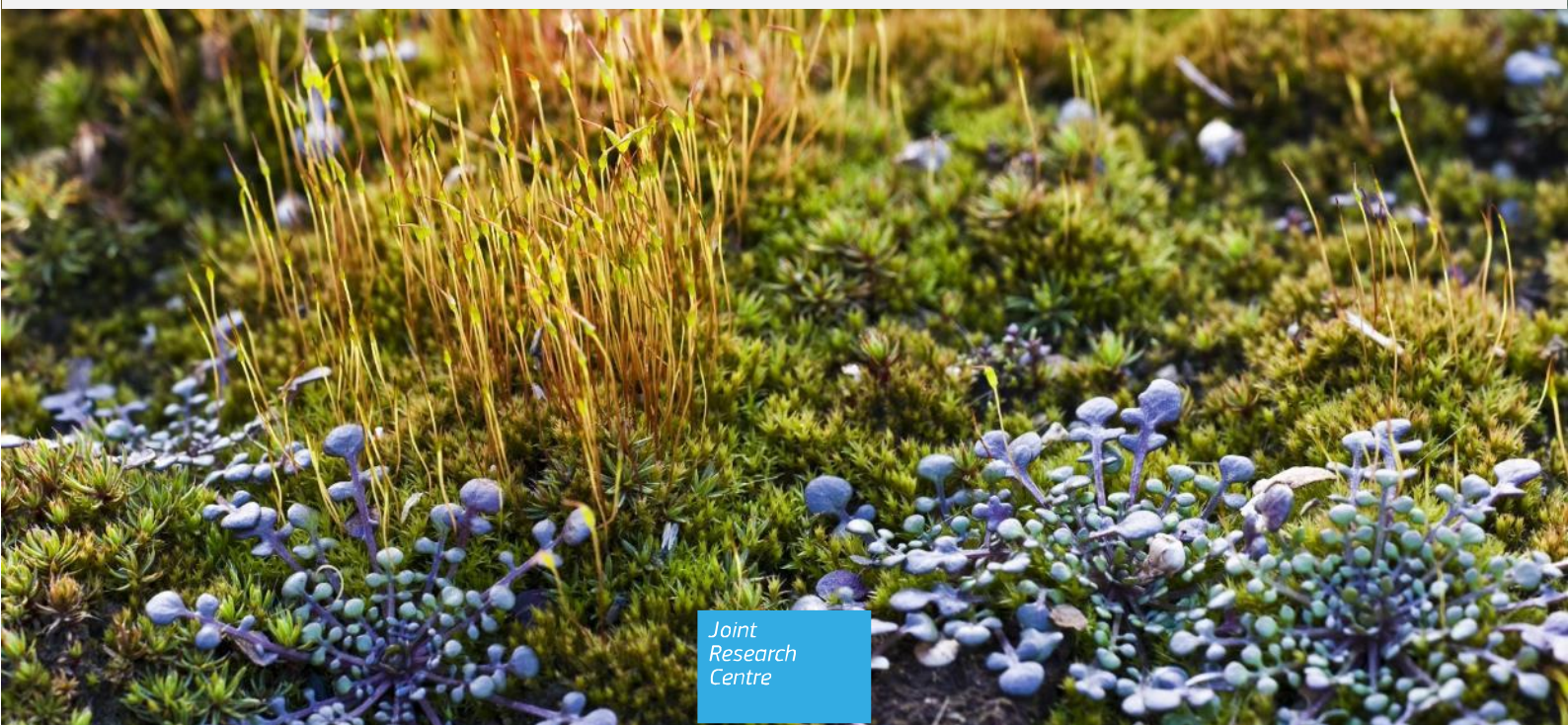
European Commission

An overview of biodiversity data reporting by Member States under Article 17 of the Habitats Directive for the reporting period 2013-2018

Lorilla, R.S., Kefalas, G., Bormpoudakis, D., Drakou, E.G.

2025



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Contents

Abstract ... 3

Foreword ... 4

Authors ... 5

1 Introduction ... 6

1.1 Aim and objectives ... 8

1.2 Structure of the report ... 9

2 Methodology for data extraction, preparation and exploration ... 10

2.1 Article 17 reporting at the MS vs the EU level ... 10

2.2 Overview of available data ... 12

2.2.1 Dataset (Tabular data) ... 13

2.2.2 Geodatabase (Spatial data) ... 14

2.3 Comparative assessment of reporting at the tabular vs the spatial data ... 17

3 Data description ... 18

3.1 Comparative analysis between tabular dataset and geodatabase ... 18

3.2 Thematic fields and data attributes ... 21

3.2.1 Estimation/assessment methods ... 23

3.2.2 Data completeness per attribute ... 26

3.2.2.1 Reporting units ... 29

3.3 Distribution of species and habitats ... 33

3.3.1 Species level ... 33

3.3.2 Habitats level ... 40

3.4 Pressures and threats ... 46

3.4.1 Query-based analysis for specific threats/pressures ... 52

4 Discussion and main conclusions ... 58

Main conclusions ... 61

References ... 62

List of abbreviations and definitions ... 64

List of boxes ... 65

List of figures ... 66

List of tables ... 69

Annexes 70

Annex 1. Level 1 and Level 2 categories of conservation measures under Article 17 of the Habitats Directive 70

Annex 2. Level 1 and Level 2 categories of pressures/threats under Article 17 of the Habitats Directive 73

Annex 3. Pressures/threats of species and habitats as reported by MS under Article 17 of the Habitats Directive 79

Abstract

The European Union's Habitats Directive (92/43/EEC) mandates Member States (MS) to report on the conservation status of species and habitats listed under Annexes I, II, IV, and V every six years. The latest Article 17 reports cover the period from 2013 to 2018, with MS submitting their reports and the EU compiling all information to provide an EU wide assessment for the conservation status and trends of species and habitats along with their main drivers. Despite some improvements between the previous and latest reporting period, most protected habitats and species still have a poor, bad and unknown status, highlighting the immediate actions that need to be taken by MS and the EU to enhance the effective monitoring of biodiversity Europe. We made a technical analysis on the biodiversity data generated by the reporting of Article 17 in 2018 to assess the way in which these data are reported and highlight the similarities and discrepancies among countries. Our analysis revealed several patterns and inconsistencies in the content and process of assessing and reporting biodiversity data, including differences in the units and methods used to calculate different estimates of species' and habitats' conservation status. A more comprehensive analysis would be needed to identify specific data gaps and mismatches in the data provided, including both spatial and tabular information, to work towards a more standardized and comprehensive EU-wide monitoring and reporting process. This study complements the analyses performed by the European Topic Center for Biodiversity and may help MS and the European Commission identify first steps to improve the harmonisation of datasets generated by the reporting of Article 17.

Foreword

The European Union's commitment to conserving biodiversity is embedded in various strategies and legal frameworks, notably the Habitats Directive (92/43/EEC), which mandates the regular reporting on the status and trends of species and habitats across Member States. The Article 17 reporting process is a fundamental tool in this effort, providing a comprehensive overview of biodiversity across Europe. However, the complex landscape of data collected by different Member States, coupled with inherent inconsistencies and gaps, makes it challenging to draw clear conclusions and guide conservation actions effectively.

This report seeks to address these challenges by analyzing the available Article 17 data and highlighting the key issues that hinder a consistent and effective approach to biodiversity monitoring and reporting. Through this analysis, we identify areas where improvements are needed, particularly in data completeness, standardization of reporting methods, and the integration of spatial information. The findings serve not only as a call to action for greater coordination among Member States but also as a foundation for more informed, robust decision-making that can lead to better conservation outcomes.

While we highlight challenges needed to overcome, the wealth of data available through the Article 17 reporting process offers a unique opportunity for collaboration, transparency, and progress in biodiversity conservation. By leveraging this information, the EU can work toward a future where biodiversity is protected, restored, and managed in a way that supports both nature and society.

We hope that this report will serve as a valuable resource for policymakers, conservation practitioners, and researchers, guiding efforts to enhance the protection of Europe's rich biodiversity and ensuring that the EU's biodiversity goals are met in alignment with international and global frameworks, such as the Kunming-Montreal Global Biodiversity Framework.

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1 Introduction

Article 17 of the European the Habitats Directive (92/43/EEC) requires all European Union (EU) Member States (MS) to report every six (6) years the conservation status of all species and habitats listed under Annexes I (for habitats) and Annexes II, IV and V (for species). The latest Article 17 reports[1] (at the time when this study was performed) cover the reporting period 2013-2018. EU MS uploaded their reports on the European Environment Information and Observation Network (Eionet) Central Data Repository CDR under the obligation "*Habitats Directive: Report on Implementation Measures (Article 17, Habitats Directive)*". In addition, the European Commission (EC) has to report and demonstrate the overall implementation of the Habitats and the Birds Directives at the EU level by assessing the conservation status of targeted species and habitats, the pressures that have affected species and habitats, the threats that are anticipated to likely have an impact as well as the implemented measures across EU and MS terrestrial and marine biogeographical regions(ETC/BD, 2020).

All these data are collected by the European Environment Agency (EEA) and stored with the Eionet data repository to be made publicly available and used for a well-informed management of biodiversity resources and human activities that impact them. Within these large databases there is an enormous amount of information on biodiversity at the species and habitat level, as well as the drivers (threats and pressures) that impact them, with high variability within and among countries or biogeographical regions (bioregions), but also species groups and habitats. Several researchers have highlighted this variability usually at the country level (Bacchetta & Gargano, 2017; Ellwanger et al., 2018) or for specific species groups (Swaay et al., 2012) and habitats (Delbosc et al., 2021; Kovac et al., 2020). (Röschel et al., 2021) within a recent report provided by the European Topic Center for Biodiversity (ETC-BD) identified the discrepancies between the data reported by the EU MS for the Habitats and Birds Directives, with data reported in the scientific literature and national reports for specific species or species groups and habitats and identified a nearly 50% on average mismatch between the two sources of information. In addition, some MS have established a special standardised monitoring programme in particular for Article 11 of the Habitats Directive, while others use data from already existing programmes and initiatives such as habitat mapping, large-scale forest inventories, landscape monitoring (Ellwanger et al., 2018). This is critical, as it indicates a tentative discontinuity between the biodiversity knowledge "in house" within research groups and that reported through the official procedures by the EU. Also, several mismatches have been identified by '*The state of nature in the EU*' report (EEA, 2020) between reporting strategies across EU MS, or across several habitat and species parameters (Röschel et al., 2021). Based on these needs, the EC (in particular, DG Environment) has commissioned a study to revise all national methodologies to monitor habitats' condition and to identify common variables, with the goal of finding synergies with ecosystem accounting methods and requirements. This study can promote the comparability and re-use at least of the ecosystem structure and function parameters.Besides the above, one major effort carried out by the EU for the reporting of these Directives, was the creation of national summary dashboards, that allow users to explore the database and get an overview of existing information (Annex III from EEA, 2022). What is still missing is a description of spatially explicit information, that can be used for reporting and planning purposes. Although, in light of the new European Green Deal, the EU MS have set targets and priorities towards achieving

[1] Reference portal for reporting under Article 17 of the Habitats Directive. https://cdr.eionet.europa.eu/help/habitats_art17/2013-2018

climate neutrality through the investment in Green Infrastructure, Renewable Energy resources (such as solar or wind energy) while enhancing human well-being. For all the above-mentioned priorities, spatial information is essential in order to plan and identify the spaces in which such infrastructures can be placed, based on where they could do less harm on biodiversity, ecosystem and landscape integrity (Frolova et al., 2019; Quero et al., 2020), while providing plural benefits to society towards an improved well-being.

The EU Biodiversity Strategy for 2030 set out targets to further protect nature in the EU. However, protection actions alone would not be enough as to reverse biodiversity loss, greater efforts are needed to bring nature back to good health across the EU, in protected areas and beyond. Despite EU and international efforts, biodiversity loss and the degradation of ecosystems continue at an alarming rate, harming people, the economy and the climate (Erdelen, 2020). In fact, in the framework of the evaluation of the EU biodiversity strategy up to 2020, a recent study by the European Union (2021) shows that the EU could not halt the loss of biodiversity between 2011 and 2020. Therefore, the Commission committed to propose legally binding targets to restore degraded EU ecosystems, in particular those with the most potential to remove and store carbon and to prevent and reduce the impact of natural disasters. Restoration will also be necessary for the EU to meet its commitments under the United Nations Framework Convention on Climate Change, and the Paris Agreement.

The new regulation on nature restoration[2] sets out an overarching objective to enable the long-term and sustained recovery of biodiverse and resilient ecosystems; contribute to achieving the EU's climate change mitigation/adaptation and land degradation neutrality objectives; enhance food security; while meeting EU's international commitments. To achieve this objective, the proposal sets multiple binding restoration targets and obligations across a broad range of ecosystems. These measures should cover at least 20% of the EU's land and sea areas by 2030 and all ecosystems in need of restoration by 2050. The proposal is further supported by an implementation framework to translate the objectives into action, by preparing and carrying out national restoration plans. The proposal thus paves the way for a broad range of ecosystems in the EU to be restored and maintained by 2050, with measurable results by 2030 and 2040, enabling the EU to demonstrate global leadership on restoring nature.

The implementation of the nature restoration law requires EU countries to submit National Restoration Plans to the Commission within two years of the Regulation coming into force, showing how they will deliver on the targets. Furthermore, MS are also required to monitor and report on their progress towards the implementation of the Regulation. The Habitats Directive has a similar implementation plan, however, with more than thirty years it being into place, there are still major issues when it comes to demonstrating its effectiveness to halting biodiversity loss.

Although some improvements in the status and trends of species and habitats compared to the previous reporting period, these were insufficient to achieve the objectives of the EU Biodiversity Strategy to 2020 (EEA, 2020) with the latest reports placing the majority of protected habitats and species under a poor or bad status (Box 1). Good quality data is essential for monitoring the progress in the implementation of the EU Nature Directives to address the EU's broader biodiversity policy objectives, such as the Biodiversity Strategy to 2030, and meet the new short- and long-term

[2] Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on Nature Restoration and Amending Regulation (EU) 2022/869, http://data.europa.eu/eli/reg/2024/1991/oj/eng

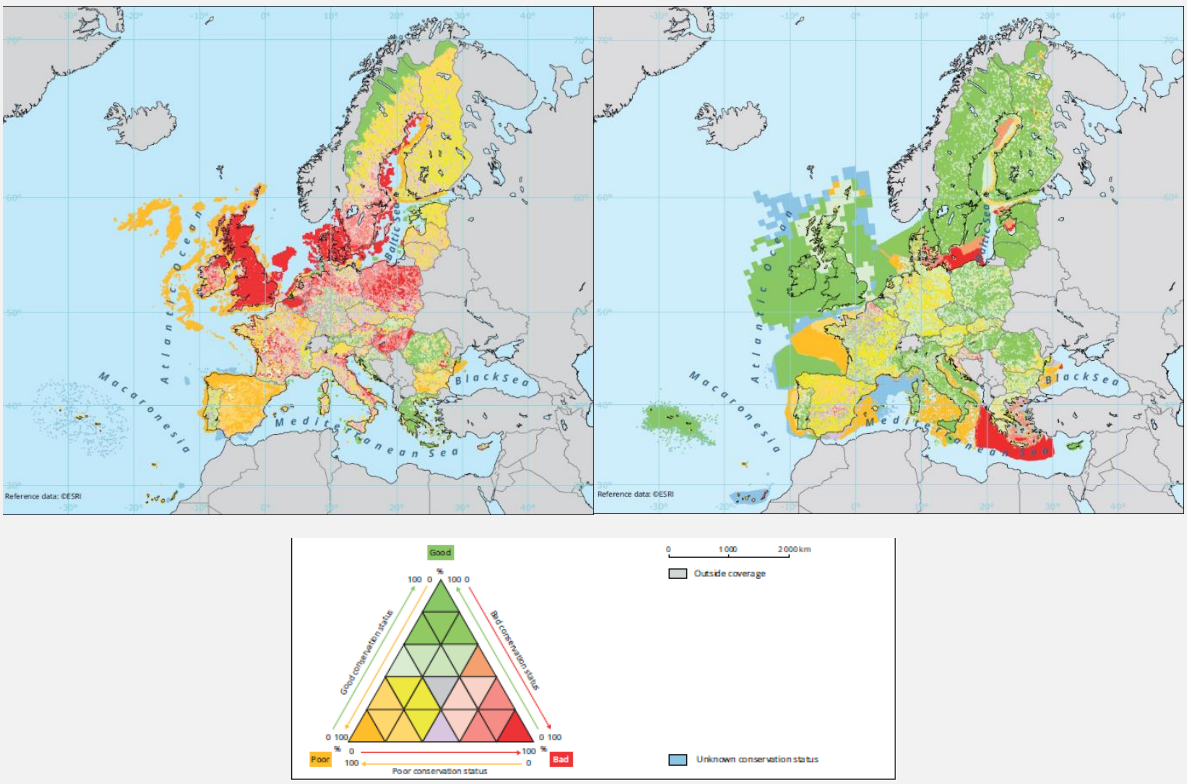
goals of the Global Biodiversity Framework, as well as the nature restoration law. Still, a full overview of the main data gaps, mismatches of spatial and non-spatial information with a critical reflection towards its improvement is missing. There is therefore a great need for a more comprehensive analysis and understanding of the biodiversity monitoring status in Europe, while identifying pitfalls and suggesting points of improvement for future spatial reporting.

Box 1. Spatial distribution of species' and habitats' conservation status at MS level.

The EEA report (No 10/2020) on the State of nature in the EU and results from reporting under the nature directives 2013-2018, revealed that "*around a quarter of species have a good conservation status at EU level, which is an increase of 4 % compared with the previous reporting period*", while "only 15 % of habitat assessments have a good conservation status, with 81 % having poor or bad conservation status at EU level".

Figure: Spatial distribution of species' and habitats' conservation status at MS level represented in a 10km x 10km grid.

Species **Habitats**



Source: European Commission (2021), The state of nature in the EU.

1.1 Aim and objectives

The aim of this report is to provide a critical technical analysis of the biodiversity data in Europe that are reported under Article 17 of the EU Habitats Directive (92/43/EEC), based on the reporting period 2013 – 2018, with an extra emphasis on the reported spatial information. The work is divided in two main tasks:

- An exploratory and in-depth descriptive analysis of the data types and the consistency of information at the EU level and across the EU MS, followed by a detailed methodology for exploration of the data. The latter can also be used for the completeness check of the data published under the following reporting period (2019-2024).
- A quantitative analysis for the identification of data mismatches between generic (tabular) and spatially referenced data across the EU and among the MS.

The developed analysis gives an overview of the biodiversity monitoring efforts within the Habitats Directive, which is then used to provide a critical reflection on monitoring and reporting on biodiversity across species, habitats and countries. This study can be used to highlight areas for which future monitoring attempts should focus on towards a more harmonised or comparable approach. Some potential uses could be the update of the present Article 17 reporting guidance (DG Environment, 2023), eventual EU coordination efforts - such as the proposed EU Biodiversity Observation Coordination Centre (Liquete et al., 2024) - or eventual guidance for the reporting or the satisfactory levels of the Nature Restoration Regulation.

1.2 Structure of the report

The document is divided in 4 main chapters:

- Chapter 1 describes the objectives and purpose of the report emphasising on the need for a better monitoring framework and scheme to report spatial information, but not limited to, on the condition, status and trends of species and habitats of Article 17 of the Habitats Directive.
- Chapter 2 presents the research design and approach used to gather and analyze the Habitats Directive Article 17 tabular dataset in relation to the spatial information provided.
- Chapter 3 describes the findings and results obtained with a focus on the comparison among Member States and the completeness of biodiversity data.
- Chapter 4 summarizes the key findings and outcomes derived from the analysis, including the discussion of results based on the specific objectives of the report.

2 Methodology for data extraction, preparation and exploration

2.1 Article 17 reporting at the MS vs the EU level

To provide a full overview of the biodiversity data reported by the MS and the European Commission we analyzed the data published in 2020 by the European Environment Agency (EEA) for the assessment of conservation status of habitat types and species under the Habitats Directive 92/43/EEC reporting; the assessment is based on information about the status and trends of species populations and of habitats at the level of the biogeographical or marine region for the reporting period 2013-2018. This chapter describes the structure of the EEA database as well as the methodology followed to perform this analysis.

Within the data reported, there are two main formats. The first one is the MS level assessment data, in which information is provided for each Member State and biogeographical region. The second option is the EU level information about species and habitats, which practically provides an aggregate across biogeographical regions.

Specifically, data at the MS level include (ETC/BD, 2020):

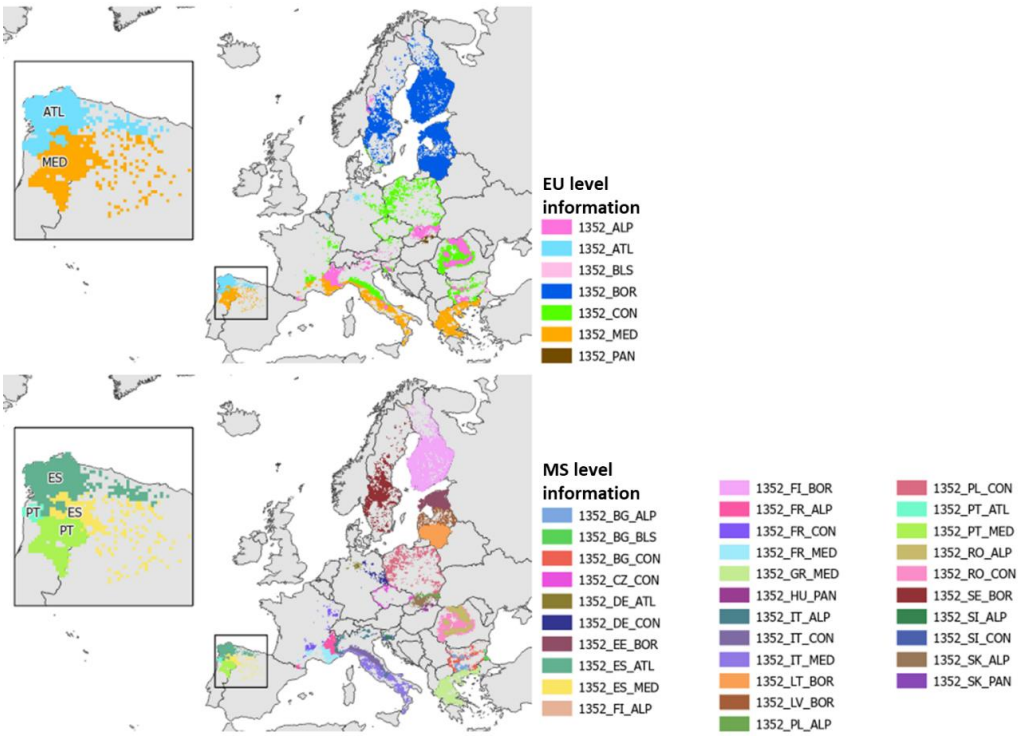
- Data on status and trends of habitats and species reported by MS
- Overall conservation status and trend (as reported by MS in the previous reporting period) and the nature of change in conservation status and trend between the two reporting periods (as reported by MS in the current reporting period)
- Area calculations from the GIS data set on distribution
- Pressures and threats reported by MS
- Information related to conservation measures, including the detailed list of measures reported by MS
- Information related to Natura 2000 coverage reported by MS
- Information related to taking and exploitation of Annex V species (Art. 14) reported by MS
- Species and habitats checklists, including cross linkage of species name used by MS and the species name used for the European level as well as the information in which Annexes of the Habitats Directive the species and habitats are listed.

- Data at the EU level include (ETC/BD, 2020):
  - Underlying information for the assessments of the conservation status at EU biogeographical level
  - Overall conservation status and trend
  - Overall conservation status and trend from the previous reporting period and nature of change in conservation status and trends between the two reporting periods as assessed by the experts.
  - Contribution to Target 1 of the European Biodiversity Strategy as assessed by the experts.

— Spatial data at the MS level provide information for each MS and each biogeographical region, while at EU level, reports/records[3] are aggregated at the biogeographical regional scale. For the sake of consistency, we use the term "records" to refer to report(s) and record(s). The difference between the two levels of information is that at the MS level, the data provided may vary in quality and completeness depending on the national monitoring systems, while the EU level removes overlapping distributions at borders and create a cohesive and harmonized layer across the EU.

— In the example below for the species of the gray wolf (species name: *Canis lupus)* (Figure 1), at the EU level, spatial data demonstrate the distribution of species across seven terrestrial biogeographical regions where two records in total are evident across Spain and Portugal. On the other hand, at the MS level, due to the fact that records are reported per MS and per region, four records in total of the above species are found in Spain and Portugal. Similarly, at the EU level for the distribution of the habitat *Coastal lagoons* (Figure 2), there are six reports in total representing different terrestrial biogeographical regions, while at the MS level, 28 records are reported. Therefore, to compare the reporting efforts about the conservation status, population or area size, threats and pressures, we used the tabular data and the spatial data at the MS level to present a detailed overview of the Article 17 data.

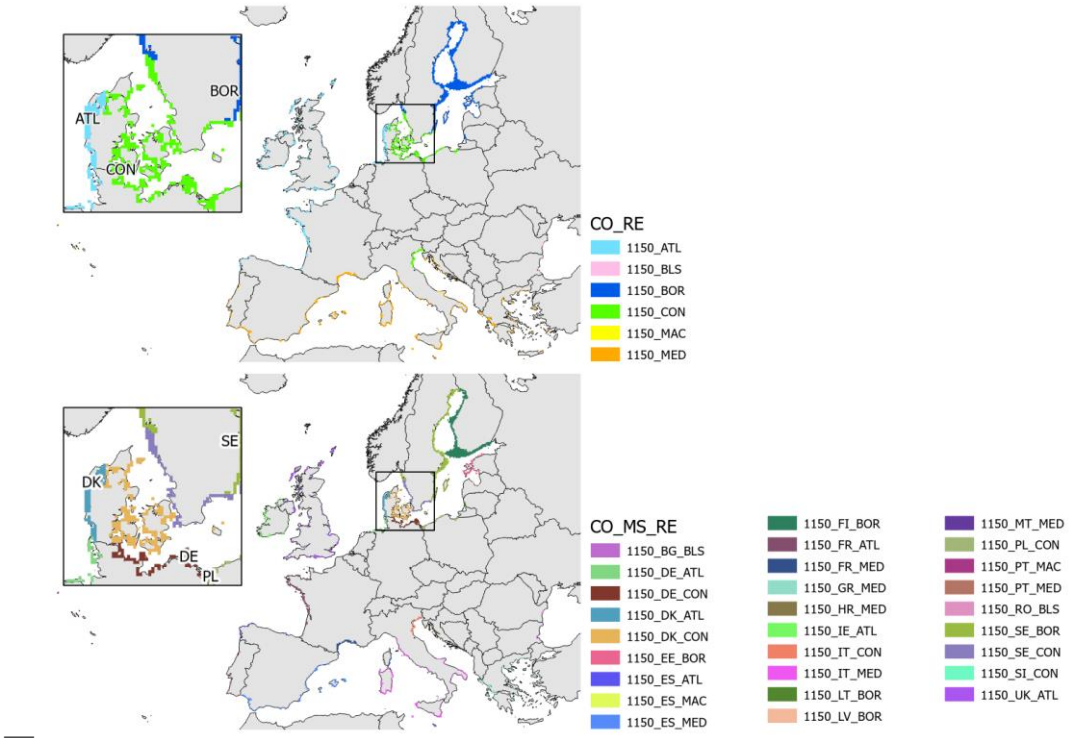
Figure 1. Differences in the level of information provided at the EU level and MS level for the species "Canis lupus".



Source: Article 17 spatial data.

[3] Within the reporting of Article 17, data entries in the attribute table of the shapefiles are labelled as records.

Figure 2. Differences in the level of information provided at the EU level (data classified per bioregion) and MS level (data classified per country) for the habitat "*Coastal lagoons*".



Source: Article 17 spatial data.

2.2 Overview of available data

The datasets compiled and provided by the EEA and ETC/BD can be found and downloaded from EEA's data portal[4]. The available datasets include:

— **Tabular data**

- Article 17 - 2020 dataset (Microsoft Access format)
- Article 17 - 2020 data (CSV format)
- Article 17 - 2020 codelists (CSV format)

— **GIS (spatial) data**

- Article 17 - 2020 spatial data (Geodatabase)
- Article 17 - 2020 spatial data (OGC GeoPackage)
- Article 17 - 2020 spatial data - INSPIRE compliant metadata set

— **Additional information**

[4] Datasets from Article 17, Habitats Directive 92/43/EEC reporting. https://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec-2

- Article 17 - 2020 dataset definitions (XLS format): Definitions of fields reported in Art. 17 dataset.
- Article 17 - 2020 dataset description (Microsoft Word (Office 2010)): Description of Art. 17 data.

— **Reference quality framework**

- Annex III: Conservation status of habitats type and species Annex III: Conservation status of habitats type and species (PDF document): metadata description and template for quality and metadata reporting.

As one of our core intentions was to explore both tabular data provided, but also the spatially referenced ones, we used the tabular data labelled as "*Article 17 – 2020 dataset*" given in a Microsoft Access format and the spatially referenced data labelled as "*Article 17 - 2020 spatial data*" given in a geodatabase format. In the following sections, the data is reported in two different ways: in terms of tabular data and in terms of spatial (georeferenced data). This is then followed by a comparative assessment between tabular and georeferenced data, to assess tentative mismatches and inconsistencies.

2.2.1 Dataset (Tabular data)

The Microsoft Access dataset includes 15 tables referring to, among others, the occurrence of species and habitats, the main conservation measures, and the main pressures and threats. The full list of all available tables is given in Table 1. Within each table a full description of what it entails is provided, along with information on the number of fields presented. These data, contain information as reported by the EU MS at the national level.

Table 1. List of tables and reference information in the Microsoft access dataset of Article 17.

