | -0.05, 0.26 | 69         |                |           |           |           |           |           |           | 0.291     | 0.317     |           |           |           |
|                 |            |                      |                     |                     |           | 1980-1989 to 2010-2019 | -0.03   | -0.28, 0.11 | 59         |                |           |           |           |           |           |           |           |           |           | 0.298     | 0.293     |
| F. truncorum    | 50000      | 1.008                | 1.001               | 1.017               | 0.039     | 1900-1909 to 1930-1939 | 0.02    | -0.14, 0.23 | 61         | 0.197          | 0.199     | 0.203     | 0.219     |           |           |           |           |           | 0.162     | 0.165     | 0.169     |
|                 |            |                      |                     |                     |           | 1930-1939 to 1980-1989 | -0.06   | -0.29, 0.05 | 77         |                |           |           |           | 0.207     | 0.182     | 0.170     | 0.162     | 0.158     |           |           |           |
|                 |            |                      |                     |                     |           | 1980-1989 to 2010-2019 | 0.01    | -0.09, 0.16 | 53         |                |           |           |           |           |           |           |           |           | 0.162     | 0.165     | 0.169     |
| F. nitidulus    | 50000      | 1.009                | 1.002               | 1.015               | 0.139     | 1900-1909 to 1910-1919 | 0.001   | -0.15, 0.13 | 51         | 0.196          | 0.197     |           |           |           |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1910-1919 to 1920-1929 | -0.005  | -0.16, 0.11 | 49         |                |           | 0.192     |           |           |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1920-1929 to 1940-1949 | 0.011   | -0.18, 0.19 | 57         |                |           |           | 0.199     | 0.202     |           |           |           |           |           |           |           |
|                 |            |                      |                     |                     |           | 1940-1949 to 1980-1989 | -0.063  | -0.31, 0.07 | 75         |                |           |           |           |           | 0.191     | 0.172     | 0.150     | 0.139     |           |           |           |
|                 |            |                      |                     |                     |           | 1980-1989 to 2010-2019 | 0.012   | -0.11, 0.18 | 52         |                |           |           |           |           |           |           |           |           |           | 0.141     | 0.147     |

| Species         | Iterations | Rhat <sub>mean</sub> | Rhat <sub>min</sub> | Rhat <sub>max</sub> | Precision | Time Period            | Change | 95% ETI     | Confidence | Mean occupancy |           |           |           |           |           |           |           |           |           |           |           |       |
|-----------------|------------|----------------------|---------------------|---------------------|-----------|------------------------|--------|-------------|------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|
|                 |            |                      |                     |                     |           |                        |        |             |            | 1900-1909      | 1910-1919 | 1920-1929 | 1930-1939 | 1940-1949 | 1950-1959 | 1960-1969 | 1970-1979 | 1980-1989 | 1990-1999 | 2000-2009 | 2010-2019 |       |
| L. meridionalis | 600000     | 1.023                | 1.004               | 1.047               | 24.455    | 1930-1939 to 1940-1949 | -0.002 | -0.10, 0.07 | 26         |                |           |           |           | 0.927     |           |           |           |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1940-1949 to 1970-1979 | 0.01   | -0.05, 0.22 | 32         |                |           |           |           |           | 0.934     | 0.942     | 0.942     |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1970-1979 to 1990-1999 | -0.01  | -0.14, 0.06 | 28         |                |           |           |           |           |           |           |           | 0.937     | 0.931     |           |           |       |
|                 |            |                      |                     |                     |           | 1990-1999 to 2010-2019 | 0.01   | -0.06, 0.13 | 28         |                |           |           |           |           |           |           |           |           |           | 0.937     | 0.941     |       |
|                 |            |                      |                     |                     |           | 1900-1909 to 1910-1919 | -0.003 | -0.21, 0.16 | 45         | 0.248          | 0.244     |           |           |           |           |           |           |           |           |           |           |       |
