

# BioTIME: A database of biodiversity time series for the Anthropocene

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#### Abstract

**Motivation:** The BioTIME database contains raw data on species identities and abundances in ecological assemblages through time. These data enable users to calculate temporal trends in biodiversity within and amongst assemblages using a broad range of metrics. BioTIME is being developed as a community-led open-source database of biodiversity time series. Our goal is to accelerate and facilitate quantitative analysis of temporal patterns of biodiversity in the Anthropocene.

**Main types of variables included:** The database contains 8,777,413 species abundance records, from assemblages consistently sampled for a minimum of 2 years, which need not necessarily be consecutive. In addition, the database contains metadata relating to sampling methodology and contextual information about each record.

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**Spatial location and grain:** BioTIME is a global database of 547,161 unique sampling locations spanning the marine, freshwater and terrestrial realms. Grain size varies across datasets from 0.0000000158 km<sup>2</sup> (158 cm<sup>2</sup>) to 100 km<sup>2</sup> (1,000,000,000,000 cm<sup>2</sup>).

**Time period and grain:** BioTIME records span from 1874 to 2016. The minimal temporal grain across all datasets in BioTIME is a year.

**Major taxa and level of measurement:** BioTIME includes data from 44,440 species across the plant and animal kingdoms, ranging from plants, plankton and terrestrial invertebrates to small and large vertebrates.

**Software format:** .csv and .SQL.

## KEYWORDS

biodiversity, global, spatial, species richness, temporal, turnover



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## 1 | BACKGROUND

Quantifying changes in biodiversity in the Anthropocene is a key challenge of our time given the paucity of temporal and spatial data for most taxa on Earth. The nature and extent of the reorganization of natural assemblages are currently controversial because conflicting estimates of biodiversity change have been obtained using different methodological approaches and for different regions, time periods and taxa. Some reports suggest alarming and systematic biodiversity loss. For example, estimates of global extinction rates place global losses orders of magnitude above background rates (Pereira, Navarro, & Martins, 2012). In addition, estimates of population trends for vertebrates suggest average declines of the order of 60% in the past 30 years (Collen et al., 2009). Nonetheless, analyses based on spatial variation yield more modest declines in the range of 8% (Newbold et al., 2015). In contrast, some analyses of assemblage time series consistently detect no systematic trend in temporal  $\alpha$ -diversity (such as species richness), on average, across local communities (Brown, Ernest, Parody, & Haskell, 2001; Dornelas et al., 2014; Vellend et al., 2013, 2016), but instead uncover substantial variation in composition (temporal  $\beta$ -diversity; i.e., temporal turnover), including both losses and gains of species (Dornelas et al., 2014; Magurran, Dornelas, Moyes, Gotelli, & McGill, 2015). Spatially structured gains and losses are also predicted from climate change projections (García Molinos et al., 2016). Some of these discrepancies are a result of differences in the temporal and spatial scales at which analyses were performed (McGill, Dornelas, Gotelli, & Magurran, 2014), whereas other differences may be attributable to the organizational level on which an analysis is focused (e.g., population vs. community). Clearly, more research is needed into how populations, communities and ecosystems are changing in the face of widespread human influence on the planet (Waters et al., 2016). Here, we introduce BioTIME, a curated database of biodiversity time series, with the goal of facilitating and promoting research in this area.

Biodiversity is a multifaceted concept, which can be measured in many different ways. Similar to the approach of essential biodiversity variables (Pereira et al., 2013), we focus on assembling data that maximize the number of metrics that can be calculated. Specifically, BioTIME is composed of species abundance records for assemblages that have been sampled through time with a consistent methodology. The focus on assemblages

differentiates BioTIME from population databases, such as the Global Population Dynamics Database (<https://www.imperial.ac.uk/cpb/gpdd2/secure/login.aspx>) and the Living Planet Index database (<http://www.livingplanetindex.org/home/index>), and enables users to quantify patterns at different organizational levels, including both the assemblage and the population level. BioTIME complements the PREDICTS database (<http://www.predicts.org.uk/>) in providing time series rather than space for time comparisons. Moreover, most previous databases have been either terrestrial (e.g., vertebrates, GPDD; vegetation, sPlot; multiple taxa, PREDICTS) or marine (e.g., OBIS), whereas BioTIME includes marine, freshwater and terrestrial realms; hence, it facilitates comparisons across realms. Finally, previous databases are not specifically focused on temporal assemblage data, which means that BioTIME fills an important gap in allowing spatial and temporal comparisons. In addition, coupling BioTIME with additional information will allow analyses of temporal change in phylogenetic diversity and trait diversity alongside taxonomic diversity.

The goals of the BioTIME database are as follows: (a) to assemble and format raw species abundance data for assemblages consistently sampled through time; (b) to encourage re-use of these data through open-source access of standardized and curated versions of the data; and (c) to promote appropriate crediting of data sources. These goals are in line with best practice in promoting maximal use of ecological data (Costello et al., 2014; White et al., 2013) and highlight data gaps to funding agencies. In addition, we hope that BioTIME will engage ecologists in the collection, standardization, sharing and quality control of assemblage-level species abundance data, particularly in poorly sampled parts of the world, and highlight the value of such data to funding agencies.

## 2 | METHODS

The BioTIME database is composed of 11 tables: a main table containing the core observations (records), and 10 tables that provide contextual information as described below and in Supporting Information Figure S1. There are five main levels of organization: record, sample, plot, site and study. A record is our fundamental unit of observation of the abundance of a species in a sample. A sample includes all the records that belong to the same sampling event; for example, a quadrat on the seashore, a single plankton tow or a bird transect. A sample is

defined by a single location and a single date. If the exact location has been repeatedly sampled through time, then all the samples that correspond to that location belong to the same plot. Multiple samples and plots can be located in the same area, which we term a site. Finally, the highest observational unit is a study, which is defined by having a regular and consistent sampling methodology. Sources of data in which the sampling methodology changed during the course of the study were classified as separate studies. Every organizational level has contextual variables that are kept either in dedicated tables or are part of the main table (see Supporting Information Figure S1 for a complete list of the fields in each table). In addition, the database also includes tables with information relating to the sampling methodology, and treatments associated with some samples when applicable, citation information, contacts and licenses for each study, and the curation steps performed on each study before it was entered in the database.

## 2.1 | Data acquisition

Searches began in 2010, and data were acquired from a variety of sources: literature searches, large databases [specifically, OBIS ([www.iobis.org/](http://www.iobis.org/)), GBIF ([www.gbif.org/](http://www.gbif.org/)) and Ecological Data Wiki (<https://ecological-data.org/>)], through personal networking and through broadcasted data requests at conferences and on social media. We have used four main criteria for data inclusion on BioTIME: (a) abundance observations come from samples of assemblages where all individuals within the sample were counted and identified (i.e., assemblage rather than population data); (b) most of the individuals were identified to species; (c) sampling methods were constant through time; and (d) the time series spans a minimum of 2 years. The last condition was changed relative to the initial criteria because it became apparent that it would allow better spatial representation given the many locations that have been surveyed historically and then resurveyed. Each study is kept separate within the database and has a specific license from the CC spectrum, whose terms must be observed (<https://creativecommons.org/>). A static version of the database is released with this publication (<http://biotime.st-andrews.ac.uk> and <https://zenodo.org/record/1095627>). However, data entry and curation is ongoing (<http://biotime.st-andrews.ac.uk/contribute.php>), and we expect the database to keep growing in the foreseeable future. We plan to release static updates of the database periodically.

## 2.2 | Data curation and quality control

Before inclusion in the database, data were subjected to standardization in a curation process described specifically for each study in the curation table of the database. Specifically, these were checked for the presence of the following: duplicates within each study and against the entire database; species with zero abundance; and non-organismal records, all of which were removed. Abundances of zero for a particular population can be inferred from their absence from samples in the study. Additionally, species names were checked for typographic errors and misspellings, and a standardized notation was used for records of morphospecies and species complexes. Most records were included as provided and may not always conform to the latest nomenclature. Furthermore, latitudes and longitudes were checked for their location

relative to other descriptors (e.g., country or marine vs. terrestrial). Finally, the grain and extent of each study were calculated from information in the methods where available, or by applying a convex hull algorithm to locations of the samples.

## 3 | DESCRIPTION OF DATA

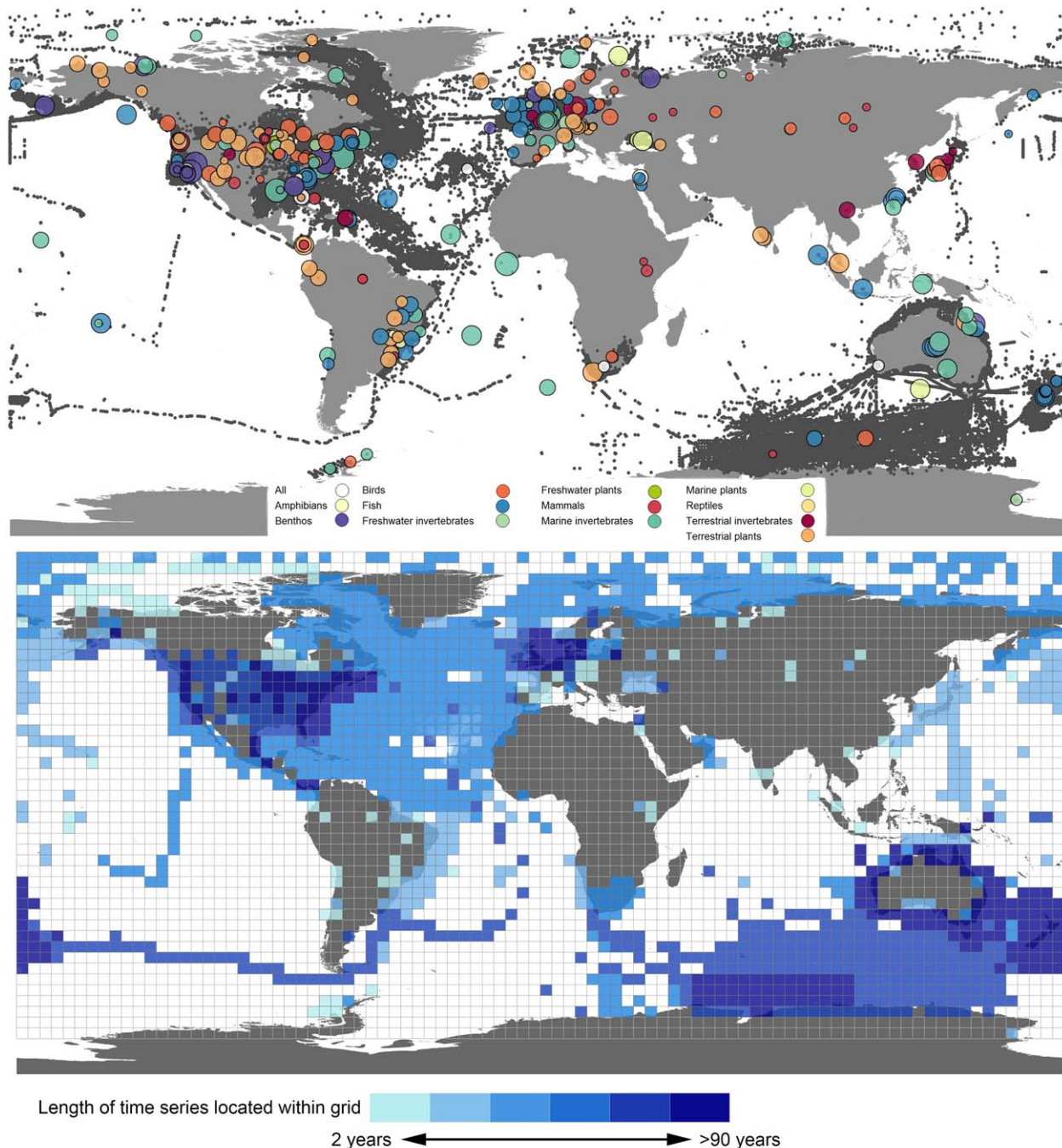
In total, the version of BioTIME released with this paper includes 8,777,413 records, across 547,161 unique locations, gathered from 361 studies (Figure 1; see Appendix for a full list of citations). These observations span the Poles to the Equator, from depths of c. 5,000 m to elevations of c. 4,000 m above sea level, and include the terrestrial, freshwater and marine realms. The database includes records spanning 21 out of 26 ecoregions [WWF; (<http://www.worldwildlife.org/biomes>)]. Nonetheless, there are spatial biases in the distribution of sampling locations, with most studies occurring in Europe, North America and Australia. This geographical bias has persisted despite the growth of the database. For example, a comparison between Supporting Information Figure S2 and the data included in the study by Dornelas et al. (2014) displays only small differences, despite the database having more than tripled its size in the interim. It is our hope that this geographical bias will decrease over time via targeted searches and data recruitment.

There are 44,440 taxa in BioTIME. The majority of these (88.8%) are species, but some organisms are identified only to coarser taxonomic levels, such as genus. BioTIME includes assemblages across the animal and plant kingdoms, ranging from mammals to microscopic plankton. As with the spatial distribution, there are also taxonomic biases in the data in BioTIME (Figure 2). Almost 70% of records fall into one of four categories: terrestrial plants, birds, fish and marine invertebrates, with fish accounting for 28% of the total database.

BioTIME records span 118 years (from 1874 to 2016), with the longest time series having 97 years and an average duration of 13 years. In more detail, 56.5% of studies contain up to 10 years of data, 42% between 10 and 50 years and 1.4% > 50 years.

## 4 | USAGE NOTES

Version 1.0 of the BioTIME database can be downloaded from <https://zenodo.org/record/1095627> or from <http://biotime.st-andrews.ac.uk/>. The use of data contained in BioTIME should cite original data citations in addition to the present paper. There is considerable variation in the spatial and temporal grain and extent among studies, which must be considered in any analysis of BioTIME data. Moreover, the number of samples was often not constant through time within studies; consequently, we recommend the use of sample-based rarefaction and provide R code to query the database, implement sample-based rarefaction and calculate a suite of biodiversity metrics. Specifically, we provide a tutorial guiding users to interact with both formats of the database (.csv and .sql; Allaire et al., 2015; Becker, Wilks, & Brownrigg, 2014; Oksanen et al., 2013; Ooms, James, DeBroy, Wickham, & Horner, 2015; R Development Core Team, 2013; Wickham, 2009; Wickham & Francois, 2015). Please note that for interacting with the .sql version of the database, users will have to set up a connection with



**FIGURE 1** Top: Geographical locations of all the records included in BioTIME in dark grey, with central points per study shown as circles of different colour and size, according to taxa and number of species. Bottom: Map overlaid with  $\sim 4^\circ$  grid cells coloured by the length of the full or partial time series contained within each cell

the server where they have installed the SQL database. For interacting with the .csv version, users have to download both the data and the metadata csv files, making sure that all the paths to these files are modified accordingly.

The data included in the present paper represent the subset of data within the BioTIME database for which we were able to secure licences to republish. The additional studies held in the full database have been obtained from publicly available data and are listed in

Supporting Information Table S1. In total, BioTIME currently holds 387 studies, containing 12,623,386 records from a total of 652,675 distinct geographical locations, and 45,093 species. These records span a total of 124 years from 1858 to 2016 inclusive. We will continue to interact with data providers in order to increase data availability and to recruit additional data. Instructions on how to contribute to future releases can be found here (<http://biotime.st-andrews.ac.uk/contribute.php>).