Table name	**Table description** [1]	**Number of fields**
data_greport	Most important facts and figures on the general implementation of the Habitats Directive from MS	25
data_greintroduction_of_species	Information on reintroduction of Annex IV species per MS	9
data_gmeasures	Information on Measures taken in relation to approval of plans and projects	8
habitats_check_list	Occurrence of the habitat in biogeographical region in MS	7
species_check_list	Occurrence of the habitat in biogeographical region in MS	12
data_habitats_regions	Report format on the 'main results of the surveillance under Article 11' for Annex I habitat types	91
data_species_regions	Report format on the 'main results of the surveillance under Article 11' for Annex II, IV and V species, main table	98

Table name	Table description [1]	Number of fields
data_species_annexV	Information related to exploitation of Annex V species (Art. 14)	36
data_change	Change and reason for change between reporting periods for overall assessment of conservation status, overall trend in conservation status and values reported for habitats and species parameters	13
data_measures_info	Information related to main conservation measures	12
data_measures	List of conservation measures taken for each habitat or species in MS biogeographical regions	8
data_pressures_threats_info	Information related to main pressures and threats	8
data_pressures_threats	List of main pressures and threats for each habitat or species in MS biogeographical regions	9
habitatsEUassessment	Assessments of conservation status at the EU biogeographical level for habitats	46
speciesEUassessment	Assessments of conservation status at the EU biogeographical level for species	42

[1] a detailed description of all tables' fields can be found here: article-17-2020-dataset-definitions-xls-format

Source: Reference portal for reporting under Article 17 of the Habitats Directive. https://cdr.eionet.europa.eu/help/habitats_art17/2013-2018

2.2.2 Geodatabase (Spatial data)

Along with the database on biodiversity data reported, within the Article 17 data, a set of spatially explicit information on the distribution of biodiversity is provided, based on what the EU MS have presented in their spatial reporting efforts. The spatial data available in the Geodatabase include four shapefiles (.shp) for the distribution of species and habitats at the EU and MSs level, which are labelled as follows:

— MS level

- Art17_species_distribution_2013_2018_MS.shp
- Art17_habitats_distribution_2013_2018_MS.shp

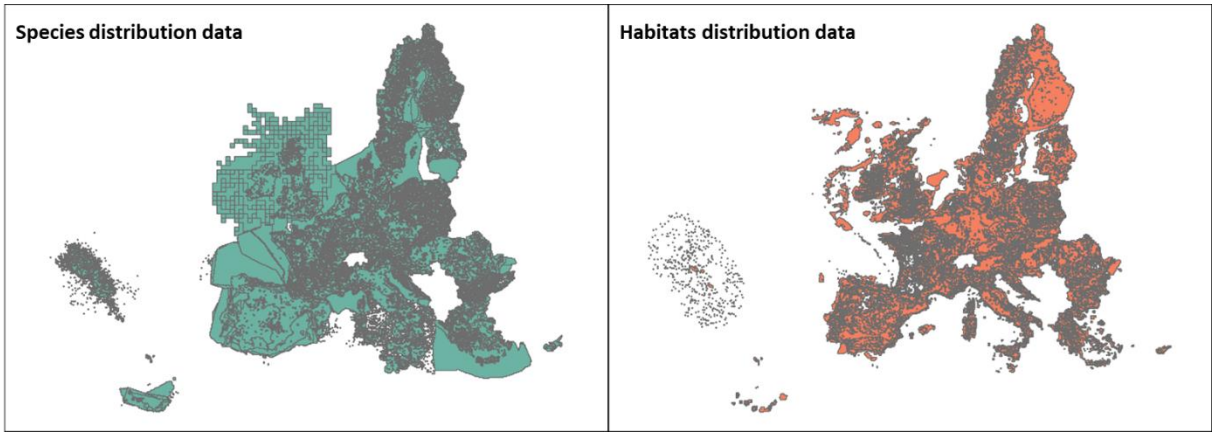
— EU level

- Art17_species_distribution_2013_2018_EU.shp
- Art17_habitats_distribution_2013_2018_EU.shp

The spatial distribution and coverage of biodiversity information is presented in Figure 3 (European scale) for both species and habitats. Since there are no noticeable differences between the MS and EU level spatial data, Figure 3 shows only the spatial data at the MS level. Within the shapefiles presented, a set attributes are provided including data category (whether the record refers to species or habitats), the codelists of species or habitats as used within the Habitats Directive, the

region to which a species or habitat is found, the country to which a species or habitat is found, and a combined information field where the codelists and region (CO_RE) are combined for the EU level information and where the codelists, country and region are combined for the MS level information (CO_MS_RE).

Figure 3. Geographic coverage of spatially explicit biodiversity data of Article 17 under the Habitats Directive 92/43/EEC reporting for the period 2013-2018.



Source: Article 17 data

In addition to the four shapefiles, the geodatabase also includes four tables about the conservation status and conservation trend, namely "*habitatsMSassessment*" and "*speciesMSassessment*" for the MS distribution, and "*habitatsEUassessment*" and "*speciesEUassessment*" for the EU distribution. These tables include the two most important information which the reporting under Article 17 of Habitats Directive mainly aims to assess, namely the conservation status and conservation trend of species and habitats across countries and regions for the MS level assessments and across only regions for the EU level assessments.

The core information fields that are shared across datasets, also included in the MS level spatial data are:

- "***country***" referring to EU-28 countries which reported under Article 17,
- "***region***" including nine terrestrial biogeographical regions (i.e. Alpine, Atlantic, Black Sea, Boreal, Continental, Macaronesian, Mediterranean, Pannonian, Steppic) and five marine regions (Marine Atlantic, Marine Baltic, Marine Black Sea, Marine Macaronesian, Marine Mediterranean) (Figure 4),
- "***speciescode***" for species distribution, and "***habitatcode***" for habitat distribution.

These information fields allow for the connection and comparative assessment between the tabular and spatial data. The analysis of the downloaded data was performed in an R language environment and all scripts used are provided in the following GitLab link: https://gitlab.com/geo-eco-hua/biodata-jrc/article-17-habitats-directive-data-overview. All scripts are provided with the intention to be re-used for similar analysis at different levels (e.g., the country level), or for data concerning the next reporting period which are due in 2025. The structure of the repository is as follows:

GEO-ECO HUA / BioData JRC /

- Article 17 Habitats Directive Data Overview

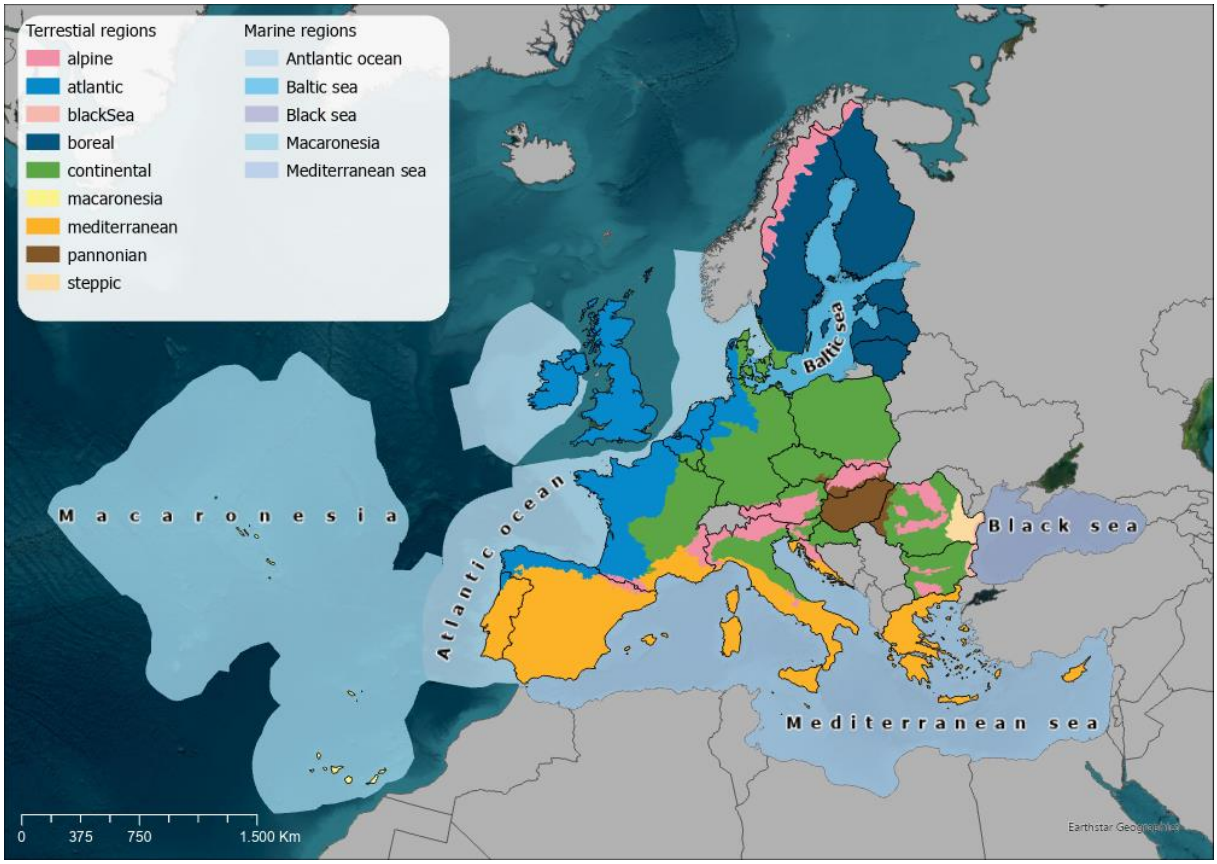
- README.md: Description of the report and GitLab repository.
- Preprocessing_Data.R: scripts for preparing the working environment, importing the tabular and spatial data, and preparing the datasets for further analysis to perform the generic overview.
- Comparative_Assessment.R:

In addition, prior to running the scripts in an efficient way with minimal adjustments, we suggest the following structure were the R project, data and outputs will be stored:

— **Art17_HabitatsDirective_JRC_analysis** *# Main folder created in any location of your disk*

- **Art17_Overview .Rproj** *# R project*
- **Data** *# Folder*
    - **Article17_2020_dataset_mdb** *# unzipped folder containing Microsoft Access dataset*
    - **Article17_2020_spatialData_gdb** *# unzipped folder containing Geodatabase*
- **Output_figures** *# Folder*
- **Output_files** *# Folder*

Figure 4. Terrestrial and marine biogeographical regions that are covered by the Article 17 reporting.



Source: modified from EEA and ETC/BD.

2.3 Comparative assessment of reporting at the tabular vs the spatial data

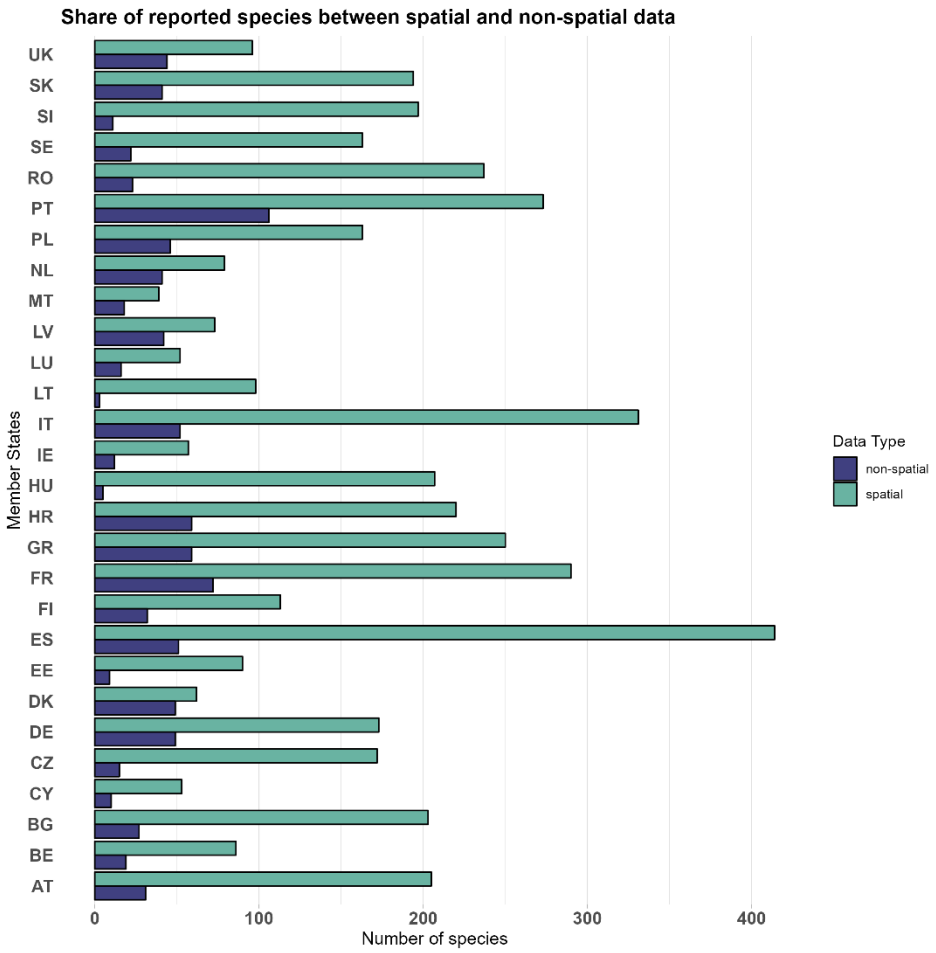
In order to produce national reports comparable across all MS, it is essential that the relevant data have been collected from robust and comprehensive surveys (Röschel et al., 2020). However, there is still not an appropriate monitoring system in place for the reporting under the Habitats Directives that ensures all MS collect data in a coherent and efficient manner (EEA, 2020). Therefore, when it comes to compiling all data to provide an EU wide assessment or indicator, inconsistent data may lead to misinformation, which in turn may result in non-relevant policy development and decisions. One issue identified is the number of records for both species and habitats in the main database (tabular data), as reported by each Member State, does not match the number of records included in the spatial data. This means that although some records of species and habitats provide some information, such as population size, coverage, region and country, an actual distribution map has not been provided. In the GitLab repository we provide the script (Comparative_Assessment.R) to identify the irregularities between tabular and spatial data.

3 Data description

3.1 Comparative analysis between tabular dataset and geodatabase

The Article 17 geodatabase consist of 8290 reports for species and 3360 reports for habitats, where each report refers to a species or habitat reported within a biogeographical region and a Member State. However not all reports are geographically annotated with 13.8% (1148 obs) of the species reports and 4.4% (149 obs) of the habitats reports not having been included in the final spatial-explicit data of the Article 17 Habitats Directives for 2013-2018. Specifically, Portugal has 106 records of species followed by France with 72 records reported in the tabular data but not included in the spatial data. Other MS range from around 30 to 60 species records also not reported spatially but reported in the tabular database (Figure 5).

Figure 5. Comparison between the reported species per MS in the tabular and database and the spatial data.



Source: this report.

In the example below (Figure 6), there are species, such as the common midwife toad (*Alytes obstetricans*), for which every record provides a distribution map (100%). Many species, including the loggerhead sea turtle (*Caretta caretta*) and the marsh fritillary (*Euphydryas aurinia*), reach a more than 80% match between the record number in the tabular information and in the spatial data. On the other hand, although the minke whale (*Balaenoptera acutorostrata*) has 15 records in the database, only 5 of them have spatially explicit information leading to a 33.33% match

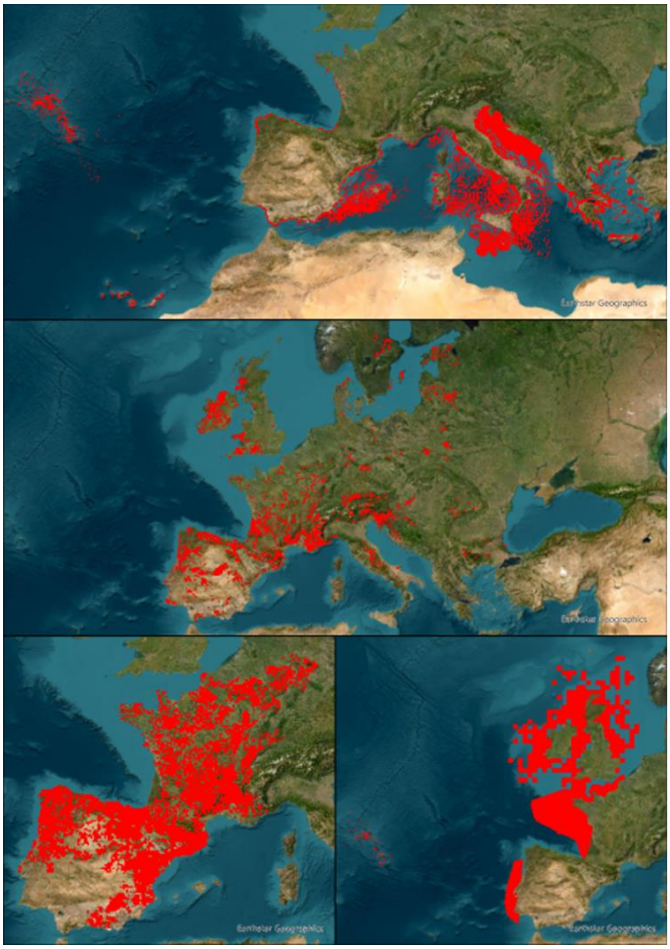
between tabular dataset and geodatabase. The irregularities between the spatial and tabular reporting of habitats are much less compared to the ones of species, with most countries having no to little non-spatially reported habitats. Only five countries are found to have more than 10 records with no distribution maps for habitats, with Spain, France and Italy having not provided distribution maps for 23, 20 and 19 habitats, respectively (Figure 7). Figure 8 shows examples of well-documented distribution maps for the common holly (*Ilex aquifolium*) with a 100% match and the sweet chestnut (*Castanea sativa*) with 94% record match, as well as the seagrass species of *Posidonia oceanica* and the active raised bogs habitats with an 88 and 87%, respectively.

Figure 6. Examples of matches and mismatches between the tabular dataset and the spatial data of the Article 17 2013-2018 reporting for species.

1224
Caretta caretta
Tabular data: 16 records
Geodatabase: 13 records
81.25% match

1065
Euphydryas aurinia
Tabular data: 44 records
Geodatabase: 39 records
88.64% match

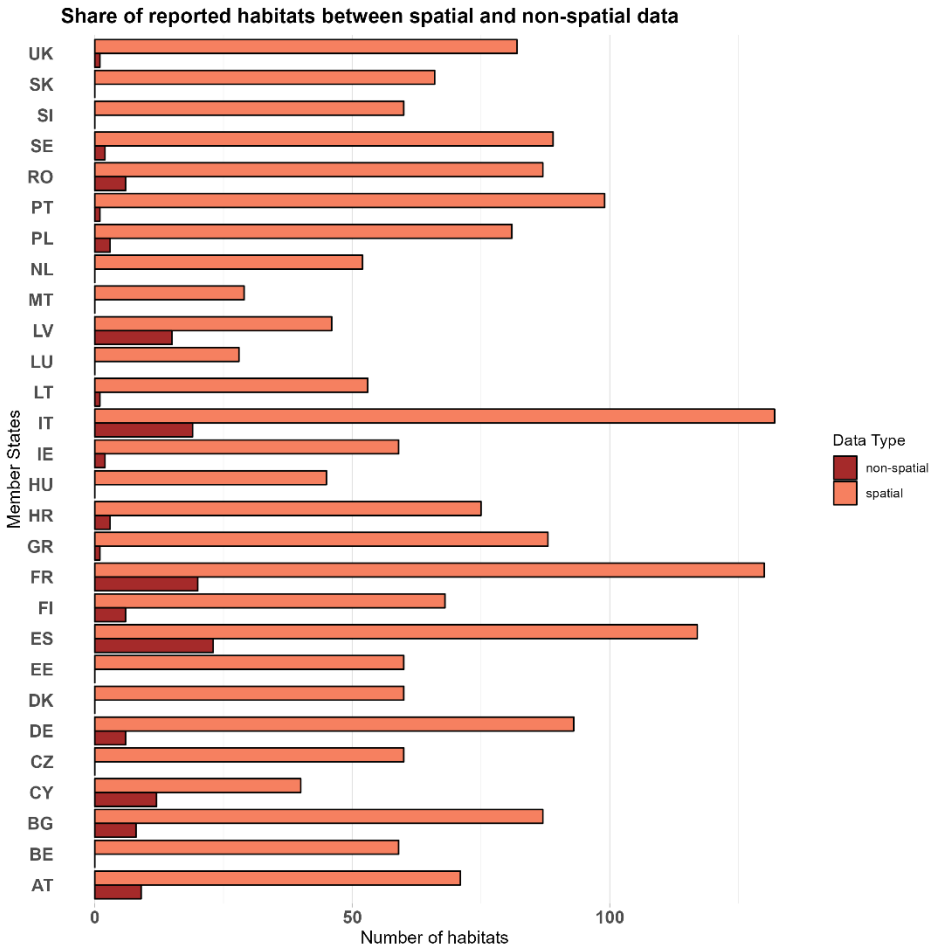
1191
Alytes obstetricans
Tabular data: 15 records
Geodatabase: 15 records
100% match



2618
Balaenoptera acutorostrata
Tabular data: 15 records
Geodatabase: 5 records
33.33% match

Source: this report.

Figure 7. Number of records for habitats reported in the tabular database but not included in the spatial data per MS.

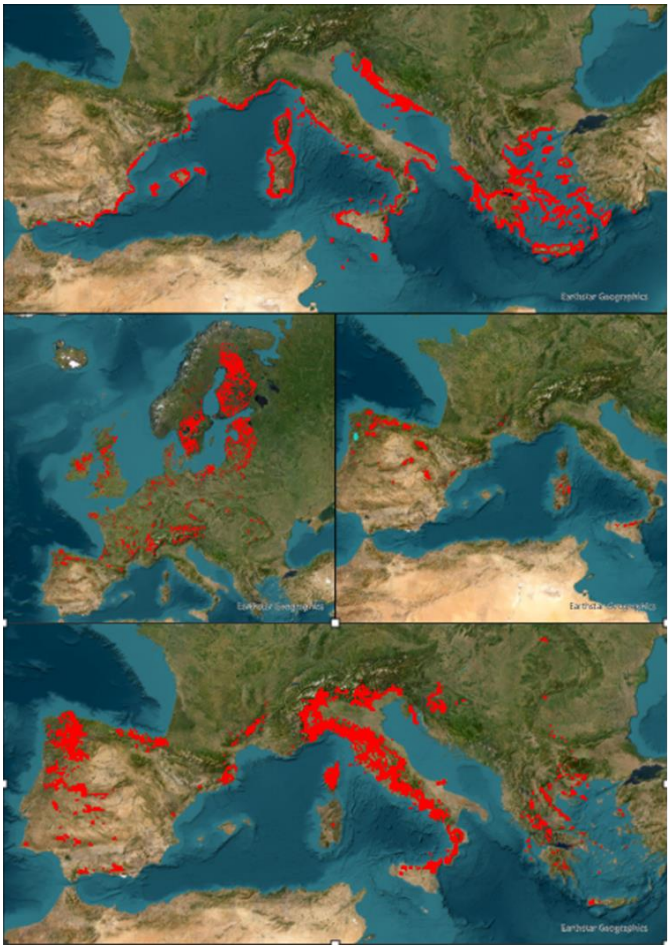


Source: this report

Figure 8. Examples of matches and mismatches between the tabular dataset and the spatial data of the Article 17 2013-2018 reporting for habitats.

1120
Posidonia oceanica
Tabular data: 8 records
Geodatabase: 7 records
87.50% match

7110
Active raised bogs
Tabular data: 39 records
Geodatabase: 34 records
87.18% match



9380
Ilex aquifolium
Tabular data: 6 records
Geodatabase: 6 records
100% match

9260
Castanea sativa
Tabular data: 17 records
Geodatabase: 16 records
94.12% match

Source: this report.

3.2 Thematic fields and data attributes

Each Member State is required to report specific data including distribution, status trend, population, area coverage, and pressures/threats, by providing information through predefined look-up tables and, when needed, actual values/estimates; the look-up tables provide different options depending on the status of species and habitat. Table 2 depicts the available options for the variables that MS were required to choose from to assess conservations status of species and habitats.

Table 2. Available options for each information variable that MS are required to report under the Habitats Directive.

Variable	Options
ref_assessments Overall assessment of Conservation Status	FV: Favourable, U1: Unfavourable – Inadequate, U2: Unfavourable – Bad, XX: Unknown.
ref_assessments_method Code of the method used to calculate the overall assessment	0EQ: Conclusions for a parameter are the same for all MS within the region; 0MS: The habitat or species only occurs in one MS within the region so, unless there are good reasons, the MS assessment is also the EU regional assessment; 1: Parameter assessed using the evaluation matrix after summing the MS data. This should only be used for range, population (species) and area (habitat); 2GD:

Variable	Options
	Parameter weighted by area of distribution from GIS data; 2XA: Parameter weighted by area of the coverage from XML data (habitats only); 2XP: Parameter weighted by population from XML data (species only); 2XR: Parameter weighted by range from XML data; 3GD: Overall conclusion weighted by area of distribution from GIS data; 3XA: Overall conclusion weighted by area from XML data (habitats only); 3XP: Overall conclusion weighted by population from XML data (species only); 3XR: Overall conclusion weighted by range from XML data; MTX: Overall conclusion assessed from assessments using methods 1 or 2 of the 4 parameters, using the last row of the evaluation matrix (only used for overall Conservation Status); OTH: Other method was used, explanations provided in Audit trail.
ref_measures List of main conservation measures	**Annex 1** of this report.
ref_measures_identified Status of measures	ident: Measures identified, but none yet taken; notIdent: Measures needed but cannot be identified; taken: Measures identified and taken.
ref_measures_location Location of the measures	in: Only inside Natura 2000; inOut: Both inside and outside Natura 2000; out: Only outside Natura 2000.
ref_measures_purpose_species Main purpose of the measures taken for species	expand: Expand the current range of the species (related to 'Range'); increase: Increase the population size and/or improve population dynamics (improve reproduction success, reduce mortality, improve age/sex structure) (related to 'Population'); maintain: Maintain the current range, population and/or habitat for the species; restore: Restore the habitat of the species (related to 'Habitat for the species')
ref_measures_purpose_habitats Main purpose of the measures taken for habitats	expand: Expand the current range of the habitat type (related to 'Range'); increase: Increase the surface area of the habitat type (related to 'Area covered by habitat'); maintain: Maintain the current range, surface area or structure and functions of the habitat type; restore: Restore the structure and functions, including the status of typical species (related to 'Specific structure and functions')
ref_measures_response Response to the measures	lonTerm: Long-term results (after 2030); medTerm: Medium-term results (within the next two reporting periods, 2019-2030); srtTerm: Short-term results (within the current reporting period, 2013-2018).
ref_methodsUsed Method used to estimate population size or distribution area	absentData: Insufficient or no data available, completeSurvey: Complete survey or a statistically robust estimate, estimateExpert: Based mainly on expert opinion with very limited data, estimatePartial: Based mainly on extrapolation from a limited amount of data.
ref_populationUnits Units used for the population size	adults: number of adults, area: area covered by population in m2, bfemales: number of breeding females, cmales: number of calling males, colonies: number of colonies, fstems: number of flowering stems, grids10x10: number of map 10x10 km grid cells, grids1x1: number of map 1x1 km grid cells, grids2x2: number of map 2x2 km grid cells, grids5x5: number of map 5x5 km grid cells, i: number of individuals, iwintering: number of wintering individuals, length: length of inhabited feature in km, localities: number of localities, logs:

Variable	Options
	number of inhabited logs, males: number of males, p: number of pairs, shoots: number of shoots, stones: number of inhabited stones/boulders, subadults: number of subadults, trees: number of inhabited trees, tufts: number of tufts.
ref_typeEstimate Type of estimate	estimate: Best estimate, interval: 95% confidence interval, mean: Multi-year mean, minimum: Minimum.
ref_presence_status_species	SCR: Scientific reserve, ARR: Newly arriving species, DEL: Not present - delete from the check-list, EXa: Species extinct after entry into force of the Habitats Directive, EXp: Species extinct prior to entry into force of the Habitats Directive, MAR: Marginal, NPRE: Not present – reserve, NTAX: Taxonomical error, OCC: Occasional, OPT: Optional report, PRE: Present regularly, TAX: Taxonomical uncertainty.
ref_presence_status_habitats	SCR: Scientific reserve, DEL: Not present - delete from the check-list, MAR: Marginal, NPRE: Not present – reserve, OPT: Optional report, PRE: Present regularly.
ref_ranking Ranking of pressure/threat	H: High importance/impact; M: Medium importance/impact.
ref_target1 Contribution to Target 1 of the EU Biodiversity Strategy	A+: favourable but unfavourable in 2000 - 2006 period; A=: favourable or unknown in 2000 - 2006 and favourable in 2013 - 2018 period; B1: improved status (change in conservation status category); B2: improved status (improving trend); C: deteriorated status; D: unfavourable and unknown assessments that did not change; E: status became unknown.
ref_threatsPressures Type of threat/pressure	**Annex 2** of this report.
ref_trends Trend of the species range or habitat area	D: Decreasing (-), I: Increasing (+), S: Stable (0), U: Uncertain (U), u: Unk: Unknown (x).
ref_trendsConclusion Overall trend in conservation status	D: Deteriorating, I: Improving, S: Stable, Unk: Unknown.

Source: Article 17 dataset and variable description.

3.2.1 Estimation/assessment methods

Reporting methodology of species and habitats refer to methods with which the species' population and habitats' distribution are estimated at the MS level. Specifically, each species and habitat were reported using one of the following methods: **absentData** for insufficient or no data available, **completeSurvey** for implementing a complete survey or a statistically robust estimate, **estimateExpert** a method based mainly on expert opinion with very limited data, and **estimatePartial** which is based mainly on extrapolation from a limited amount of data. For specific information, MS need to, above others, report the method with which their estimate or value was calculated. The data fields that require this clarification are shown in Table 3.