| L. niger        | 400000     | 1.006                | 1.003               | 1.011               | 519.021   | 1910-1919 to 1940-1949 | 0.14   | -0.14, 0.63 | 72         |                |           | 0.257     | 0.295     | 0.382     |           |           |           |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1940-1949 to 1970-1979 | -0.15  | -0.61, 0.06 | 78         |                |           |           |           |           | 0.350     | 0.235     | 0.229     |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1970-1979 to 2010-2019 | 0.17   | -0.08, 0.83 | 75         |                |           |           |           |           |           |           |           | 0.273     | 0.321     | 0.361     | 0.400     |       |
|                 |            |                      |                     |                     |           | 1900-1909 to 1910-1919 | -0.009 | -0.26, 0.19 | 43         | 0.897          | 0.888     |           |           |           |           |           |           |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1910-1919 to 1940-1949 | 0.05   | -0.10, 0.44 | 51         |                |           | 0.900     | 0.918     | 0.938     |           |           |           |           |           |           |           |       |
| L. acervorum    | 100000     | 1.030                | 1.004               | 1.087               | 11.325    | 1940-1949 to 1950-1959 | -0.05  | -0.35, 0.06 | 59         |                |           |           |           |           | 0.889     |           |           |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1950-1959 to 1970-1979 | 0.07   | -0.03, 0.39 | 68         |                |           |           |           |           |           |           | 0.939     | 0.962     |           |           |           |       |
|                 |            |                      |                     |                     |           | 1970-1979 to 1990-1999 | -0.06  | -0.54, 0.05 | 62         |                |           |           |           |           |           |           |           |           | 0.935     | 0.901     |           |       |
|                 |            |                      |                     |                     |           | 1990-1999 to 2010-2019 | 0.04   | -0.08, 0.49 | 46         |                |           |           |           |           |           |           |           |           |           | 0.915     | 0.942     |       |
|                 |            |                      |                     |                     |           | 1900-1909 to 1970-1979 | 0.56   | 0.00, 1.00  | 72         | 0.421          | 0.435     | 0.594     | 0.801     | 0.819     | 0.947     | 0.977     | 0.983     |           |           |           |           |       |
| M. lobicornis   | 200000     | 1.046                | 1.024               | 1.053               | 997.235   | 1970-1979 to 1990-1999 | -0.07  | -0.72, 0.04 | 33         |                |           |           |           |           |           |           |           | 0.918     | 0.915     |           |           |       |
|                 |            |                      |                     |                     |           | 1990-1999 to 2010-2019 | 0.06   | -0.10, 0.69 | 31         |                |           |           |           |           |           |           |           |           |           |           | 0.958     | 0.971 |
|                 |            |                      |                     |                     |           | 1900-1909 to 1940-1949 | 0.18   | -0.20, 0.91 | 64         | 0.519          | 0.527     | 0.555     | 0.627     | 0.695     |           |           |           |           |           |           |           |       |
| M. scabrinodis  | 50000      | 1.008                | 1.002               | 1.020               | 1.781     | 1940-1949 to 2010-2019 | -0.21  | -0.93, 0.24 | 70         |                |           |           |           |           | 0.670     | 0.656     | 0.655     | 0.595     | 0.533     | 0.512     | 0.481     |       |
|                 |            |                      |                     |                     |           | 1900-1909 to 1940-1949 | -0.04  | -0.34, 0.23 | 60         | 0.746          | 0.731     | 0.721     | 0.712     | 0.710     |           |           |           |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1940-1949 to 1950-1959 | 0.02   | -0.13, 0.24 | 56         |                |           |           |           |           | 0.732     |           |           |           |           |           |           |       |
|                 |            |                      |                     |                     |           | 1950-1959 to 1980-1989 | -0.14  | -0.56, 0.11 | 79         |                |           |           |           |           |           | 0.717     | 0.661     | 0.589     |           |           |           |       |
|                 |            |                      |                     |                     |           | 1980-1989 to 2010-2019 | 0.01   | -0.14, 0.57 | 71         |                |           |           |           |           |           |           |           |           | 0.614     | 0.651     | 0.689     |       |