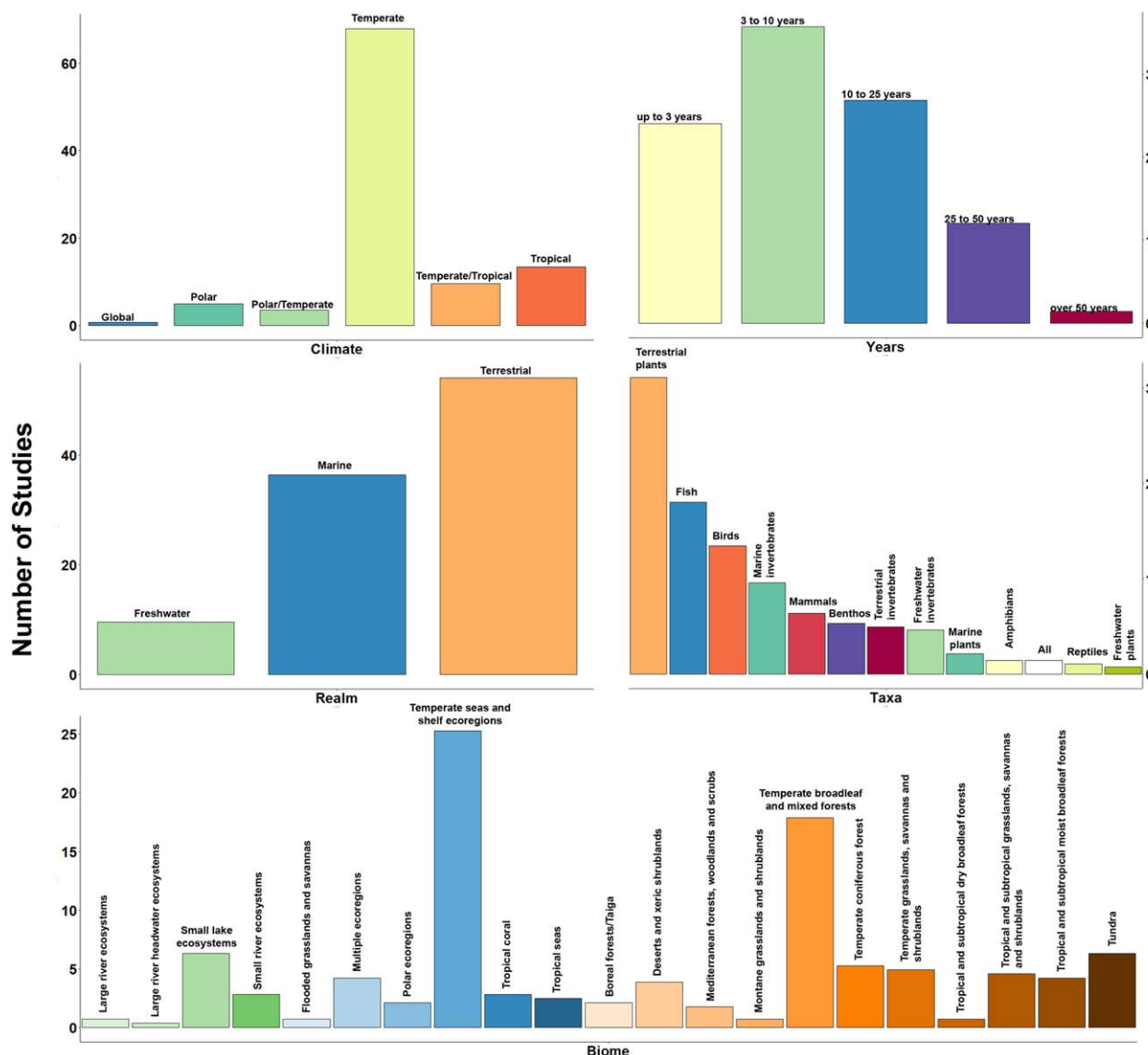


FIGURE 2 Proportion of studies that fall into the different classifications of: Climate, number of years sampled, realm, taxa and biome

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## DATA ACCESSIBILITY

The BioTIME database is accessible through the BioTIME website (<http://biotime.st-andrews.ac.uk>) and through the Zenodo repository (<https://zenodo.org/record/1095627>).

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## REFERENCES

- Allaire, J., Cheng, J., Xie, Y., McPherson, J., Chang, W., Allen, J., ... Hyndman, R. (2015). *rmarkdown: Dynamic documents for R* (R package version 0.5.1). Available at: <https://rmarkdown.rstudio.com/>
- Becker, R. A., Wilks, A. R., & Brownrigg, R. (2014). *mapdata: Extra map databases*. Available at: <https://CRAN.R-project.org/package=mapdata>
- Brown, J. H., Ernest, S. M., Parody, J. M., & Haskell, J. P. (2001). Regulation of diversity: Maintenance of species richness in changing environments. *Oecologia*, 126, 321–332.



- Collen, B. E. N., Loh, J., Whitmee, S., McRae, L., Amin, R., & Baillie, J. E. M. (2009). Monitoring change in vertebrate abundance: The living planet index. *Conservation Biology*, 23, 317–327.
- Costello, M. J., Appeltans, W., Bailly, N., Berendsohn, W. G., de Jong, Y., Edwards, M., ... Bisby, F. A. (2014). Strategies for the sustainability of online open-access biodiversity databases. *Biological Conservation*, 173, 155–165.
- Dornelas, M., Gotelli, N. J., McGill, B., Shimadzu, H., Moyes, F., Sievers, C., & Magurran, A. E. (2014). Assemblage time series reveal biodiversity change but not systematic loss. *Science*, 344, 296–299.
- García Molinos, J., Halpern, B. S., Schoeman, D. S., Brown, C. J., Kiessling, W., Moore, P. J., ... Burrows, M. T. (2016). Climate velocity and the future global redistribution of marine biodiversity. *Nature Climate Change*, 6, 83–88.
- Magurran, A. E., Dornelas, M., Moyes, F., Gotelli, N. J., & McGill, B. (2015). Rapid biotic homogenization of marine fish assemblages. *Nature Communication*, 6, 8405.
- McGill, B. J., Dornelas, M., Gotelli, N. J., & Magurran, A. E. (2014). Fifteen forms of biodiversity trend in the Anthropocene. *Trends in Ecology and Evolution*, 30, 104–113.
- Newbold, T., Hudson, L. N., Hill, S. L., Contu, S., Lysenko, I., Senior, R. A., ... Puvion, A. (2015). Global effects of land use on local terrestrial biodiversity. *Nature*, 520, 45–50.
- Oksanen, J., Blanchet, F. G., Kindt, R., Legendre, P., Minchin, P. R., O'Hara, R. B., ... Wagner, H. (2013). *vegan: Community ecology package* (R package version 2.0–7). Available at: <http://CRAN.R-project.org/package=vegan>
- Ooms, J., James, D., DebRoy, S., Wickham, H., & Horner, J. (2015). *RMySQL: Database interface and MySQL driver for R*. Available at: <https://CRAN.R-project.org/package=RMySQL>
- Pereira, H. M., Ferrier, S., Walters, M., Geller, G. N., Jongman, R. H. G., Scholes, R. J., ... Wegmann, M. (2013). Essential biodiversity variables. *Science*, 339, 277–278.
- Pereira, H. M., Navarro, L. M., & Martins, I. S. (2012). Global biodiversity change: The bad, the good, and the unknown. *Annual Review of Environment and Resources*, 37, 25–50.
- R Development Core Team. (2013). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.
- Vellend, M., Baeten, L., Myers-Smith, I. H., Elmendorf, S. C., Beauséjour, R., Brown, C. D., Frenne, D. P., ... Wipf, S. (2013). Global meta-analysis reveals no net change in local-scale plant biodiversity over time. *Proceedings of the National Academy of Sciences USA*, 110, 19456–19459.
- Vellend, M., Dornelas, M., Baeten, L., Beausejour, R., Brown, C. D., De Frenne, P., ... Myers-Sievers, C. (2016). Estimates of local biodiversity change over time stand up to scrutiny. *Ecology*, 98, 583–590.
- Waters, C. N., Zalasiewicz, J., Summerhayes, C., Barnosky, A. D., Poirier, C., Gałuszka, A., ... Wolfe, A. P. (2016). The Anthropocene is functionally and stratigraphically distinct from the Holocene. *Science*, 351, aad2622.
- White, E. P., Baldridge, E., Brym, Z. T., Locey, K. J., McGlinn, D. J., & Supp, S. R. (2013). Nine simple ways to make it easier to (re) use your data. *Ideas in Ecology and Evolution*, 6, 1–10.
- Wickham, H. (2009). *ggplot2: Elegant graphics for data analysis*. New York, NY: Springer.
- Wickham, H., & Francois, R. (2015). *dplyr: A grammar of data manipulation*. Available at: <https://dplyr.tidyverse.org/>

## BIOSKETCH

The **BioTIME** consortium emerged from the ERC project BioTIME in 2010. The consortium currently includes 271 authors distributed among 35 countries engaged in collecting biodiversity time series data

and committed to sharing it for wider use. We hope that the BioTIME database allows analysis of large-scale patterns of biodiversity change and contributes to giving credit to the data collectors, without whom synthesis would not be possible.

## SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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## APPENDIX : DATA SOURCES

- "A transect survey of small land carnivore and red fox populations on a subarctic fell in Finnish forest Lapland over 13 winters". NERC Centre for Population Biology, Imperial College, The Global Population Dynamics Database v2.0. Available at: <http://www3.imperial.ac.uk/cpb/databases/gpdd>, accessed 2012.
- "Animal Demography Unit - Coordinated Waterbird Counts (CWAC) - AfrOBIS". Available at <http://www.iobis.org/>, accessed 2012.
- "Bahamas Marine Mammal Research Organisation Opportunistic Sightings - OBIS SEAMAP". Available at: <http://www.iobis.org>, accessed 2012.
- "Baltic Seabirds Transect Surveys", Institute of Ecology of Vilnius University - OBIS-SEAMAP. Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dased=1971>, accessed 2012.
- "CMarZ (Census of Marine Zooplankton)-Asia Database". Accessed through OBIS- SCAR-MarBIN. Available at: <http://www.iobis.org/mapper/?dataset=1500>, accessed 2012.
- "CRED Rapid Ecological Assessments of Coral Population in the Pacific Ocean 2007–2010". (2011) Coral Reef Ecosystem Division (CRED), Pacific Island Fisheries Sciences Center, National Marine Fisheries Service. Available at: <http://www.iobis.org/mapper/?dataset=1578>, accessed 2012.
- "CRED REA Algal Quadrant Images in the Pacific Ocean 2002–2008". (2011) Coral Reef Ecosystem Division (CRED), Pacific Island Fisheries Sciences Center, National Marine Fisheries Service. Available at: <http://www.iobis.org/mapper/?dataset=1577>, accessed 2012.
- "CRED Towed-Diver Fish Biomass Surveys in the Pacific Ocean 2000–2010". (2011) Coral Reef Ecosystem Division (CRED), Pacific Island Fisheries Sciences Center, National Marine Fisheries Service. Available at: <http://www.iobis.org/mapper/?dataset=1581>, accessed 2012.
- "CSIRO Marine Data Warehouse - OBIS Australia", CSIRO Division of Marine and Atmospheric Research (CMAR), Australia. Available at <http://www.iobis.org>, accessed 2012.
- "East Coast North America Strategic Assessment Project, Groundfish Atlas for the East Coast of North America". Available at: <http://www.iobis.org>, accessed 2012.
- "EPA'S EMAP Database". U.S. Environmental Protection Agency through its Environmental Monitoring and Assessment Program (EMAP). Available at: <http://www.iobis.org>, accessed 2012. Also available at <https://archive.epa.gov/emap/archive-emap/web/html/index-21.html>
- "Fluctuations and long-term trends in the relative densities of tetraonid populations in Finland, 1964–77." NERC Centre for Population Biology, Imperial College. The Global Population Dynamics Database