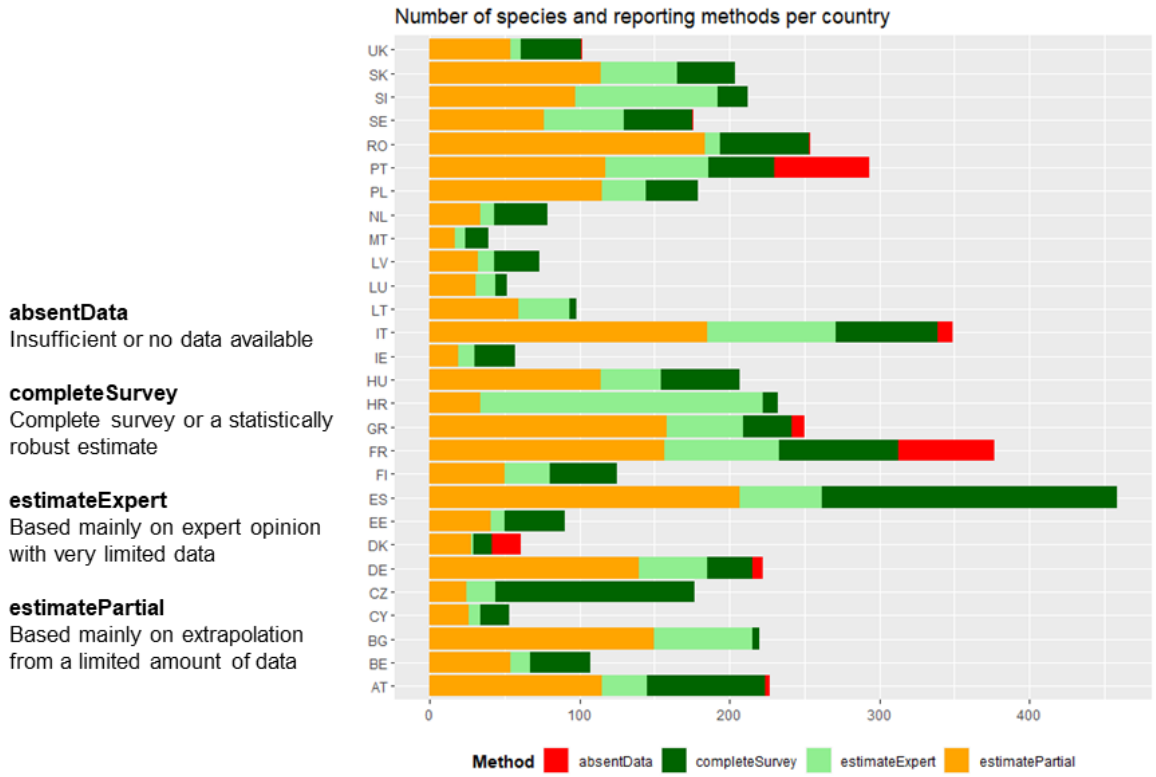
Focusing on the methods for defining the population size of species and the surface area of habitats the estimatePartial, which is a method based on the extrapolation from a limited amount of data, was mainly used by MS (Figures 9 and 10). Specifically, Italy and Luxembourg used almost solely the estimatePartial method to provide habitat distribution maps. Expert opinion was used by most MS to define species population size, as well as by some MS to report the surface area of habitats. Specifically, for most species in Croatia and most habitats in France, expert knowledge was the most used method, while in Portugal an estimate with insufficient or no available data was still provided.

Table 3. List of data fields that require from Member State to report the specific method used for an estimate or value.

Variable	Description
distribution_method [for species and habitats]	Method used for defining the distribution map. The method is assessed at the MS level and is not relevant at the biogeographical level.
range_trend_method [for species and habitats]	Method used for defining the short-term trend of range.
range_trend_long_method [for species and habitats]	Method used for defining the long-term trend of range.
population_method [only for species]	Method used for defining the population unit of species.
population_trend_method [only for species]	Method used for defining the short-term trend of population size of species.
population_trend_long_method [only for species]	Method used for defining the long-term trend of population size of species.
habitat_sufficiency_method [only for species]	Methods used for defining the sufficiency of area and quality of occupied habitat by species.
habitat_trend_method [only for species]	Method used for defining the short-term trend of species habitats.
habitat_trend_long_method [only for species]	Method used for defining the long-term trend of species habitats.
coverage_method [only for habitats]	Method used for defining the surface area of habitat.
coverage_trend_method [only for habitats]	Method used for defining the short-term trend of coverage of habitat.
coverage_trend_long_method [only for habitats]	Method used for defining the long-term trend of coverage of habitat.
hab_condition_method [only for habitats]	Method used for defining the condition of habitat.
hab_condition_trend_method [only for habitats]	Method used for defining the short-term trend of the condition of habitat.
natura2000_population_method [only for species]	Method used for defining the species population size inside the Natura 2000 network.
natura2000_population_trend_method [only for species]	Method used for defining the short-term trend of species population size within the Natura 2000 network.
natura2000_area_method [only for habitats]	Method used for defining the surface area of the habitat type inside the Natura 2000 network.
natura2000_area_trend_method [only for habitats]	Method used for defining the short-term trend of habitat area in good condition within the Natura 2000 network.

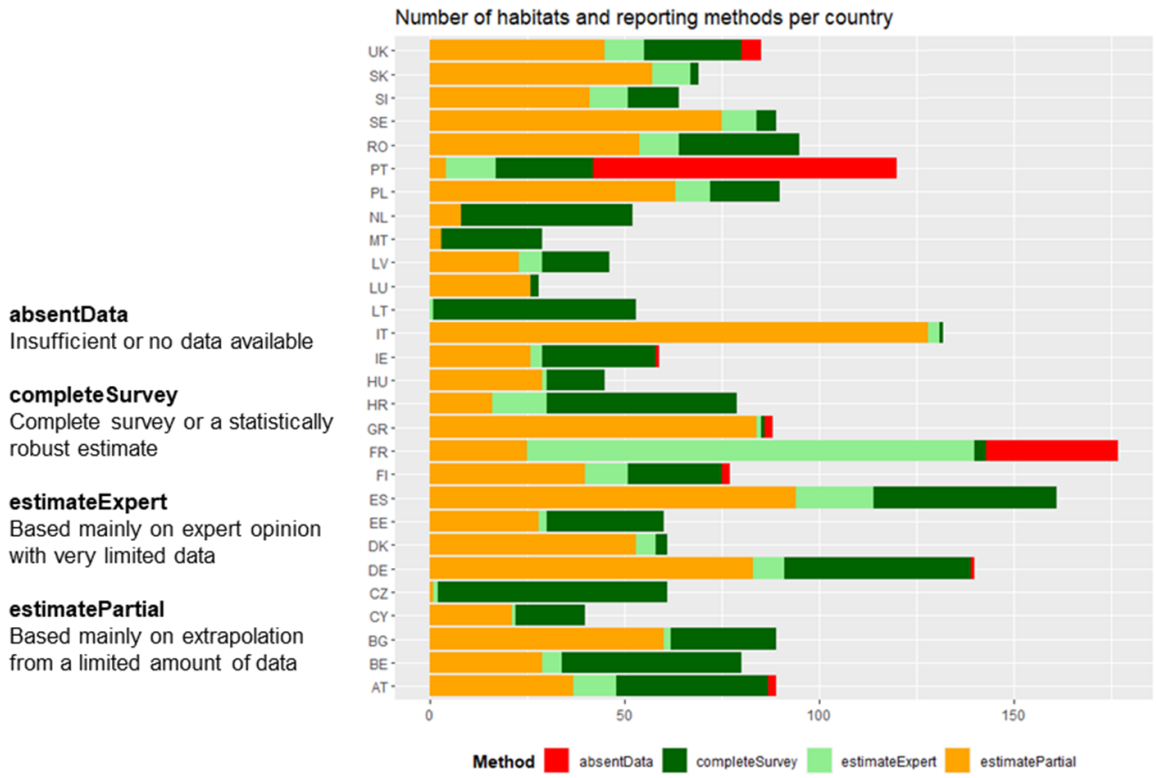
Source: Article 17 dataset description.

Figure 9. Reporting method for defining the population size of species per MS.



Source: this report.

Figure 10. Reporting method for defining the surface area of habitats size per MS.



Source: this report.

3.2.2 Data completeness per attribute

In this section, we identified the main issues, in terms of data quality and completeness, resulting in inconsistencies among countries also affecting the coherent monitoring efforts at the European scale. MS are required to report information on different aspects of the conservation status, population, size or area, measures, threats of species and habitats resulting in a large number of separate fields to be filled in the Article 17 database. This has led to numerous fields within the database that have little to no information where in many cases, information is reported by only few countries. In the following table, it is evident that various fields referring to estimates of trends have a 5% and less completeness of reported information (Table 4). Completeness of information referring to population size (mean or actual, min and max) varies between 49 and 55%. Finally, for most information on population estimates within Natura 2000 protected areas, data completeness reaches up to 73% for used methods (natura2000_population_method).

Similar to the species dataset, various fields referring to habitats' estimates of trends have less than 5% completeness of reported information (Table 5). Information referring to the size of coverage surface area across Europe (coverage_surface_area) as well as within Natura 2000 protected areas (natura2000_area) reached 74% of data completeness.

Table 4. Completeness of various data fields from the reporting of species.

Information (field)	**Completeness (%)**	**Information (field)**	**Completeness (%)**
range_trend_magnitude_min	5,5	habitat_sufficiency_unoccupied	27,8
range_trend_magnitude_max	5,5	habitat_trend_long_period	27,7
range_trend_long_period	28,1	habitat_trend_long	27,4
range_trend_long	28,3	habitat_trend_long_method	26,7
range_trend_long_magnitude_min	3,5	main_reason_trend_etc	48,1
range_trend_long_magnitude_max	3,5	natura2000_population_unit	67,5
range_trend_long_method	29,3	natura2000_population_min	32,0
population_size_min	51,4	natura2000_population_max	27,3
population_size_max	48,7	natura2000_population	38,0
population_size	54,7	natura2000_population_estimate_type	64,6
population_trend_magnitude_min	5,1	natura2000_population_method	73,3
population_trend_magnitude_max	5,0	natura2000_population_trend	66,4
population_trend_magnitude_ci	1,8	natura2000_population_trend_method	66,3
population_trend_long_period	28,5	natura2000_popsize_etc	63,6
population_trend_long	28,8	natura2000_coverage_etc	61,9
population_trend_long_magnitude_min	3,6		
population_trend_long_magnitude_max	3,6		
population_trend_long_magnitude_ci	1,5		
population_trend_long_method	28,0		

Note: This table includes only data fields with completeness less than 90%.

Source: this report.

Table 5. Completeness of various data fields from the reporting of habitats.

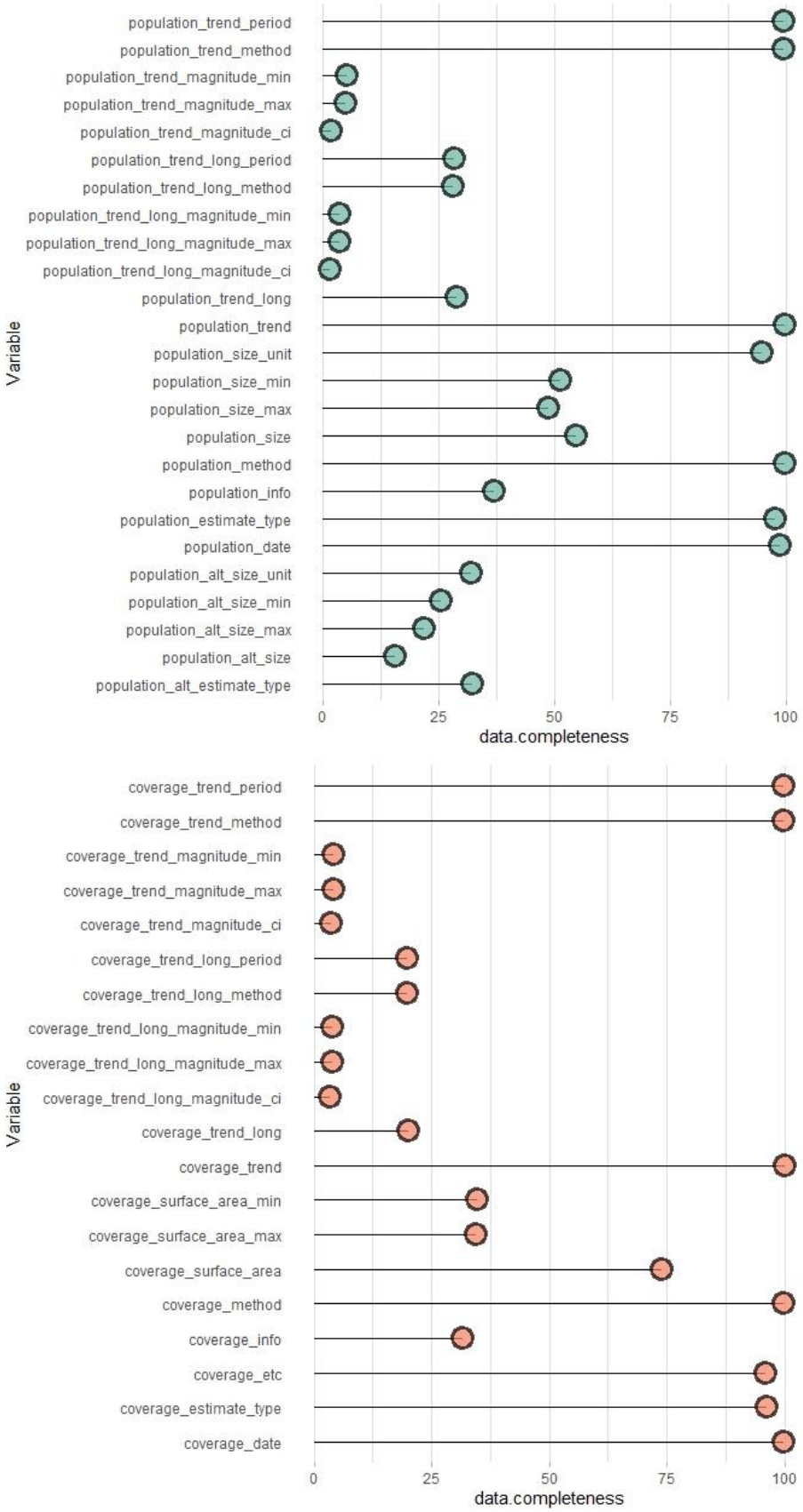
Information (field)	Completeness (%)	Information (field)	Completeness (%)
range_trend_magnitude_min	4,0	coverage_trend_long_period	19,9
range_trend_magnitude_max	3,9	coverage_trend_long	20,2
range_trend_long_period	20,5	coverage_trend_long_magnitude_min	4,0
range_trend_long	20,8	coverage_trend_long_magnitude_max	4,0
range_trend_long_magnitude_min	3,8	coverage_trend_long_magnitude_ci	3,4
range_trend_long_magnitude_max	3,8	coverage_trend_long_method	19,9
range_trend_long_method	20,6	main_reason_trend_etc	65,3
coverage_surface_area_min	34,6	natura2000_area_min	33,7
coverage_surface_area_max	34,4	natura2000_area_max	33,4
coverage_surface_area	73,9	natura2000_area	74,4
coverage_trend_magnitude_min	4,3		
coverage_trend_magnitude_max	4,3		
coverage_trend_magnitude_ci	3,7		

Note: This table includes only data fields with completeness less than 90%.

Source: this report.

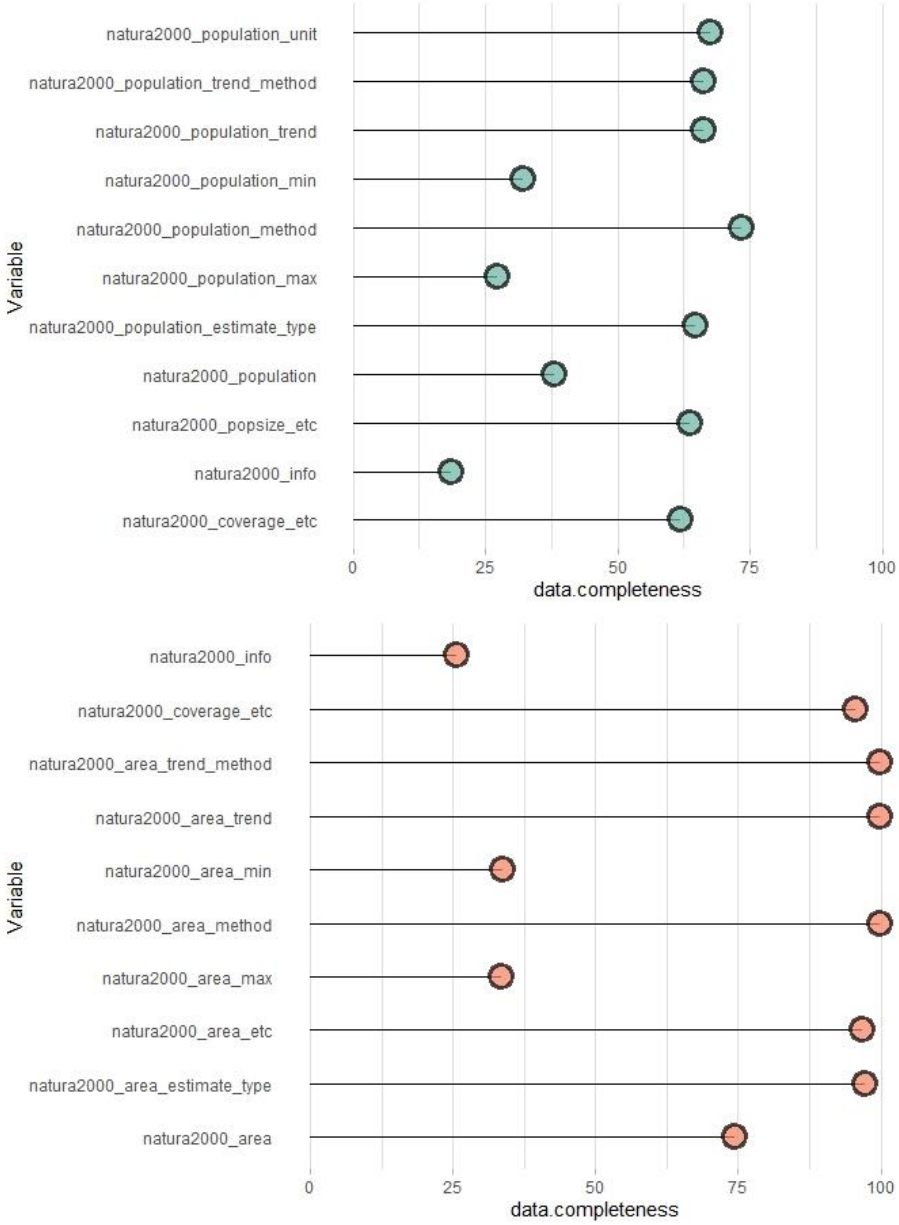
From the 25 variables, in total related to information on species populations, only seven (7) variables have over 95% completeness of data reported by MS (Figure 11). Three (3) variables referring to the population size measures (reported value, min and max) are completed by around 50%. The rest of the variables have been completed by less than 40% with six (6) of them related to population trend magnitude being around 0% in terms of data completeness. For habitats' coverage information regarding eight (8) out of 20 variables are over 98% to 100% completed, while the rest have been filled in by less than 35%. Similar to the species population reports, the trends' magnitude variables have very little information from MS. The majority of Information on the species population within Natura 2000 areas is characterized by approximately 66% data completeness, while the majority of information on habitats coverage within Natura 2000 areas reaches up to 100% completeness of reported data (Figure 12).

Figure 11. Completeness of data related to species population and habitats coverage within the Article 17 database.



Source: this report.

Figure 12. Completeness of data related to species and habitats within Natura 2000 Protected Areas.



Source: this report.

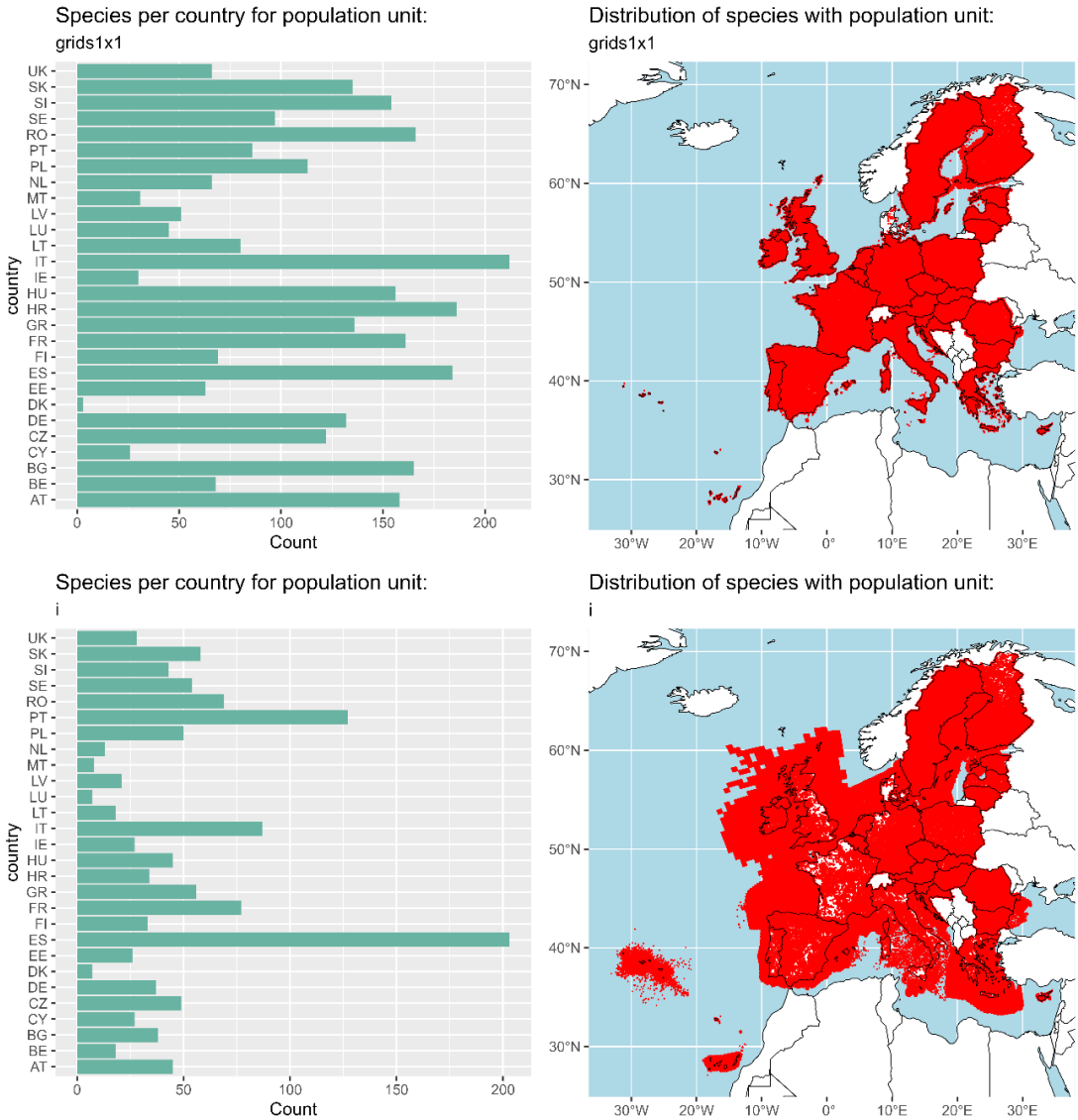
3.2.2.1 Reporting units

The options given to MS for reporting units of species populations include 21 different unique unit types, as listed in Table 2 under variable 'ref_populationUnits'.

Generally, the EU recommends that MS use 'individuals' wherever possible to report the unit of species populations and maintain coherence within the assessments, however, the EU also states that MS are free to use other units if they find it most appropriate for specific species. In the final dataset, 9 out of the 21 options have been selected by MS for the different species with 'grids1x1' and 'individuals' being the most used (Figures 13). The various grids units (1x1, 2x2, 5x5 and 10x10) refer to the population size based on areas with sampling size that of the respective grid. The 'grids1x1' (population size was based on sampling area 1 by a km), is the unit used by most MS and for mostly terrestrial and coastal species, while the 'individuals' option which refers to number

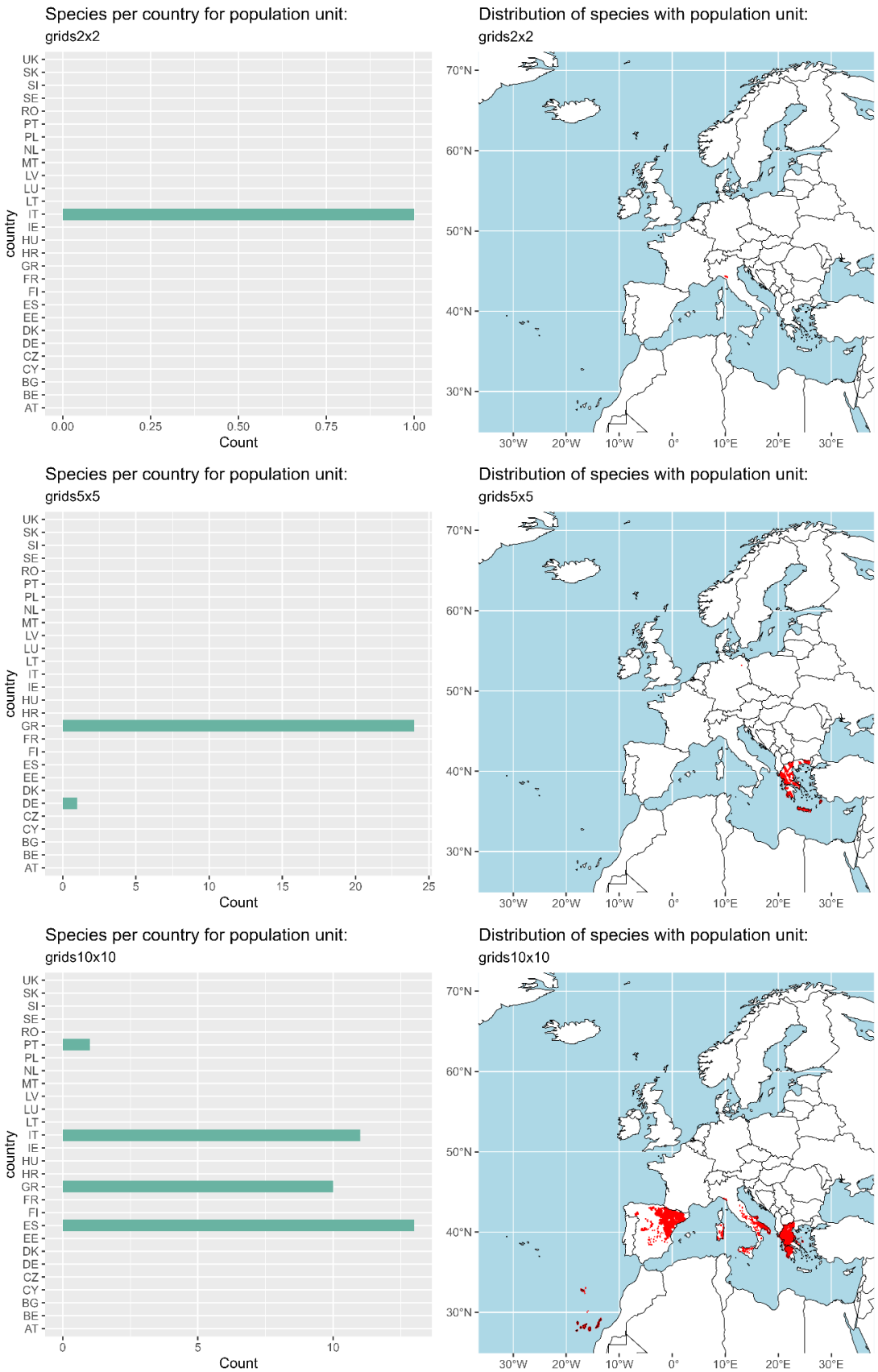
of individuals is also used for species distributed in marine regions. The 'grid10x10' unit was used only for some species by MS located in the Mediterranean region, namely, Portugal, Italy, Greece and Spain (Figure 14). In addition, there were units specifically referring to 'grid2x2' and 'grid5x5' that were used by one or two countries with Greece using 'grid5x5' for about 25 species. Units referring to 'adults', 'area' and 'localities' are used by few countries for both terrestrial and marine species (Figure 15). Finally, Denmark was the only country that used the 'colonies' unit for a single species (Figure 16).

Figure 13. Number and distribution of species reported using the 'grid1x1', and 'individuals' population units.



