

Freshwater insect abundance trends vary between continents and families



J.F. Murphy, J.I. Jones, Y.-S. Park, S.-J. Hwang, E. Dyer, B. Woodcock



Natural Environment Research Council

<https://glitrs.ceh.ac.uk>

@qmulrivercomms.bsky.social

Insects are a remarkably diverse animal group. They perform many critical roles in the functioning of terrestrial and freshwater ecosystems. However, insect communities are changing and there is much concern that human pressures may be leading to declines in their abundance and diversity.

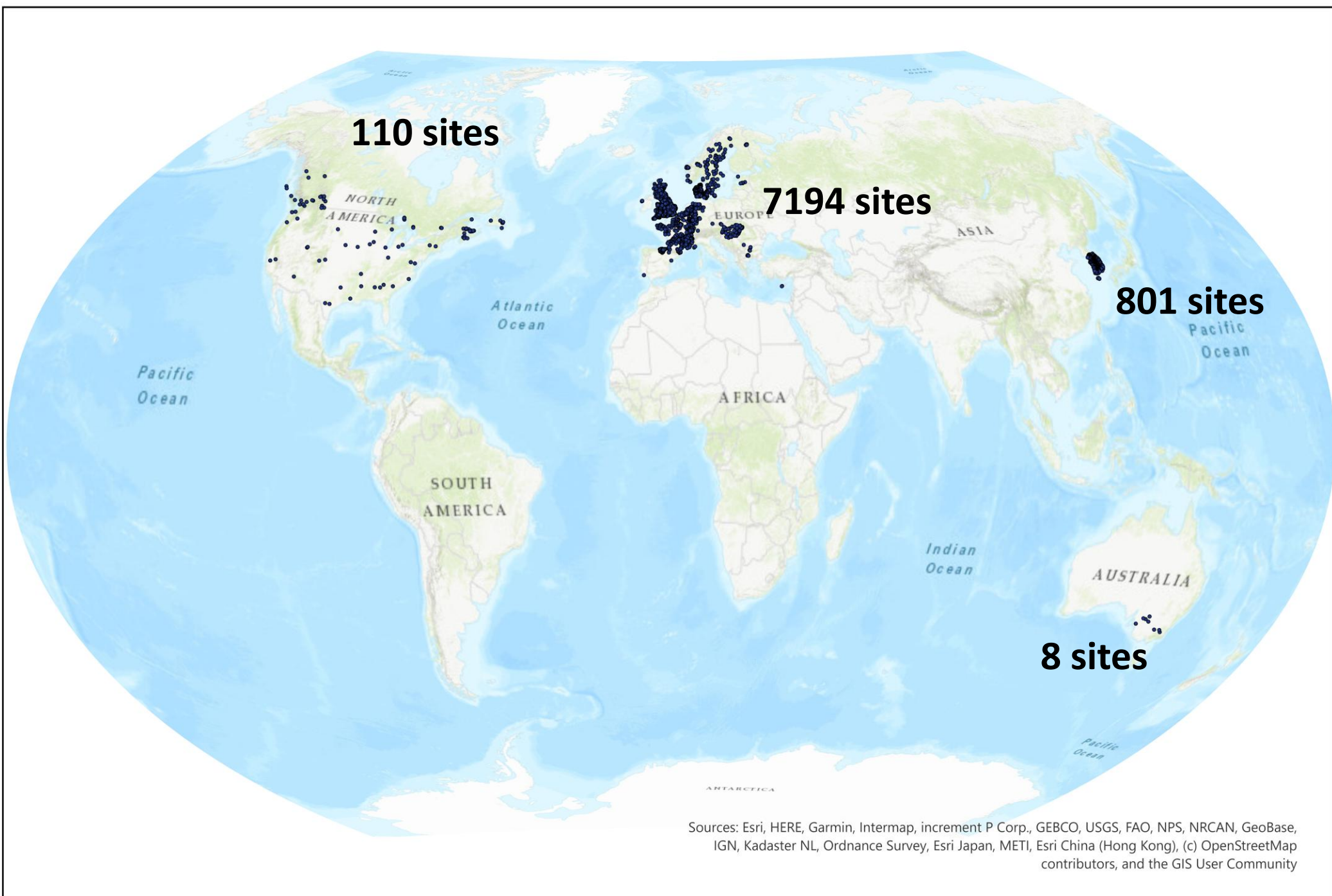
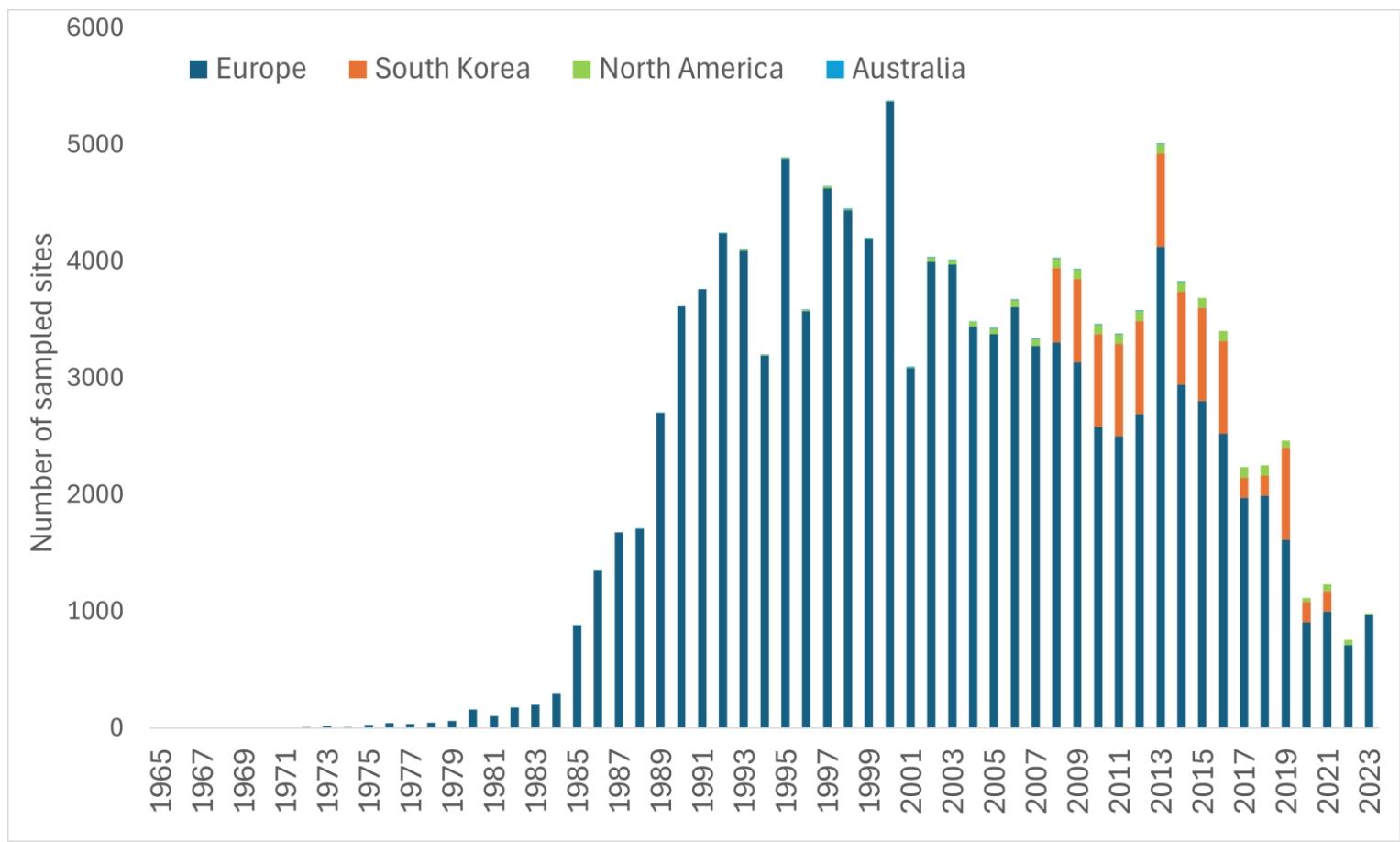
Objective: To quantify trends in the abundance of freshwater insects across broad spatial scales

Data description: We collated abundance time series (> 9 sampling occasions over > 9-year period) for 138 freshwater insect families from 8,113 river sites in Europe^{1,2,3,4}, South Korea⁵, North America^{6,7} and Australia⁸.