- v2.0. Available at: <https://www.imperial.ac.uk/cpb/gpdd2/secure/register.aspx>, accessed 2012.
- "Great Barrier Reef Seabed Biodiversity Study 2003–2006" (CMAR\_A-NACC), accessed through OBIS-Australia. Available at <http://www.iobis.org>, accessed 2012.
- "Marine and Coastal Management - Copepod Surveys - AfrOBIS". Available at: <http://www.iobis.org/>, accessed 2012.
- "Marine Biological Sample Database, JAMSTEC" (OBIS\_JAPAN). Available at: <http://www.iobis.org/mapper/?dataset=2289>, accessed 2012.
- "MEDITS seabird surveys 1999 / 2000 / 2002" (2011). Mediterranean Institute for Advanced Studies (IMEDEA) In: OBIS-SEAMAP. Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dasid=1979>, accessed 2012.
- "National Benthic Infaunal Database (NBID)" (2003). NOAA/NOS/NCCOS/CCEHBR/Coastal Ecology Program. NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS). Available at: <https://data.noaa.gov/dataset/national-benthic-infaunal-database-nbid>, accessed 2012.
- "NEFSC Benthic Database (OBIS-USA)", (2010) Northeast Fisheries Science Center, National Marine Fisheries Service, NOAA, U.S. Department of Commerce. Available at: <http://www.iobis.org/mapper/?dataset=1694>, accessed 2012.
- "Northeast Fisheries Science Center Bottom Trawl Survey Data (OBIS-USA)." (2005) NOAA's National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center. Woods Hole, Massachusetts, USA. Available at: <http://www.iobis.org/mapper/?dataset=1435>, accessed 2013.
- "PIROP Northwest Atlantic 1965–1992 - OBIS SEAMAP". Available at: <http://www.iobis.org/mapper/?dataset=2245>, accessed 2012.
- "POPA cetacean, seabird, and sea turtle sightings in the Azores area 1998–2009 - OBIS SEAMAP". Available at: <http://www.iobis.org/mapper/?dataset=4257>, accessed 2012.
- "Previous\_fisheries\_REVIZEE\_Program", accessed through Tropical and Subtropical Western South Pacific OBIS. Available at: <http://www.iobis.org/mapper/?dataset=2411>, accessed 2012.
- "REVIZEE South Score / Pelagic and Demersal Fish Database II". Available at: <http://www.iobis.org/mapper/?dataset=105>, accessed 2012.
- "Southeast Fisheries Science Center, National Oceanic and Atmospheric Administration. NOAA Southeast Fishery Science Center (SEFSC) Fisheries Log Book System (FLS) Commercial Pelagic Logbook Data". Available at: <http://www.iobis.org/mapper/?dataset=1496>, accessed 2012.
- "South TX Outer Continental Shelf and MI, AL, and FL Outer Continental Shelf benthic organism sampling 1974–1978". US National Oceanographic Data Center, Silver Spring, Maryland, USA (2011). Available at [http://www.usgs.gov/obis-usa/data\\_search\\_and\\_access/participants.html](http://www.usgs.gov/obis-usa/data_search_and_access/participants.html), accessed 2012.
- "South Western Pacific Regional OBIS Data Asteroid Subset", NIWA (National Institute of Water and Atmospheric Research - New Zealand) MBIS (Marine Biodata Information System) accessed through South Western Pacific OBIS. Available at: <http://www.iobis.org/mapper/?dataset=219>, accessed 2012.
- "South Western Pacific Regional OBIS Data Bryozoan Subset". Accessed through South Western Pacific OBIS. Available at: <http://www.iobis.org/mapper/?dataset=221>, accessed 2012.
- "South Western Pacific Regional OBIS Data provider for the NIWA Marine Biodata Information System". Ocean Biogeographic Information System. Occurrence Dataset. Available at: <https://doi.org/10.15468/zuuiyu>, accessed 2012.
- "St. Croix, USVI Fish Assessment and Monitoring Data (2002 - Present)", (2007) Silver Spring, MD Publisher: NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS). National Oceanic and Atmospheric Association (NOAA)-National Ocean Service (NOS)-National Centers for Coastal Ocean Science (NCCOS)-Center for Coastal Monitoring and Assessment (CCMA)-Biogeography Team. Available at: <http://www.iobis.org/mapper/?dataset=1673>, accessed 2012.
- "St. John, USVI Fish Assessment and Monitoring Data (2002 - Present)", (2007) Silver Spring, MD Publisher: NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS). National Oceanic and Atmospheric Association (NOAA)-National Ocean Service (NOS)-National Centers for Coastal Ocean Science (NCCOS)-Center for Coastal Monitoring and Assessment (CCMA)-Biogeography Team. Available at: <http://www.iobis.org/mapper/?dataset=1672>, accessed 2012.
- "The Observer Program database", accessed through the OBIS-USA North Pacific Groundfish Observer (North Pacific Research Board). Available at: <http://www.iobis.org>, accessed 2012.
- "Whale Catches in Southern Ocean". OBIS - Australian Antarctic Data Centre. Available at: <http://www.iobis.org>, accessed 2013.
- "Zooplankton in the Bay of Biscay (1995–2004, yearly DEPM surveys)". Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dasid=2774>, accessed 2012.
- "The Main Cropping System Experiment (MCSE)". KBS LTER, Kellogg Biological Station. Available at: <http://lter.kbs.msu.edu/research/long-term-experiments/main-cropping-system-experiment/>, accessed 2016.
- Addinck, W. & de Kluijver, M. (2003) North Sea observations of Crustacea, Polychaeta, Echinodermata, Mollusca and some other groups between 1986 and 2003. Expert Centre for Taxonomic Identification (ETI), the Netherlands. Available at: <http://www.emodnet-biology.eu/data-catalog?module=dataset&dasid=1037>, accessed 2012.
- Adler, P. B., Tyburczy, W. R. & Lauenroth, W. K. (2007) Long-Term Mapped Quadrats From Kansas Prairie: Demographic Information For Herbaceous Plants. *Ecology*, 88, 2673. [https://doi.org/10.1890/0012-9658\(2007\)88\[2673:LMQFKP\]2.0.CO;2](https://doi.org/10.1890/0012-9658(2007)88[2673:LMQFKP]2.0.CO;2).
- Amorim, P., Figueiredo, M., Machete, M., Morato, T., Martins, A. & Serrão Santos, R. (2008) Spatial variability of seabird distribution associated with environmental factors: a case study of marine Important Bird Areas in the Azores. *ICES Journal of Marine Science*, 66, 29–40.
- Anderson, J., Vermeire, L. & Adler, P. B. (2011) Fourteen years of mapped, permanent quadrats in a northern mixed prairie, USA. *Ecology*, 92, 1703.
- Bakker, C., Herman, P. & Vink, M. (1994) A new trend in the development of the phytoplankton in the Oosterschelde (SW Netherlands) during and after the construction of a storm-surge barrier. The Oosterschelde Estuary (The Netherlands): a Case-Study of a Changing Ecosystem, pp. 79–100. Springer.
- Bakker, C., Herman, P.M.J. & Vink, M. (1990) Changes in seasonal succession of phytoplankton induced by the storm-surge barrier in the Oosterschelde (S.W. Netherlands). *Journal of Plankton Research*, 12, 947–972.
- Bakker, C. & Herman, P.M.J. (1990) Phytoplankton in the Oosterschelde before, during and after the storm-surge barrier (1982–1990). Netherlands Institute of Ecology; Centre for Estuarine and Marine Ecology, Netherlands. EurOBIS Data. Available at: <http://www.iobis.org/mapper/?dataset=505>, accessed 2013.
- Barceló, C., Ciannelli, L., Olsen, E. M., Johannessen, T. & Knutsen, H. (2016) Eight decades of sampling reveal a contemporary novel fish assemblage in coastal nursery habitats. *Global Change Biology*, 22, 1155–1167. <https://doi.org/10.1111/gcb.13047>.
- Barreto, T. E. Patterns and processes affecting the dynamics and structure of seasonally semi-deciduous forests in SE of Brazil. University of Campinas, PhD thesis. Accessed 2016.

- Battles, J. J., Fahey, T. & Cleavitt, N. (2003) "Forest Inventory of a Whole Tree Harvest: Hubbard Brook Experimental Forest Watershed 5, 1982, pre-harvest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=36>, accessed 2012.
- Battles, J. J., Fahey, T. & Cleavitt, N. (2013) "Forest Inventory of a Whole Tree Harvest: Hubbard Brook Experimental Forest Watershed 5, 1990, 7 years post-harvest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=37>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. (2013b) "Forest Inventory of a Whole Tree Harvest: Hubbard Brook Experimental Forest Watershed 5, 1994, 10 years post-harvest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=38>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. (2013c) "Forest Inventory of a Whole Tree Harvest: Hubbard Brook Experimental Forest Watershed 5, 1999, 15 years post-harvest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=39>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. "Forest Inventory of a Northern Hardwood Forest: Watershed 6 1965, Hubbard Brook Experimental Forest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=29>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. "Forest Inventory of a Northern Hardwood Forest: Watershed 6 1977, Hubbard Brook Experimental Forest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=30>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. "Forest Inventory of a Northern Hardwood Forest: Watershed 6 1982, Hubbard Brook Experimental Forest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=31>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. "Forest Inventory of a Northern Hardwood Forest: Watershed 6 1987, Hubbard Brook Experimental Forest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=32>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. "Forest Inventory of a Northern Hardwood Forest: Watershed 6 1992, Hubbard Brook Experimental Forest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=33>, accessed 2016.
- Battles, J. J., Fahey, T. & Cleavitt, N. "Forest Inventory of a Northern Hardwood Forest: Watershed 6 1997, Hubbard Brook Experimental Forest." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=34>, accessed 2016.
- Battles, J. J., Johnson, C., Hamburg, S., Fahey, T., Driscoll, C. & Likens, G. (2003) "Forest Inventory of a Northern Hardwood Forest: Watershed 6 2002." The Hubbard Brook Ecosystem Study LTER Program. Available at: <http://www.hubbardbrook.org/data/dataset.php?id=35>, accessed 2012.
- Belmaker, J., Ziv, Y. & Shashar, N. (2011) The influence of connectivity on richness and temporal variation of reef fishes. *Landscape Ecology*, 26, 587–597.
- Benedetti-Cecchi, L. "Calafuria Low-shore Intertidal Dataset (1991–2014)". Department of Biology, University of Pisa. Accessed 2016.
- Benedetti-Cecchi, L. "Calafuria Mid-shore Intertidal Dataset (1991–2014)". Department of Biology, University of Pisa. Accessed 2016.
- Berezovikov, N. N. (2004) The birds of settlements in Markakol Depression (Southern Altai). *Russian Ornithological Journal*, 249, 3–15.
- Bernardes, R.Á. (2005) Peixes da Zona Econômica Exclusiva da região sudeste-sul do Brasil: levantamento com armadilhas, pargueiras e rede de arrasto de fundo. Edusp.
- Bernardes, R.A., Rodrigues, A.R., Rossi-Wongtschowski, C.L., dos Santos, A.P., Vieira, R.C. & Wahrlich, R. (2005) Prospecção pesqueira de recursos demersais com armadilhas e pargueiras na Zona Econômica Exclusiva da Região Sudeste-Sul do Brasil. Instituto Oceanográfico.
- Billett, D. S. M., Bett, B. J., Reid, W. D. K., Boorman, B. & Priede, I. G. (2010) Long-term change in the abyssal NE Atlantic: The "Amperima Event" revisited. *Deep-Sea Research Part II: Topical Studies in Oceanography*, 57, 1406–1417.
- Billett, D. S. M., Bett, B. J., Rice, A. L., Thurston, M. H., Galéron, J., Sibuet, M. & Wolff, G. A. (2001) Long-term change in the megabenthos of the Porcupine Abyssal Plain (NE Atlantic). *Progress in Oceanography*, 50, 325–348.
- Björnberg, T. K. S. (1963) On the marine free-living copepods off Brazil. *Boletim do Instituto Oceanográfico*, 13, 03–142.
- Bonebrake, T.C., Pickett, E.J., Tsang, T.P., Tak, C.Y., Vu, M.Q. & Van Vu, L. (2016) Warming threat compounds habitat degradation impacts on a tropical butterfly community in Vietnam. *Global Ecology and Conservation*, 8, 203–211.
- Boutillier, J. A. (2007) "Pacific Shrimp Trawl Survey". In: ShrimpTrawl Bio database, Fisheries and Oceans Canada PBS Shellfish Data Unit. OBIS Canada Digital Collections, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada. Available at: <http://www.iobis.org>, accessed 2012.
- Bradford, M. G., Murphy, H. T., Ford, A. J., Hogan, D. L. & Metcalfe, D. J. (2014) Long-term stem inventory data from tropical rain forest plots in Australia. *Ecology*, 95, 2362. <https://doi.org/10.1890/14-0458R.1>.
- Brook, B. W., Traill, L. W. & Bradshaw, C. J. A. (2006) Minimum viable population sizes and global extinction risk are unrelated. *Ecology Letters*, 9, 375–382. <https://doi.org/10.1111/j.1461-0248.2006.00883.x>.
- Brooks, A. J. of Moorea Coral Reef LTER. (2016) MCR LTER: Coral Reef: Long-term Population and Community Dynamics: Fishes. Available at: [knbn-lter-mcr.6.54](http://knbn-lter-mcr.6.54) <https://doi.org/10.6073/pasta/d688610e536f54885a3c59d287f6c4c3>, accessed 2012.
- Brooks, A. J. "MCR LTER: Coral Reef: Long-term Population and Community Dynamics: Fishes". Moorea Coral Reef LTER; Long Term Ecological Research Network. Available at: <https://doi.org/10.6073/pasta/85e08a1ea6548ac2eaf808a70ce3eeb2>, accessed 2012.
- Brown, R.G., Nettleship, D.N., Germain, P., Tull, C.E. & Davis, T. (1975) Atlas of eastern Canadian seabirds.
- Budy, P., Luecke, C. & O'Brien, J. "Zooplankton density for lake samples collected near Toolik Lake Arctic LTER in the summer from 1983 to 1992". Arctic Long-Term Ecological Research. Available at: <http://arc-lter.ecosystems.mbl.edu/1983-1992arclterzoops>, accessed 2016.
- Budy, P., Luecke, C. & O'Brien, J. "Zooplankton density for lake samples collected near Toolik Lake Arctic LTER in the summers between 1993–2002". Arctic Long-Term Ecological Research. Available at: <http://arc-lter.ecosystems.mbl.edu/1993-2002arclterzoops>, accessed 2016.
- Carpenter, R. (2015) "MCR LTER: Coral Reef: Long-term Population and Community Dynamics: Other Benthic Invertebrates, ongoing since 2005". Moorea Coral Reef LTER, knbn-lter-mcr.7.28. Available at: <https://doi.org/10.6073/pasta/8e7b3a0c7a8bf315739921861cc79d10>, accessed 2016.
- Carvalho, F., Zocche, J. J. & Mendonça, R. A. (2009) Morcegos, (Mammalia, Chiroptera) em restinga no município de Jaguaruna, sul de Santa Catarina, Brasil). *Biotemas*, 22, 193–201.