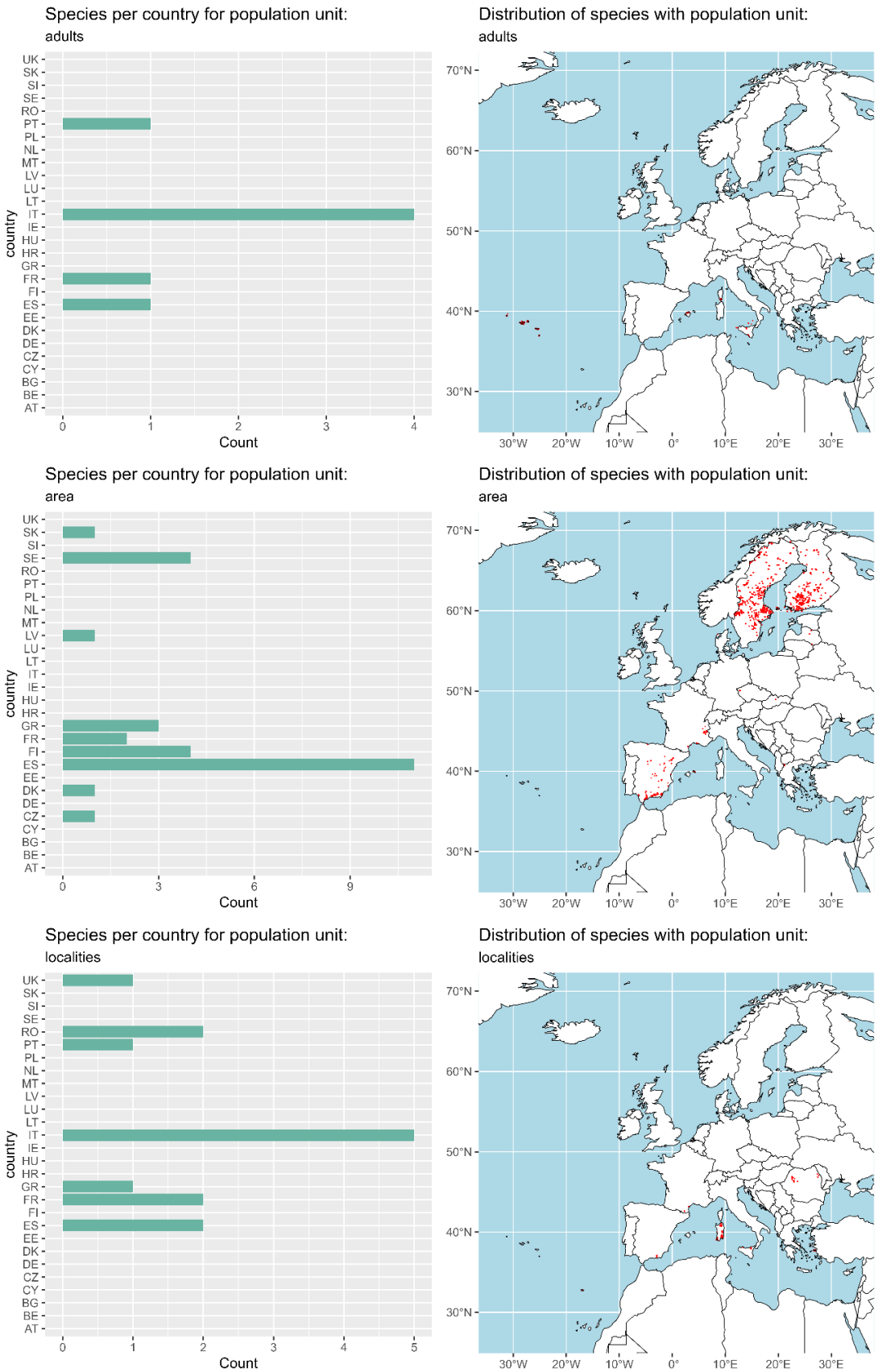
Source: this report.

Figure 14. Number and distribution of species reported using the 'grid2x2', 'grid5x5' and 'grid10x10' population units.



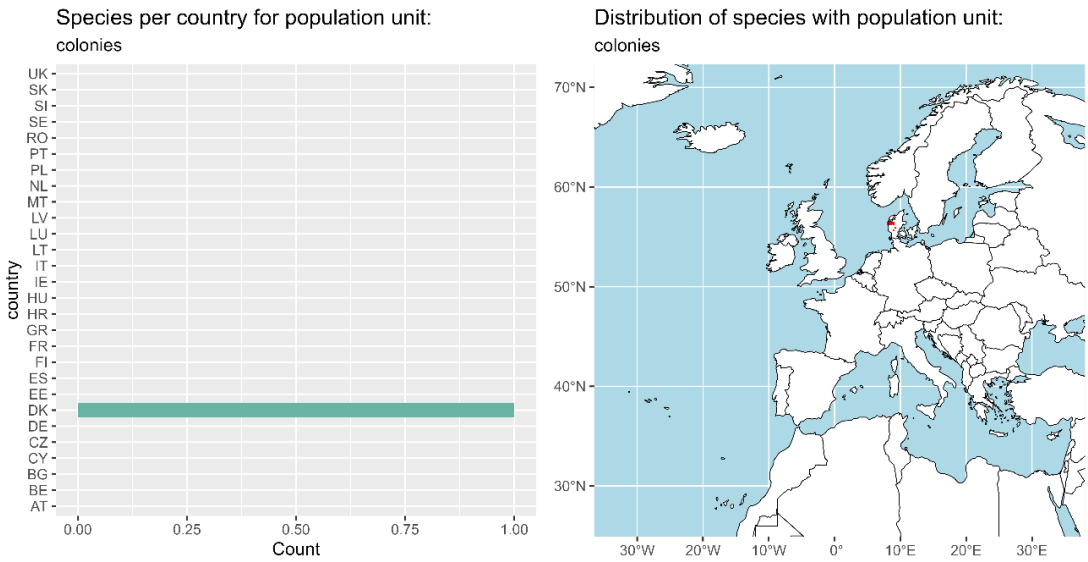
Source: this report.

Figure 15. Number and distribution of species reported using the 'adults', 'area' and 'localities' population units.



Source: this report.

Figure 16. Number and distribution of species reported using the 'grid2x2', 'grid2x2' and 'colonies' population units.



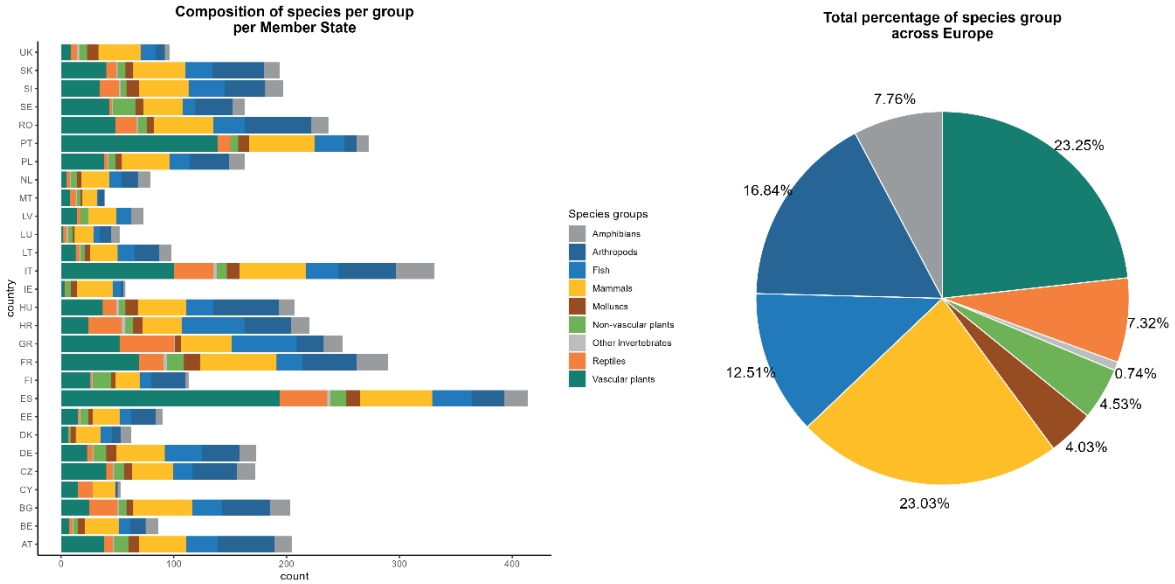
Source: this report.

3.3 Distribution of species and habitats

3.3.1 Species level

In total, 1394 unique species and 233 habitats are reported under the monitoring framework of the Habitats Directive's Article 17. In general, vascular plants and mammals account for approximately 46% of the reported species, followed by arthropods, fish, amphibians and reptiles with approximately 17, 13, 8 and 7%, respectively, while molluscs, non-vascular plants, and other invertebrates each represent an under 5% percentage (Figure 17). Among the EU-28 countries (since UK was included in this reporting period), Spain, Italy, France and Portugal seem to have the highest number of reported species whereas Malta, Luxembourg, Cyprus and Ireland seem to have the lowest number of reported species.

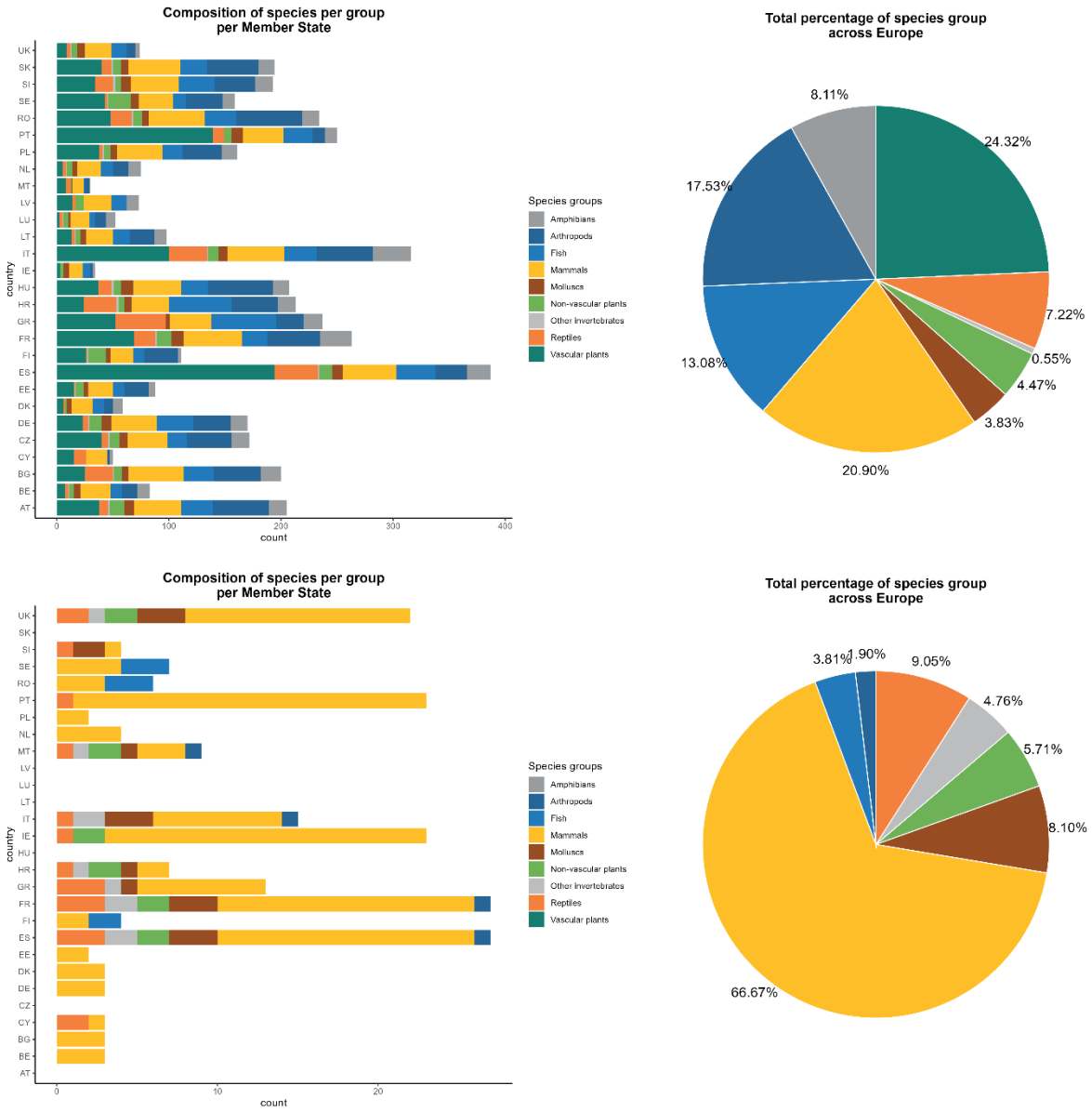
Figure 17. Number of reported species and composition of species groups per MS.



Source: this report.

In an attempt to identify the differences among marine and terrestrial species we created two subset datasets, one referring to species reported for the nine terrestrial biogeographical regions (MAC, ATL, MED, ALP, BOR, CON, BLS, PAN, STE) and one for the five marine regions (MATL, MMAC, MMED, MBAL, MBLS). For terrestrial regions, the results showed similar patterns of the total percentage and composition of species groups with that of the general (terrestrial and marine combined) dataset (Figure 18). By contrast, marine regions exhibited an abundance of mainly mammals reaching 67%, while the rest of the species groups (except for amphibians and vascular plants which, logically, were not reported at all in the marine regions) each accounted for less than 10%. As expected, inland countries, such as Slovakia, Luxembourg, Austria, and the Czech Republic have not reported any species with distribution maps in the marine regions. However, coastal countries in the Baltic Sea, where one would expect some species to be located in the marine regions, Latvia and Lithuania had not reported any species within he marine regions of those countries.

Figure 18. Number of reported species and composition of species groups per MS in terrestrial & marine regions.

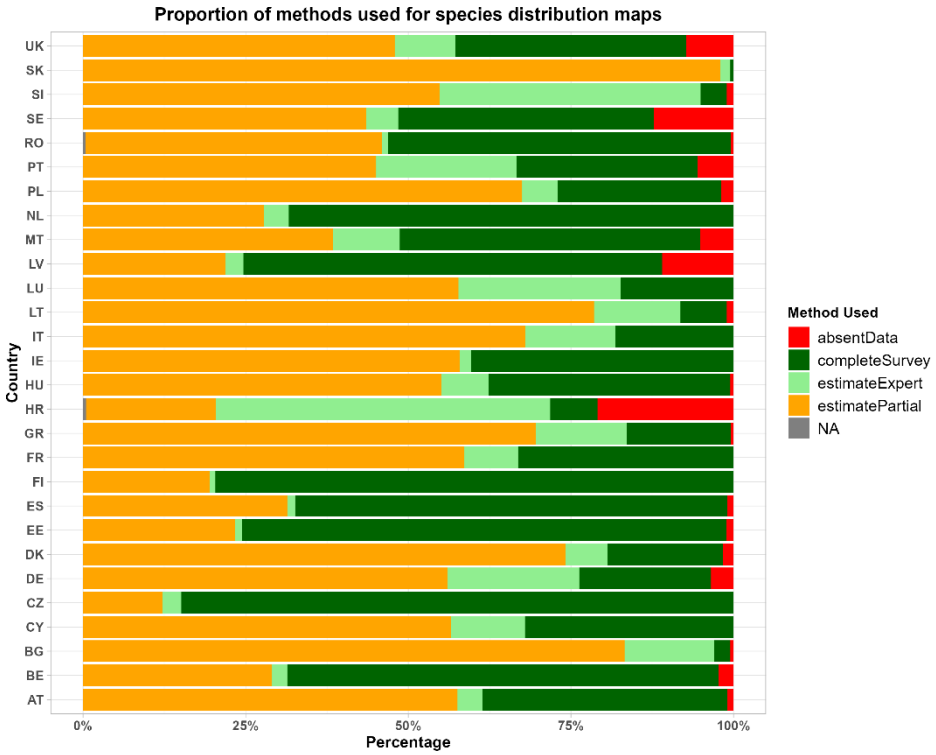


Source: this report.

In terms of the spatial distribution of species groups, amphibians, arthropods, and vascular plants cover the entire terrestrial EU region (Figures 19 and 20), while mammals cover the entire terrestrial region as well as large areas in the marine biogeographical regions (Figure 21), with France, Spain, Italy and Portugal having the most reported species. Species under the fish group cover the terrestrial regions rather than the marine areas (Figure 20) as these refer to mostly freshwater fish. Molluscs and non-vascular plants are found to be more concentrated in central and north European regions (Figure 21), while reptiles cover most of the central and south regions (Figure 22). Other invertebrates have the least reported species with countries reporting zero to three maximum species.

When it comes to the method with which the distribution maps were produced, the majority of countries provided maps based on the extrapolation from a limited amount of data (estimatePartial), and on statistically robust estimates (completeSurvey) (Figure 19). Only in the case of Croatia, approximately 25% of the produced distribution maps were based on data that were either insufficient or not available at all. Overall, 51.31% distribution maps of species were based on extrapolation from a limited amount of data (estimatePartial), followed by 34.34% exhaustive data collection with minimum data gaps (completeSurvey) and 11.61% expert opinion (estimateExpert) (Table 6).

Figure 19. Percentage of methods used for species distribution maps per MS



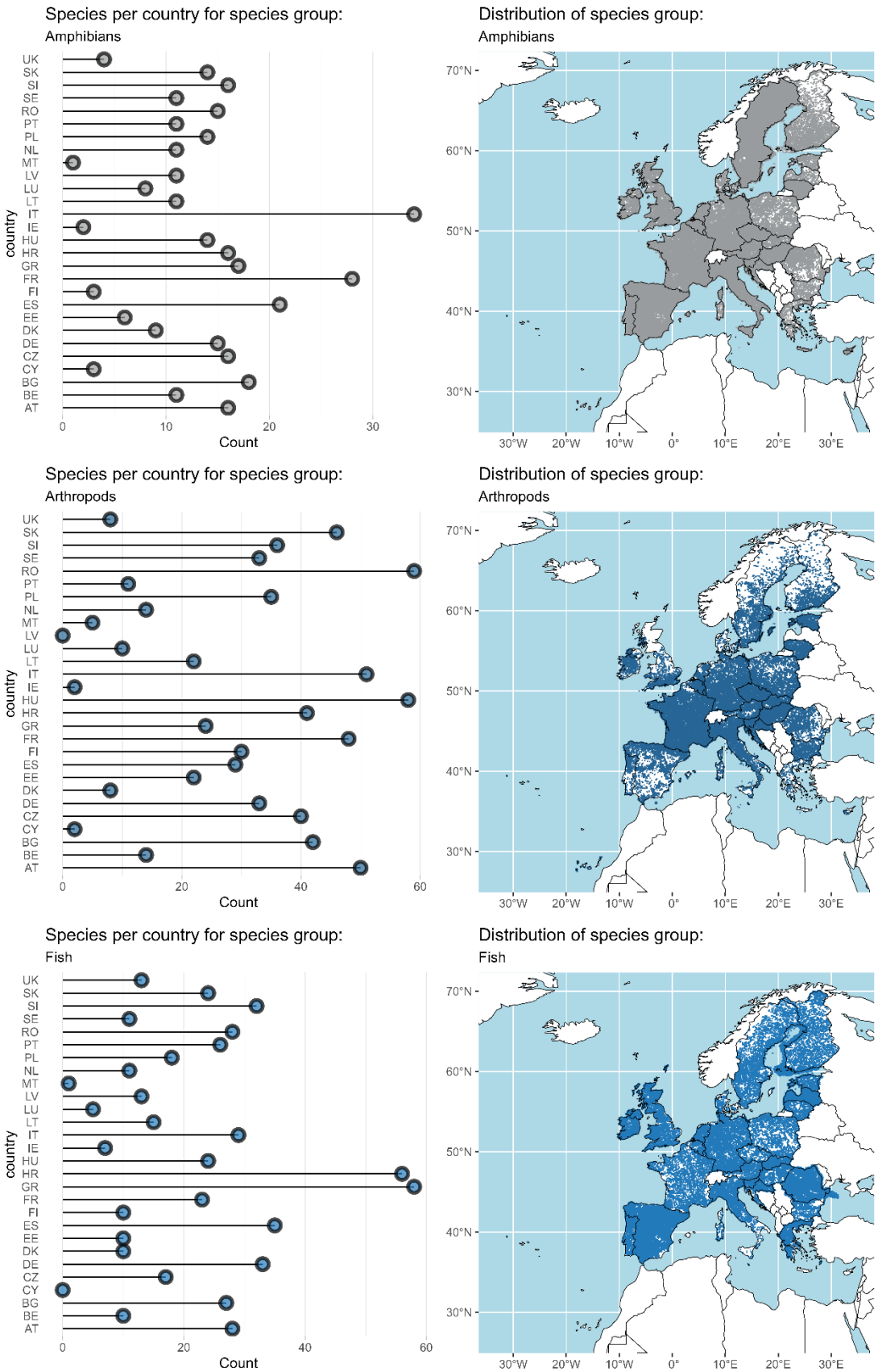
Source: this report.

Table 6. Overall percentage of methods used for species' distribution maps.

Method	Percentage (%)
absentData	2.70
completeSurvey	34.34
estimateExpert	11.61
estimatePartial	51.31
NA	0.04

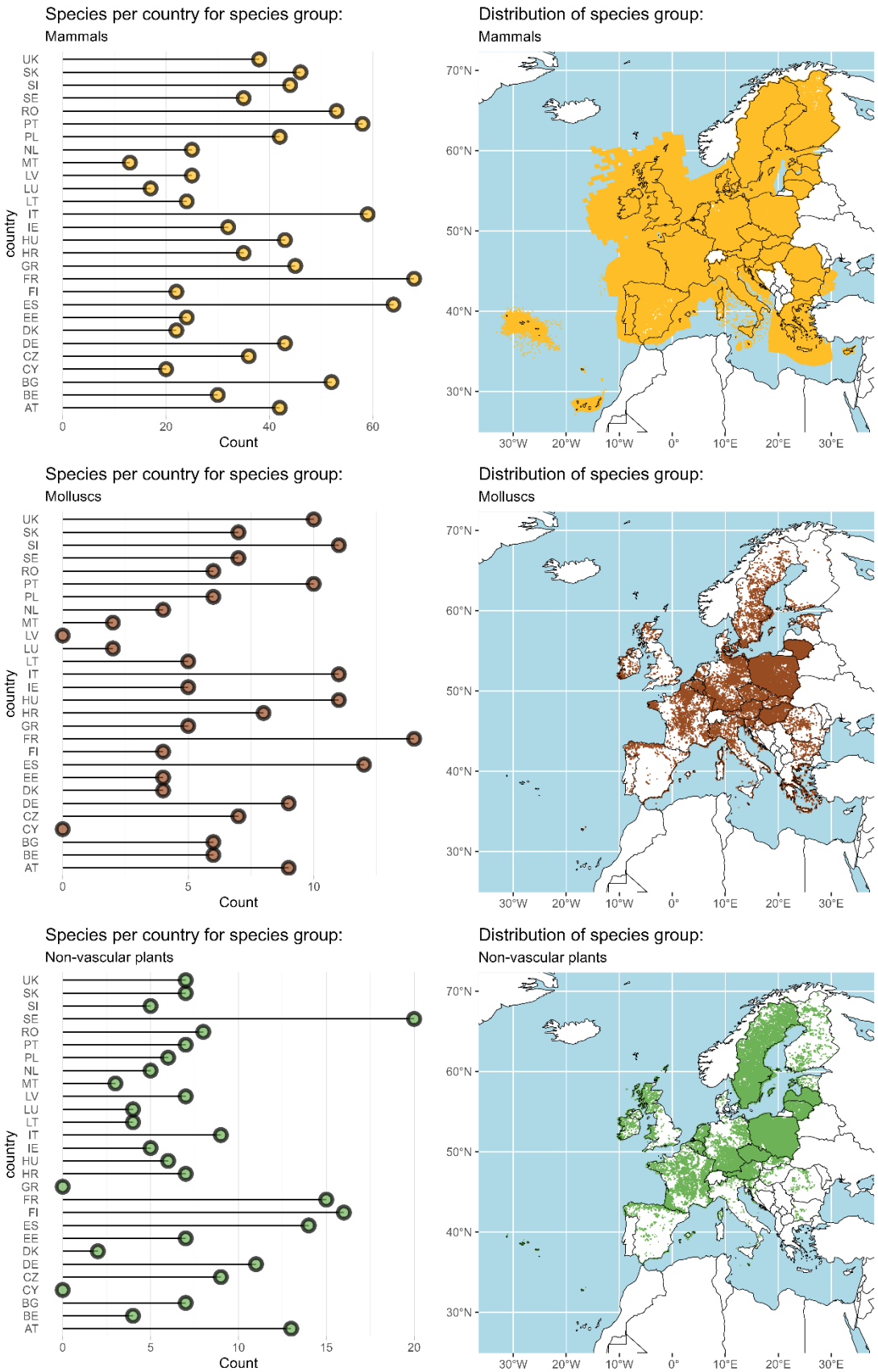
Source: this report.

Figure 20. [Part 1 of 3] Number of species reported by each MS and for each species group (left), and spatial distribution of species group across the EU-28 countries (right).



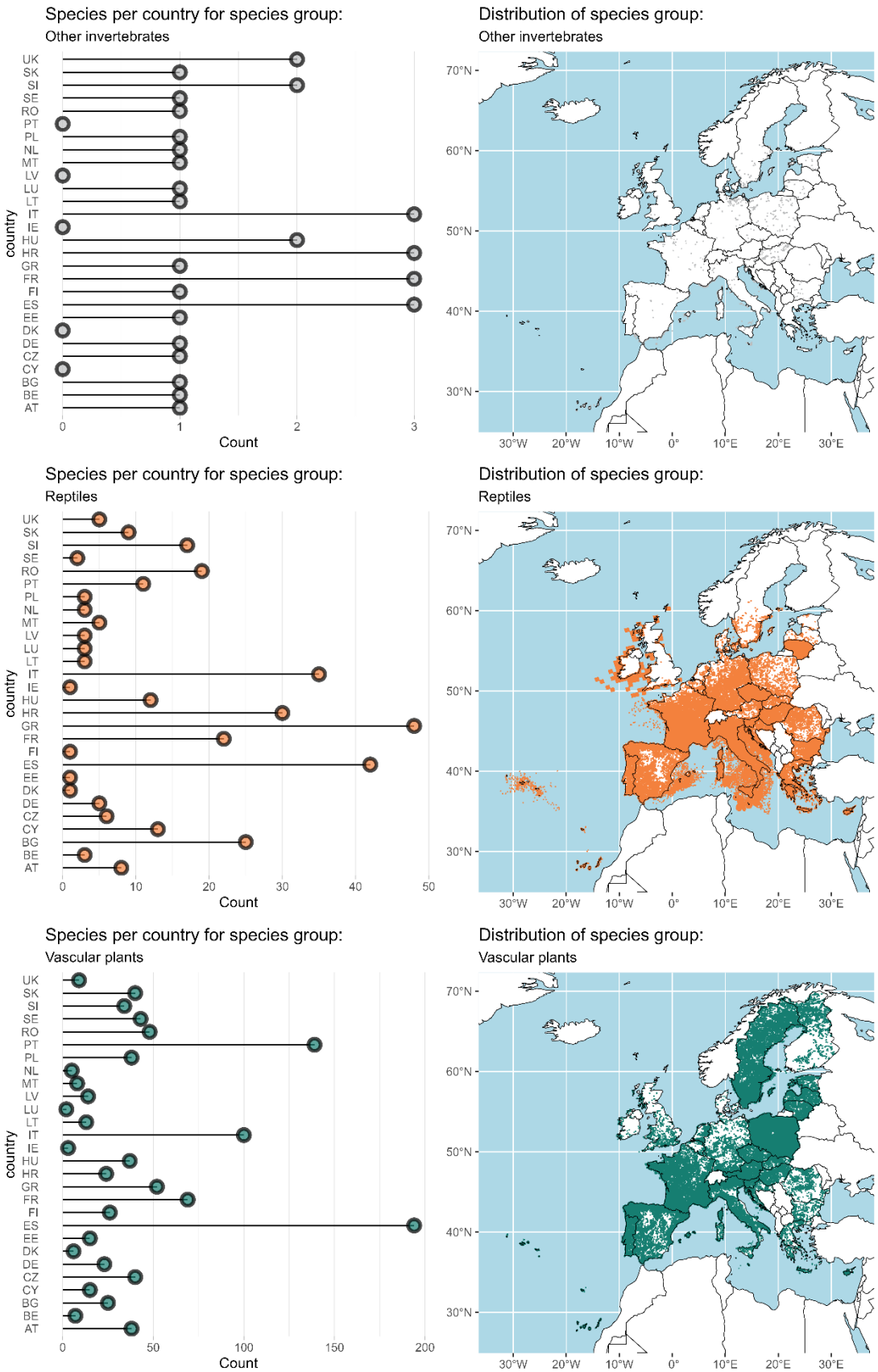
Source: this report.

Figure 21. [Part 2 of 3] Number of species reported by each MS and for each species group (left), and spatial distribution of species group across the EU-28 countries (right).



Source: The authors

Figure 22. [Part 3 of 3] Number of species reported by each MS and for each species group (left), and spatial distribution of species group across the EU-28 countries (right).

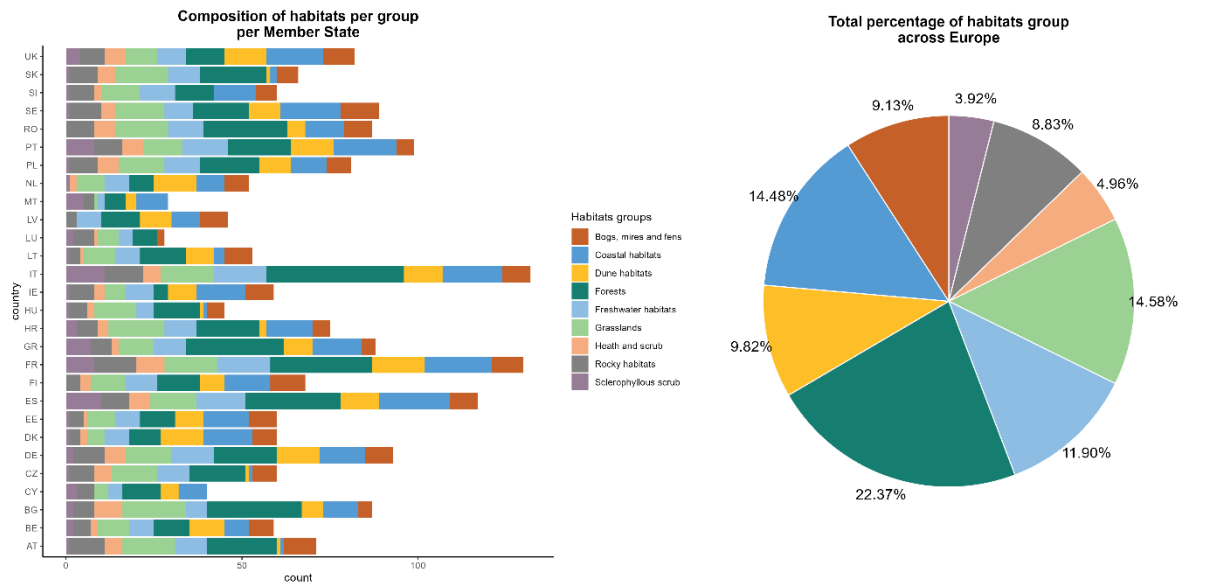


Source: The authors

3.3.2 Habitats level

The reported terrestrial habitats cover almost one third of the terrestrial area of the EU-28 MS (from July 1st 2013 to January 31st 2020), equivalent to 1.3 million km2, and marine habitats cover an additional 0.4 million km2 of EU waters (EEA, 2020). Forests constitute approximately 22% of the reported habitats followed by grasslands, coastal habitats, freshwater habitats and dune habitats covering approximately 15, 14, 12 and 10%, respectively (Figure 23). The remaining habitat types, including heath and scrub, sclerophyllous scrub, bogs, mires, fens, and rocky habitats, each comprise a percentage under 10%. Among the 28 countries, Italy, France and Spain have the highest number of reported habitats each having more than 100 unique habitat codes while Malta and Luxembourg have the lowest number of unique habitat codes.