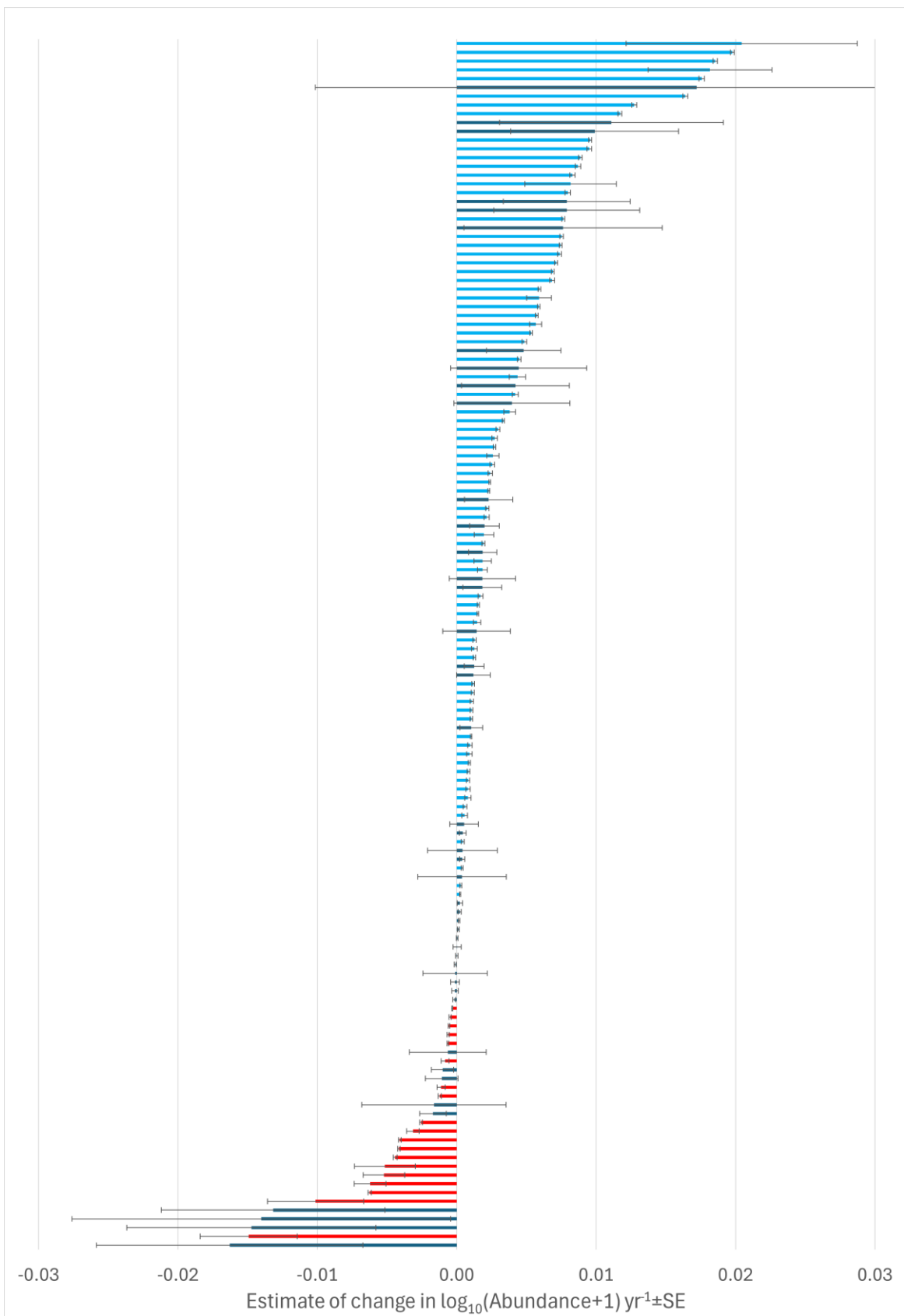
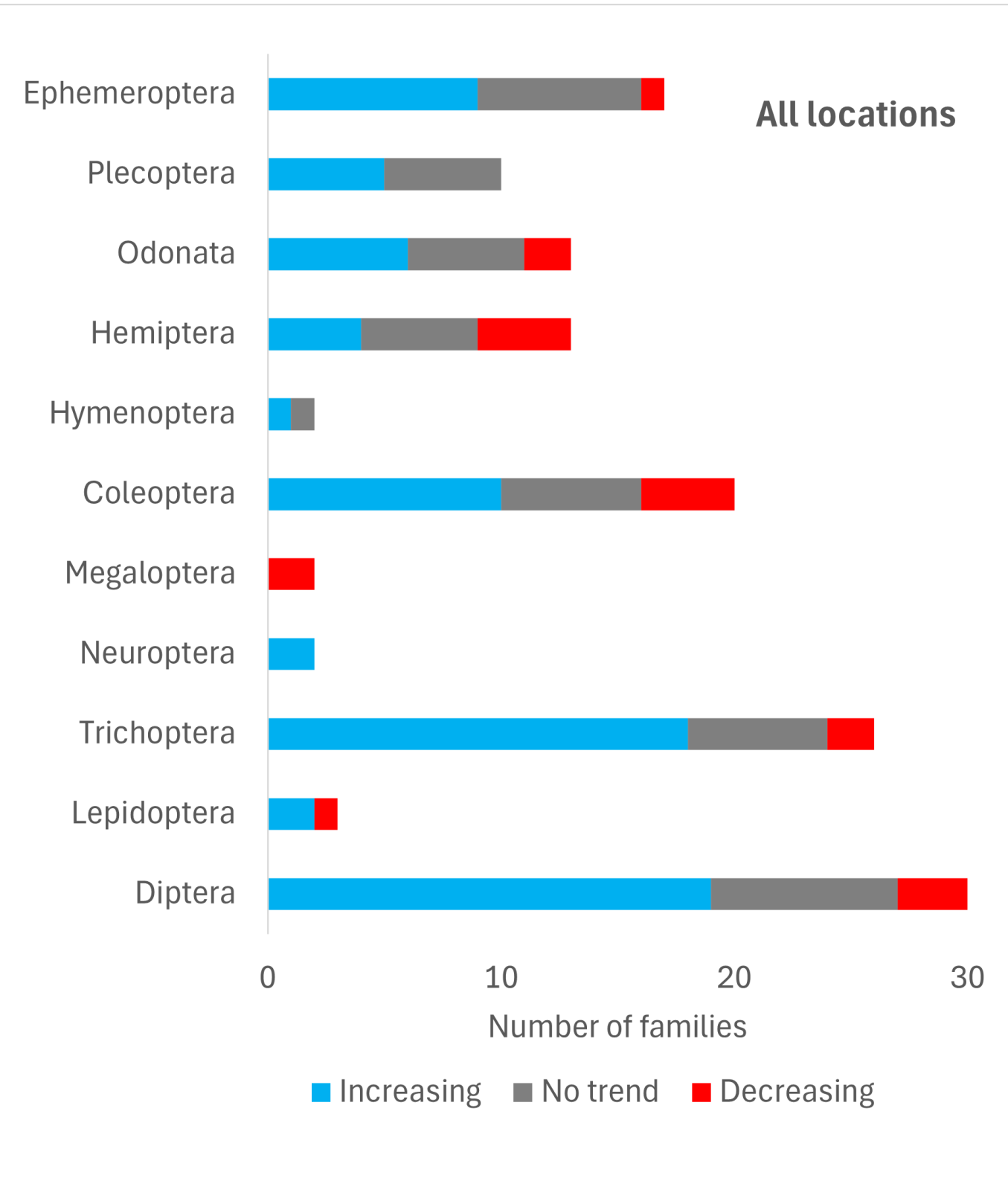
Sites were sampled using consistent protocols within each time series. Data spanned 59 years (1965–2023) with most sampling effort after 1985.