- Cavender-Bares, J. & Reich, P. B. (2012) Shocks to the system: community assembly of the oak savanna in a 40-year fire frequency experiment. *Ecology*, 93, S52–S69.
- Chen, H., Liao, Y.-C., Chen, C.-Y., Tsai, J.-I., Chen, L.-S. & Shao, K.-T. (2015) Long-term monitoring dataset of fish assemblages impinged at nuclear power plants in northern Taiwan. *Scientific Data*, 2, 150071. <http://doi.org/10.1038/sdata.2015.71>.
- Clark, D. & Branton, B. (2007) "DFO Maritimes Research Vessel Trawl Surveys, OBIS Canada Digital Collections". Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, OBIS Canada. Available at: <http://www.iobis.org>, accessed 2012.
- Condit, R. (1998) Tropical forest census plots: methods and results from Barro Colorado Island, Panama and a comparison with other plots. Springer-Verlag, Berlin.
- Condit, R., Chisholm, R.A. & Hubbell, S.P. (2012) Thirty years of forest census at Barro Colorado and the importance of immigration in maintaining diversity. *PLoS one*, 7, e49826.
- Condit, R. "Sherman Forest Dynamics Plot, Panama." The Center for Tropical Forest Science. Smithsonian Tropical Research Institute. Available at: <http://www.ctfs.si.edu/site/Sherman/>, accessed 2013.
- Condit, R., Ashton, P., Bunyavechewin, S., Dattaraja, H. S., Davies, S., Esufali, S., Ewango, C., Foster, R., Gunatilleke, I. A. U. N., Gunatilleke, C. V. S., Hall, P., Harms, K. E., Hart, T., Hernandez, C., Hubbell, S., Itoh, A., Kiratiprayoon, S., Lafrankie, J., de Lao, S. L., Makana, J.-R., Noor, M. N. S., Kassim, A. R., Russo, S., Sukumar, R., Samper, C., Suresh, H. S., Tan, S., Thomas, S., Valencia, R., Vallejo, M., Villa, G. & Zillio, T. (2006) The importance of demographic niches to tree diversity. *Science*, 313, 98–101.
- Danis, B., Van de Putte, A., Youdjou, N. & Segers, H. (Editors) "The Antarctic Biodiversity Information Facility". Available at: <http://www.biodiversity.aq>, accessed 2013.
- Dapporto, L. (2009) Core and satellite butterfly species on Elba island (Tuscan Archipelago, Italy). A study on persistence based on 120 years of collection data. *Journal of Insect Conservation*, 13, 421–428.
- Davies, C. H., Armstrong, A. J., Baird, M., Coman, F., Edgar, S., Gaughan, D., Greenwood, J., Gusmão, F., Henschke, N., Koslow, J. A., Leterme, S. C., McKinnon, A. D., Miller, M., Pausina, S., Palomino, J. U., Roennfeldt, R.-L., Rothlisberg, P., Slotwinski, A., Strzelecki, J., Suthers, I. M., Swadling, K. M., Talbot, S., Tonks, M., Tranter, D. H., Young, J. W. & Richardson, A. J. (2014) Over 75 years of zooplankton data from Australia. *Ecology*, 95, 3229. <https://doi.org/10.1890/14-0697.1>.
- Davies, C. H., Coughlan, A., Hallegraeff, G., Ajani, P., Armbricht, L., Atkins, N., Bonham, P., Brett, S., Brinkman, R., Burford, M., Clementson, L., Coad, P., Coman, F., Davies, D., Dela-Cruz, J., Devlin, M., Edgar, S., Eriksen, R., Furnas, M., Hassler, C., Hill, D., Holmes, M., Ingleton, T., Jameson, I., Leterme, S. C., Lønborg, C., McLaughlin, J., McEnnulty, F., McKinnon, A. D., Miller, M., Murray, S., Nayar, S., Patten, R., Pritchard, T., Proctor, R., Purcell-Meyerink, D., Raes, E., Rissik, D., Ruszczyk, J., Slotwinski, A., Swadling, K. M., Tattersall, K., Thompson, P., Thomson, P., Tonks, M., Trull, T.W., Uribe-Palomino, J., Waite, A. M., Yauwenas, R., Zammit, A. & Richardson, A. J. (2016) A database of marine phytoplankton abundance, biomass and species composition in Australian waters. *Scientific Data*, 3, 160043. <http://10.1038/sdata.2016.43>.
- Davis, R. A. & Doherty, T. S. (2015) Rapid Recovery of an Urban Remnant Reptile Community following Summer Wildfire. *PLoS ONE* 10(5), e0127925. <https://doi.org/10.1371/journal.pone.0127925>.
- Day, F. (2010) "Long-term N-fertilized vegetation plots on Hog Island, Virginia Coastal Barrier Islands, 1992–2014." Virginia Coast Reserve Long-Term Ecological Research Project. Available at: <http://www.vcrlter.virginia.edu/cgi-bin/showDataset.cgi?docid=knb-lter-vcrlter.106>, accessed 2013.
- Day, F. P., Conn, C., Crawford, E. & Stevenson, M. (2004) Long-term effects of nitrogen fertilization on plant community structure on a coastal barrier island dune chronosequence. *Journal of Coastal Research*, 20, 722–730.
- Degraer, S., Wittoeck, J., Appeltans, W., Cooreman, K., Deprez, T., Hillewaert, H., Hostens, K., Mees, J., Vanden Berghe, E. & Vincx, M. (2006) "Macrobet: Long term trends in the macrobenthos of the Belgian Continental Shelf." Oostende, Belgium. Available at: <http://www.emodnet-biology.eu/data-catalog?module=dataset&dasid=145>, accessed 2013.
- Derezuyk, N. "Phytoplankton of the Ukrainian Black Sea shelf (1985–2005)". Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dasid=2694>, accessed 2012.
- Diamond, A., Gaston, A. & Brown, R. (1986) Converting PIROP Counts of Seabirds at Sea to Absolute Densities. Progress Notes No 164. Canadian Wildlife Service, Ottawa.
- Dickson, J.G., Conner, R.N. & Williamson, J.H. (1993) Neotropical migratory bird communities in a developing pine plantation. Proceedings on the Annual Conference. SEAFWA, 47, 439–446.
- Douglass, J.G., France, K.E., Richardson, J.P. & Duffy, J.E. (2010) Seasonal and interannual change in a Chesapeake Bay eelgrass community: Insights into biotic and abiotic control of community structure. *Limnology and Oceanography*, 55, 1499–1520.
- Durigan, G. "Brazil Dataset 2", Instituto Florestal, Floresta Estadual de Assis. Accessed 2016.
- Durigan, G. "Brazil Dataset 3", Instituto Florestal, Floresta Estadual de Assis. Accessed 2016.
- Durigan, G. "Brazil Dataset 4", Instituto Florestal, Floresta Estadual de Assis. Accessed 2016.
- Durigan, G. "Brazil Dataset 5", Instituto Florestal, Floresta Estadual de Assis. Accessed 2016.
- Edelist, D., Rilov, G., Golani, D., Carlton, J.T. & Spanier, E. (2013) Restructuring the Sea: profound shifts in the world's most invaded marine ecosystem. *Diversity and Distributions*, 19, 69–77.
- Edgar, G. J. & Stuart-Smith, R. D. (2014) Systematic global assessment of reef fish communities by the Reef Life Survey program. *Nature Scientific Data* 1, 140007. <https://doi.org/10.1038/sdata.2014.7>.
- Elmendorf, S.C., Henry, G.H., Hollister, R.D., Björk, R.G., Björkman, A.D., Callaghan, T.V., Collier, L.S., Cooper, E.J., Cornelissen, J.H. & Day, T. A. (2012a) Global assessment of experimental climate warming on tundra vegetation: heterogeneity over space and time. *Ecology letters*, 15, 164–175.
- Elmendorf, S.C., Henry, G.H., Hollister, R.D., Björk, R.G., Boulanger-Lapointe, N., Cooper, E.J., Cornelissen, J.H., Day, T.A., Dorrepaal, E. & Elumeeva, T.G. (2012b) Plot-scale evidence of tundra vegetation change and links to recent summer warming. *Nature Climate Change*, 2, 453–457.
- Elmendorf, S.C., Henry, G.H., Hollister, R.D., Fosaa, A.M., Gould, W.A., Hermanutz, L., Hofgaard, A., Jónsdóttir, I.S., Jorgenson, J.C. & Lévesque, E. (2015) Experiment, monitoring, and gradient methods used to infer climate change effects on plant communities yield consistent patterns. *Proceedings of the National Academy of Sciences*, 112, 448–452.
- Elmendorf, S.C. (2012) Global Tundra Vegetation Change –30 years of plant abundance data from unmanipulated and experimentally-warmed plots. Available at: <http://www.polardata.ca>, accessed 2017. CCIN reference number 10786.
- Enemar, A., Sjöstrand, B. E., Andersson, G. Ö. & von Proschwitz, T. (2004) The 37-year dynamics of a subalpine passerine bird community, with special emphasis on the influence of environmental temperature and Epirrita autumnata cycles. *Ornis Svecica*, 14, 63–106.

- Ernest, S. K. M., Valone, T. J. & Brown, J. H. (2009) Long-term monitoring and experimental manipulation of a Chihuahuan Desert ecosystem near Portal, Arizona, USA. *Ecology*, **90**, 1708.
- Escribano, R., Manríquez, K. & Godoy, F. (2006) "Copepoda-COPAS Center (COPAS\_CPD1) - Planktonic copepods from the Chilean Humboldt Current System - Eastern South Pacific Regional Node of OBIS (ESPOBIS)". Available at: <http://www.iobis.org>, accessed 2012.
- ESRI (2015) ArcGIS Desktop: Release 10.1
- Farah, F. T., Rodrigues, R. R., Santos, F. A. M., Tamashiro, J. Y., Shepherd, G. J., Siqueira, T., Batista, J. L. F. & Manly, B. J. F. (2014) Forest destructuring as revealed by the temporal dynamics of fundamental species - Case study of Santa Genebra Forest in Brazil. *Ecological Indicators*, **37**, 40-44. <https://doi.org/10.1016/j.ecolind.2013.09.011>.
- Farneda, F. Z., Rocha, R., López-Baucells, A., Sampaio, E. M., Palmeirim, J. M., Bobrowiec, P. E., Grelle, C. E. & Meyer, C. F. (2018) Functional recovery of Amazonian bat assemblages following secondary forest succession. *Biological Conservation*, **218**, 192-199.
- Fefilova, E. B., Baturina, M. A., Kononova, O. N., Loskutova, O. A., Khokhlova, L. G. & Dubovskaya, O. P. (2014) Long-Term Changes of Aquatic Communities in the Kharbeyksie Lakes. *Journal of Siberian Federal University. Biology*, **3** 240-266.
- Fidelis, A. & Damasceno, G. "Brazil Dataset 7", Lab of Vegetation Ecology, Universidade Estadual Paulista. Accessed 2016.
- Fidelis, A. "Brazil Dataset 8", Lab of Vegetation Ecology, Universidade Estadual Paulista. Accessed 2016.
- Fidelis, A., Blanco, C. C., Müller, S. C., Pillar, V. D. & Pfadenhauer, J. (2012) Short-term changes caused by fire and mowing in Brazilian Campos grasslands with different long-term fire histories. *Journal of Vegetation Science*, **23**, 552-562. <https://doi.org/10.1111/j.1654-1103.2011.01364.x>
- Fletcher, C. & Kassim, A.R. Pasoh Forest Dynamics Plot Data. Available at: <http://www.ctfs.si.edu/site/Pasoh/>, accessed 2013.
- Foster, D., Von Holle, B. & Marshall, T. (2006) "Land Use on the Southern New England and New York Coasts 1600-2001. Harvard Forest Data Archive: HF044." The Harvard Forest Long Term Ecological Research Program. Available at: <http://harvardforest.fas.harvard.edu:8080/exist/xquery/data.xq?id=hf044>, accessed 2013.
- Fraser, W. (2014) "At-sea seabird censuses. Data on the species encountered (including marine mammals), their abundance, distribution and behavior. Data collected aboard cruises off the coast of the Western Antarctic Peninsula, 1993 - present". Palmer Station Antarctica LTER. Available at: <https://doi.org/10.6073/pasta/e3871e749fa737dd94-d5a269ac90e8ce>, accessed 2016.
- Friggens, M. (2008) "Sevilleta LTER Small Mammal Population Data", Albuquerque, NM: Sevilleta Long Term Ecological Research Site Database: SEV008. Available at: <http://sev.lternet.edu/data/sev-8>, accessed 2012.
- Gaiser, E. (2010) Macrophyte count data collected from Northeast Shark Slough, Everglades National Park (FCE) from September 2006 to Present. Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/effd9e98134913af21b670feb6bd6233>, accessed 2012.
- Gavrilov, G. M. & Glebov, I. A. (2013) The composition and community structure of benthic fish in the economic zone of Russia Bering sea on the results of studies of "TINRO centre" in 2005-2012 years. *Modern problems of science and education*, **11**, 37-49.
- Gido, K. B. "Fish population on selected watersheds at Konza Prairie - CFP01." Konza Prairie LTER Program. Available at: <http://www.konza.ksu.edu/KNZ/pages/data/Knzdsdetail.aspx?datasetCode=CFP01>, accessed 2012.
- Goheen, J.R., Palmer, T.M., Charles, G.K., Helgen, K.M., Kinyua, S.N., Maclean, J.E., Turner, B.L., Young, H.S. & Pringle, R.M. (2013) Piecewise disassembly of a large-herbivore community across a rainfall gradient: the UHURU experiment. *PLoS One*, **8**, e55192.
- Grant, P. R. (1976) An 11-year study of small mammal populations at Mont St. Hilaire, Quebec. *Canadian Journal of Zoology*, **54**, 2156-2173.
- Grant, P. R. (1976) "An 11-year study of small mammal populations at Mont St. Hilaire, Quebec". NERC Centre for Population Biology, Imperial College. The Global Population Dynamics Database v2.0. Available at: <http://www3.imperial.ac.uk/cpb/databases/gpdd>, accessed 2012.
- Grossman, G. D. (1982) Dynamics and Organization of a Rocky Intertidal Fish Assemblage: The Persistence and Resilience of Taxocene Structure. *The American Naturalist*, **119**, 611-637. <http://www.jstor.org/stable/2461182>.
- Grossman, G. D. (2007) "Stream fish assemblage stability in a southern Appalachian stream at the Coweeta Hydrologic Laboratory from 1984 to 1995". Coweeta Long Term Ecological Research Program. Available at: <https://doi.org/10.6073/pasta/f0baf5f59c89f670e04f537f5cc05290>, accessed 2016.
- Grossman, G. D., Moyle, P. B. & Whitaker Jr, J. O. (1982) Stochasticity in structural and functional characteristics of an Indiana stream fish assemblage: a test of community theory. *The American Naturalist*, **1**, 423-454.
- Hale, S. S., Hughes, M. M., Strobel, C. J., Buffum, H. W., Copeland, J. L. & Paul, J. F. (2002) Coastal ecological data from the Virginian Biogeographic Province, 1990-1993. *Ecology*, **83**, 2942.
- Hall, G. A. (1984) A Long-Term Bird Population Study in an Appalachian Spruce Forest. *The Wilson Bulletin*, **96**, 228-240.
- Halpin, P.N., Read, A.J., Fujioka, E., Best, B.D., Donnelly, B., Hazen, L.J., Kot, C., Urian, K., LaBrecque, E. & Dimatteo, A. (2009) OBIS-SEA-MAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography*, **22**, 104-115.
- Harmon, M. & Franklin, J. (2012) "Long-term growth, mortality and regeneration of trees in permanent vegetation plots in the Pacific Northwest, 1910 to present." Long-Term Ecological Research. Forest Science Data Bank, Corvallis. Available at: <http://andrews-forest.oregonstate.edu/data/abstract.cfm?dbcode=TV010>, accessed 2012.
- Hartnett, D.C. & Collins, S.L. (2016) PVC02 Plant Species Composition on Selected Watersheds at Konza Prairie. Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/7b6df00de4d0f-cecf344c02de9f9c62>, accessed 2017.
- Hidalgo, P., Escribano, R., Vergara, O., Jorquera, E., Donoso, K. & Mendoza, P. (2010) Patterns of copepod diversity in the Chilean coastal upwelling system. *Deep Sea Research Part II: Topical Studies in Oceanography*, **57**, 2089-2097.
- Hirche, H.-J., Kosobokova, K., Gaye-Haake, B., Harms, I., Meon, B. & Nöthig, E.-M. (2006) Structure and function of contemporary food webs on Arctic shelves: A panarctic comparison: The pelagic system of the Kara Sea-Communities and components of carbon flow. Originator: B. Meon and E.-M. Nöthig. Available at: <http://www.iobis.org/mapper/?dataset=4396>, accessed 2012.
- Hirche, H.-J., Kosobokova, K., Gaye-Haake, B., Harms, I., Meon, B. & Nöthig, E.-M. (2006) Structure and function of contemporary food webs on Arctic shelves: A panarctic comparison: The pelagic system of the Kara Sea-Communities and components of carbon flow. *Progress in Oceanography*, **71**, 288-313.
- Hoey, A. "Aceh WCS fish 2010-16". Accessed 2016.
- Hoey, A. "Aceh WCS fish surveys". Accessed 2016.
- Hoey, A. "Karimunjawa WCS fish data". Accessed 2016.