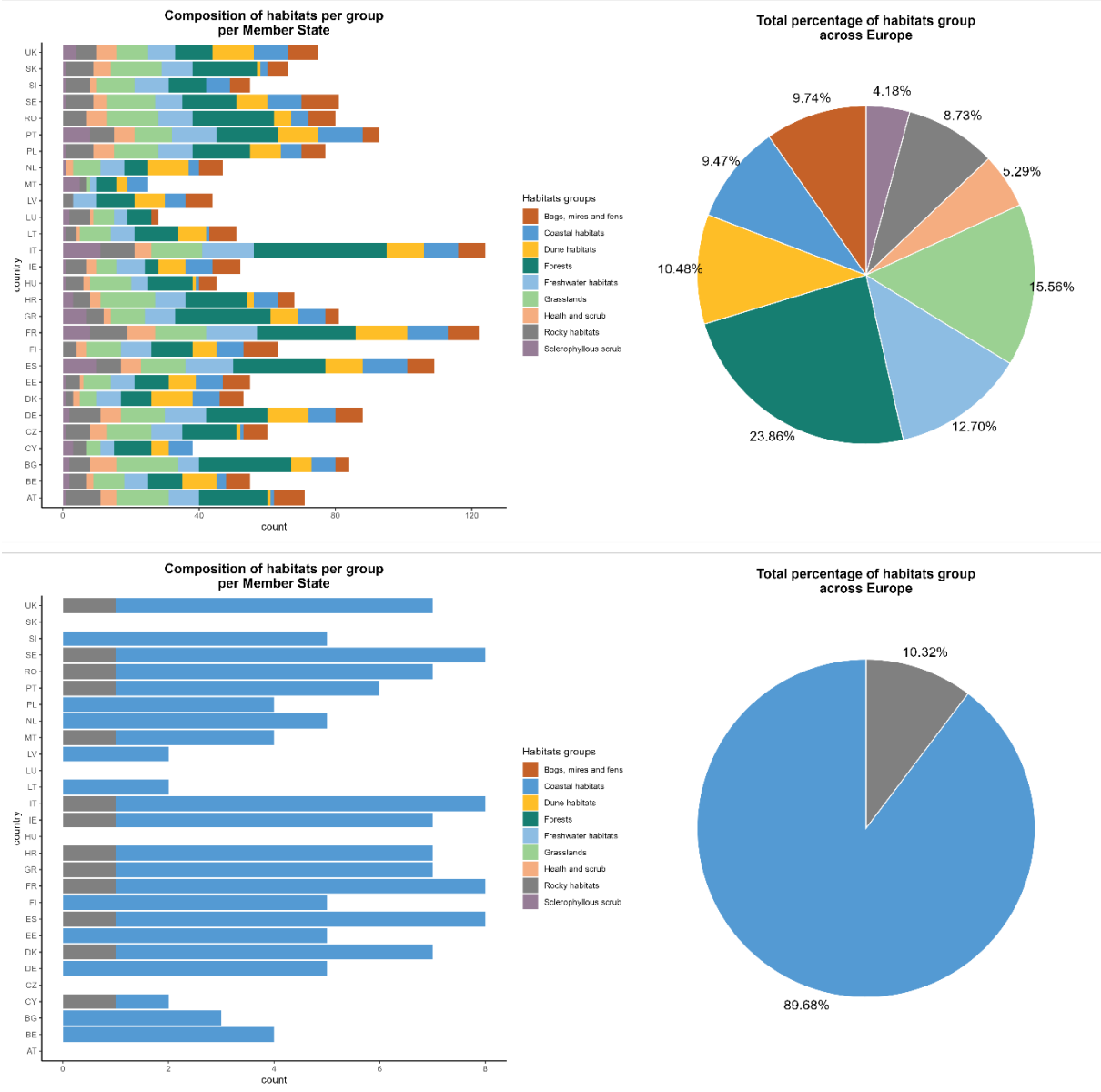
Figure 23. Number of reported habitats and composition of habitats groups per MS.



Source: this report.

Similar to the species datasets, we estimated the composition and total percentage of habitats in the terrestrial and the marine regions (Figure 24). Species on the terrestrial regions presented a similar composition of species groups with that of the overall dataset with the exceptions of coastal habitats which decreased by 5%. For marine regions, as expected, coastal habitats accounted for almost 90% followed by rocky habitats with approximately 10% total percentage. In addition, only inland countries, including Slovakia, Luxembourg, Austria, and the Czech Republic did not report any habitats covering the marine regions.

Figure 24. Number of reported species and composition of habitats groups per MS in terrestrial & marine regions.



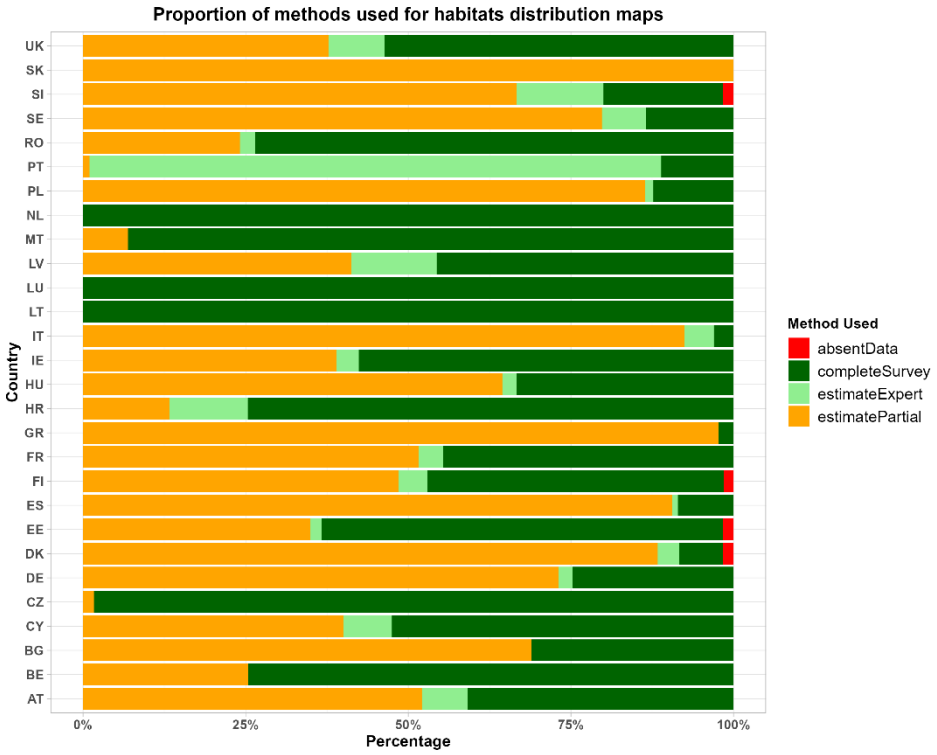
Source: this report.

The reporting of distribution maps for habitats was based on exhaustive data collection with minimum data gaps (completeSurvey) and data interpolation for the majority of MS (Figure 25), except for Portugal were more than 80% of the distribution maps provided were based on expert knowledge and limited data (estimateExpert). Overall, 52.98% distribution maps of habitats were based on extrapolation from a limited amount of data (estimatePartial), followed by 39.04% complete surveys (Table 7).

In terms of spatial distribution of habitats' groups, forests, freshwater habitats, and grasslands cover the entire terrestrial EU region (Figure 27). Bogs, mires and fens also cover a large number of areas with the northern countries exhibiting the most spatially evident habitats (Figure 26). Interestingly, although coastal and dune habitats seem to cover most of the coastline across Europe, some countries have provided distribution maps within the main terrestrial land (Figure 26).

This was particularly evident with coastal habitats in Spain and Hungary, as well as some central European countries, while the dune habitats were reported across most of central European countries and south Portugal. Heath and scrub were reported across Europe, mostly in the central and west regions, while the distribution of sclerophyllous scrub seem to mainly characterise Mediterranean countries (Figure 28).

Figure 25. Percentage of methods used for habitats distribution maps per MS



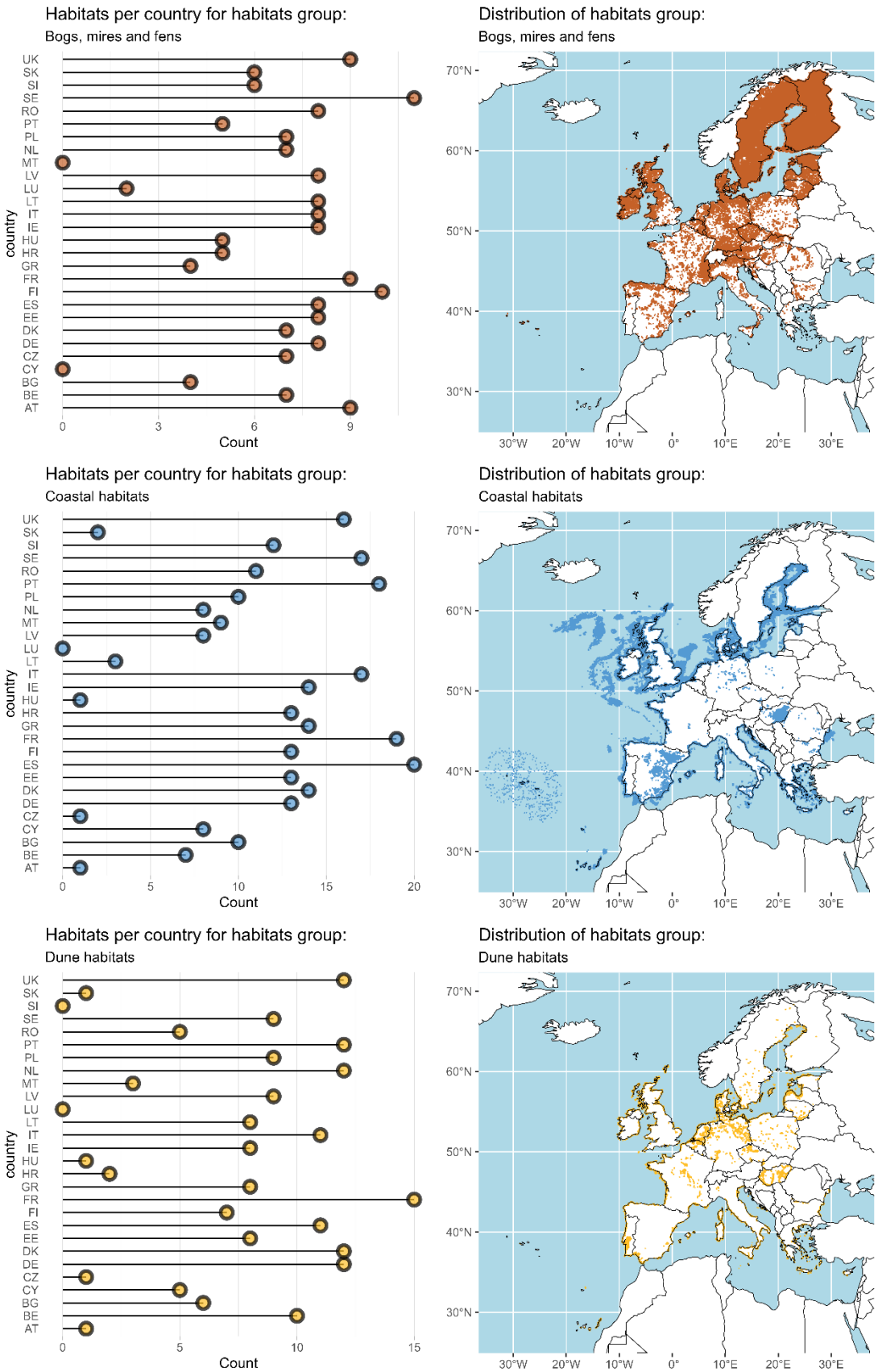
Source: this report.

Table 7. Overall percentage of methods used for habitats' distribution maps.

Method	Percentage (%)
absentData	0.20
completeSurvey	39.04
estimateExpert	7.79
estimatePartial	52.98

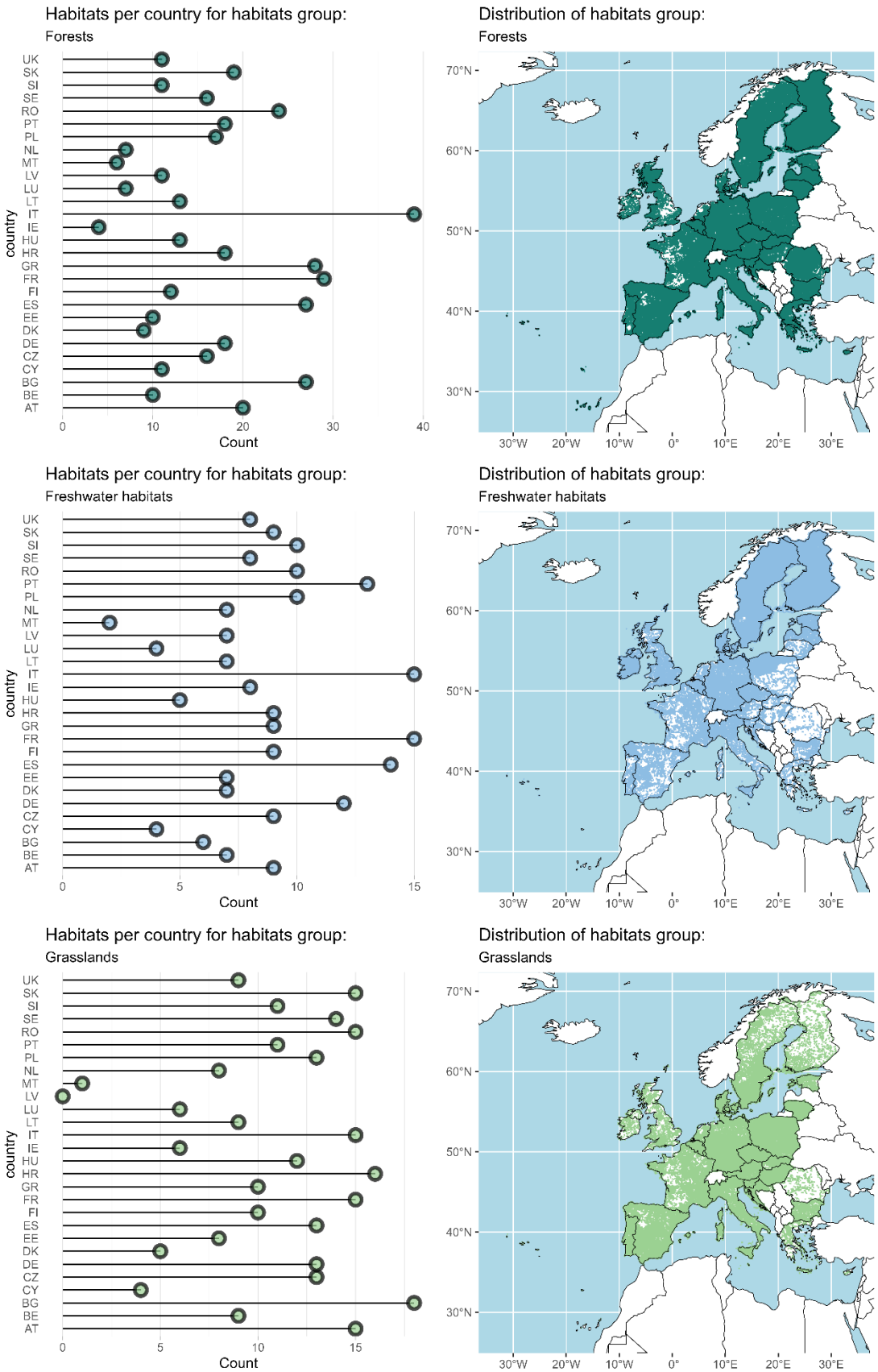
Source: this report.

Figure 26. [Part 1 of 3] Number of habitat types reported by each MS and for each habitat group (left), and spatial distribution of habitat group across the EU-28 countries (right).



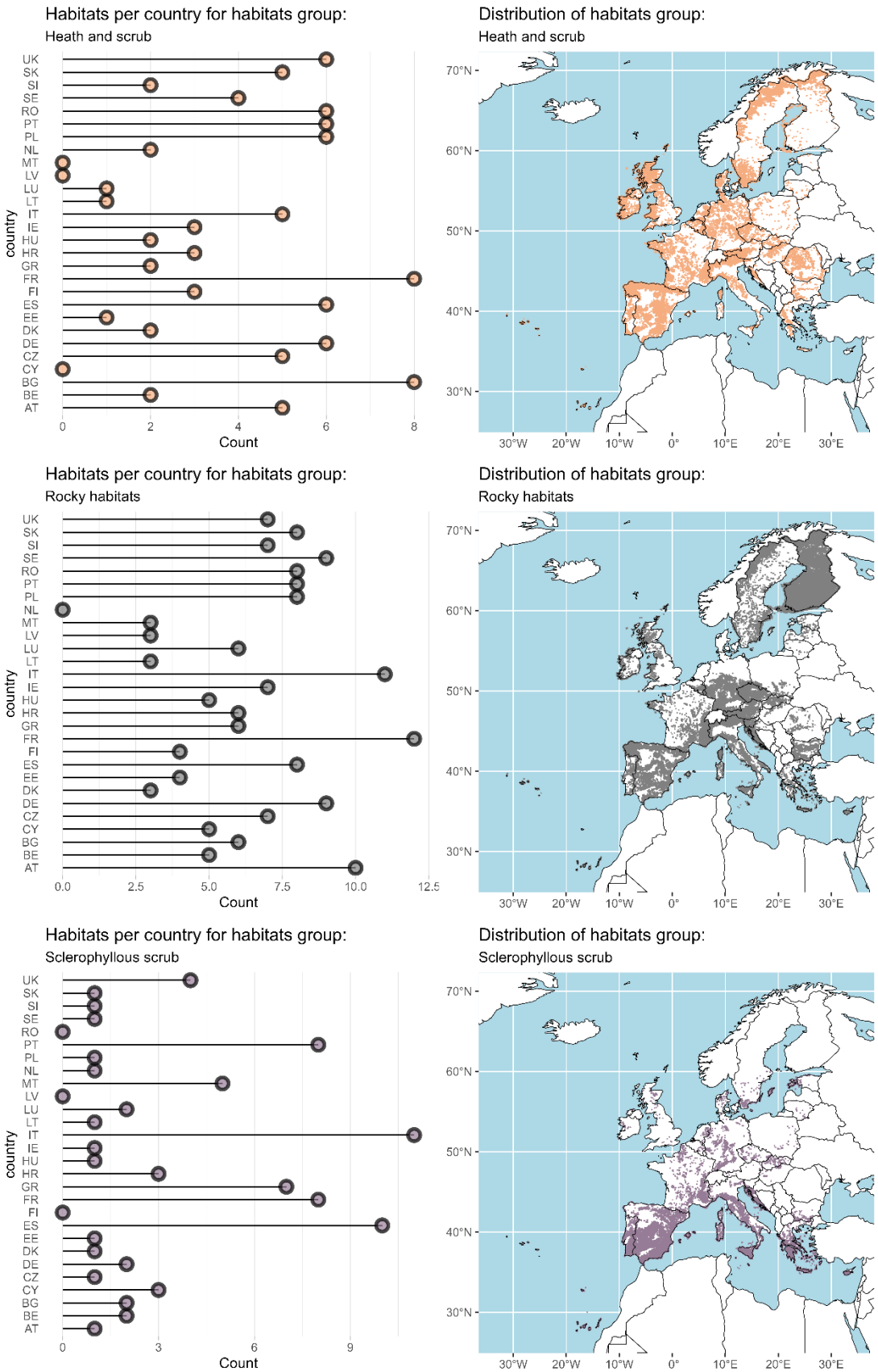
Source: this report.

Figure 27. [Part 2 of 3] Number of habitat types reported by each MS and for each habitat group (left), and spatial distribution of habitat group across the EU-28 countries (right).



Source: this report.

Figure 28. [Part 3 of 3] Number of habitat types reported by each MS and for each habitat group (left), and spatial distribution of habitat group across the EU-28 countries (right).



Source: this report.

3.4 Pressures and threats

Being the most densely populated regions globally, Europe is faced with an increasing deterioration of species and habitats due to the highly concentrated human activities affecting its natural ecosystems. In an attempt to assess this trend and identify the most critical pressures and threats, the Nature Directives require MS to report on the principal causes of species loss and habitat degradation (EEA, 2020). Within Article 17, pressures are considered to be factors that have affected habitats and species within the current reporting period, while threats are factors that are anticipated to be likely to have an impact during the subsequent two reporting periods. Note, pressures and threats are not distinguished within the reporting process; these however are given either a high importance or medium importance by MS, in terms of their impact on species and habitats. For the 2013–2018 reporting period, pressures/threats are classified into 15 Level 1 categories (Table 8) corresponding to the main sectoral driver and 203 Level 2 individual pressures/threats. For both species and habitats, the most frequently reported pressures are mainly driven by agricultural activities, forestry and urbanization, followed by exploitation of species (biological resource extraction other that agriculture and forestry) and human-induced changes in water regimes (EEA, 2020). In the following sections, we will focus on the afore-mentioned key pressures.

Table 8. List of level 1 categories for pressures and threats as described in Article 17 of the Habitats Directive.

Pressure code	Label
A	Agriculture
B	Forestry
C	Extraction of resources (minerals, peat, non-renewable energy resources)
D	Energy production processes and related infrastructure development
E	Development and operation of transport systems
F	Development, construction and use of residential, commercial, industrial and recreational infrastructure and areas
G	Extraction and cultivation of biological living resources (other than agriculture and forestry)
H	Military action, public safety measures, and other human intrusions
I	Alien and problematic species
J	Mixed source pollution
K	Human-induced changes in water regimes
L	Natural processes (excluding catastrophes and processes induced by human activity or climate change)
M	Geological events, natural catastrophes
N	Climate change
X	Unknown pressures, no pressures and pressures from outside the Member State

Source: Article 17 of the Habitats Directive.

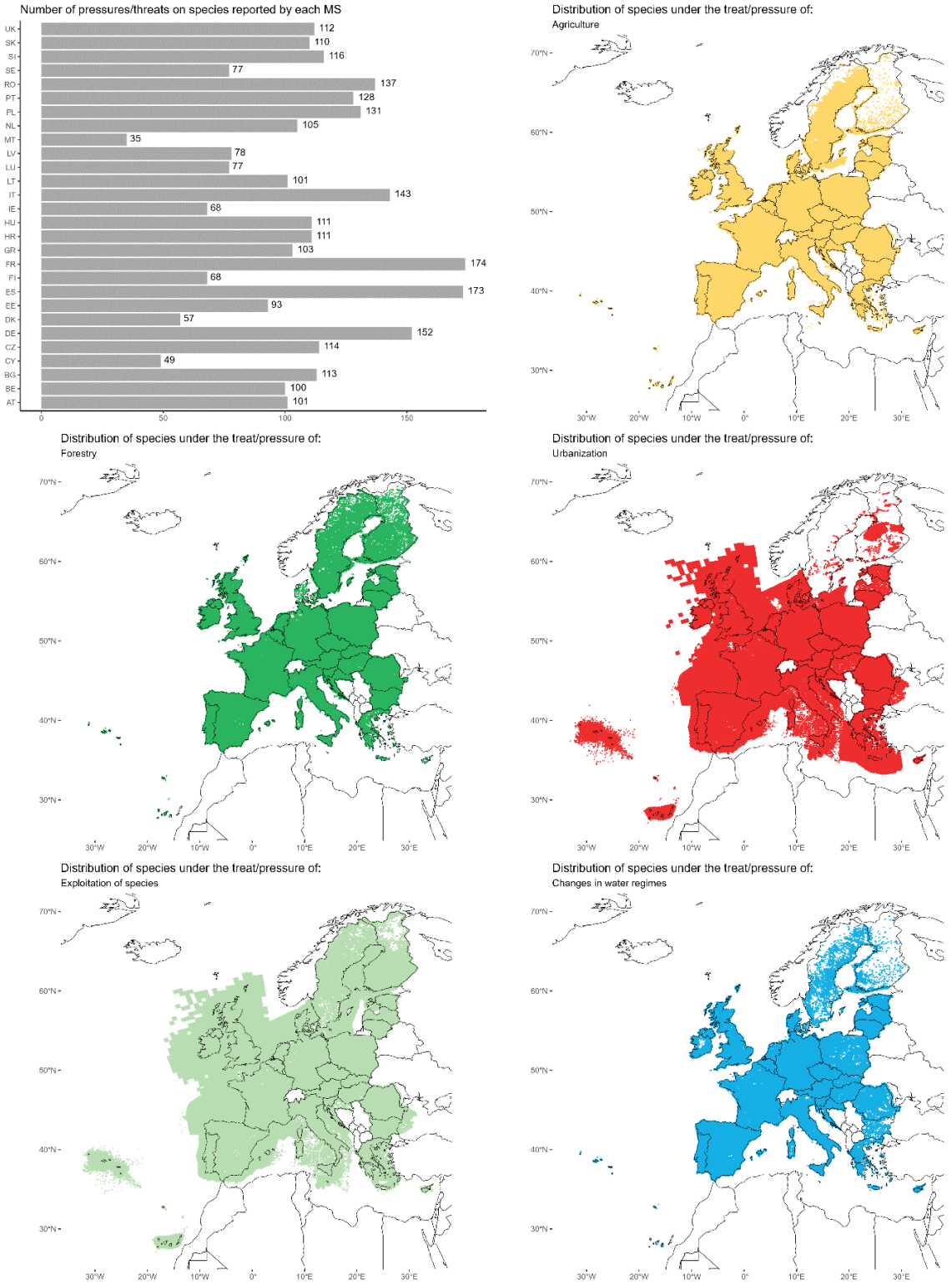
France, Spain, Denmark and Italy used the highest number of pressures/threats on species with 174, 173, 152 and 143 unique level 2 pressure codes, respectively, while Malta with 35 unique pressure codes followed by Cyprus with 49 constituted the MS with the lowest number of used pressures on species (Figure 29). Pressures related to agriculture, forestry and changes in water regimes seem to mainly impact species in the terrestrial regions while urbanization and exploitation of species seem to affect both terrestrial and marine species. Focusing on marine regions, urbanization and exploitation of species are found to be affecting species located in all marine areas i.e. the Mediterranean Sea, Macaronesia, the Atlantic Ocean, the Baltic and the Black Sea.

In general, mammals seem to be affected by most categories of pressures/threats (Figure 30). Agricultural activities are found to be the main drivers of the deterioration of multiple groups in the majority of MS, specifically of vascular plants, mammals, arthropods and amphibians, however reptiles and molluscs also seem to have been affected by agriculture. Pressures and threats driven by forestry, such as the increased extraction of forest products and intensified forestry practices have been reported as the main determinants affecting mammal species. This was the case for most MS except for Cyprus where forestry activities were not reported as pressures of any species. Other species groups affected by forestry are arthropods and vascular plants with the latter being the most affected species overall in Portugal. With urbanization including the development of residential, commercial, industrial and recreational areas across terrestrial and marine regions it is hardly surprising that it is consider the second most critical driver, after agriculture, of species in Europe. In particular, mammals and vascular plants, followed by fish are the species groups mostly affected as reported by MS. In Greece, however, fish and reptiles are the most vulnerable species when it comes to pressures from urbanization processes, such as coastline modifications, compared to the other species groups. Exploitation of species mainly refers to the activity of illegal killing and bird hunting. The United Kingdom, Portugal, the Netherlands, Luxembourg, Finland and Cyprus are among the many countries whose mammals' species group are affected by either hunting or illegal killing, while in Romania, Latvia and Lithuania, which are coastal countries, fish have been found to be mostly impacted. Lastly, for activities related to changes in the water regime, the species groups of fish, arthropods and amphibians are greatly impacted in the majority of MS, except for Portugal and Ireland, where vascular plants are the most affected species groups.

The unique pressures/threats on habitats reported by MS follow similar patterns of that on species where France, Spain, Italy and Denmark presented the highest number of pressures with 162, 141, 132 and 114 unique pressure codes, respectively (Figure 31), while Malta and Cyprus reported the lowest number on unique pressure codes on habitats (35 and 49, respectively). The abandonment of grassland management is the main agricultural activity reported as pressure to habitats leading to the general observation of grasslands being the most affected habitats in most countries (Figure 32). However, other habitat groups such as, forests, freshwater habitats, 'bogs, mires and fens', and sclerophyllous scrub seem to also be affected by agriculture. As expected, forestry activities are the main drivers among MS of the degradation of forest habitats. Urbanization processes affect various habitat groups with coastal, dune and rocky habitats being the most evident that the modification of coastline conditions aim for commercial and recreational activities. In connection with the impact of exploitation of biological resources on species, where mammals and fish are the most affected, this exploitation of species has led to the degradation of coastal, freshwater and forest habitats. Coastal and freshwater habitats are generally influenced by multiple pressures, which was also the case for changes in the water regime, where freshwater habitats and wetlands (bogs, mires and fens) were the most evident habitats to have been affected by such modifications.