Vast majority of data are from Europe with other regions mostly contributing post-2007.

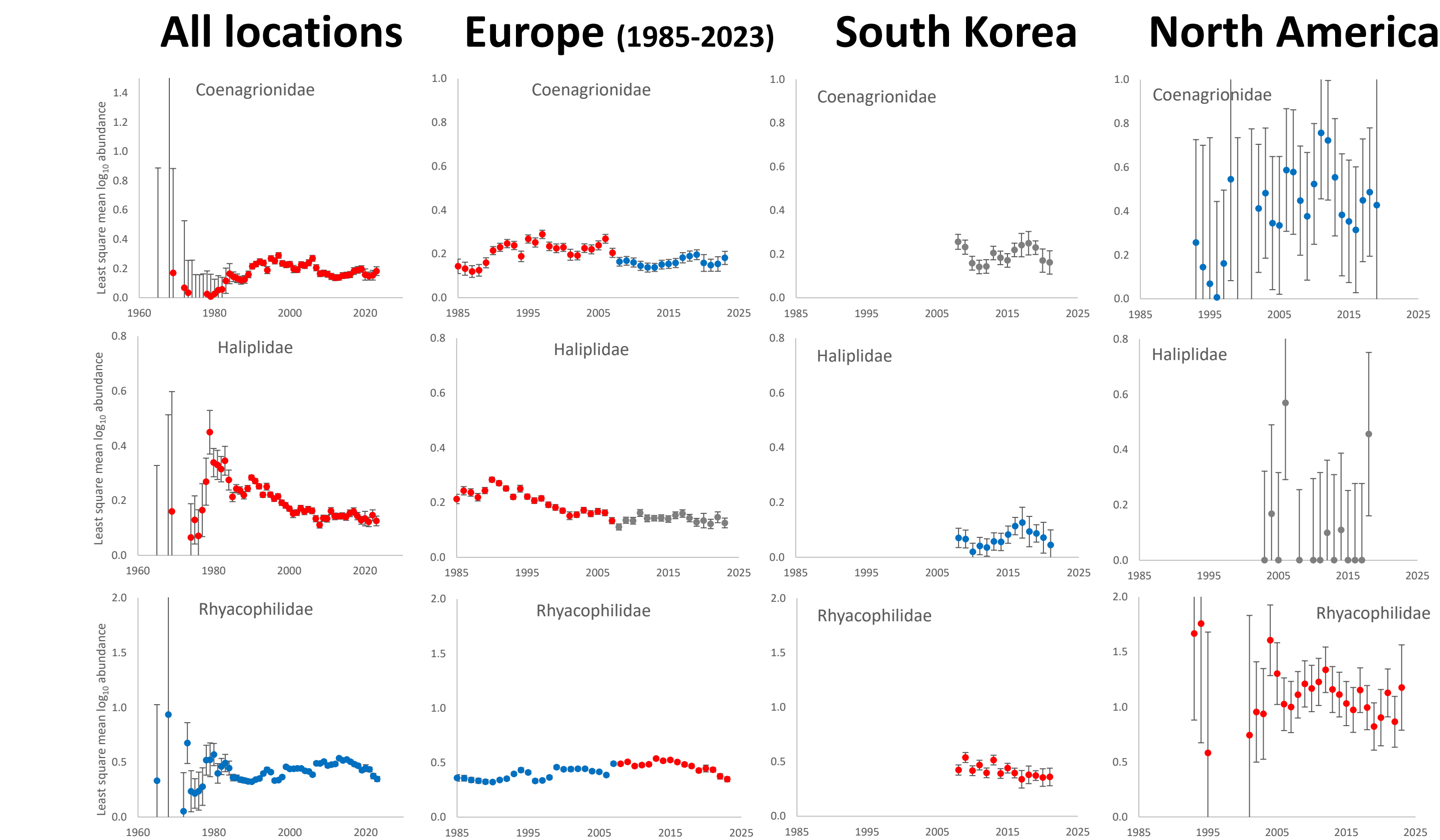
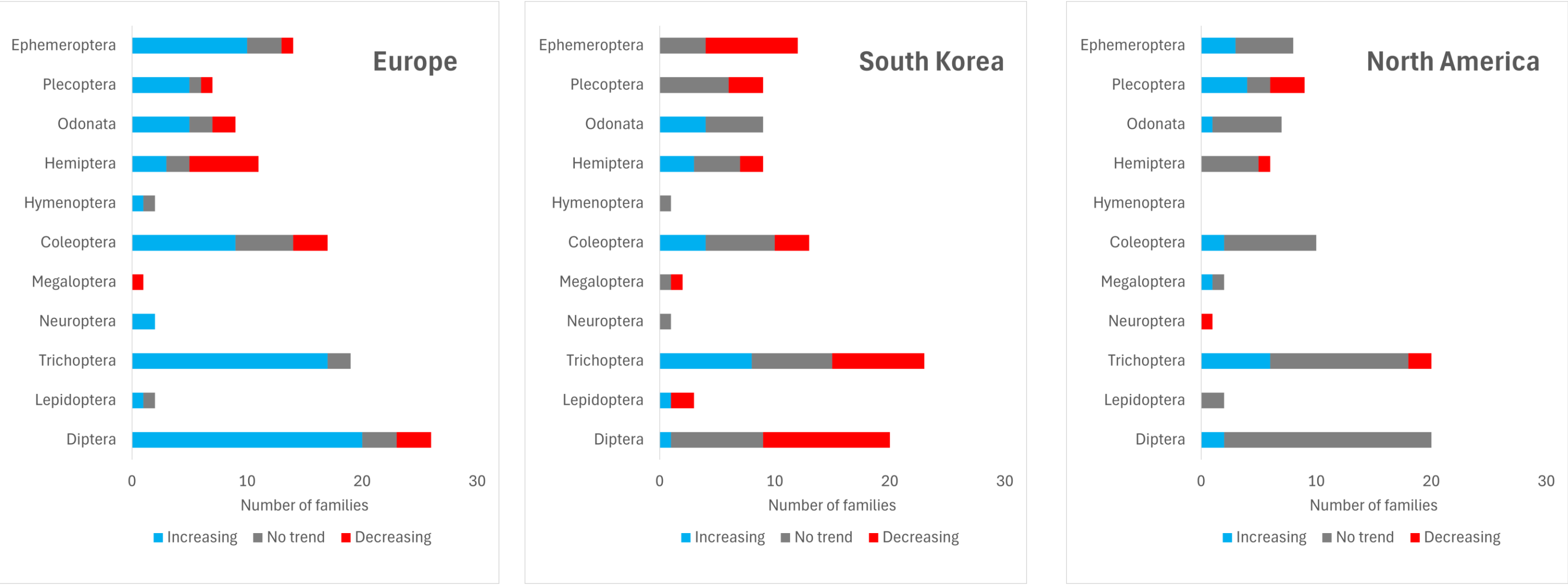
Temporal trends in insect family abundance (\log_{10} transformed) were analysed using linear mixed-effects models.