- Hogstad, O. (1993) Structure and dynamics of a passerine bird community in a spruce-dominated boreal forest. A 12-year study. *Annales Zoologici Fennici*, 30, 43–54.
- Hollister, R.D., May, J.L., Kremers, K.S., Tweedie, C.E., Oberbauer, S. F., Liebig, J.A., Botting, T.F., Barrett, R.T. & Gregory, J.L. (2015) Warming experiments elucidate the drivers of observed directional changes in tundra vegetation. *Ecology and Evolution*, 5, 1881–1895.
- Holmes, R. T. & Sherry, T. W. (2001) Thirty-year bird population trends in an unfragmented temperate deciduous forest: the importance of habitat change. *The Auk*, 118, 589–610.
- Holmes, R. T. & Sturges, F. W. (1975) Bird community dynamics and energetics in a northern hardwoods ecosystem. *Journal of Animal Ecology*, 44, 175–200.
- Holmes, R. T. & Sherry, T. W. (1988) Assessing population trends of New Hampshire forest birds: Local versus regional patterns. *The Auk*, 105, 756–768.
- Holmes, R. T., Sherry, T. W. & Sturges, F. W. (1986) Bird Community Dynamics in a Temperate Deciduous Forest: Long-Term Trends at Hubbard Brook. *Ecological Monographs*, 56, 201–220.
- Hopky, G.E., Lawrence, M.J. & Chiperzak, D.B. "Beaufort Sea NOGAP1 Zooplankton - NOGAP B1, Zooplankton Data from the Canadian Beaufort Sea Shelf, 1984–1985". Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks. Available at: [http://www.arcodiv.org/Database/Plankton\\_datasets](http://www.arcodiv.org/Database/Plankton_datasets), accessed 2012.
- Hopky, G.E., Lawrence, M.J. & Chiperzak, D.B. "Beaufort Sea NOGAP2 Zooplankton - NOGAP B2, Zooplankton Data from the Canadian Beaufort Sea Shelf, 1987–1988". Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks. Available at: [http://www.arcodiv.org/Database/Plankton\\_datasets](http://www.arcodiv.org/Database/Plankton_datasets), accessed 2012.
- Hopky, G.E., Lawrence, M.J. & Chiperzak, D.B. "Beaufort Sea NOGAP3 Zooplankton - NOGAP B3, Zooplankton Data from the Canadian Beaufort Sea Shelf, 1986". Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks. Available at: [http://www.arcodiv.org/Database/Plankton\\_datasets](http://www.arcodiv.org/Database/Plankton_datasets), accessed 2012.
- How, R.A. (1998) Long-term sampling of a herpetofaunal assemblage on an isolated urban bushland remnant, Bold Park, Perth. *Journal of the Royal Society of Western Australia*, 81, 143–148.
- Hsieh, C.-H. "Ichthyoplankton data collected from Yenliao Bay in 6 stations northeast of Taiwan (1995–2000)". Ecoinformatics Lab, Institute of Oceanography National Taiwan University. Accessed 2016.
- Hubbell, S. P., Condit, R. & Foster, R. B. (2005) "Barro Colorado Forest Census Plot Data". Available at: <https://ctfs.arnarb.harvard.edu/webatlas/datasets/bci>, accessed 2012.
- Huettmann, F. (1998) An ecological GIS research application for the northern Atlantic-The PIROP database software, environmental data sets and the role of the internet. In: Riekert W.-F. and Tochtermann K. (Eds.) *Hypermedia im Umweltschutz Proceedings of Deutsche Gesellschaft für Informatik (GI) und Forschungsinstitut für anwendungsorientierte Wissensverarbeitung (FAW) Ulm. Umwelt-Informatik aktuell*; Bd.17, Metropolis Verlag/Marburg. pp. 213–217
- Hundt, R. (2001) Ökologisch-geobotanische Untersuchungen an den mitteleuropäischen Wiesen- und Weidengesellschaften unter besonderer Berücksichtigung ihres Wasserhaushaltes und ihrer Veränderung durch die Intensivbewirtschaftung im Rahmen der Großflächenproduktion. Biosphärenreservat Rhön, Thüringen. *Monografie*, 3, 366.
- Institute of Agricultural and Fisheries research (ILVO), Belgium (2015) Epibenthos and demersal fish monitoring at long-term monitoring stations in the Belgian part of the North Sea. Available at: <https://doi.org/10.14284/54>, accessed 2016.
- Institute of Agricultural and Fisheries research (ILVO), Belgium (2016) Macrobenthos monitoring at long-term monitoring stations in the Belgian part of the North Sea between 1979 and 1999. Available at: <https://doi.org/10.14284/201>, accessed 2016.
- Institute of Agricultural and Fisheries research (ILVO), Belgium (2016) Macrobenthos monitoring at long-term monitoring stations in the Belgian part of the North Sea from 2001 on. Available at: <https://doi.org/10.14284/202>, accessed 2016.
- Jahncke, J. & Rintoul, C. (2006) "CalCOFI and NMFS Seabird and Marine Mammal Observation Data, 1987–2006". California Cooperative Oceanic Fisheries Investigations (CalCOFI) and National Marine Fisheries Service (NMFS) cruises, 1987–2006 - OBIS SEAMAP. Available at: <http://www.ioibis.org>, accessed 2012.
- Jalilov, A. B., Andreychev, A. V. & Kuznetsov, V. A. (2014) Monitoring and conservation of medium and large mammals in Chamzinsky District of the Republic of Mordovia. *Vestnik of Lobachevsky University of Nizhni Novgorod*, 4(1), 222–227.
- Jandt, U. & Bruehlheide, H. (2012) German vegetation reference database (GVRD). *Biodiversity & Ecology*, 4, 355–355.
- Joern, A. (2016) CGR02 Sweep Sampling of Grasshoppers on Konza Prairie LTER watersheds (1982–present). Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/7060b2c244229a37e3bfc8c18f14ad02>, accessed 2016.
- Jonas, J.L. & Joern, A. (2007) Grasshopper (Orthoptera: Acrididae) communities respond to fire, bison grazing and weather in North American tallgrass prairie: a long-term study. *Oecologia*, 153, 699–711.
- Jones, J. & Miller, J. "Spatial and temporal distribution and abundance of moths in the Andrews Experimental Forest, 1994 to 2008". H. J. Andrews Experimental Forest. Forest Science Data Bank, Corvallis. Available at: <http://andrewsforest.oregonstate.edu/data/abstract.cfm?dbcode=SA015>, accessed 2013.
- Karatayev, V. A., Karatayev, A. Y., Burlakova, L. E. & Rudstam, L. G. (2014) Eutrophication and Dreissena Invasion as Drivers of Biodiversity: A Century of Change in the Mollusc Community of Oneida Lake. *PLoS ONE*, 9(7), e101388. <https://doi.org/10.1371/journal.pone.0101388>.
- Kartzinel, T.R., Goheen, J.R., Charles, G.K., DeFranco, E., Maclean, J.E., Otieno, T.O., Palmer, T.M. & Pringle, R.M. (2014) Plant and small-mammal responses to large-herbivore exclusion in an African savanna: five years of the UHURU experiment. *Ecology*, 95, 787–787. <https://doi.org/10.1890/13-1023R.1>.
- Kaufman, D.W. Seasonal summary of numbers of small mammals on 14 LTER traplines in prairie habitats at Konza Prairie. Konza Prairie Long-Term Ecological Research. Available at: <http://lter.konza.ksu.edu/content/csm01-seasonal-summary-numbers-small-mammals-14-lter-traplines-prairie-habitats-konza>, accessed 2016.
- Kelt, D. A., Meserve, P. L., Gutiérrez, J. R., Milstead, W. B. & Previtali, M. A. (2013) Long-term monitoring of mammals in the face of biotic and abiotic influences at a semiarid site in north-central Chile. *Ecology*, 94, 977. <https://doi.org/10.1890/12-1811.1>.
- Kendeigh, S. C. (1982) Bird populations in east central Illinois: Fluctuations, variations, and development over a half-century. University of Illinois Press.
- Kennedy, M. & Spry, J. (2011) Atlantic Zone Monitoring Program Maritimes Region plankton datasets. Fisheries and Oceans Canada-BioChem archive. OBIS Canada, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada.
- Kenner, M. C., Estes, J. A., Tinker, M. T., Bodkin, J. L., Cowen, R. K., Harrold, C., Hatfield, B. B., Novak, M., Rassweiler, A. & Reed, D. C. (2013) A multi-decade time series of kelp forest community structure



- at San Nicolas Island, California (USA). *Ecology*, 94, 2654. <https://doi.org/10.1890/13-0561R.1>.
- Khoruzhiy, A. A. & Naydenko, S. V. (2014) Species structure and year-to-year dynamics of nekton biomass in the upper epipelagic layer of the Pacific waters at Kuril Islands in summer periods of the 2000s. *Izv. TINRO*, 176, 16–36.
- Knops, J. & Tilman, D. Successional Dynamics on a Resampled Chronosequence - Experiment 014. Cedar Creek Ecosystem Science Reserve. Available at <http://www.cedarcreek.umn.edu/research/data/dataset?ghe014>, accessed 2016.
- Kosobokova, K. "White Sea Zooplankton". Shirshov Institute of Oceanology, Moscow; Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks. Available at: <http://www.iobis.org/mapper/?dataset=4488>, accessed 2012.
- Krefting, L. W. & Ahlgren, C. E. (1974) Small Mammals and Vegetation Changes After Fire in a Mixed Conifer-Hardwood Forest. *Ecology*, 65, 1391–1398.
- Krivenko, V. G. (1991) *Waterfowl and their protection*. Moscow, Agropromizdat Publishers, 271 p.
- Kuhnz, L. A., Ruhl, H. A., Huffard, C. L. & Smith, K. L. (2014) Rapid changes and long-term cycles in the benthic megafaunal community observed over 24 years in the abyssal northeast Pacific. *Progress in Oceanography*, 124, 1–11.
- Kuo, C.-Y., Yuen, Y.S., Meng, P.-J., Ho, P.-H., Wang, J.-T., Liu, P.-J., Chang, Y.-C., Dai, C.-F., Fan, T.-Y., Lin, H.-J., Baird, A. H. & Chen, C. A. (2012) Recurrent Disturbances and the Degradation of Hard Coral Communities in Taiwan. *PLoS ONE*, 7, e44364.
- Kuo, C.-Y. "Scleractinian Coral Dataset", ARC Centre of Excellence for Coral Reef Studies, James Cook University, Australia. Accessed 2016.
- Kuo, C.-Y. "unpublished data from a tropical coral reef in Taiwan". Accessed 2016.
- Kushner, D. J., Rassweiler, A., McLaughlin, J. P. & Lafferty, K. D. (2013). A multi-decade time series of kelp forest community structure at the California Channel Islands. *Ecology*, 94, 2655. <https://doi.org/10.1890/13-0562.1>.
- Laguionie-Marchais, C., Billett, D. S. M., Paterson, G. L. D., Ruhl, H. A., Soto, E. H., Smith, J. L. & Thatje, S. (2013) Inter-annual dynamics of abyssal polychaete communities in the North East Pacific and North East Atlantic-A family-level study. *Deep-Sea Research Part I: Oceanographic Research Papers*, 75, 175–186.
- Laguionie-Marchais, C., Paterson, G. L. J., Bett, B. J., Smith, K. L. & Ruhl, H. A. (2016) Inter-annual species-level variations in an abyssal polychaete assemblage (Sta. M, NE Pacific, 4000 m). *Progress in Oceanography*, 140, 43–53.
- Lancaster, L. T. & Fitt, R. "unpublished Damselfly abundance data", University of Aberdeen. Accessed 2016.
- Landis, D. & Gage, S. (2014) Insect Populations via Sticky Traps at KBS-LTER. Available at: <http://lter.kbs.msu.edu/datatables/67>, accessed 2016.
- Lathrop, R. (2000) "Madison Wisconsin Lakes Zooplankton 1976 - 1994." North Temperate Lakes Long Term Ecological Research Program, Center for Limnology, University of Wisconsin-Madison. Available at: <http://lter.limnology.wisc.edu/dataset/madison-wisconsin-lakes-zooplankton-1976-1994>, accessed 2013.
- Lee, C.M., Kim, S.-S. & Kwon, T.-S. (2016) Butterfly fauna in Mount Gariwang-san, Korea. *Journal of Asia-Pacific Biodiversity*, 9, 198–204.
- Lefcheck, J. S. (2015) The use of functional traits to elucidate the causes and consequences of biological diversity. The College of William & Mary, PhD thesis. Available at: <http://gradworks.umi.com/36/62/3662989.html>, accessed 2016.
- Lightfoot, D. (2007) "Jornada Grasshopper Data". Jornada Basin LTER. Available at: <http://jornada.nmsu.edu/lter/dataset/49712/view>, accessed 2016.
- Lightfoot, D. & Schooley, R. L. "SMES rodent trapping data, Small Mammal Exclosure Study". Jornada LTER. Available at: [http://jornada.nmsu.edu/sites/jornada.nmsu.edu/files/data\\_files/JornadaStudy\\_086\\_smes\\_rodent\\_trapping\\_data\\_0.csv](http://jornada.nmsu.edu/sites/jornada.nmsu.edu/files/data_files/JornadaStudy_086_smes_rodent_trapping_data_0.csv), accessed 2016.
- Lightfoot, D. (2013) "Lizard pitfall trap data (LTER-II, LTER-III)". Jornada Basin LTER. Available at: <http://jornada.nmsu.edu/lter/dataset/49821/view>, accessed 2016.
- Lightfoot, D. "Small Mammal Exclosure Study (SMES)". Sevilleta Long Term Ecological Research Program. Available at: <http://sev.lternet.edu/content/small-mammal-exclosure-study-smes-0>, accessed 2016.
- Lightfoot, D. (2011) "Small Mammal Exclosure Study (SMES) Vegetation Data from the Chihuahuan Desert Grassland and Shrubland at the Sevilleta National Wildlife Refuge, New Mexico (2006–2009)". Long Term Ecological Research Network. Available at: <https://doi.org/10.6073/pasta/d80d5e2196cd11ef79df23ebe5a77c19>, accessed 2016.
- Lindén, H. & Rajala, P. (1981) Fluctuations and long-term trends in the relative densities of tetraonid populations in Finland, 1964–77. *Finnish Game Research*, 39, 13–34.
- Ling, S. D., Scheibling, R. E., Rassweiler, A., Johnson, C. R., Shears, N., Connell, S. D., Salomon, A. K., Norderhaug, K. M., Pérez-Matus, A., Hernández, J. C., Clemente, S., Blamey, L. K., Hereu, B., Ballesteros, E., Sala, E., Garabou, J., Cebrian, E., Zabala, M., Fujita, D. & Johnson, L. E. (2014) Global regime shift dynamics of catastrophic sea urchin overgrazing. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 370, 20130269.
- Lloret, F., Peñuelas, J. & Estiarte, M. (2004) Experimental evidence of reduced diversity of seedlings due to climate modification in a Mediterranean-type community. *Global Change Biology*, 10, 248–258. <https://doi.org/10.1111/j.1365-2486.2004.00725.x>.
- Louza, M., Hyrenbach, K.D., Arcos, J.M., Abelló, P., Sola, L.G. & Oro, D. (2006) Oceanographic habitat of an endangered Mediterranean procariiform: implications for marine protected areas. *Ecological Applications*, 16, 1683–1695.
- Machete, M. & Santos, R. (2007) Azores Fisheries Observer Program (POPA): a case study of the multidisciplinary use of observer data. Proceedings of the 5<sup>th</sup> International Fisheries Observer Conference, pp. 15–18.
- Mack, M. C., Schuur, E. A. G., Bret-Harte, M. S., Shaver, G. R. & Chapin, F. S. (2004) Ecosystem carbon storage in arctic tundra reduced by long-term nutrient fertilization. *Nature*, 431, 440–443.
- Madin, J.S., Hoogenboom, M., Chase, T.J., Dornelas, M., Frank, G.E., Pizarro, O., Williams, S.B. & Zawada, K. "Lizard Island Trimodal Coral 2015 - 2016". Accessed 2017.
- Madin, L. & Horgan, E. (2006) Zooplankton Sampled with 10m2MOC-NESS Net in Georges Bank 1995–1999. Woods Hole Oceanographic Institution, USA: U.S. GLOBEC Data Management Office. Available at: <http://www.iobis.org/mapper/?dataset=2339>, accessed 2012.
- Malyshev, Y. S. (2011) On the diagnostic techniques of ranks of the number dynamics cycles of small mammals. *Baikal Zoological Journal*, 1(6), 92–106.
- Markhaseva, E.L., Golikov, A.A., Agapova, T.A. & Beig, A.A. (1985) Archives of the Arctic Seas Zooplankton. Available at: <http://www.iobis.org/mapper/?dataset=4470>, accessed 2012.
- McKnight, D., Priscu, J., Keeley, E. & Tursich, N. "Summer Phytoplankton Densities 1992–2001". McMurdo Dry Valleys LTER. Available at: <http://mcm.lternet.edu/content/summer-phytoplankton-densities-1992-2001>, accessed 2016.