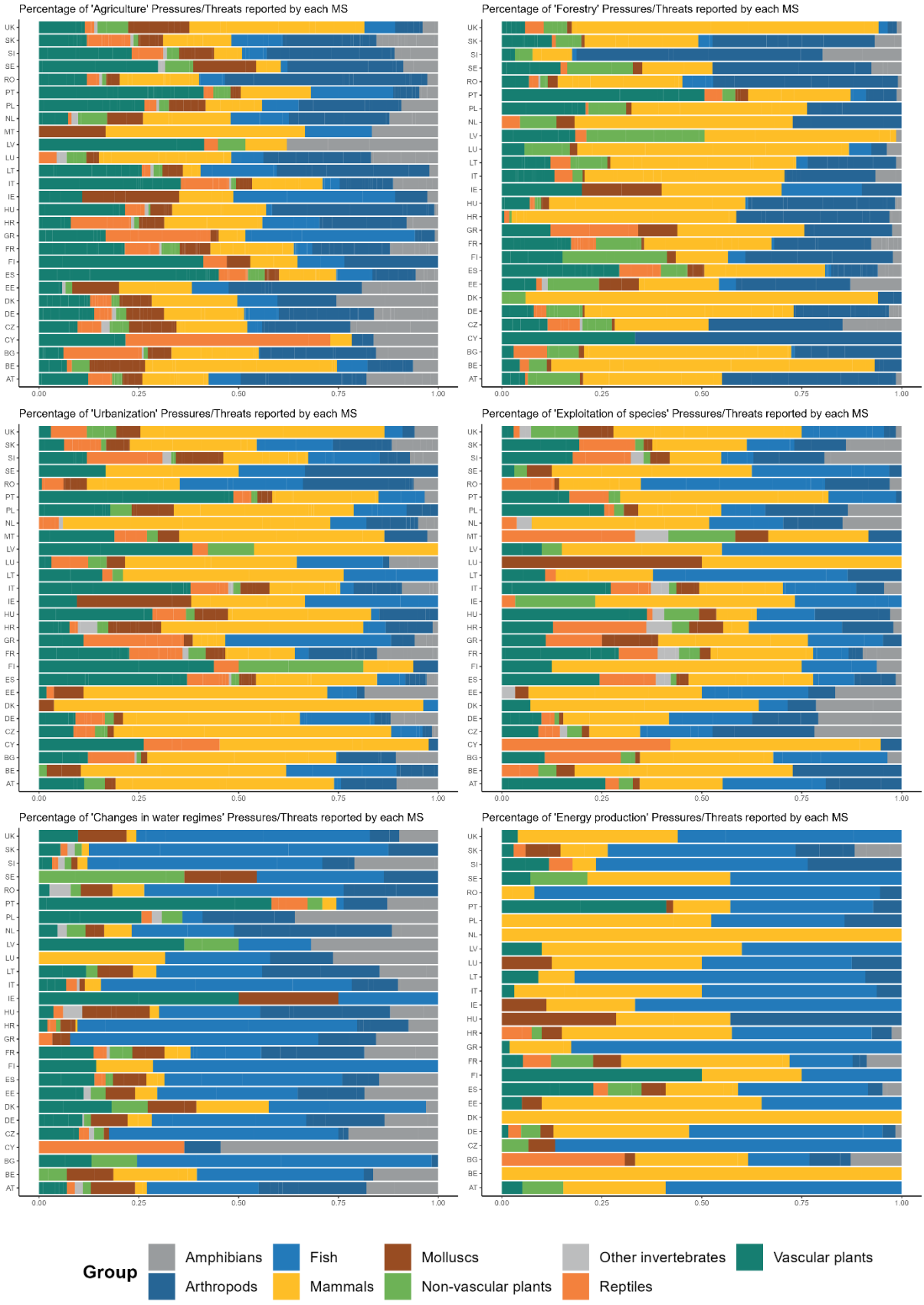
Pressures led by energy production were not found as the most critical drivers of species deterioration of habitat degradation. But with Europe producing a high amount of energy and renewable resources being a big part of this production it is expected that the pressures from energy production to species and habitats will increase. In Europe, sources of energy production mainly include coal, hydropower, gas and nuclear power. however, in the recent decades a transition towards wind and solar based energy production, led to a 34% in 2018 of total EU energy production coming from renewable energy (Frolova et al., 2019). The results showed that mammals and fish are the most affected species in Europe when it comes to energy production, while coastal, freshwater and forest ecosystems are the most affected habitats. Individual maps and graphs of pressures/threats categories not presented here are available in **Annex 3**.

Figure 29. Total number of unique pressures code reported by MS for species and spatial distribution of key pressures categories.



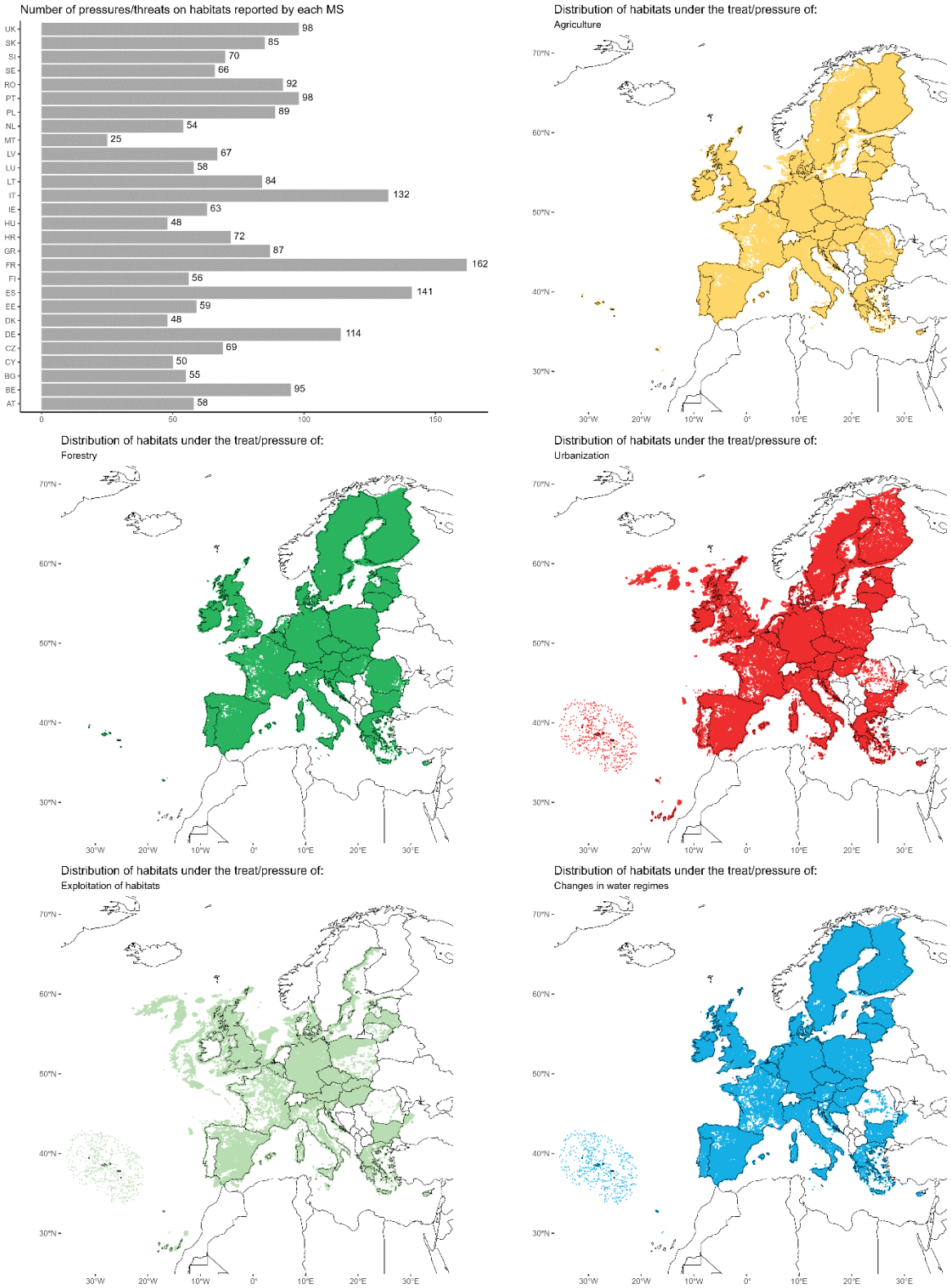
Source: this report.

Figure 30. Percentage of key pressures/threats affecting species per MS.



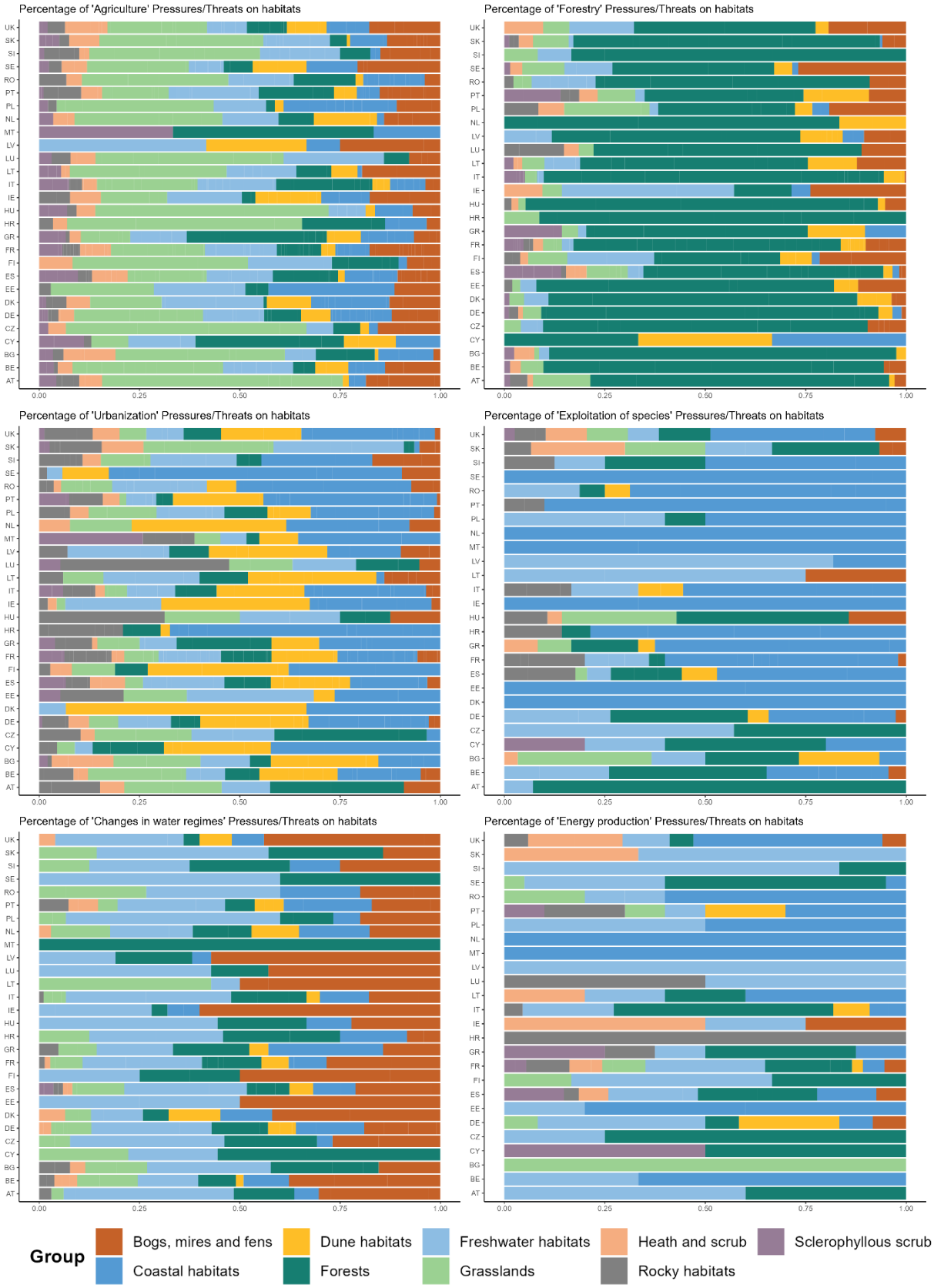
Source: this report.

Figure 31. Total number of unique pressures code reported by MS for habitats and spatial distribution of key pressures categories.



Source: this report.

Figure 32. Percentage of key pressures/threats affecting habitats per MS.



Source: this report.

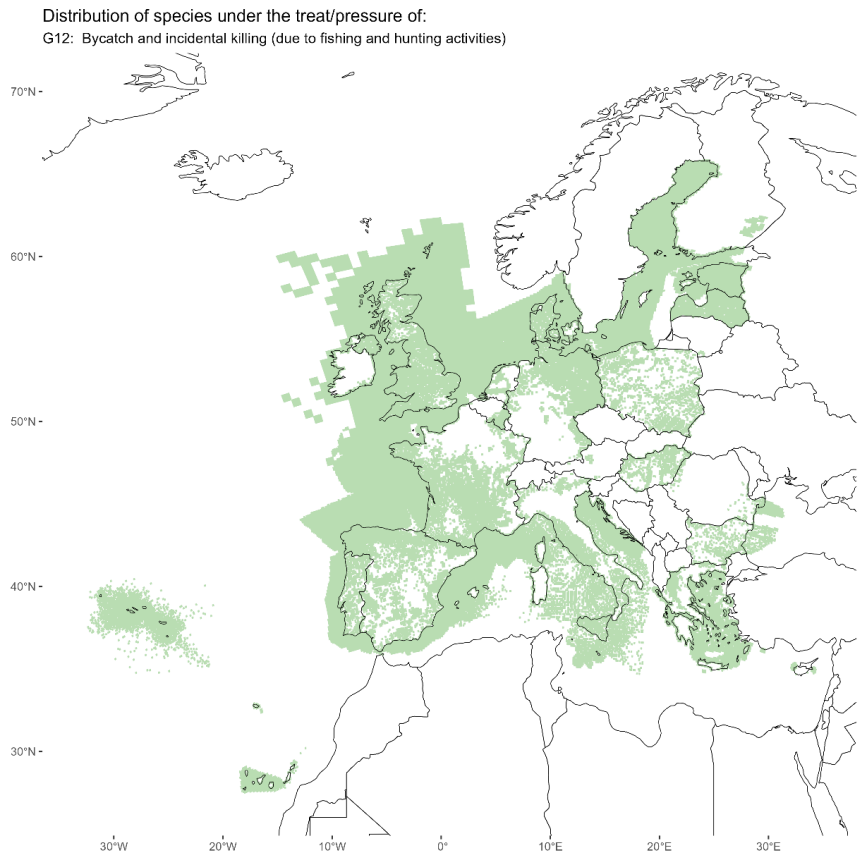
3.4.1 Query-based analysis for specific threats/pressures

The Habitats Directive data plays a fundamental role in assessing threats and pressures to species and habitats under Article 17. These data provide valuable information for understanding the conservation status of European species and habitats, identifying the main factors affecting them, and guiding conservation efforts at both MS and EU levels. By categorizing and identifying threats and pressures, conservation efforts can be better targeted and managed to mitigate the negative impacts and improve the conservation status of species and habitats. Below we present two examples of filtering the Habitats Directive data based on specific threats/pressures, which can be used for national and/or European wide policy implications.

Example 1: G12 - Bycatch and incidental killing (due to fishing and hunting activities)

Fisheries bycatch is widely recognized as the primary conservation threat to marine mammals (Luck et al., 2020). Over the past three decades, there has been considerable progress in developing conservation strategies to mitigate the threat of bycatch, notably under the Common Fisheries Policy and the Marine Strategy Framework Directive. However, despite protection for priority species under the Habitats Directive, the EU has failed to adequately assess and, where necessary, mitigate the bycatch of, for example, small cetaceans (Rogan et al., 2021). Incidental hunting can also occur during hunting activities affecting both terrestrial and marine species. According to the data reported by 24 countries, bycatch and incidental killing poses a threat and/or pressure to 77 species distributed across Europe (Figure 33, Figure 34 and Table 9).

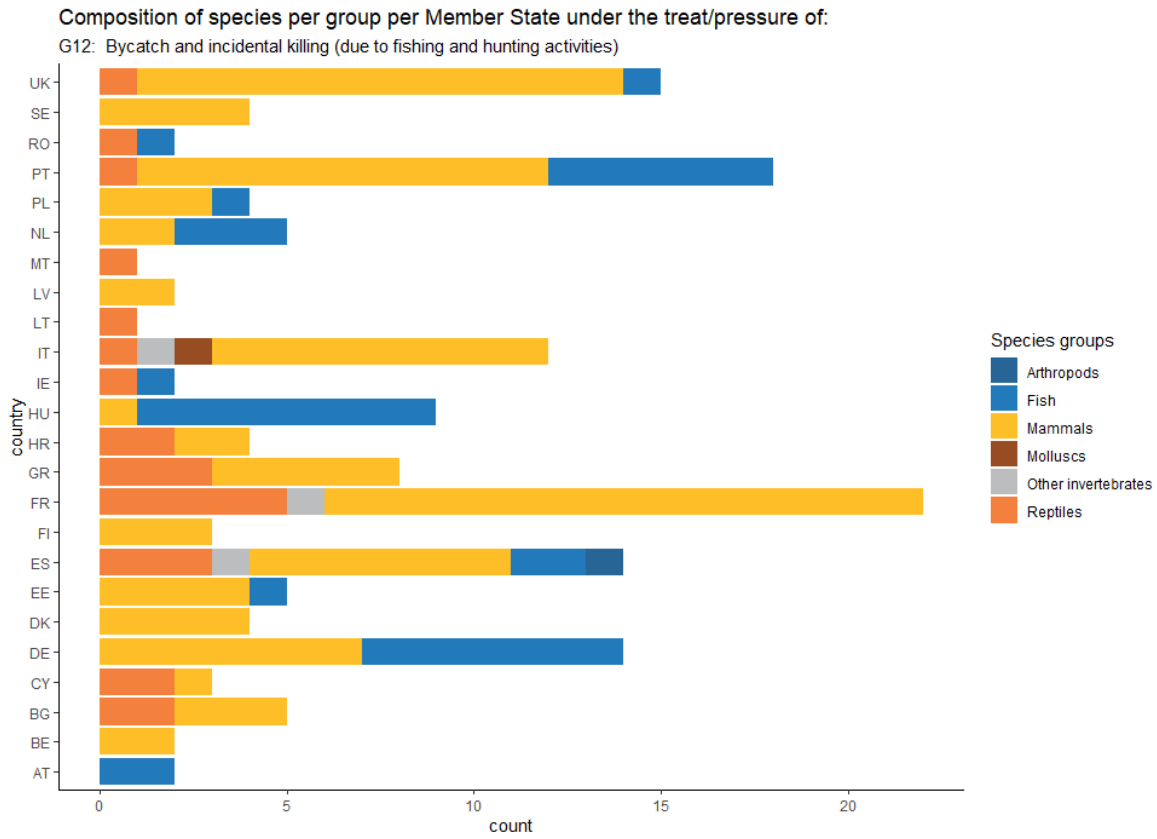
Figure 33. Distribution of habitats under the threat/pressure of "Bycatch and incidental killing (due to fishing and hunting activities)" (pressurecode: G12) in Europe.



Source: this report.

Countries located in Western Europe (France, Portugal and Spain), and Central Northern Europe (the UK and Germany) have a higher number of reported species under the threat of bycatch the majority of which are mammals followed by fish species and reptiles (Figure 34). For Hungary, the most threatened species are fish, in particular riverine fish species, such as *Hucho hucho* (1105), *Aspius aspius* (1130), *Gymnocephalus schraetzer* (1157), while Germany has both marine and freshwater fish species threatened by incidental killing (Table 9).

Figure 34. Species groups under the threat/pressure of "Bycatch and incidental killing (due to fishing and hunting activities)" (pressurecode: G12) per MS.



Source: this report.

Table 9. Species under the threat/pressure of "Bycatch and incidental killing (due to fishing and hunting activities)" (pressurecode: G12) per group and per MS.

Country	Species group	Species code[1]	Count[2]
AT	Fish	5289, 6146	2
BE	Mammals	1337, 1355	2
BG	Mammals	1349, 1350, 1351	3
	Reptiles	1220, 2373	2
CY	Mammals	1349	1
	Reptiles	1224, 1227	2
DE	Fish	1095, 1099, 1101, 1102, 1103, 2492, 5042	7
	Mammals	1337, 1351, 1352, 1355, 1363, 1364, 1365	7

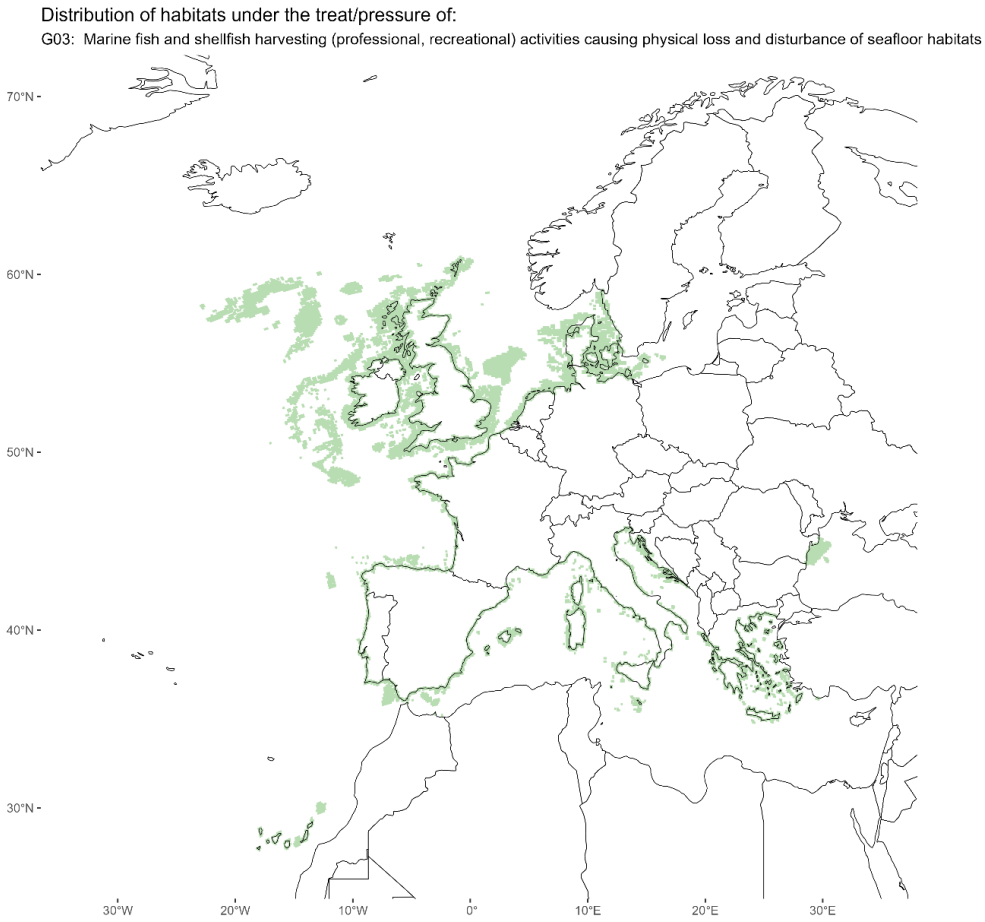
Country	Species group	Species code[1]	Count[2]
DK	Mammals	1337, 1351, 1355, 1364	4
EE	Fish	1130	1
	Mammals	1354, 1355, 1364, 6307	4
ES	Arthropods	1090	1
	Fish	1102, 1103	2
	Mammals	1349, 1351, 1352, 1354, 1355, 1362, 1363	7
	Other invertebrates	1001	1
	Reptiles	1223, 1224, 1227	3
FI	Mammals	1364, 6306, 6307	3
FR	Mammals	1337, 1349, 1350, 1351, 1354, 1355, 1356, 1364, 1365, 2027, 2029, 2030, 2032, 2034, 2618, 2621	16
	Other invertebrates	1008	1
	Reptiles	1220, 1221, 1223, 1224, 1227	5
GR	Mammals	1349, 1350, 1351, 1354, 2030	5
	Reptiles	1223, 1224, 1227	3
HR	Mammals	1349, 2034	2
	Reptiles	1224, 2373	2
HU	Fish	1105, 1130, 1157, 1159, 2522, 2555, 5085, 5345	8
	Mammals	1363	1
IE	Fish	1103	1
	Reptiles	1223	1
IT	Mammals	1344, 1349, 1350, 1354, 2029, 2030, 2034, 2035, 2624	9
	Molluscs	1026	1
	Other invertebrates	1008	1
	Reptiles	1224	1
LT	Reptiles	1220	1
LV	Mammals	1354, 1355	2
MT	Reptiles	1224	1
NL	Fish	1103, 1106, 1113	3
	Mammals	1364, 1365	2
PL	Fish	2522	1
	Mammals	1351, 1355, 1364	3
PT	Fish	1102, 1103, 1106, 5281, 5302, 5303	6
	Mammals	1349, 1350, 1351, 1366, 2029, 2030, 2034, 2035, 2618, 2621, 2628	11
	Reptiles	1224	1
RO	Fish	2489	1
	Reptiles	1220	1
SE	Mammals	1351, 1364, 1365, 6307	4
UK	Fish	5076	1
	Mammals	1349, 1350, 1351, 1355, 1363, 1364, 2027, 2029, 2030, 2031, 2032, 2034, 2618	13
	Reptiles	1224	1

[1] 77 unique species
[2] the "count" column refers to the number of unique species code. *1001: Corallium rubrum, 1008: Centrostephanus longispinus, 1026: Helix pomatia, 1090: Scyllarides latus, 1095: Petromyzon marinus, 1099: Lampetra fluviatilis, 1101: Acipenser sturio, 1102: Alosa alosa, 1103: Alosa fallax, 1105: Hucho hucho, 1106: Salmo salar, 1113: Coregonus oxyrhynchus, 1130: Aspius aspius, 1157: Gymnocephalus schraetzer, 1159: Zingel zingel, 220: Emys orbicularis, 1221: Mauremys leprosa, 1223: Dermochelys coriacea, 1224: Caretta caretta, 1227: Chelonia mydas, 1337: Castor fiber, 1344: Hystrix cristata, 1349: Tursiops truncatus, 1350: Delphinus delphis, 1351: Phocoena phocoena, 1352: Canis lupus, 1354: Ursus arctos, 1355: Lutra lutra, 1356: Mustela lutreola, 1362: Lynx pardinus, 1363: Felis silvestris, 1364: Halichoerus grypus, 1365: Phoca vitulina, 1366: Monachus monachus, 2027: Orcinus orca, 2029: Globicephala melas, 2030: Grampus griseus, 2031: Lagenorhynchus acutus, 2032: Lagenorhynchus albirostris, 2034: Stenella coeruleoalba, 2035: Ziphius cavirostris, 2373: Mauremys rivulata, 2489: Huso huso, 2492: Coregonus albula, 2522: Pelecus cultratus, 2555: Gymnocephalus baloni, 2618: Balaenoptera acutorostrata, 2621: Balaenoptera physalus, 2624: Physeter macrocephalus, 2628: Stenella frontalis, 5042: Acipenser oxyrinchus, 5076: Coregonus pollan, 5085: Barbus barbus, 5281: Luciobarbus bocagei, 5289: Alburnus mento, 5302: Cobitis paludica, 5303: Cobitis calderoni, 5345: Rutilus virgo, 6146: Rutilus meidingeri, 6306: Pusa hispida saimensis, 6307: Pusa hispida botnica.*
Source: this report.

Example 2: G03 - Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats

Fish and shellfish harvesting activities such as bottom trawling is the most widespread human activity affecting seabed habitats (Hiddink et al., 2017). The growing adoption of ecosystem-based fisheries management has led to increased requests for guidance on the sustainable management of bottom-contact gears. To develop such guidance, knowledge about the distribution and various types of bottom fishing activity and the affected habitats is essential (Sciberras et al., 2018). For the latter, data reported under Article 17 of the Habitats Directive can serve as a valuable resource for assessing the effects of seabed disturbance or destruction on seafloor habitats. Such information aids in the decision-making process, enabling more efficient and sustainable management of habitats. In Europe, as expected, coastal habitats (such as *Posidonion oceanicae* and *Spartinion maritimae*), and rocky habitats (submerged sea caves) encounter fish and shellfish harvesting (Figure 35 & 36, and Table 10). In total, 11 habitats are reported as affected by this specific threat/pressure, with Portugal, France and Spain reporting 7 unique habitats, followed by Romania, Greece and the UK with 6 reported unique habitats.

Figure 35. Distribution of habitats under the threat/pressure of "*Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats*" (pressurecode: G03) in the EU.



Source: this report.

Table 10. Habitats under the threat/pressure of "Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats" (pressurecode: G03) per group and per MS.