Results 1: Across all time series, there were many more insect families with increasing than decreasing abundance trends; particularly among the Plecoptera, Trichoptera and Diptera. Only Hemiptera had equal numbers of families increasing and decreasing.



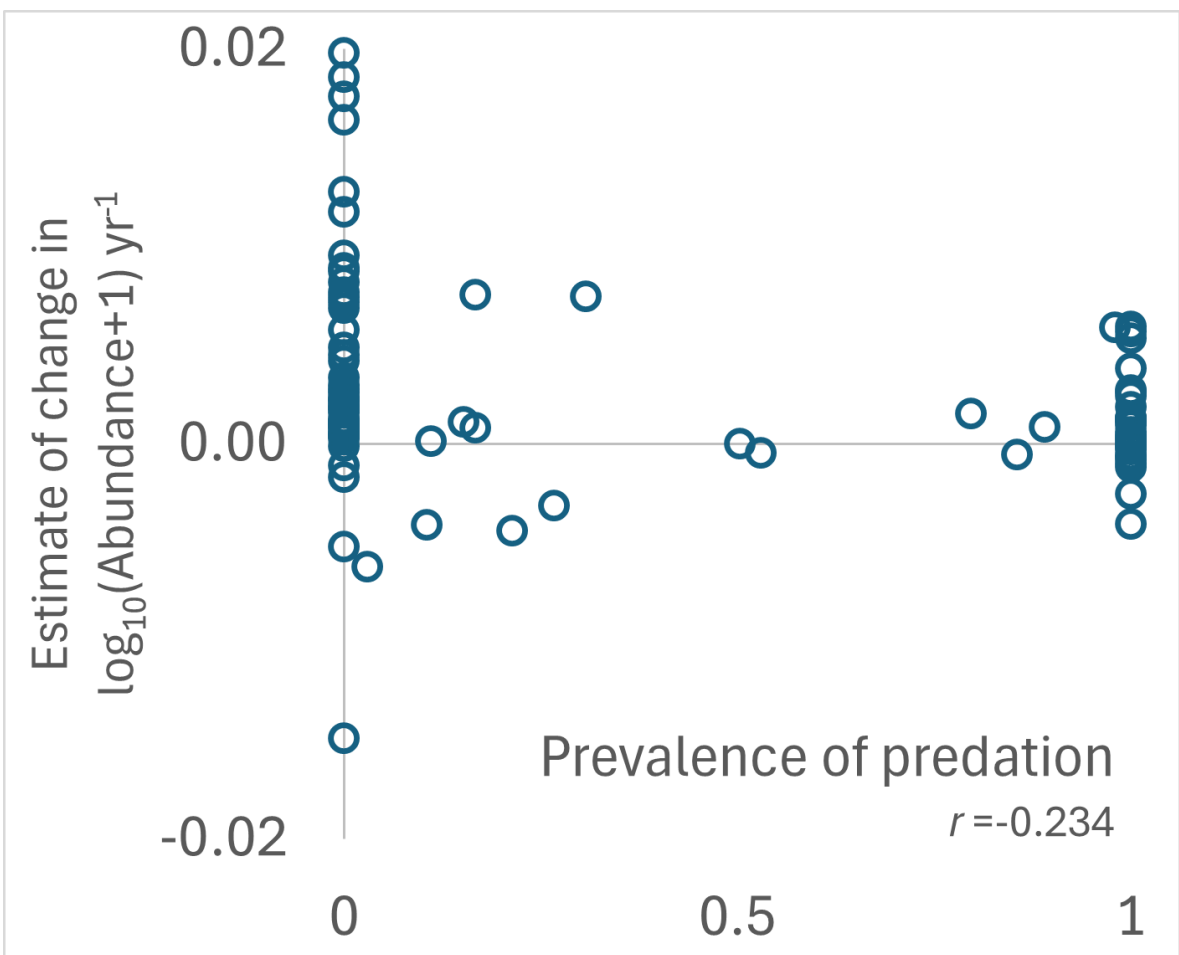
Results 2: There were differences between Europe, South Korea and North America in the relative numbers of families, within orders, with increasing and decreasing trends. South Korea had more families with decreasing trends than Europe. North America had more families with no detectable trends in abundance.