- McLarney, W. O., Meador, J. & Chamblee, J. (2010) "Upper Little Tennessee River Biomonitoring Program Database." Coweeta Long Term Ecological Research Program. Available at: [https://coweeta.uga.edu/dbpublic/dataset\\_details.asp?accession=4045](https://coweeta.uga.edu/dbpublic/dataset_details.asp?accession=4045), accessed 2012.
- Melnikov, Y. I., Melnikova, N. & Pronkevich, V. V. (2000) Migration of birds of prey in the mouth of the river Irkut. *Russian Ornithological Journal*, 108, 3–17.
- Mendenhall, C.D., Karp, D.S., Meyer, C.F., Hadly, E.A. & Daily, G.C. (2014) Predicting biodiversity change and averting collapse in agricultural landscapes. *Nature*, 509, 213.
- Merritt, J. (1999) Long Term Mammal Data from Powdermill Biological Station 1979–1999. Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/83c888854e239a7959799895bb61cfe>, accessed 2016.
- Meyer, C.F. & Kalko, E.K. (2008) Assemblage-level responses of phyllostomid bats to tropical forest fragmentation: land-bridge islands as a model system. *Journal of Biogeography*, 35, 1711–1726.
- Meyer, C.F. & Kalko, E.K. (2008) Bat assemblages on Neotropical land-bridge islands: nested subsets and null model analyses of species co-occurrence patterns. *Diversity and Distributions*, 14, 644–654.
- Meyer, C.F., Fründ, J., Lizano, W.P. & Kalko, E.K. (2008) Ecological correlates of vulnerability to fragmentation in Neotropical bats. *Journal of Applied Ecology*, 45, 381–391.
- Milchakova, N. A., Ryabogina, V. G. & Chernyshova, E. B. (2011) "Macroalgae of the Crimean coastal zone (the Black Sea, 1967–2007)". Sevastopol, IBSS. Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dasid=2690>, accessed 2012.
- Mitchell, P. I., Newton, S. F., Ratcliffe, N. & Dunn, T. E. Seabird 2000. Joint Nature Conservation Committee, Peterborough, UK. Available at: <http://www.iobis.org/>, accessed 2012.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2013) "Monitoring site 1000 Shorebird Survey" (ShorebirdsDatapackage2012.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2014) "Monitoring site 1000 Forest and grassland research - Bird survey data" (BirdData2009-B\_ver20120328.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2014) "Monitoring site 1000 Forest and grassland research - Surface wandering beetles survey data" (GBDataPackage2014ver1.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2014) "Monitoring site 1000 Village survey - Bird survey data (2005–2012)" (SAT02.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2014) "Monitoring site 1000 Village survey - Medium and large mammal survey data (2006–2012)" (SAT03.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Alpine research - Bumblebee Survey" (KOZ08.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Alpine research - Butterfly Survey" (KOZ06.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Alpine research - Surface wandering beetles" (KOZ07.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Coastal zone research - Algae survey" (MOB01.zip, downloaded from [http://www.biodic.go.jp/moni1000/findings/data/index\\_file\\_algalbeds.html](http://www.biodic.go.jp/moni1000/findings/data/index_file_algalbeds.html)). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Coastal zone research - Algae survey" (MOB02.zip, downloaded from [http://www.biodic.go.jp/moni1000/findings/data/index\\_file\\_algalbeds.html](http://www.biodic.go.jp/moni1000/findings/data/index_file_algalbeds.html)). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Coastal zone research - Tidal flat survey" (HIG01.zip, downloaded from [http://www.biodic.go.jp/moni1000/findings/data/index\\_file\\_tidalflats.html](http://www.biodic.go.jp/moni1000/findings/data/index_file_tidalflats.html)). Accessed 2016.
- Monitoring Site 1000 Project, Biodiversity Center, Ministry of Environment of Japan (2015) "Monitoring site 1000 Land waters research - Lakes: benthic animal research" (LKbenthosDatapackage2014ver1.zip, downloaded from <http://www.biodic.go.jp/moni1000/findings/data/index.html>). Accessed 2016.
- Moore, J. J. & Howson, C. M. "Survey of the rocky shores in the region of Sullom Voe, Shetland, A report to SOTEAG from Aquatic Survey & Monitoring Ltd", Cosheston, Pembrokeshire. 29 p. Available at: <http://www.soteag.org.uk>, accessed 2013.
- Moore, N. W. (1991) "The development of dragonfly communities and the consequences of territorial behaviour: A 27-year study on small ponds at Woodwalton Fen, Cambridgeshire, United Kingdom". NERC Centre for Population Biology, Imperial College. The Global Population Dynamics Database Version 2.0. Available at: <http://www3.imperial.ac.uk/cpb/databases/gpdd>, accessed 2012.
- Moore, N. (1991) The development of dragonfly communities and the consequences of territorial behaviour: A 27 year study on small ponds at Woodwalton Fen, Cambridgeshire, United Kingdom. *Odonatologica*, 20, 203–231.
- Morato, T., Varkey, D.A., Damaso, C., Machete, M., Santos, M., Prieto, R., Santos, R.S. & Pitcher, T.J. (2008) Evidence of a seamount effect on aggregating visitors. *Marine Ecology Progress Series*, 357, 23–32.
- Muldavin, E. "Pinon Juniper Net Primary Production Quadrat Data from the Seville National Wildlife Refuge, New Mexico: 1999–2001." Seville Long Term Ecological Research Program. Available at: <http://sev.lternet.edu/data/sev-187>, accessed 2013.
- Muldavin, E. "Pinon-Juniper (Core Site) Quadrat Data for the Net Primary Production Study at the Seville National Wildlife Refuge, New Mexico (2003–Present)." Seville Long Term Ecological Research Program. Available at: <http://sev.lternet.edu/node/1718>, accessed 2013.
- Muldavin, E. & Collins, S. (2003) Prescribed Burn Effect on Chihuahuan Desert Grasses and Shrubs at the Seville National Wildlife Refuge, New Mexico: Species Composition Study 2004 to present. Seville LTER. Available at: <http://sev.lternet.edu/data/sev-166>, accessed 2016.
- Myster, R.W. "Flooded forest plot sampling in Peru". Luquillo LTER. Available at: <http://luq.lternet.edu/data/luqmetadata169>, accessed 2016.
- Naumov, A. "Benthos of the White Sea. A database". White Sea Biological Station, Zoological Institute RAS. Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dasid=2769>, accessed 2012.
- Neat, F. & Campbell, N. (2011) Demersal fish diversity of the isolated Rockall plateau compared with the adjacent west coast shelf of

- Scotland. *Biological Journal of the Linnean Society*, 104, 138–147. <https://doi.org/10.1111/j.1095-8312.2011.01699.x>.
- Nedosekin, V. Y. (2015) Long-term dynamics of the population and the quantity of small mammals under conditions of the reserve "Galichya Gora". *Proceedings of National Nature Reserve Prisurey*, 30, 87–90.
- NERC (2010) "The Global Population Dynamics Database Version 2". Centre for Population Biology, Imperial College. Available at: <http://www.sw.ic.ac.uk/cpb/cpb/gpdd.html>, accessed 2016.
- NIWA "The New Zealand Freshwater Fish Database". Available at: <https://www.niwa.co.nz/our-services/online-services/freshwater-fish-database>, accessed 2016.
- Norden, N., García, H. & Salgado, B. "La Planada Forest Dynamics Plot". The Center for Tropical Forest Science. Smithsonian Tropical Research Institute. Available at: <http://www.ctfs.si.edu/site/La+Planada>, accessed 2016.
- NTL LTER "NTLFI02 North Temperate Lakes LTER: Fish Abundance 1981 - current". North Temperate Lakes Long Term Ecological Research program, NSF. Center for Limnology, University of Wisconsin-Madison. Available at: <https://lter.limnology.wisc.edu/dataset/north-temperate-lakes-lter-fish-abundance-1981-current>, accessed 2012.
- NTL LTER (2011) "North Temperate Lakes LTER: Zooplankton - Madison Lakes Area 1997 - current." North Temperate Lakes Long Term Ecological Research Program, Center for Limnology, University of Wisconsin-Madison. Available at: <http://lter.limnology.wisc.edu/dataset/north-temperate-lakes-lter-zooplankton-madison-lakes-area-1997-current>, accessed 2013.
- NTL LTER "North Temperate Lakes LTER: Phytoplankton - Madison Lakes Area 1995 - current." North Temperate Lakes Long Term Ecological Research Program, Center for Limnology, University of Wisconsin-Madison. Available at: <https://lter.limnology.wisc.edu/dataset/north-temperate-lakes-lter-phytoplankton-madison-lakes-area-1995-current>, accessed 2013.
- NTL LTER "North Temperate Lakes LTER: Zooplankton - Trout Lake Area 1982 - current." North Temperate Lakes Long Term Ecological Research Program, Center for Limnology, University of Wisconsin-Madison. Available at: <https://lter.limnology.wisc.edu/dataset/north-temperate-lakes-lter-zooplankton-trout-lake-area-1982-current>, accessed 2013.
- Ohmart, R., Pearson, D., Hostetler, M., Katti, M. & Hulen, T. (2003) "Transect bird survey with data synthesis from multiple transects in the central Arizona-Phoenix area: period 1998 to 2000." Central Arizona-Phoenix Long-Term Ecological Research. Global Institute for Sustainability, Arizona State University. Available at: <https://caplter.asu.edu/data/data-catalog/?id=43>, accessed 2012.
- Oliver, J. C., Prudic, K. L. & Collinge, S. K. (2006) Boulder County Open Space butterfly diversity and abundance. *Ecology*, 87, 1066.
- Olsen, E. M., Carlson, S. M., Gjosæter, J. & Stenseth, N. C. (2009) Nine decades of decreasing phenotypic variability in Atlantic cod. *Ecology Letters*, 12, 622–631. <https://doi.org/10.1111/j.1461-0248.2009.01311.x>
- Ostler, R. "Marine Nature Conservation Review (MNCR) and associated benthic marine data held and managed by JNCC - EurOBIS". Joint Nature Conservation Committee, Centre for Ecology and hydrology, Aberdeenshire, UK. Available at: <http://www.emodnet-biology.eu/data-catalog/?module=dataset&dasid=621>, accessed 2012.
- Paquette, A., Laliberté, E., Bouchard, A., Blois, S. de, Legendre, P. & Brisson, J. (2007) Lac Croche understory vegetation data set (1998–2006). *Ecology*, 88, 3209. <https://doi.org/10.1890/07-0513.1>
- Pautzke, C.G. "Arctic Copepods T3 & AIDJEX Ice Islands". Available at: [http://www.arcodiv.org/Database/Plankton\\_datasets](http://www.arcodiv.org/Database/Plankton_datasets), accessed 2012.
- Pautzke, C.G. "Copepoda collected from the Canada Basin Arctic Ocean; Fletcher's Ice Island (T-3) 1970–1972 and AIDJEX, 1975". Phytoplankton Primary Production Below Arctic Ocean Pack Ice: An Ecosystems Analysis. PhD Thesis University of Washington; Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks. Accessed 2012.
- Pélissier, R., Pascal, J.-P., Ayyappan, N., Ramesh, B. R., Aravajy, S. & Ramalingam, S. R. (2011) Tree demography in an undisturbed Dipterocarp permanent sample plot at Uppangala, Western Ghats of India. *Ecology*, 92, 1376.
- Pérez-Matus, A. & Ruz, C. S. "Conicyt-Fondecyt Fish and Turf Algae Data", Chile, Subtidal Ecology Laboratory, Estacion Costera de Investigaciones Marinas, Facultad de Ciencias Biológicas. Pontificia Universidad Católica de Chile, accessed 2016.
- Pollard, E. (1991) Monitoring butterfly numbers. In: F. B. Goldsmith (ed) *Monitoring for Conservation and Ecology*. Chapman and Hall.
- Pomati, F., Matthews, B., Jokela, J., Schildknecht, A. & Ibelings, B. W. (2012) Effects of Re-Oligotrophication and Climate Warming on Plankton Richness and Community Stability in a Deep Mesotrophic Lake. *Oikos*, 121, 1317–1327.
- Pomati, F., Tellenbach, C., Matthews, B., Venail, P., Ibelings, B. W. & Ptacnik, R. (2015) Challenges and Prospects for Interpreting Long-Term Phytoplankton Diversity Changes in Lake Zurich (Switzerland). *Freshwater Biology*, 60, 1052–1059. <https://doi.org/10.1111/fwb.12416>
- Pombo, L. & Rebelo, J. E. (2002) Spatial and temporal organization of a coastal lagoon fish community-Ria de Aveiro, Portugal. *Cybio*, 26(3), 185–196.
- Pombo, L., Elliott, M. I. & Rebelo, J. E. (2005) Environmental influences on fish assemblage distribution of an estuarine coastal lagoon, Ria de Aveiro (Portugal). *Scientia Marina*, 69(1), 143–159.
- Pombo, L., Rebelo, J. E. & Elliott, M. (2007) The structure, diversity and somatic production of the fish community in an estuarine coastal lagoon, Ria de Aveiro (Portugal). *Hydrobiologia*, 587(1), 253–268.
- Preston, F. W. (1960) Time and Space and the Variation of Species. *Ecology*, 41, 611–627.
- Prins, H. H. T. & Douglas-Hamilton, I. (1990) Stability in a Multi-Species Assemblage of Large Herbivores in East Africa. *Oecologia*, 83, 392–400.
- Privett, S., Cowling, R. & Taylor, H. (2001) Thirty years of change in the fynbos vegetation of the Cape of Good Hope Nature Reserve, South Africa. *Bothalia*, 31(1), 99–115. <https://doi.org/10.4102/abc.v31i1.509>.
- Pugh, P. Discovery Collections Midwater Database. National Oceanography Centre, Southampton, UK. Available at: <http://www.iobis.org/mapper/?dataset=12>, accessed 2012.
- Pulliamin, E. (1981) A transect survey of small land carnivore and red fox populations on a subarctic fell in Finnish Forest Lapland over 13 winters. *Annales Zoologici Fennici*, 18, 270–278.
- Ratkova, T. N. "Phytoplankton of the White Sea, Barents Sea, Amundsen & Nansen Basins". Institute of Oceanology, Academy of Sciences of Russia, Moscow, Russia; Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks. Available at: [http://www.arcodiv.org/Database/Plankton\\_datasets](http://www.arcodiv.org/Database/Plankton_datasets), accessed 2012.
- Read, A., Halpin, P., Crowder, L., Best, B. & Fujioka, E. (2010) OBIS-SEA-MAP: mapping marine mammals, birds and turtles. World Wide Web electronic publication. <http://seamap.env.duke.edu>
- Reagan, D.P. (1991) The response of Anolis lizards to hurricane-induced habitat changes in a Puerto Rican rain forest. *Biotropica*, 23, 468–474.
- Rebelo, J. E. (1992) The ichthyofauna and abiotic hydrological environment of the Ria de Aveiro, Portugal. *Estuaries*, 15(3), 403–413.
- Reed, D. C. (2014a) "SBC LTER: Reef: Kelp forest community dynamics: Abundance and size of giant kelp (*Macrocystis pyrifera*), ongoing since