Country	Habitats group	Habitat code[1]	Count[2]
BE	Coastal habitats	1140	1
DE	Coastal habitats	1110, 1140, 1160, 1170	4
DK	Coastal habitats	1110, 1160, 1170	3
ES	Coastal habitats	1110, 1120, 1170, 1180, 1210, 1310, 1320	7
FR	Coastal habitats	1110, 1120, 1140, 1160, 1170, 1180	6
	Rocky habitats	8330	1
GR	Coastal habitats	1110, 1120, 1130, 1150, 1160, 1170	6
HR	Coastal habitats	1110, 1120, 1170	3
	Rocky habitats	8330	1
IE	Coastal habitats	1170	1
IT	Coastal habitats	1110, 1120, 1140, 1150, 1170	5
MT	Coastal habitats	1120, 1170	2
NL	Coastal habitats	1110, 1140, 1170	3

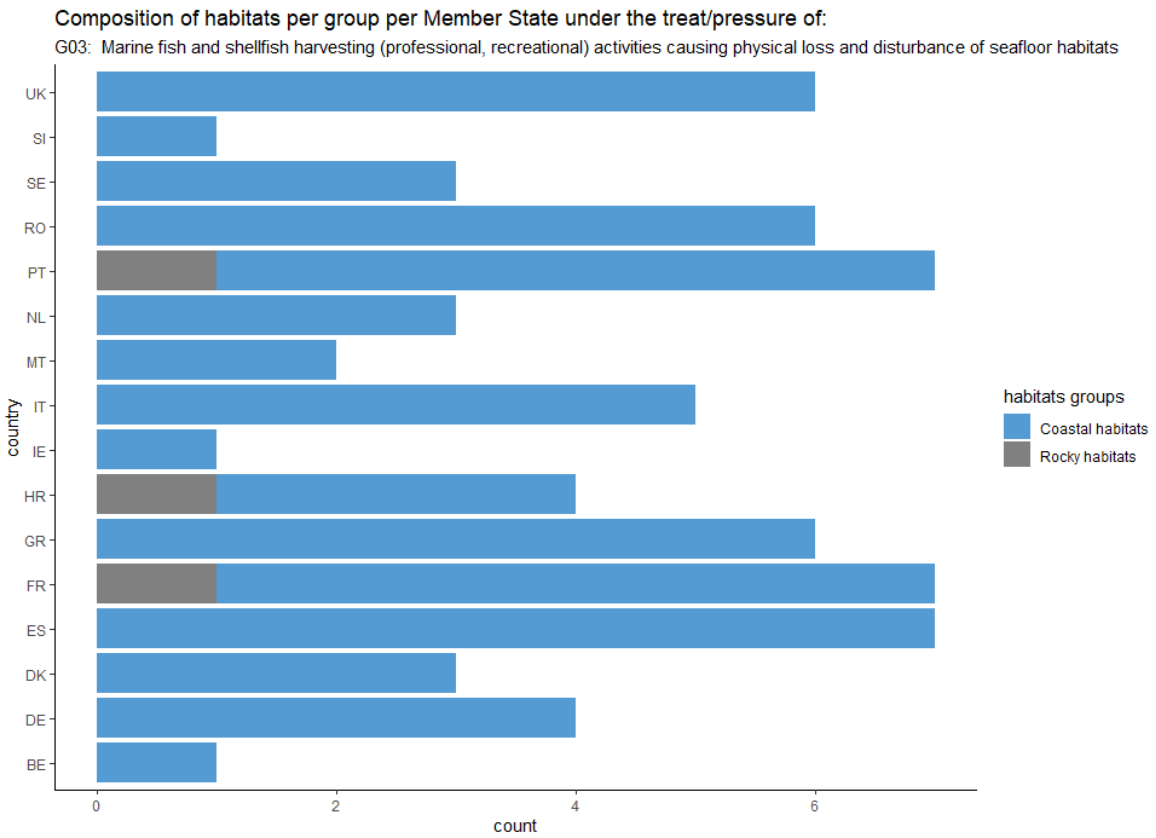
PT	Coastal habitats	1110, 1130, 1140, 1160, 1310, 1320	6
	Rocky habitats	8330	1
RO	Coastal habitats	1110, 1130, 1140, 1160, 1170, 1180	6
SE	Coastal habitats	1110, 1170, 1180	3
SI	Coastal habitats	1120	1
UK	Coastal habitats	1110, 1130, 1140, 1160, 1170, 1180	6

[1] 11 unique habitats

[2] *the "count" column refers to the number of unique habitats code. 1110: Sandbanks which are slightly covered by sea water all the time, 1120: Posidonia beds (Posidonion oceanicae), 1130: Estuaries, 1140: Mudflats and sandflats not covered by seawater at low tide, 1150: Coastal lagoons, 1160: Large shallow inlets and bays, 1170: Reefs, 1180: Submarine structures made by leaking gases, 1210: Annual vegetation of drift lines, 1310: Salicornia and other annuals colonizing mud and sand, 1320: Spartina swards (Spartinion maritimae), 8330: Submerged or partially submerged sea caves.*

Source: this report.

Figure 36. Habitats groups under the threat/pressure of "*Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats*" (pressurecode: G03) per MS.



Source: this report.

4 Discussion

Under Article 17 of the Habitats Directive (Directive 92/43/EEC), both the MS and the EU have specific roles and responsibilities in providing information on the status and trends of species and habitats. Each Member State is responsible for monitoring the conservation status of species and habitats within its territory by conducting regular assessments and providing comprehensive reports. This includes collecting relevant data on the conservation status of species and habitats through surveys, scientific research, and monitoring programs, as well as implementing measures to ensure their protection. While there is a common framework that provides guidelines and standards for data collection, assessment, and reporting on the conservation status of species and habitats, MS have developed different monitoring programs or adapted previously existing monitoring schemes adapted to their national needs and priorities (Ellwanger et al., 2018). This plurality in approaches leads to a plurality in the data reported for these MS, generating a complex landscape of data which is not always self-explanatory or easy to navigate. Hence, this report emerged as a need to generate an overview of the different data and data types, to facilitate the use of these datasets. Such an overview could be used as guidance that may facilitate comparison among the different countries. Besides the data use by the community of research and practice, such an overview could serve for the update of the present Article 17 reporting guidance, and the consequent EU coordination efforts (such as the proposed EU Biodiversity Observation Coordination Centre). Given the timing of this and the novel Nature Restoration Regulation, such an overview could also serve as eventual guidance for the reporting, the satisfactory levels and concervation status of biodiversity across the EU MS.

In the sub-sections below we highlight the main attributes which require consideration when these datasets are used.

a. Spatial data

Under the assessment of spatial data, the data completeness and consistency across MS was assessed. **Data on the spatial distribution for species and habitats was heterogeneous across countries**. For some of the species and habitats such information is not ubiquitous There is no clear pattern on where this data is available or not throughout Europe, indicating that such inconsistencies might be more an issue of reporting rather than a matter of publishing and sharing sensitive information. For instance, the cases for some endangered marine species, such as the loggerhead sea turtle (*Caretta caretta*) and the monk seal (*Monachus monachus*). For the loggerhead sea turtle we detected a fairly good match between the tabular and spatial data, while for monk seal, although known to be found in the Mediterranean Sea according to the tabular data, spatial information was provided only for Portugal. Challenges in data collection processes, data availability and accessibility, lack of specialized expertise, technological limitations in data processing infrastructure, and administrative procedures involved in data compilation, report preparation, and submission (Liquete et al., 2024) could be possible reasons behind the mismatches between the tabular and spatial data. These reasons can be complex and time- and resource-consuming. Regardless of the reasons, MS make reasonable efforts to fulfil their obligations under the Habitats Directive, as the EU collects and compiles information from the national reports to produce a consolidated report on the state of Europe's biodiversity. However, a systematic and consistent approach across MS in reporting all relevant information is crucial for quality assurance, especially when used for the development and implementation of policies and measures to enhance the conservation of species and habitats.

b. Data completeness

To ensure comprehensiveness, the European Commission provides guidelines and templates to assist MS in the reporting process and maintain consistency in data collection and reporting across the EU. MS have the flexibility to adapt their reporting processes to fit their specific national circumstances while meeting the requirements outlined in the Habitats Directive. However, the extensive amount of information that MS are required to report has resulted in **many data types having limited completeness throughout Europe**. For instance, "population size" of species and "coverage surface area" of habitats is among the less reported fields in the habitats directive datasets at the EU (see section 3.2) and national level (ETC/BD, 2019). In addition, with several sections and data-fields that must be filled, the optional fields are less than 10% completed (see "Reporting Format Art. 17" of the 'Article 17 reference portal'[5]). The absence of data and unknown information, which is often excluded in European or national statistics, can lead to underestimation or overestimation of the status, condition, and trends of specific species and habitats (ETC/BD, 2020; Röschel et al., 2021). Furthermore, MS are scored based on the quality and completeness of their data, with less than half receiving a very good score. On one hand, MS are obligated to report all required information in a robust, comprehensive, and consistent manner to assess the condition and status of species and habitats. On the other hand, the European Commission must ensure that the guidelines, framework, and options provided (such as look-up tables) are relevant to the diverse conditions across MS.

c. Reporting units

In terms of specific parameters that need to be recorded, aside from population size and surface area, the reporting units and methods are crucial for comparing the conservation status and trends of species and habitats among MS. Regarding the **reporting units for population size**, the EU provides 21 different options within the look-up tables, but only nine of them are used by MS. While the EU recommends using a unit representing the number of individuals as the most appropriate for reporting population size, the majority of MS still utilize another unit for specific species that refers to an estimate based on 1 by 1 km sampling areas. Moreover, there are cases where different population units appear to be region- or country-specific, leading to further inconsistencies. For example, Greece exclusively uses the unit of 5 by 5 km sampling areas for several species, and the unit of 10 by 10 km sampling areas is solely employed in the Mediterranean region. These issues underscore the importance of a consistent and standardized approach to reporting and monitoring spatially biodiversity under the Habitats Directive.

d. Assessment methods for monitoring

The same issue arises with the estimation/assessment method for multiple parameters (e.g. "population size" for species, "coverage surface area" for habitat types and "range trend" for both species and habitats), where a comprehensive survey for collecting species and habitat data was often not implemented. The results indicate that most MS have based their estimations on **spatial interpolation of limited data** rather than relying on expert opinion or conducting a complete survey, which would provide a statistically robust estimate (see section 3.2.1). Part of this finding could be due to the different methods and data required to derive species distribution and habitat maps. For example, in France, the species' population size was derived from a mix of different

[5] Reference portal for reporting under Article 17 of the Habitats Directive. https://cdr.eionet.europa.eu/help/habitats_art17

methods, while the habitats' surface area was mainly based on expert opinion. This raises questions about the appropriateness of decisions made and policies developed thus far, given that the majority of species and habitats listed in Article 17 are still in poor condition (EEA, 2020).

e. Comparisons across marine and terrestrial habitats

During the handling and analysis of the Article 17 dataset, both tabular and spatial, **the distinction between terrestrial and marine species and habitats was not particularly evident**. In an attempt to identify the differences between the spatial distribution of terrestrial and marine species, we created two subsets where one represented data reported for the terrestrial biogeographical regions and one on the marine biogeographical regions. The terrestrial data on species accounted for the 96% of reported species under Article 17 of the Habitats directive with 63% of the reported terrestrial species consisting of vascular plants, mammals and arthropods, while marine mammals represented 67% of the reported marine species. Forests, grasslands, freshwater habitats and dunes accounted for the 63% of terrestrial habitats (representing 95% of the total reported habitats), while coastal habitats covered the majority (~90%) of the marine habitat. The proportion of marine species and habitats (4% and 5%, respectively) over the total reported data highlights the lack of marine data information at the EU and national level. This data gap could lead to insufficient conservation efforts to marine biodiversity that is continuously degraded (Aminian-Biquet et al., 2025). For example, with the majority of mammals covering most of the reported marine species, and the worrying fact that marine mammals are among those species with the highest proportion of unknown conservation status (EEA, 2020), lack of appropriate reporting could result in insufficient monitoring and conservation measures.

5 Main conclusions

Accurate and comprehensive spatial data remains fragmented across the EU, making it difficult to identify conservation priorities and track progress effectively. The analysis of Article 17 reporting data performed within this report, highlights the need for a more systematic and consistent approach to biodiversity monitoring and reporting across Member States in the EU. Significant inconsistencies in data completeness and quality across MS pose challenges for comparing the conservation status of species and habitats. This includes the provision of accurate spatial information, comprehensive data collection methods, as well as standardized reporting units. This kind of information may be already available at the national level but does not emerge directly from the official Article 17 reported information. In particular, the lack of standardization in reporting units and assessment methods, such as differing population size units and estimation techniques, can complicate cross-country comparisons and could potentially undermine the effectiveness of conservation efforts. Furthermore, a holistic and standardized approach to data collection and reporting is essential to strengthen biodiversity conservation efforts and guide the development of policies that will protect species and habitats across the EU. These data gaps and inconsistencies highlight the need for coordinated efforts to ensure the accurate reporting of both terrestrial and marine biodiversity, aligning with the objectives of the EU Biodiversity Strategy for 2030, Nature Restoration Law, and other Global initiatives, such as the Kunming-Montreal Global Biodiversity Framework.

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List of abbreviations and definitions

Abbreviations	Definitions
EC	European Commission
EEA	European Environment Agency
ETC/BD	European Topic Centre on Biological Diversity
EU	European Union
MS	Member State(s)

List of boxes

Box 1. Spatial distribution of species' and habitats' conservation status at MS level. 8

List of figures

Figure 1. Differences in the level of information provided at the EU level and MS level for the species "Canis lupus" 11

Figure 2. Differences in the level of information provided at the EU level (data classified per bioregion) and MS level (data classified per country) for the habitat "*Coastal lagoons*" 12

Figure 3. Geographic coverage of spatially explicit biodiversity data of Article 17 under the Habitats Directive 92/43/EEC reporting for the period 2013-2018. 15

Figure 4. Terrestrial and marine biogeographical regions that are covered by the Article 17 reporting. 16

Figure 5. Comparison between the reported species per MS in the tabular and database and the spatial data. 18

Figure 6. Examples of matches and mismatches between the tabular dataset and the spatial data of the Article 17 2013-2018 reporting for species. 19

Figure 7. Number of records for habitats reported in the tabular database but not included in the spatial data per MS. 20

Figure 8. Examples of matches and mismatches between the tabular dataset and the spatial data of the Article 17 2013-2018 reporting for habitats. 21

Figure 9. Reporting method for defining the population size of species per MS. 25

Figure 10. Reporting method for defining the surface area of habitats size per MS. 25

Figure 11. Completeness of data related to species population and habitats coverage within the Article 17 database. 28

Figure 12. Completeness of data related to species and habitats within Natura 2000 Protected Areas. 29

Figure 13. Number and distribution of species reported using the 'grid1x1', and 'individuals' population units. 30

Figure 14. Number and distribution of species reported using the 'grid2x2', 'grid5x5' and 'grid10x10' population units. 31

Figure 15. Number and distribution of species reported using the 'adults', 'area' and 'localities' population units. 32

Figure 16. Number and distribution of species reported using the 'grid2x2', 'grid2x2' and 'colonies' population units. 33

Figure 17. Number of reported species and composition of species groups per MS. 34

Figure 18. Number of reported species and composition of species groups per MS in terrestrial & marine regions. 35

Figure 19. Percentage of methods used for species distribution maps per MS 36

Figure 20. [Part 1 of 3] Number of species reported by each MS and for each species group (left), and spatial distribution of species group across the EU-28 countries (right). 37

Figure 21. [Part 2 of 3] Number of species reported by each MS and for each species group (left), and spatial distribution of species group across the EU-28 countries (right). 38

Figure 22. [Part 3 of 3] Number of species reported by each MS and for each species group (left), and spatial distribution of species group across the EU-28 countries (right). 39

Figure 23. Number of reported habitats and composition of habitats groups per MS. 40

Figure 24. Number of reported species and composition of habitats groups per MS in terrestrial & marine regions. 41

Figure 25. Percentage of methods used for habitats distribution maps per MS 42

Figure 26. [Part 1 of 3] Number of habitat types reported by each MS and for each habitat group (left), and spatial distribution of habitat group across the EU-28 countries (right). 43

Figure 27. [Part 2 of 3] Number of habitat types reported by each MS and for each habitat group (left), and spatial distribution of habitat group across the EU-28 countries (right). 44

Figure 28. [Part 3 of 3] Number of habitat types reported by each MS and for each habitat group (left), and spatial distribution of habitat group across the EU-28 countries (right). 45

Figure 29. Total number of unique pressures code reported by MS for species and spatial distribution of key pressures categories. 48

Figure 30. Percentage of key pressures/threats affecting species per MS. 49

Figure 31. Total number of unique pressures code reported by MS for habitats and spatial distribution of key pressures categories. 50

Figure 32. Percentage of key pressures/threats affecting habitats per MS. 51

Figure 33. Distribution of habitats under the threat/pressure of "Bycatch and incidental killing (due to fishing and hunting activities)" (pressurecode: G12) in Europe. 52

Figure 34. Species groups under the threat/pressure of "Bycatch and incidental killing (due to fishing and hunting activities)" (pressurecode: G12) per MS. 53

Figure 35. Distribution of habitats under the threat/pressure of "*Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats*" (pressurecode: G03) in the EU. 56

Figure 36. Habitats groups under the threat/pressure of "*Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats*" (pressurecode: G03) per MS. 57

Figure A1. Pressures on species. 79

Figure A1. Pressures on species (continued). 80

Figure A1. Pressures on species (continued). 81

Figure A2. Pressures on habitats. 81

Figure A2. Pressures on habitats (continued). 82

Figure A3. Percentage of pressures reported by each MS for species 83

Figure A3. Percentage of pressures reported by each MS for species (continued). 84

Figure A4. Percentage of pressures reported by each MS for habitats 85

Figure A4. Percentage of pressures reported by each MS for habitats (continued) 86

List of tables

Table 1. List of tables and reference information in the Microsoft access dataset of Article 17. 13

Table 2. Available options for each information variable that MS are required to report under the Habitats Directive. 21

Table 3. List of data fields that require from Member State to report the specific method used for an estimate or value. 24

Table 4. Completeness of various data fields from the reporting of species. 26

Table 5. Completeness of various data fields from the reporting of habitats. 27

Table 6. Overall percentage of methods used for species' distribution maps. 36

Table 7. Overall percentage of methods used for habitats' distribution maps. 42

Table 8. List of level 1 categories for pressures and threats as described in Article 17 of the Habitats Directive. 46

Table 9. Species under the threat/pressure of "Bycatch and incidental killing (due to fishing and hunting activities)" (pressurecode: G12) per group and per MS. 53

Table 10. Habitats under the threat/pressure of "Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats" (pressurecode: G03) per group and per MS. 56

Table A1. List of main conservation measures under the Article 17 of the Habitats Directive (ref_measures). 70

Table A2. List of pressures and threats under the Article 17 of the Habitats Directive (ref_threatsPressures). 73

Annexes

Annex 1. Level 1 and Level 2 categories of conservation measures under Article 17 of the Habitats Directive.

Table A1. List of main conservation measures under the Article 17 of the Habitats Directive (ref_measures).

code	label
CA	**Measures related to agriculture and agriculture-related habitats**
CA01	Prevent conversion of natural and semi-natural habitats, and habitats of species into agricultural land
CA02	Restore small landscape features on agricultural land
CA03	Maintain existing extensive agricultural practices and agricultural landscape features
CA04	Reinstate appropriate agricultural practices to address abandonment, including mowing, grazing, burning or equivalent measures
CA05	Adapt mowing, grazing and other equivalent agricultural activities
CA06	Stop mowing, grazing and other equivalent agricultural activities
CA07	Recreate Annex I agricultural habitats
CA08	Adapt soil management practices in agriculture
CA09	Manage the use of natural fertilisers and chemicals in agricultural (plant and animal) production
CA10	Reduce/eliminate point pollution to surface or ground waters from agricultural activities
CA11	Reduce diffuse pollution to surface or ground waters from agricultural activities
CA12	Reduce/eliminate air pollution from agricultural activities
CA13	Reduce/eliminate marine pollution from agricultural activities
CA14	Reduce/eliminate soil pollution from agricultural activities
CA15	Manage drainage and irrigation operations and infrastructures in agriculture
CA16	Other measures related to agricultural practices
CB	**Measures related to forestry and forest-related habitats**
CB01	Prevent conversion of (semi-) natural habitats into forests and of (semi-)natural forests into intensive forest plantation
CB02	Maintain existing traditional forest management and exploitation practices
CB03	Reinstate forest management and exploitation practices
CB04	Adapt/manage reforestation and forest regeneration
CB05	Adapt/change forest management and exploitation practices
CB06	Stop forest management and exploitation practices
CB07	Combat illegal logging
CB08	Restoration of Annex I forest habitats
CB09	Manage the use of chemicals for fertilisation, liming and pest control in forestry
CB10	Reduce diffuse pollution to surface or ground waters from forestry activities
CB11	Reduce air pollution from forestry activities
CB12	Reduce marine pollution from forestry activities
CB13	Reduce soil pollution from forestry activities
CB14	Manage drainage and irrigation operations and infrastructures
CB15	Other measures related to forestry practices
CC	**Measures related to resources extraction and energy production**
CC01	Adapt/manage extraction of non-energy resources
CC02	Adapt/manage exploitation of energy resources

code	label
CC03	Adapt/manage renewable energy installation, facilities and operation
CC04	Reduce impact of hydropower operation and infrastructure
CC05	Adapt/manage fossil energy installation, facilities and operation
CC06	Reduce impact of service corridors and networks
CC07	Habitat restoration/creation from resources, exploitation areas or areas damaged due to installation of renewable energy infrastructure
CC08	Manage/reduce/eliminate point pollution to surface or ground waters from resource exploitation and energy production
CC09	Manage/reduce/eliminate diffuse pollution to surface or ground waters from resource exploitation and energy production
CC10	Manage/reduce/eliminate air pollution from resource exploitation and energy production
CC11	Manage/reduce/eliminate marine pollution from resource exploitation and energy production
CC12	Reduce/eliminate noise, light, thermal and other forms of pollution related to resource exploitation and energy production
CC13	Manage water abstraction for resource extraction and energy production
CC14	Other measures related to extraction and energy exploitation activities
CE	**Measures related to development and operation of transport systems**
CE01	Reduce impact of transport operation and infrastructure
CE02	Manage/reduce/eliminate pollution to surface or ground water from transport
CE03	Manage/reduce/eliminate air pollution from transport
CE04	Manage/reduce/eliminate marine pollution from transport
CE05	Manage/reduce/eliminate noise, light and other forms of pollution from transport
CE06	Habitat restoration of areas impacted by transport
CE07	Other measures related to transport
CF	**Measures related to residential, commercial, industrial and recreational infrastructures, operations and activities**
CF01	Manage conversion of land for construction and development of infrastructure
CF02	Habitat restoration of areas impacted by residential, commercial, industrial and recreational infrastructure, operations and activities
CF03	Reduce impact of outdoor sports, leisure and recreational activities
CF04	Reduce/eliminate point source pollution to surface or ground waters from industrial, commercial, residential and recreational areas and activities
CF05	Reduce/eliminate diffuse pollution to surface or ground waters from industrial, commercial, residential and recreational areas and activities
CF06	Reduce/eliminate air pollution from industrial, commercial, residential and recreational areas and activities
CF07	Reduce/eliminate marine pollution from industrial, commercial, residential and recreational areas and activities
CF08	Reduce/eliminate marine contamination with litter
CF09	Reduce/eliminate noise, light, heat or other forms pollution from industrial, commercial, residential and recreational areas and activities
CF10	Manage changes in hydrological and coastal systems and regimes for construction and development
CF11	Manage water abstraction for public supply and for industrial and commercial use
CF12	Other measures related to residential, commercial, industrial and recreational infrastructures, operations and activities
CG	**Measures related to the effects of extraction and cultivation of biological living resources**
CG01	Management of professional/commercial fishing (including shellfish and seaweed harvesting)

code	label
CG02	Management of hunting, recreational fishing and recreational or commercial harvesting or collection of plants
CG03	Reducing the impact of (re-) stocking for fishing and hunting, of artificial feeding and predator control
CG04	Control/eradication of illegal killing, fishing and harvesting
CG05	Reduce bycatch and incidental killing of non-target species
CG06	Reduce impact of lead poisoning
CG07	Manage changes in coastal conditions for marine aquaculture
CG08	Reduce/eliminate marine pollution from marine aquaculture
CG09	Other measures to reduce impacts from marine aquaculture infrastructures and operation
CG10	Manage water abstraction and modifications of hydrological conditions for freshwater aquaculture
CG11	Reduce/eliminate point source pollution to surface waters from freshwater aquaculture
CG12	Reduce/eliminate diffuse pollution to surface waters from freshwater aquaculture
CG13	Reduce/eliminate marine pollution from freshwater aquaculture
CG14	Other measures to reduce impacts of freshwater aquaculture infrastructures and operation
CG15	Other measures related to exploitation of species
CH	**Measures related to military installations and activities and other specific human activities**
CH01	Reduce impact of military installations and activities
CH02	Adapt/maintain military activities
CH03	Reduce impact of other specific human actions
CI	**Measures related to alien and problematic native species**
CI01	Early detection and rapid eradication of invasive alien species of Union concern
CI02	Management, control or eradication of established invasive alien species of Union concern
CI03	Management, control or eradication of other invasive alien species
CI04	DO NOT USE Management, control or eradication of other alien species
CI05	Management of problematic native species
CI06	Other measures related to problematic species
CI07	Controlling and eradicating plant and animal diseases, pathogens and pests
CJ	**Measures related to mixed source pollution and human-induced changes in hydraulic conditions for several uses**
CJ01	Reduce impact of mixed source pollution
CJ02	Reduce impact of multi-purpose hydrological changes
CJ03	Restore habitats impacted by multi-purpose hydrological changes
CJ04	Other measures related to mixed source pollution and multi-purpose human-induced changes in hydraulic conditions
CL	**Measures related to natural processes, geological events and natural catastrophes**
CL01	Management of habitats (others than agriculture and forest) to slow, stop or reverse natural processes
CL02	Minimise/prevent impacts of geological and natural catastrophes
CL03	Restore habitats following geological and natural catastrophes
CL04	Other measures related to natural processes
CN	**Measures related to climate change**
CN01	Adopt climate change mitigation measures
CN02	Implement climate change adaptation measures

code	label
CS	**Measures related to management of species from the nature directives and other native species**
CS01	Reinforce populations of species from the directives
CS02	Reintroduce species from the directives
CS03	Improvement of habitat of species from the directives
CS04	Manage other native species
CX	**Measures outside the Member State**
CX01	Support conservation measures in another EU Member State
CX02	Support conservation measures in countries outside the EU

Source: Article 17 of the Habitats Directive.

Annex 2. Level 1 and Level 2 categories of pressures/threats under Article 17 of the Habitats Directive.

Table A2. List of pressures and threats under the Article 17 of the Habitats Directive (ref_threatsPressures).

Code	label
A	**Agriculture**
A01	Conversion into agricultural land (excluding drainage and burning)
A02	Conversion from one type of agricultural land use to another (excluding drainage and burning)
A03	Conversion from mixed farming and agroforestry systems to specialised (e.g. single crop) production
A04	Changes in terrain and surface of agricultural areas
A05	Removal of small landscape features for agricultural land parcel consolidation (hedges, stone walls, rushes, open ditches, springs, solitary trees, etc.)
A06	Abandonment of grassland management (e.g. cessation of grazing or mowing)
A07	Abandonment of management/use of other agricultural and agroforestry systems (all except grassland)
A08	Mowing or cutting of grasslands
A09	Intensive grazing or overgrazing by livestock
A10	Extensive grazing or undergrazing by livestock
A11	Burning for agriculture
A12	Suppression of fire for agriculture
A13	Reseeding of grasslands and other semi-natural habitats
A14	Livestock farming (without grazing)
A15	Tillage practices (e.g. ploughing) in agriculture
A16	Other soil management practices in agriculture
A17	Harvesting of crops and cutting of croplands
A18	Irrigation of agricultural land
A19	Application of natural fertilisers on agricultural land
A20	Application of synthetic (mineral) fertilisers on agricultural land
A21	Use of plant protection chemicals in agriculture
A22	Use of physical plant protection in agriculture
A23	Use of other pest control methods in agriculture (excluding tillage)
A24	Waste management practices in agriculture
A25	Agricultural activities generating point source pollution to surface or ground waters
A26	Agricultural activities generating diffuse pollution to surface or ground waters

Code	label
A27	Agricultural activities generating air pollution
A28	Agricultural activities generating marine pollution
A29	Agricultural activities generating soil pollution
A30	Active abstractions from groundwater, surface water or mixed water for agriculture
A31	Drainage for use as agricultural land
A32	Development and operation of dams for agriculture
A33	Modification of hydrological flow or physical alteration of water bodies for agriculture (excluding development and operation of dams)
A34	Introduction and spread of new crops (including GMOs)
A35	Agricultural crops for renewable energy production
A36	Agriculture activities not referred to above
B	**Forestry**
B01	Conversion to forest from other land uses, or afforestation (excluding drainage)
B02	Conversion to other types of forests including monocultures
B03	Replanting with or introducing non-native or non-typical species (including new species and GMOs)
B04	Abandonment of traditional forest management
B05	Logging without replanting or natural regrowth
B06	Logging (excluding clear cutting) of individual trees
B07	Removal of dead and dying trees, including debris
B08	Removal of old trees (excluding dead or dying trees)
B09	Clear-cutting, removal of all trees
B10	Illegal logging
B11	Cork extraction and forest exploitation excluding logging
B12	Thinning of tree layer
B13	Burning for forestry
B14	Suppression of fire for forestry
B15	Forest management reducing old growth forests
B16	Wood transport
B17	Tillage practices in forestry and other soil management practices in forestry
B18	Application of natural fertilisers
B19	Application of synthetic fertilisers in forestry, including liming of forest soils
B20	Use of plant protection chemicals in forestry
B21	Use of physical plant protection in forestry, excluding tree layer thinning
B22	Use of other pest control methods in forestry
B23	Forestry activities generating pollution to surface or ground waters
B24	Forestry activities generating air pollution
B25	Forestry activities generating marine pollution
B26	Forestry activities generating soil pollution
B27	Modification of hydrological conditions, or physical alteration of water bodies and drainage for forestry (including dams)
B28	Forests for renewable energy production
B29	Other forestry activities, excluding those relating to agro-forestry
C	**Extraction of resources (minerals, peat, non-renewable energy resources)**
C01	Extraction of minerals (e.g. rock, metal ores, gravel, sand, shell)
C02	Extraction of salt

Code	label
C03	Extraction of oil and gas, including infrastructure
C04	Coal mining
C05	Peat extraction
C06	Dumping/depositing of inert materials from terrestrial extraction
C07	Dumping/depositing of dredged materials from marine extraction
C08	Abandonment or conversion of saltpans
C09	Geotechnical surveying
C10	Extraction activities generating point source pollution to surface or ground waters
C11	Extraction activities generating diffuse pollution to ground or surface waters
C12	Extraction activities generating marine pollution
C13	Extraction activities generating noise, light or other forms of pollution
C14	Abstraction of surface and ground water for resource extraction
C15	Mining and extraction activities not referred to above
D	**Energy production processes and related infrastructure development**
D01	Wind, wave and tidal power, including infrastructure
D02	Hydropower (dams, weirs, run-off-the-river), including infrastructure
D03	Solar power, including infrastructure
D04	Geothermal power generation (including infrastructure)
D05	Development and operation of energy production plants (including bioenergy plants, fossil and nuclear energy plants)
D06	Transmission of electricity and communications (cables)
D07	Oil and gas pipelines
D08	Energy production and transmission activities generating pollution to surface or ground waters
D09	Energy production and transmission activities generating air pollution
D10	Energy production and transmission activities generating marine pollution
D11	Energy production and transmission activities generating noise pollution
D12	Energy production and transmission activities generating light, heat or other forms pollution
D13	Abstraction of surface and ground water for energy production (excluding hydropower)
D14	Energy production and transmission activities not referred to above
E	**Development and operation of transport systems**
E01	Roads, paths, railroads and related infrastructure (e.g. bridges, viaducts, tunnels)
E02	Shipping lanes and ferry lanes transport operations
E03	Shipping lanes, ferry lanes and anchorage infrastructure (e.g. canalisation, dredging)
E04	Flight paths of planes, helicopter and other non-leisure aircrafts
E05	Land, water and air transport activities generating pollution to surface or ground waters
E06	Land, water and air transport activities generating air pollution
E07	Land, water and air transport activities generating marine pollution
E08	Land, water and air transport activities generating noise, light and other forms of pollution
E09	Land, water and air transport activities not referred to above
F	**Development, construction and use of residential, commercial, industrial and recreational infrastructure and areas**
F01	Conversion from other land uses to housing, settlement or recreational areas (excluding drainage and modification of coastline, estuary and coastal conditions)
F02	Construction or modification (e.g. of housing and settlements) in existing urban or recreational areas
F03	Conversion from other land uses to commercial / industrial areas (excluding drainage and modification of coastline, estuary and coastal conditions)