Trends for three of the 138 families. **All locations:** entire dataset. **Europe (1985–2023):** entire European dataset but only 1985 onwards plotted for clarity; 2008–23 trend also represented for comparison. **Blue:** increasing; **Grey:** no trend; **Red:** decreasing

Results 3: Differences between Europe, South Korea and North America are being driven in part by differences between datasets in time-span and replication. A relatively low number of North American sites creates greater uncertainty reducing power to detect trends. The 14-year time-span of South Korean data is not comparable to 59-year European dataset. However, when recent (post-2007) European trends are compared to South Korean trends, differences still predominate. Most Korean mayflies are in decline but in Europe, even over the recent (2008–2023) period, only one family is in decline; Baetidae.

Results 4: Predators tended to have lower rates of increase than non-predators while detritivores tended to have greater increasing trends. No relationships between abundance trends and voltinism, body size or fecundity.



Conclusions

- Most freshwater insect families are increasing in abundance
- South Korea had more families with decreasing trends than Europe
- More robust time series data needed outside of Europe

1. Welti *et al.* (2024) Time series of freshwater macroinvertebrate abundances and site characteristics of European streams and rivers. *Scientific Data* 11:601 <https://doi.org/10.1038/s41597-024-03445-3>. 2. Environment Agency, England, UK <https://environment.data.gov.uk/ecology/explorer>. 3. Natural Resources Wales, Wales, UK <https://registry.nbnatlas.org/public/show/dr2116>. 4. Scottish Environment Protection Agency, Scotland, UK <https://www.sepa.org.uk/environment/environmental-data>. 5. South Korea Ministry of Environment and National Institute of Environmental Research: National Aquatic Ecological Monitoring Program provided by Prof. Soon-Jin Hwang (Department of Environmental Science, Konkuk University, Seoul 143-701, Republic of Korea). 6. Canadian Aquatic Biomonitoring Network, <https://open.canada.ca/data/en/dataset/13564ca4-e330-40a5-9521-bfb1be767147>. 7. Rumschlag *et al.* (2023) Density declines, richness increases, and composition shifts in stream macroinvertebrates. *Science Advances* <https://doi.org/10.1126/sciadv.adf4896>. 8. Murray-Darling Basin Authority, Murray-Darling Basin Fish and Macroinvertebrate Survey <https://data.gov.au/data/dataset/7826d7c9-bcc5-48c0-832a-66aaedfe7b0f>.