- 2000". Santa Barbara Coastal LTER. Available at: <http://sbc.lternet.edu/cgi-bin/showDataset.cgi?docid=knb-lter-sbc.18>, accessed 2016. <https://doi.org/10.6073/pasta/d90872297e30026b263a119d4f5bca9f>
- Reed, D. C. (2014b) "SBC LTER: Reef: Kelp forest community dynamics: Fish abundance". Santa Barbara Coastal LTER. Available at: <http://sbc.lternet.edu/cgi-bin/showDataset.cgi?docid=knb-lter-sbc.17>, accessed 2016. <https://doi.org/10.6073/pasta/e37ed29111b2fddffc08355252b8b8c7>.
- Reed, D. C. (2014c) "SBC LTER: Reef: Kelp forest community dynamics: Invertebrate and algal density". Santa Barbara Coastal LTER. Available at: <http://sbc.lternet.edu/cgi-bin/showDataset.cgi?docid=knb-lter-sbc.19>, accessed 2016. <https://doi.org/10.6073/pasta/cd4cf864efecd69891dfe1d73b9ac9c3>.
- Reed, D. C. (2014d) "SBC LTER: Reef: Kelp forest community dynamics: Cover of sessile organisms, Uniform Point Contact". Santa Barbara Coastal LTER. Available at: <http://sbc.lternet.edu/cgi-bin/showDataset.cgi?docid=knb-lter-sbc.15>, accessed 2016. <https://doi.org/10.6073/pasta/f906c91e98c2a5fe752dfa0ccdc8895f>.
- Reed, D. C. (2014) "SBC LTER: Reef: Kelp Forest Community Dynamics: Fish abundance". Santa Barbara Coastal LTER. Available at: <https://doi.org/10.6073/pasta/e37ed29111b2fddffc08355252b8b8c7>, accessed 2016.
- Rees, H., Pendle, M., Waldock, R., Limpenny, D. & Boyd, S. (1999) "A comparison of benthic biodiversity in the North Sea, English Channel and Celtic Seas - Epifauna". Centre for Environment, Fisheries and Aquaculture Science; Burnham Laboratory, UK. Available at: <http://www.iobis.org/mapper/?dataset=51>, accessed 2012.
- Rees, H., Pendle, M., Waldock, R., Limpenny, D. & Boyd, S. (1999) A comparison of benthic biodiversity in the North Sea, English Channel, and Celtic Seas. *ICES Journal of Marine Science*, 56, 228–246.
- Reich, P., Wedin, D., Hobbie, S. & Davis, M. "Experiment 133 - Effect of Burning Patterns on Vegetation in the Fish Lake Burn Compartments - Shrub Survey". Cedar Creek Ecosystem Science Reserve. Available at: <http://www.cedarcreek.umn.edu/research/data/experiment?e133>, accessed 2012.
- Reichert, M. (2009) "MARMAP Chevron Trap Survey 1990–2009". SCDNR/NOAA MARMAP Program, SCDNR MARMAP Aggregate Data Surveys, The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program, Marine Resources Research Institute, South Carolina Department of Natural Resources U.S.A. Available at: [http://www.usgs.gov/obis-usa/data\\_search\\_and\\_access/participants.html](http://www.usgs.gov/obis-usa/data_search_and_access/participants.html), accessed 2012.
- Reichert, M. (2009) "MARMAP Florida Antillean Trap Survey 1990–2009". SCDNR/NOAA MARMAP Program, SCDNR MARMAP Aggregate Data Surveys, The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program, Marine Resources Research Institute, South Carolina Department of Natural Resources U.S.A. Available at: [http://www.usgs.gov/obis-usa/data\\_search\\_and\\_access/participants.html](http://www.usgs.gov/obis-usa/data_search_and_access/participants.html), accessed 2012.
- Reichert, M. (2010) "MARMAP Neuston Nets 1990–2009". SCDNR/NOAA MARMAP Program, SCDNR MARMAP Aggregate data surveys, The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program, Marine Resources Research Institute, South Carolina Department of Natural Resources U.S.A. Available at: [http://www.usgs.gov/obis-usa/data\\_search\\_and\\_access/participants.html](http://www.usgs.gov/obis-usa/data_search_and_access/participants.html), accessed 2012.
- Reichert, M. (2010) "MARMAP Fly Net 1990–2009". SCDNR/NOAA MARMAP Program, SCDNR MARMAP Aggregate Data Surveys, The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program, Marine Resources Research Institute, South Carolina Department of Natural Resources USA. Available at: <http://www.usgs.gov/obis-usa/>, accessed 2013.
- Reichert, M. (2010) "MARMAP Yankee Trawl 1990–2009". SCDNR/NOAA MARMAP Program, SCDNR MARMAP Aggregate data surveys, The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program, Marine Resources Research Institute, South Carolina Department of Natural Resources USA. Available at: <http://www.usgs.gov/obis-usa/>, accessed 2013.
- Reichert, M. (2010) "MARMAP Blackfish Trap Survey 1990–2009". SCDNR/NOAA MARMAP Program. SCDNR MARMAP Aggregate Data Surveys. The Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program. Marine Resources Research Institute. South Carolina Department of Natural Resources USA. Available at: <http://www.usgs.gov/obis-usa/>. accessed 2013.
- Richardson, B.A. (1999) The bromeliad microcosm and the assessment of faunal diversity in a neotropical forest. *Biotropica*, 31, 321–336.
- van Rijn, I. "Trawl fisheries in the Israeli Mediterranean 1980–2013". Accessed 2016.
- Rinnan, R., Stark, S. & Tolvanen, A. (2009) Responses of vegetation and soil microbial communities to warming and simulated herbivory in a subarctic heath. *Journal of Ecology*, 97, 788–800.
- Rintoul, C., Schlagenhauf-Langabeer, B., Hyrenbach, K. D., Morgan, K. H. & Sydeman, W. J. (2006) Atlas of California Current Marine Birds and Mammals: Version 1. Unpublished report, PRBO Conservation Science, Petaluma, California.
- Robinson, K.P., Baumgartner, N., Eisfeld, S.M., Clark, N.M., Culloch, R.M., Haskins, G.N., Zapponi, L., Whaley, A.R., Weare, J.S. & Tetley, M.J. (2007) The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland (UK). *Lutra*, 50, 19.
- Robinson, K. P.(2010) "CRRU (Cetacean Research and Rescue Unit) Cetacean sightings in Scotland waters". Available at: <http://www.emodnet-biology.eu/component/imis/?module=dataset&dsid=2819>, accessed 2012.
- Rocha, R. (2017) Tropical forest fragmentation: effects on the spatio-temporal dynamics of its bat communities. PhD Thesis, University of Lisbon, Lisbon, Portugal.
- Rocha, R., López-Baucells, A., Farneda, F.Z., Groenenberg, M., Bobrowiec, P.E.D., Cabeza, M., Palmeirim, J.M. & Meyer, C.F.J. (2017) Consequences of a large-scale fragmentation experiment for Neotropical bats: disentangling the relative importance of local and landscape-scale effects. *Landscape Ecology*, 32, 31–45.
- Rocha, R., Ovaskainen, O., López-Baucells, A., Farneda, F. Z., Sampaio, E. M., Bobrowiec, P. E., Cabeza, M., Palmeirim, J. M. & Meyer, C. F. (2018) Secondary forest regeneration benefits old-growth specialist bats in a fragmented tropical landscape. *Scientific reports*, 8, 3819.
- Rogers, L. A., Stige, L. C., Olsen, E. M., Knutsen, H., Chan, K.-S. & Stenseth, N. C. (2011) Climate and population density drive changes in cod body size throughout a century on the Norwegian coast. *Proceedings of the National Academy of Sciences*, 108(5), 1961–1966.
- Rossa-Feres, D. C. (1997) Community ecology of anura amphibia at Northwest region of Sao Paulo state, Brazil: microhabitat, seasonality, diet and multidimensional niche. State University of São Paulo, PhD thesis. Accessed 2016.
- Rudstam, L. (2008) "Zooplankton survey of Oneida Lake, New York, 1964 – 2012", KNB Data Repository. Available at: <https://knb.ecoinformatics.org/#view/kgordon.17.56>, accessed 2016.
- Ruhl, H. A. & Rybicki, N. B. (2010) Long-term reductions in anthropogenic nutrients link to improvements in Chesapeake Bay habitat. *Proceedings of the National Academy of Sciences*, 107(38), 16566–16570. <https://doi.org/10.1073/pnas.1003590107>.
- Ruhl, H. A. & Smith, K. L. (2004) Shifts in Deep-Sea Community Structure Linked to Climate and Food Supply. *Science*, 305, 513–515.

- Ruiz, G.M., Fofonoff, P.W., Steves, B., Huber, T., Larson, K., McCann, L., Hitchcock, N.G., Hines, A.H. & Carlton, J.T. (2005) North American Sessile Marine Invertebrate Survey. Available at: <http://www.iobis.org/mapper/?dataset=106>, accessed 2012.
- Sackett, W. & University of Texas. University of Texas - Austin; Marine Science Institute (2011). Benthic organism data from the South Texas Outer Continental Shelf (STOCS) and the Mississippi, Alabama, and Florida (MAFLA) Outer Continental Shelf studies from 16 May 1974 to 20 February 1978 (NODC Accession 8500179). Version 2.2. National Oceanographic Data Center, NOAA, accessed 2012.
- Sal, S., López-Urrutia, Á., Irigoien, X., Harbour, D. S. & Harris, R. P. (2013) Marine microplankton diversity database. *Ecology*, 94, 1658. <https://doi.org/10.1890/13-0236.1>.
- Salami, B., Higuchi, P., Silva, A. C., Ferreira, T. S., Marcon, A. K., Buzzi Jr, F. & Bento, M. A. (2014) Influência de variáveis ambientais na dinâmica do componente arbóreo em um fragmento de Floresta Ombrófila Mista em Lages, SC. *Scientia Forestalis (IPEF)*, 42, 197–207.
- Sampaio, E.M., Kalko, E.K., Bernard, E., Rodríguez-Herrera, B. & Handley, C.O. (2003) A biodiversity assessment of bats (Chiroptera) in a tropical lowland rainforest of Central Amazonia, including methodological and conservation considerations. *Studies on Neotropical fauna and environment*, 38, 17–31.
- Sandercock, B. K. "Variable distance line-transect sampling of bird population numbers in different habitats on Konza Prairie (1981–2009)". Konza Prairie Long Term Ecological Research Program. Available at: <http://www.konza.ksu.edu/knz/pages/data/KnzEntity.aspx?id=CBP011>, accessed 2016.
- Sanquetta, C. R. (2008) "Monitoring experiences at the Atlantic rainforest biome using permanent plots. (Experiencias de monitoramento no bioma mata atlântica com uso de parcelas permanentes)", Universidade Federal Do Parana. Accessed 2016.
- Scott, D., Metts, B. & Lance, S. "The Rainbow Bay Long-term Study". Available at: <http://srelherp.uga.edu/projects/rbay.htm>, accessed 2016.
- Scott, D.A. & English, T.S. "Arctic copepod Zooplankton Ice Island T3". Available at: [http://www.arcodiv.org/Database/Data\\_overview.html](http://www.arcodiv.org/Database/Data_overview.html), accessed 2012.
- Scott, D.A. & English, T.S. (1969) Copepoda collected from Fletcher's Ice Island (T-3) in the Canadian Basin of the Arctic Ocean. Technical Report No. 240, Reference M69-62. University of Washington and Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks.
- Shao, K. T., Lin, J., Wu, C.-H., Yeh, H.-M. & Cheng, T.-Y. (2012) "A dataset from bottom trawl survey around Taiwan". Available at: <http://www.iobis.org>, accessed 2013.
- Shaver, G. (2015) "Above ground plant biomass a moist acidic tussock tundra experimental site, 1984, Artic LTER, Toolik Lake, Alaska". Available at: <https://doi.org/10.6073/pasta/08a91cb2697f7cdc82d654e82b53c5c5>, accessed 2016.
- Shaver, G. R. & Chapin, F. S. (1991) Production: biomass relationships and element cycling in contrasting arctic vegetation types. *Ecological Monographs*, 61(1), 1–31.
- Sheftel, B. I., Samiya, R., Aleksandrov, D.Y., Tserendavaa, R., Tamir, M. & Mühlenberg, M. (2010) Population dynamics of small mammals at Western Khentey during ten years. Proceedings of the international conference Ecological consequences of biosphere processes in the ecotone zone of southern Siberia, vol. I. Oral reports, 230–233.
- Sherman, S. (2010) "Maine Department of Marine Resources Inshore Trawl Survey, 2000 – 2009". Maine Department of Marine Resources, Maine. Available at: [http://www.usgs.gov/obis-usa/data\\_search\\_and\\_access/datasets.html](http://www.usgs.gov/obis-usa/data_search_and_access/datasets.html), accessed 2012.
- Shi, Z., Sherry, R., Xu, X., Hararuk, O., Souza, L., Jiang, L., Xia, J., Liang, J. & Luo, Y. (2015) Evidence for long-term shift in plant community composition under decadal experimental warming. *Journal of Ecology*, 103, 1131–1140.
- Shochat, E., Katti, M. & Warren, P. (2004) "Point count bird censusing: long-term monitoring of bird distribution and diversity in central Arizona-Phoenix: period 2000 to 2011". Central Arizona-Phoenix Long-Term Ecological Research. Global Institute for Sustainability, Arizona State University. Available at: <https://caplter.asu.edu/data/data-catalog/?id=46>, accessed 2012.
- Sicinski, J. & Bamber, R. (2008) "Admiralty Bay Benthos Diversity Data Base (ABBED). Pycnogonida". Available at: <http://www.scarmarbin.be>, accessed 2012.
- Sicinski, J. & Blazewicz-Paszkwycz, M. (2008) "Admiralty Bay Benthos Diversity Data Base (ABBED). Cumacea". Available at: <http://www.scarmarbin.be>, accessed 2012.
- Sicinski, J. & Blazewicz-Paszkwycz, M. (2008) "Admiralty Bay Benthos Diversity Data Base (ABBED). Tanaidacea". Available at: <http://www.scarmarbin.be>, accessed 2012.
- Siferd, T. (2010) Central and Arctic Multi-Species Stock Assessment Surveys. OBIS Canada Digital Collections. Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada (OBIS Canada). Available at: <http://www.iobis.org/mapper/?dataset=2293>, accessed 2012.
- Silva, F. R. "Brazil Dataset 1", Universidade Federal de São Carlos. Accessed 2016.
- Silveira, F. L. & Lopes, R. M. (2008) "On the Marine Free-Living Copepods off Brazil -WSAOBIS". Western South Atlantic OBIS, São Paulo. Available at: <http://www.iobis.org>, accessed 2012.
- Souza, G.B.G. & Vianna, M. "Demersal fish hauls from Guanabara Bay, Brazil 2005–2015". Accessed 2017.
- Stallings, C. D., Mickle, A., Nelson, J. A., McManus, M. G. & Koenig, C. C. (2015) Faunal communities and habitat characteristics of the Big Bend seagrass meadows, 2009–2010. *Ecology*, 96, 304.
- Stapp, P. (2013) SGS-LTER Long-Term Monitoring Project: Small Mammals on Trapping Webs on the Central Plains Experimental Range, Nunn, Colorado, USA 1994 –2006, ARS Study Number 118. Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/2e311b4e40fea38e573890f473807ba9>, accessed 2017.
- Steinberg, D. (2017) Zooplankton collected with a 2-m, 700-um net towed from surface to 120 m, aboard Palmer Station Antarctica LTER annual cruises off the western antarctic peninsula, 2009 – 2016. Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/fb658789188724be5f27c81a634647d5>, accessed 2017.
- Stenseth, N. C., Bjørnstad, O. N., Falck, W., Fromentin, J. M., Gjøsæter, J. & Gray, J. S. (1999) Dynamics of coastal cod populations: intra-and inter-cohort density dependence and stochastic processes. *Proceedings of the Royal Society of London B: Biological Sciences*, 266(1429), 1645–1654.
- Sterza, J. M. & Fernandes, L. L. (2006) Zooplankton community of the Vitoria Bay estuarine system (Southeastern Brazil): Characterization during a three-year study. *Brazilian Journal of Oceanography*, 54(2–3), 95–105. <https://doi.org/10.1590/S1679-87592006000200001>.
- Stevens, M. (2010) "Trekvis - Migratory fishes in the river Scheldt." Research Institute for Nature and Forest (INBO). Available at: <http://www.gbif.org/dataset/b2d0f29e-4614-4001-93c8-f651878a86d2>, accessed 2014.
- Suarez, Y. R. "Brazil Dataset 6", Mato Grosso do Sul State University. Accessed 2016.
- Sukumar, R. Mudumalai Forest Dynamics Plot Data. Available at: <http://www.ctfs.si.edu/site/Mudumalai/>, accessed 2013.