Code	label
F04	Construction or modification of commercial / industrial infrastructure in existing commercial / industrial areas
F05	Creation or development of sports, tourism and leisure infrastructure (outside the urban or recreational areas)
F06	Development and maintenance of beach areas for tourism and recreation incl. beach nourishment and beach cleaning
F07	Sports, tourism and leisure activities
F08	Modification of coastline, estuary and coastal conditions for development, use and protection of residential, commercial, industrial and recreational infrastructure and areas (including sea defences or coastal protection works and infrastructures)
F09	Deposition and treatment of waste/garbage from household/recreational facilities
F10	Deposition and treatment of waste/garbage from commercial and industrial facilities
F11	Pollution to surface or ground water due to urban run-offs
F12	Discharge of urban waste water (excluding storm overflows and/or urban run-offs) generating pollution to surface or ground water
F13	Plants, contaminated or abandoned industrial sites generating pollution to surface or ground water
F14	Other residential and recreational activities and structures generating point pollution to surface or ground waters
F15	Other industrial and commercial activities and structures generating point pollution to surface or ground waters
F16	Other residential and recreational activities and structures generating diffuse pollution to surface or ground waters
F17	Other industrial and commercial activities and structures generating diffuse pollution to surface or ground waters
F18	Residential and recreational activities and structures generating air pollution
F19	Industrial and commercial activities and structures generating air pollution
F20	Residential or recreational activities and structures generating marine pollution (excl. marine macro- and micro-particular pollution)
F21	Industrial or commercial activities and structures generating marine pollution (excluding marine macro- and micro-particular pollution)
F22	Residential or recreational activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam)
F23	Industrial or commercial activities and structures generating marine macro- and micro- particulate pollution (e.g. plastic bags, Styrofoam)
F24	Residential or recreational activities and structures generating noise, light, heat or other forms of pollution
F25	Industrial or commercial activities and structures generating noise, light, heat or other forms of pollution
F26	Drainage, land reclamation and conversion of wetlands, marshes, bogs, etc. to settlement or recreational areas
F27	Drainage, land reclamation or conversion of wetlands, marshes, bogs, etc. to industrial/commercial areas
F28	Modification of flooding regimes, flood protection for residential or recreational development
F29	Construction or development of reservoirs and dams for residential or recreational development
F30	Construction or development of reservoirs and dams for industrial or commercial development
F31	Other modification of hydrological conditions for residential or recreational development
F32	Other modification of hydrological conditions for industrial or commercial development
F33	Abstraction of ground and surface waters (including marine) for public water supply and recreational use
F34	Abstraction of ground and surface waters (including marine) for commercial/industrial use (excluding energy)
G	**Extraction and cultivation of biological living resources (other than agriculture and forestry)**
G01	Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species
G02	Marine fish and shellfish processing
G03	Marine fish and shellfish harvesting (professional, recreational) activities causing physical loss and disturbance of seafloor habitats
G04	Marine plant harvesting

Code	label
G05	Freshwater fish and shellfish harvesting (professional)
G06	Freshwater fish and shellfish harvesting (recreational)
G07	Hunting
G08	Management of fishing stocks and game
G09	Harvesting or collecting of other wild plants and animals (excluding hunting and leisure fishing)
G10	Illegal shooting/killing
G11	Illegal harvesting, collecting and taking
G12	Bycatch and incidental killing (due to fishing and hunting activities)
G13	Poisoning of animals (excluding lead poisoning)
G14	Use of lead ammunition or fishing weights
G15	Modification of coastal conditions for marine aquaculture
G16	Marine aquaculture generating marine pollution
G17	Introduction and spread of species (including GMOs) in marine aquaculture
G18	Abandonment of marine aquaculture
G19	Other impacts from marine aquaculture, including infrastructure
G20	Abstraction of water, flow diversion, dams and other modifications of hydrological conditions for freshwater aquaculture
G21	Freshwater aquaculture generating point source pollution to surface or ground waters
G22	Freshwater aquaculture generating diffuse source pollution to surface or ground waters
G23	Freshwater aquaculture generating marine pollution
G24	Introduction and spread of species (including alien species and GMOs) in freshwater aquaculture
G25	Abandonment of freshwater aquaculture
G26	Other impacts from freshwater aquaculture, including infrastructure
G27	Other activities related to extraction and cultivation of biological living resources not referred to above
H	**Military action, public safety measures, and other human intrusions**
H01	Military, paramilitary or police exercises and operations on land
H02	Military, paramilitary or police exercises and operations in the freshwater and marine environment
H03	Abandonment of terrestrial military or similar exercises (loss of open habitats)
H04	Vandalism or arson
H05	Tree surgery, felling/removal of roadside trees and vegetation for public safety
H06	Closure or restricted access to site/habitat
H07	Intrusive and destructive research and monitoring activities
H08	Other human intrusions and disturbance not mentioned above
I	**Alien and problematic species**
I01	Invasive alien species of Union concern
I02	Other invasive alien species (other than species of Union concern)
I03	DO NOT USE Other alien species (not invasive)
I04	Problematic native species
I05	Plant and animal diseases, pathogens and pests
J	**Mixed source pollution**
J01	Mixed source pollution to surface and ground waters (limnic and terrestrial)
J02	Mixed source marine water pollution (marine and coastal)
J03	Mixed source air pollution, air-borne pollutants
J04	Mixed source soil pollution and solid waste (excluding discharges)

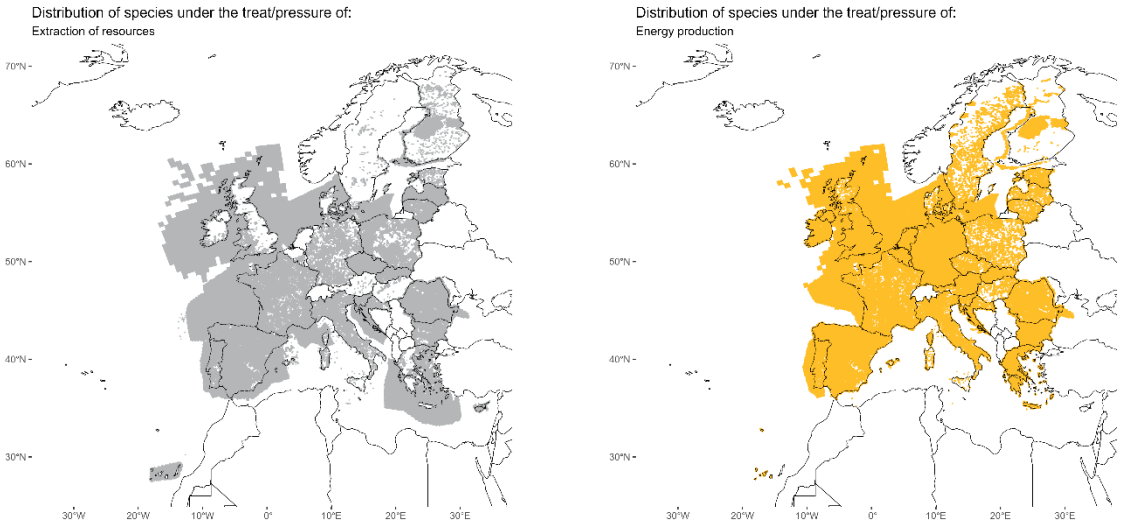
Code	label
J05	Mixed source excess energy
K	**Human-induced changes in water regimes**
K01	Abstraction from groundwater, surface water or mixed water
K02	Drainage
K03	Development and operation of dams
K04	Modification of hydrological flow
K05	Physical alteration of water bodies
L	**Natural processes (excluding catastrophes and processes induced by human activity or climate change)**
L01	Abiotic natural processes (e.g. erosion, silting up, drying out, submersion, salinization)
L02	Natural succession resulting in species composition change (other than by direct changes of agricultural or forestry practices)
L03	Accumulation of organic material
L04	Natural processes of eutrophication or acidification
L05	Reduced fecundity / genetic depression (e.g. inbreeding or endogamy)
L06	Interspecific relations (competition, predation, parasitism, pathogens)
L07	Absence or reduction of interspecific faunal and floral relations (e.g. pollinators)
M	**Geological events, natural catastrophes**
M01	Volcanic activity
M02	Tidal waves, tsunamis
M03	Earthquake
M04	Avalanche (snow)
M05	Collapse of terrain, landslide
M06	Underground collapses (natural processes)
M07	Storm, cyclone
M08	Flooding (natural processes)
M09	Fire (natural)
M10	Other natural catastrophes
N	**Climate change**
N01	Temperature changes (e.g. rise of temperature & extremes) due to climate change
N02	Droughts and decreases in precipitation due to climate change
N03	Increases or changes in precipitation due to climate change
N04	Sea-level and wave exposure changes due to climate change
N05	Change of habitat location, size, and / or quality due to climate change
N06	Desynchronisation of biological / ecological processes due to climate change
N07	Decline or extinction of related species (e.g. food source / prey, predator / parasite, symbiote, etc.) due to climate change
N08	Change of species distribution (natural newcomers) due to climate change
N09	Other climate related changes in abiotic conditions
X	**Unknown pressures, no pressures and pressures from outside the Member State**
Xe	Threats and pressures from outside the EU territory
Xo	Threats and pressures from outside the Member State
Xp	No information on pressures
Xt	No information on threats
Xu	Unknown pressure

Code	label
Xxp	No pressures
Xxt	No threats

Source: Article 17 of the Habitats Directive.

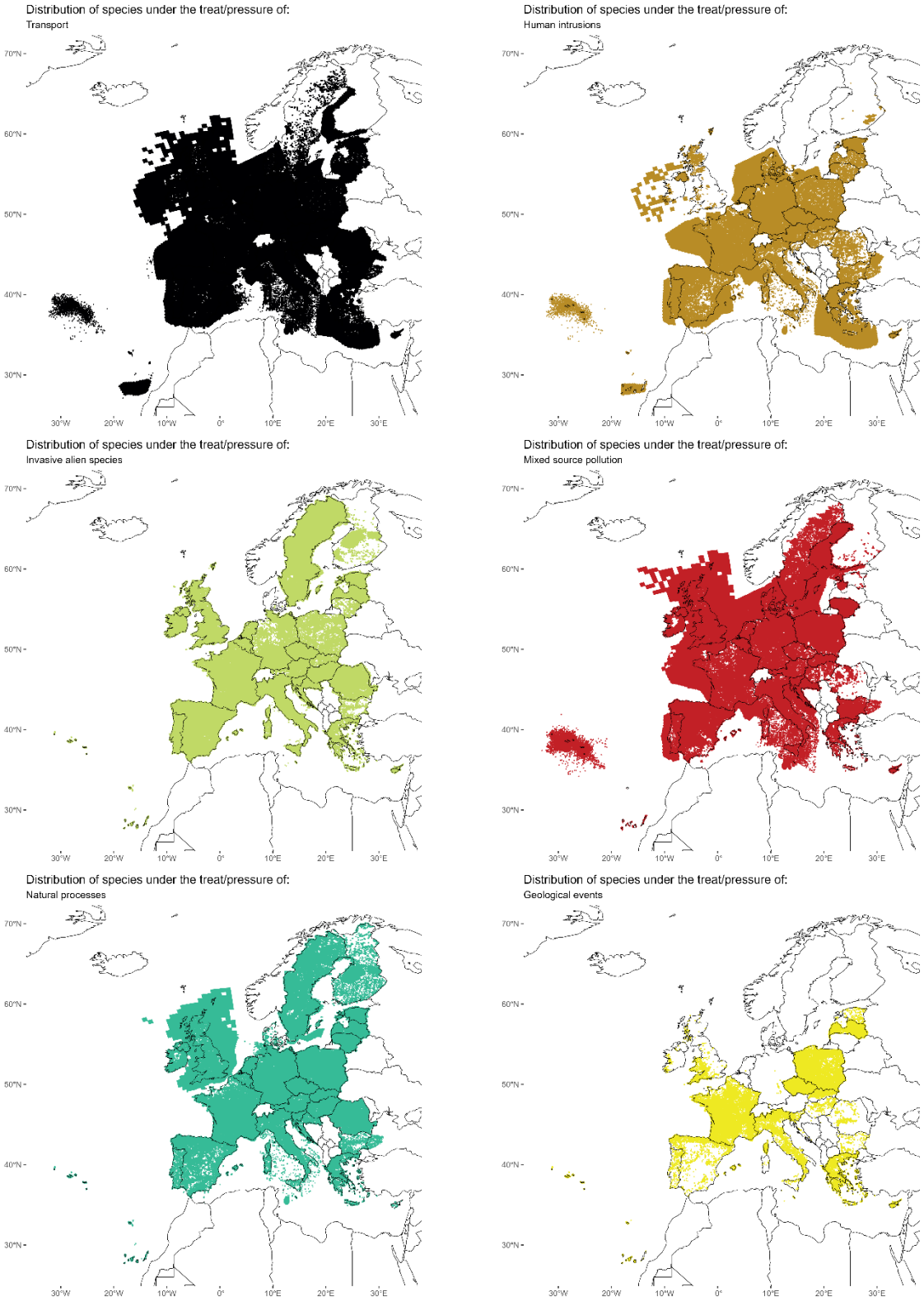
Annex 3. Pressures/threats of species and habitats as reported by MS under Article 17 of the Habitats Directive.

Figure A1. Pressures on species.



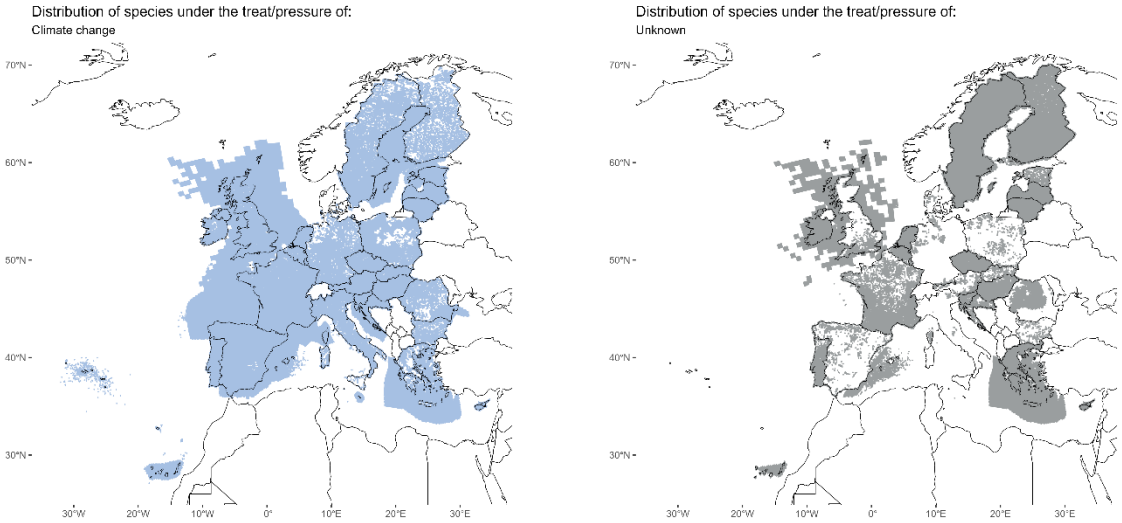
Source: this report.

Figure A1. Pressures on species (continued).



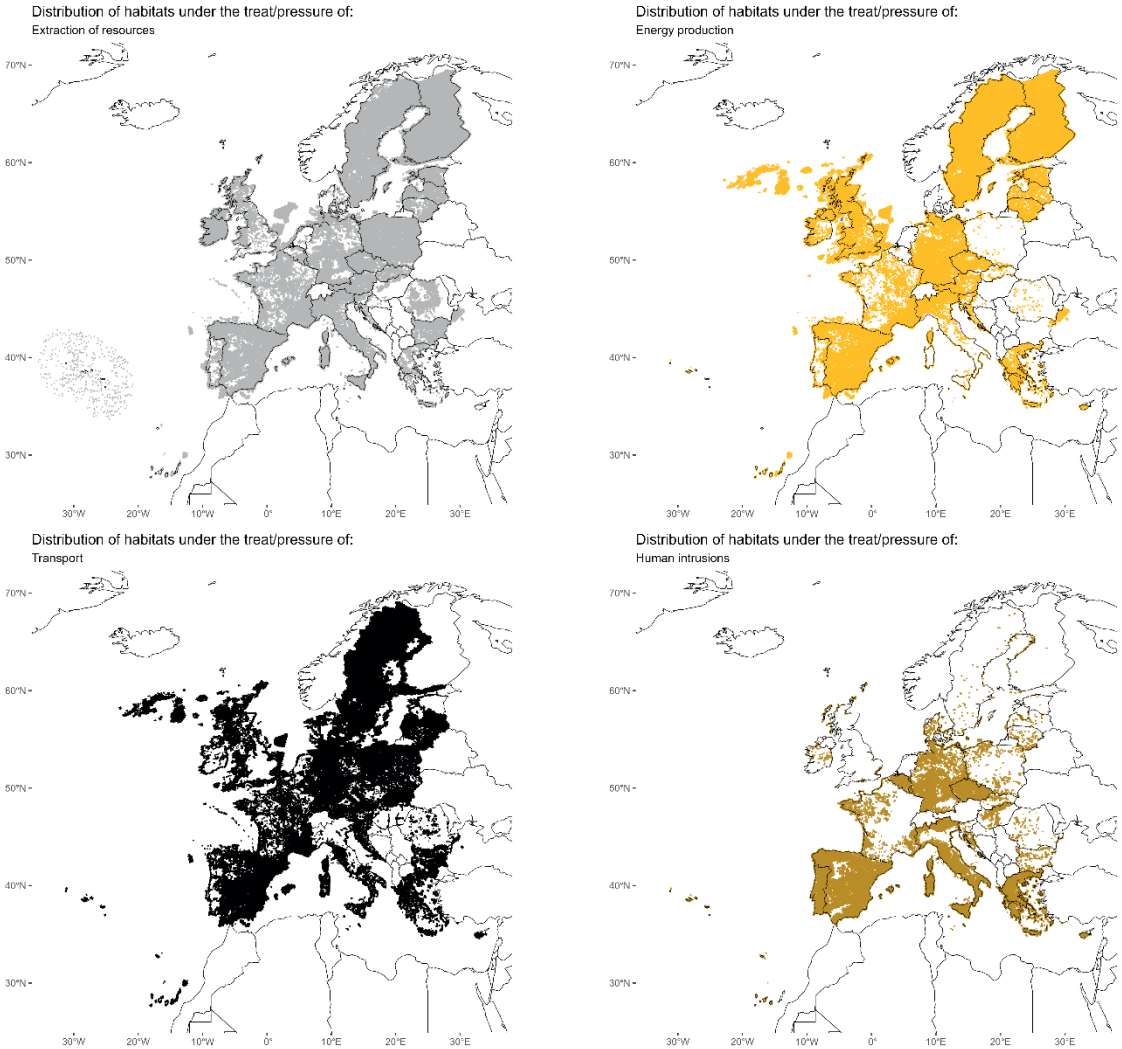
Source: this report.

Figure A1. Pressures on species (continued).



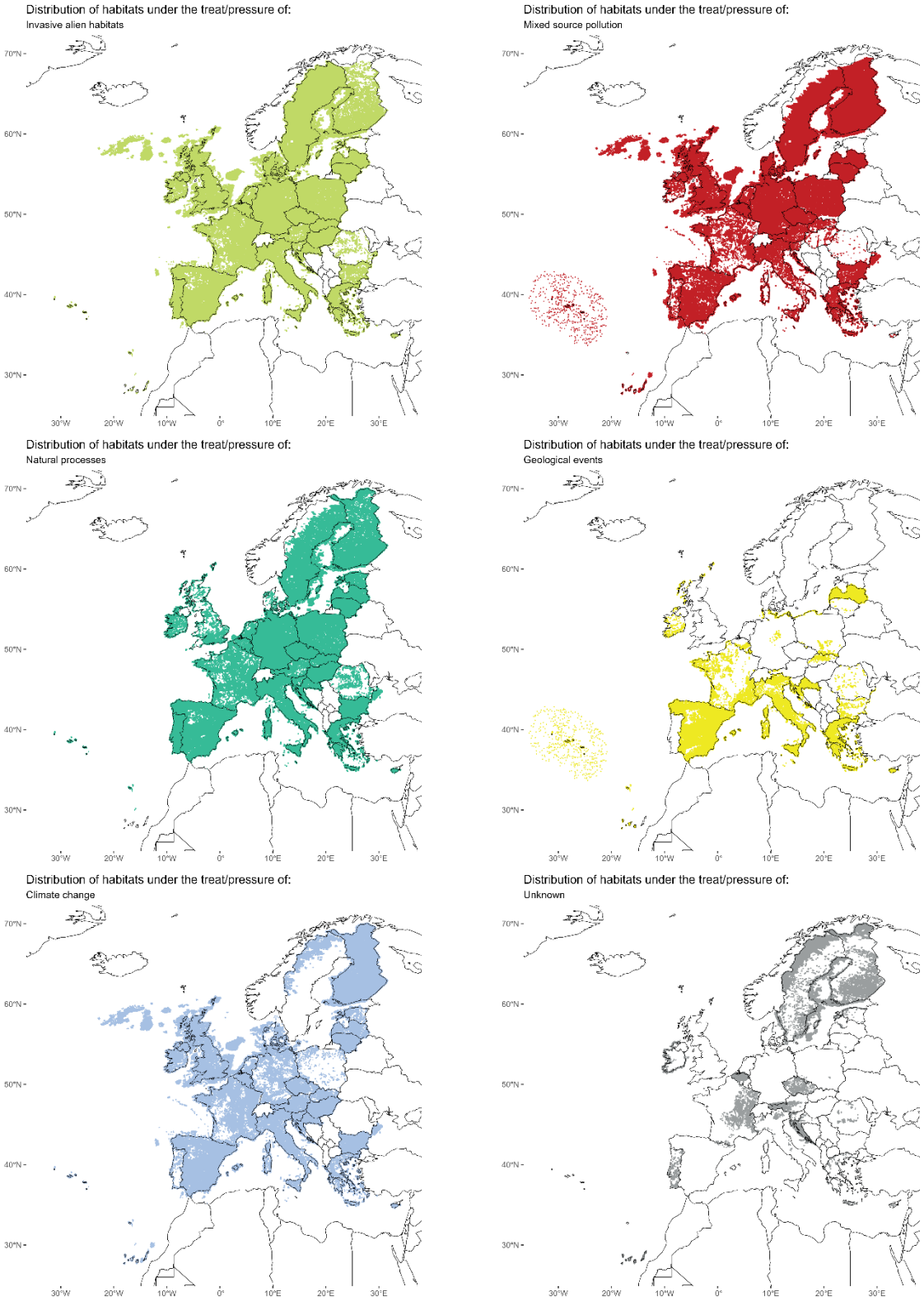
Source: this report.

Figure A2. Pressures on habitats.



Source: this report.

Figure A2. Pressures on habitats (continued).



Source: this report.

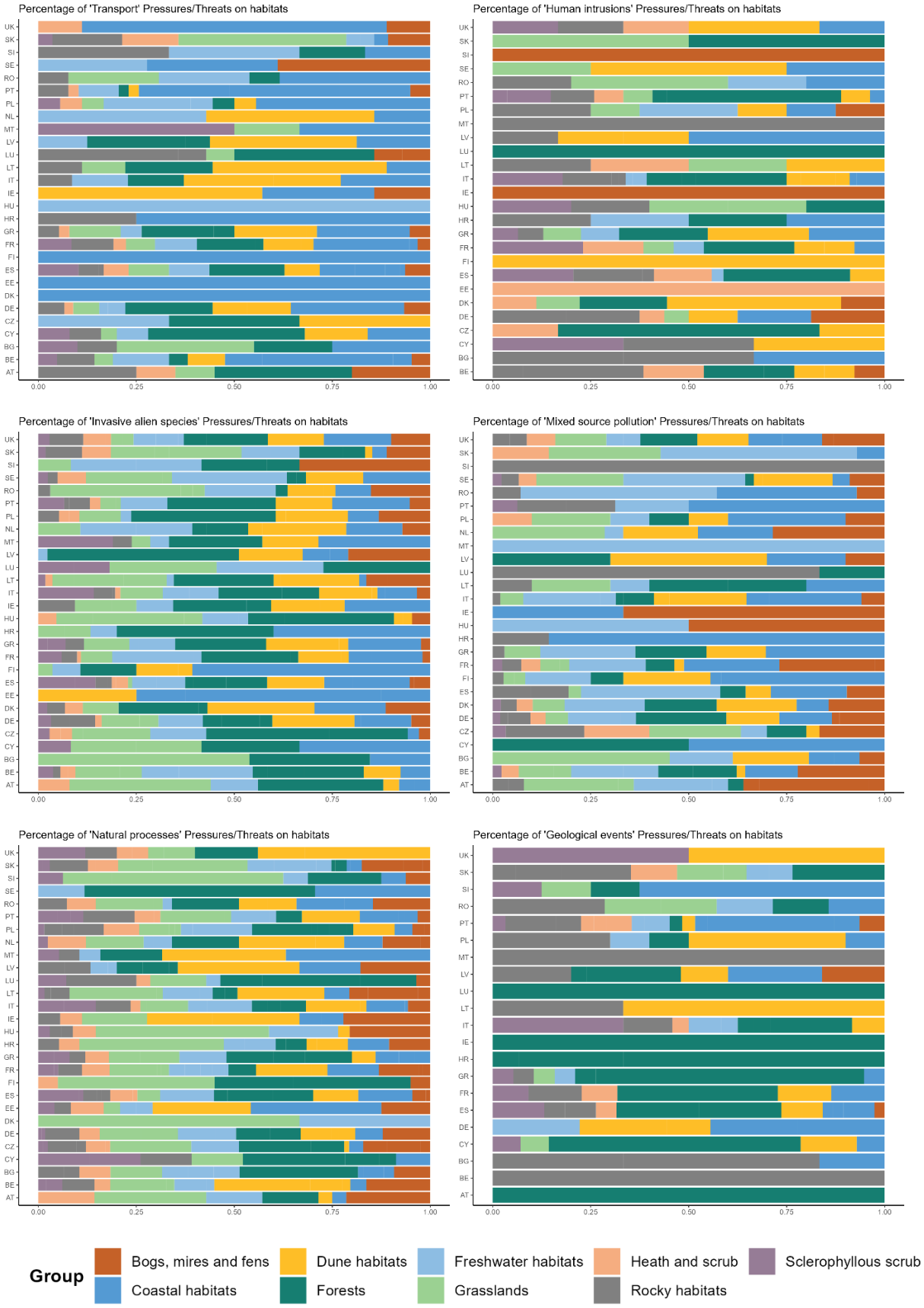
Figure A3. Percentage of pressures reported by each MS for species.

Source: this report.

Figure A3. Percentage of pressures reported by each MS for species (continued).

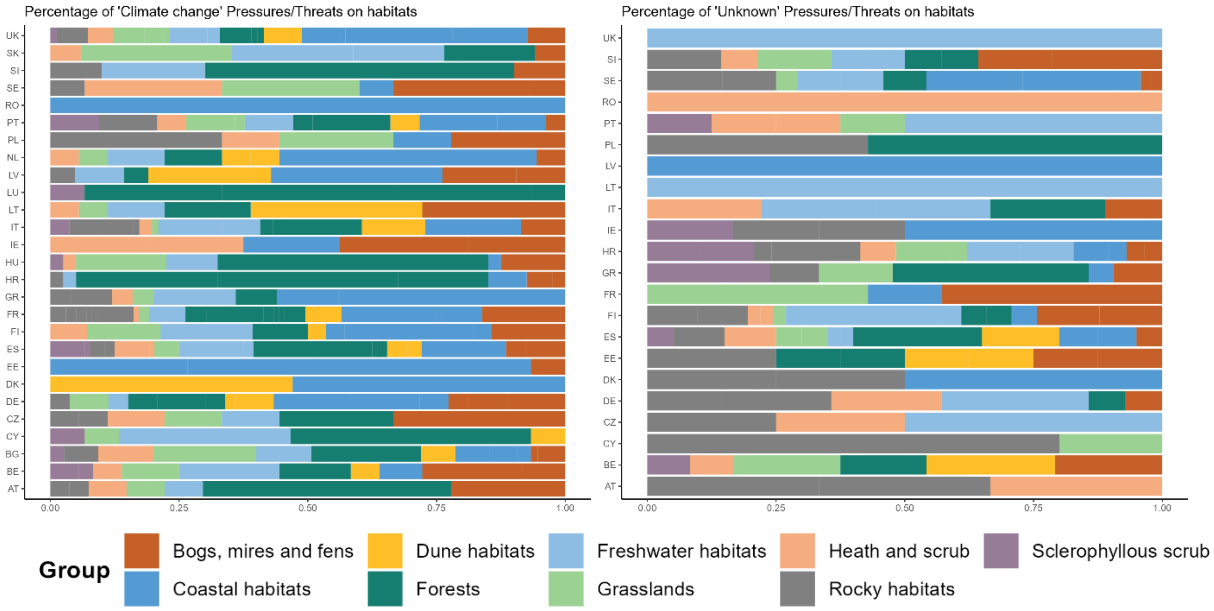
Source: this report.

Figure A4. Percentage of pressures reported by each MS for habitats.



Source: this report.

Figure A4. Percentage of pressures reported by each MS for habitats (continued).



Source: this report.

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