- Sumner, F. B., Osborn, R. C., Cole, L. J. & Davis, B. M. "A biological survey of the waters of Woods Hole and vicinity". Available at: <http://www.iobis.org>, accessed 2012.
- Sumner, F. B., Osborn, R. C., Cole, L. J. & Davis, B. M. (1911) A biological survey of the waters of Woods Hole and vicinity. *Bulletin of the U.S. Bureau of Fisheries*, 31, 1.
- Svensson, S. (2006) Species composition and population fluctuations of alpine bird communities during 38 years in the Scandinavian mountain range. *Ornis Svecica*, 16(4), 183–210.
- Svensson, S., Thorner, A. M. & Nyholm, N. E. I. (2010) Species trends, turnover and composition of a woodland bird community in southern Sweden during a period of 57 years. *Ornis Svecica* 20, 31–44.
- Sweatman, H.P.A., Cheal, A.J., Coleman, G.J., Delean, S., Fitzpatrick, B.M., Miller, I.R., Ninio, R., Osborne, K., Page, C.M. & Thompson, A.A. (2001) Long-Term Monitoring of the Great Barrier Reef. Status Report Number 5. Available at: <http://www.iobis.org/mapper/?dataset=233>, accessed 2017.
- Taylor, H. (1984) A vegetation survey of the Cape of Good Hope Nature Reserve. I. The use of association-analysis and Braun-Blanquet methods. *Bothalia*, 15, 245–258.
- Thomsen, P.F., Jørgensen, P.S., Bruun, H.H., Pedersen, J., Riis-Nielsen, T., Jonko, K., Słowińska, I., Rahbek, C. & Karsholt, O. (2016) Resource specialists lead local insect community turnover associated with temperature – analysis of an 18-year full-seasonal record of moths and beetles. *Journal of Animal Ecology*, 85, 251–261.
- Thorn, S., Bässler, C., Bernhardt-Römermann, M., Cadotte, M., Heibl, C., Schäfer, H., Seibold, S. & Müller, J. (2016) Changes in the dominant assembly mechanism drive species loss caused by declining resources. *Ecology Letters*, 19, 163–170.
- Thorn, S., Bässler, C., Gottschalk, T., Hothorn, T., Bussler, H., Raffa, K. & Müller, J. (2014) New insights into the consequences of post-windthrow salvage logging revealed by functional structure of saproxylic beetles assemblages. *PLoS ONE*, 9, e101757.
- Thorn, S., Werner, S. A., Wohlfahrt, J., Bässler, C., Seibold, S., Quillfeldt, P. & Müller, J. (2016) Response of bird assemblages to windstorm and salvage logging - Insights from analyses of functional guild and indicator species. *Ecological Indicators*, 65, 142–148.
- Thuiller, W., Slingsby, J. A., Privett, S. D. J. & Cowling, R. M. (2007) Stochastic Species Turnover and Stable Coexistence in a Species-Rich, Fire-Prone Plant Community. *PLoS ONE*, 2(9), e938. <https://doi.org/10.1371/journal.pone.0000938>
- Tkachenko, K. S., Wu, B.-J., Fang, L.-S. & Fan, T.-Y. (2007) Dynamics of a coral reef community after mass mortality of branching *Acropora* corals and an outbreak of anemones. *Marine Biology*, 151, 185–194.
- Tomiałojć, L. & Wesołowski, T. (1994) Die Stabilität der Vogelgemeinschaft in einem Urwald der gemässigten Zone: Ergebnisse einer 15jährigen Studie aus dem Nationalpark von Białowieża (Polen). *Beob.*, 91, 73–110.
- Tomiałojć, L. & Wesołowski, T. (1996) Structure of a primaeval forest bird community during 1970s and 1990s (Białowieża National Park, Poland). *Acta Ornithologica*, 31, 133–154.
- Tomiałojć, L., Wesołowski, T. & Walankiewicz, W. (1984) Breeding bird community of a primaeval temperate forest (Białowieża National Park, Poland). *Acta Ornithologica*, 20, 241–310.
- Tremblay, J.M. & Branton, B. (2007) DFO Maritimes Research Vessel Trawl Surveys, OBIS Canada Digital Collections. Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, OBIS Canada.
- Trexler, J. (2007) "Consumer Stocks: Fish, Vegetation, and other Non-physical Data from Everglades National Park (FCE), South Florida from February 2000 to Present." Florida Coastal Everglades LTER Program. Available at: [http://fcelter.fiu.edu/data/core/metadata/EML/?datasetid=LT\\_CD\\_Trexler\\_001](http://fcelter.fiu.edu/data/core/metadata/EML/?datasetid=LT_CD_Trexler_001), accessed 2012.
- Twilley, R., Rivera-Monroy, V. H. & Castaneda, E. (2005) "Mangrove Forest Growth from the Shark River Slough, Everglades National Park (FCE), South Florida from January 1995 to Present". Florida Coastal Everglades LTER. <https://doi.org/10.6073/pasta/bec6c029df692768f349106c69162df7>. Available at: [http://fcelter.fiu.edu/data/core/metadata/?datasetid=LT\\_PP\\_Rivera\\_002](http://fcelter.fiu.edu/data/core/metadata/?datasetid=LT_PP_Rivera_002), accessed 2016.
- USFS "Landbird Monitoring Program (UMT-LBMP)." US Forest Service. Available at: <http://www.avianknowledge.net/>, accessed 2012.
- USGS Patuxent Wildlife Research Center "North American Breeding Bird Survey" ftp data set, version 2014.0. Available at: <ftp://ftpext.usgs.gov/pub/er/md/laurel/BBS/DataFiles/>, accessed 2013.
- Vanholder, B. (1997) "Belgian Migrating Lepidoptera". NERC Centre for Population Biology, Imperial College. The Global Population Dynamics Database v2.0. Available at: <https://www.imperial.ac.uk/cpb/gpdd2/secure/register.aspx>, accessed 2012.
- Venturoli, F., Felfili, J. M. & Fagg, C. W. (2011) Temporal evaluation of natural regeneration in a semideciduous secondary forest in Pirenópolis, Goiás, Brazil. *Revista Arvore*, 35(3), 473–483. <https://doi.org/10.1590/S0100-67622011000300010>
- Vermont Center for Ecostudies, Lambert, J. D. & Hart, J. (2015) "Mountain Birdwatch 1.0". KNB Data Repository, 10.5063/F1DN430G, accessed 2016.
- Vickery, W. L. & Nudds, T. D. (1984) Detection of Density-Dependent Effects in Annual Duck Censuses. *Ecology*, 65, 96.
- Viereck, L.A., Van Cleve, K., Chapin, F.S., Ruess, R.W. & Hollingsworth, T. N. (2005) Vegetation Plots of the Bonanza Creek LTER Control Plots: Species Count (1975 - 2004). Environmental Data Initiative. Available at: <https://doi.org/10.6073/pasta/8dd0e1ac48e2f82b51adabfbd3-c62ae2>, accessed 2012.
- Vrška, T., Král, K., Janík, D. & Adam, D. "Natural Forests of the Czech Republic". Available at: <http://naturalforests.cz/research>, accessed 2016.
- Vu, L. V. (2009) Diversity and similarity of butterfly communities in five different habitat types at Tam Dao National Park, Vietnam. *Journal of Zoology*, 277, 15–22. <https://doi.org/10.1111/j.1469-7998.2008.00498.x>
- Wacasey, J., Atkinson, E., Derick, L. & Weinstein, A. "Zoobenthos data from the southern Beaufort Sea". Available at: <http://www.iobis.org/mapper/?dataset=4461>, accessed 2012.
- Wacasey, J., Atkinson, E., Derick, L. & Weinstein, A. (1977) Zoobenthos data from the southern Beaufort Sea. Fisheries and Environment Canada. Fisheries and Marine Service Data report 41, Arctic Biological Station fisheries and Marine Service Department of Fisheries and the Environment; Arctic Ocean Diversity, University of Alaska Fairbanks, Fairbanks.
- Wade, E. (2011) Snow crab research trawl survey database (Southern Gulf of St. Lawrence, Gulf region, Canada) from 1988 to 2010. OBIS Canada, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada,
- Wagner, R., Marxsen, J., Zwick, P. & Cox, E. J. (2011) Central European Stream Ecosystems: The Long Term Study of the Breitenbach. John Wiley & Sons.
- Waide, R. B. (2010) "Bird abundance - point counts". Long Term Ecological Research Network. Available at: <https://doi.org/10.6073/pasta/Od96957379936a038ebbbcc6135b2fab>, accessed 2012.
- Waide, R. B. "Bird abundance - point counts, El Verde Field Station, Puerto Rico: Luquillo Long Term Ecological Research Site Database: Data Set 23". Available at: <http://luq.lternet.edu/data/luqmetadata23>, accessed 2012.



- Webb, S. L. & Scanga, S. E. (2001) Windstorm Disturbance without Patch Dynamics: Twelve Years of Change in a Minnesota Forest. *Ecology*, 82, 893–897.
- Wesołowski, T., Mitrus, C., Czeszczewik, D. & Rowiński, P. (2010) Breeding Bird Dynamics in a Primeval Temperate Forest Over Thirty-Five Years: Variation and Stability in the Changing World. *Acta Ornithologica*, 45(2), 209–232.
- Wesołowski, T., Tomiało, L., Mitrus, C., Rowiński, P. & Czeszczewik, D. (2002) The breeding bird community of a primeval temperate forest (Białowieża National Park, Poland) at the end of the 20<sup>th</sup> century. *Acta ornithologica*, 37, 27–45.
- Wesołowski, T., Rowiński, P., Mitrus, C. & Czeszczewik, D. (2006) Breeding bird community of a primeval temperate forest (Białowieża National Park, Poland) at the beginning of the 21<sup>st</sup> century. *Acta Ornithologica*, 41, 55–70.
- Wesołowski, T., Czeszczewik, D., Hebda, G., Maziarz, M., Mitrus, C. & Rowiński, P. (2015) 40 years of breeding bird community dynamics in a primeval temperate forest (Białowieża National Park, Poland). *Acta Ornithologica*, 50, 95–120.
- Widdicombe, C. E., Eloire, D., Harbour, D., Harris, R. P. & Somerfield, P. J. (2010) Long-term phytoplankton community dynamics in the Western English Channel. *Journal of Plankton Research*, 32, 643–655. <https://doi.org/10.1093/plankt/fbp127>
- Widdicombe, C. E., Eloire, D., Harbour, D., Harris, R. P. & Somerfield, P. J. (2010) Time series of phyto- and microzooplankton abundance and composition at station L4 in the English Channel from 1988 to 2009. <https://doi.org/10.1594/PANGAEA.758061>
- Wiley, R. H. "Population estimates of Appalachian salamanders". Coweeta LTER. Available at: <http://coweeta.uga.edu/eml/1044.xml>, accessed 2016.
- Wilgers, D. J., Horne, E. A., Sandercock, B. K. & Volkmann, A. W. (2006) Effects of rangeland management on community dynamics of the herpetofauna of the tallgrass prairie. *Herpetologica*, 62, 378–388.
- Williams, D. "Pelagic Fish Observations 1968–1999." Australian Antarctic Data Centre. Available at: <http://www.gbif.org/dataset/85b0a82a-f762-11e1-a439-00145eb45e9a>, accessed 2012.
- Williamson, M. (1983) The Land-Bird Community of Skokholm: Ordination and Turnover. *Oikos*, 41, 378–384.
- Willig, M. R. & Bloch, C. P. (2016) "El Verde Grid long-term invertebrate data: Luquillo Long Term Ecological Research Site Database: Data Set 107". Available at: <http://luq.lternet.edu/data/luqmetadata107/7427>, accessed 2016.
- Willis, T. "Hahei marine dataset (1997–2002), New Zealand fish". Institute of Marine Sciences, University of Portsmouth. Accessed 2016.
- Woehler, E. "Seabirds of the Southern and South Indian Ocean - Australian Antarctic Data Centre". Available at: <http://www.iobis.org>, accessed 2012.
- Woods, K. D. (2009) Multi-decade, spatially explicit population studies of canopy dynamics in Michigan old-growth forests. *Ecology*, 90, 3587.
- Woods, K. D. (2014) Multi-decade biomass dynamics in an old-growth hemlock-northern hardwood forest, Michigan, USA. *PeerJ*, 2, e598.
- Yen, P. P. W., Sydeman, W. J. & Hyrenbach, K. D. (2004) Marine bird and cetacean associations with bathymetric habitats and shallow-water topographies: Implications for trophic transfer and conservation. *Journal of Marine Systems*, 50, 79–99.
- Yen, P. P. W., Sydeman, W. J., Bograd, S. J. & Hyrenbach, K. D. (2006) Spring-time distributions of migratory marine birds in the southern California Current: Oceanic eddy associations and coastal habitat hotspots over 17 years. *Deep-Sea Research Part II: Topical Studies in Oceanography*, 53, 399–418.
- Yläne, H., Stark, S. & Tolvanen, A. (2015) Vegetation shift from deciduous to evergreen dwarf shrubs in response to selective herbivory offsets carbon losses: evidence from 19 years of warming and simulated herbivory in the subarctic tundra. *Global Change Biology*, 21, 3696–3711.
- Zachmann, L., Moffet, C. & Adler, P. (2010) Mapped quadrats in sagebrush steppe: long-term data for analyzing demographic rates and plant-plant interactions. *Ecology*, 91, 3427.
- Zakharov, V. D. (1998) Biodiversity of bird population of terrestrial habitats in Southern Ural. Miass: IGZ, Ural Branch of Russian Academy of Sciences, 158 p.
- Zettler, M.L. (2005) Macrozoobenthos baltic sea (1980–2005) as part of the IOW-Monitoring. Institut für Ostseeforschung Warnemünde, Germany. Available at: <http://www.iobis.org/mapper/?dataset=2289>, accessed 2012.