EXTERNAL SCIENTIFIC REPORT

Analysis of hunting statistics collection frameworks for wild boar across Europe and proposals for improving the harmonisation of data collection

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Abstract

Heterogeneities in the wild boar data collection frameworks across Europe were analysed using questionnaires to explore comparability of hunting data in the short term and propose a common framework for future collection. Fifty-seven respondents representing 32 countries covering more than 95% of European territory participated to the questionnaire. The most frequently recorded information in the official statistics included the quantity of animals shot per hunting ground and season (24 countries) and the size of the hunting (management) ground (21 countries). Georeferenced maps for the hunting grounds were collected (total or partial) for 20 countries. The least frequently recorded information was at the level of hunting events. We conclude that (i) sources of hunting statistics providing quantitative information on wild boar (and by extension, for other big game species) are lacking or are not harmonised across Europe, as well as incomplete, dispersed and difficult to compare; (ii) a feasible effort is needed to achieve harmonisation of data in a short time for the most basic statistics at the hunting ground level, and (iii) the coordination of the collection of hunting statistics must be achieved first at national and then at European level. The following is recommended: (i) countries should collect data at hunting ground level; (ii) efforts should be focused on data-poor countries (e.g. Eastern Europe), and (iii) the data should be collected at the finest spatial and temporal resolution, i.e. at hunting event level. ENETWILD proposes the development of a robust and well-informed data collection model as the basis for a common data collection framework. The present report identified some countries where, though the potential to share good quality data is present, the data collection promoted by ENETWILD has not succeeded so far (i. e. Eastern Europe). This highlights the need of further strategies to be developed so to encourage and support these countries to share hunting data.

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Summary

The organisation and collection of wildlife hunting statistics and their analysis is essential not only for hunting management but also for developing wildlife policies. On a large spatial scale, and in order to provide long-term trends, high quality hunting data statistics (when sampled at high spatial resolution) are readily available and, potentially, comparable across Europe for use in the predictive spatial modelling of wild boar abundance. No European-wide harmonised monitoring scheme currently exists to gather information on the numbers of big game shot per year, particularly wild boar. At present, each country and organisation collects hunting data using its own different procedure, and acquires different types of data that are later implemented in different repositories with variable accessibility: this hampers the comparison and common use of data across Europe. Further steps are, therefore, still required to harmonise, standardise and coordinate data collection and, eventually, analyse hunting bag information. In the present report, we analyse the heterogeneities in wild boar data collection frameworks across Europe and highlight the major strengths and weaknesses of the statistical information that is collected. We list several improvements that may be feasible in the short term and could improve the comparability of the data obtained from national and regional statistical sources. Moreover, we propose a common framework for wild boar hunting data collection across Europe, which would also be applicable to other game species.

The methodology was based on a questionnaire whose objective was to identify and describe the sources and systems employed to collect wild boar hunting data throughout European countries. The questionnaire was distributed to stakeholders and potential data providers, representing all the European countries, as well as international and national associations. These are mainly wildlife managers and/or researchers working for administrative and public institutions, who potentially have access to or directly manage hunting data, or who know their respective national/regional hunting data recording systems. The questionnaire, which is available at this link, reflects three major subjects underpinning hunting activity and data collection systems: (i) Hunters, (ii) Hunting grounds and (iii) game animals. For the analysis, we selected several variables and different levels of spatio-temporal aggregation of data (e.g. hunting event vs. season; municipality vs. hunting ground).

The information gathered through the questionnaire obtained were analysed at country level. We performed hierarchical clustering analyses for qualitative variables to determine the similarities/differences among countries. The clustering variables used as a categorical binomial (collected/not collected), were: Area size of which kind of spatial unit (ha or km^2), Availability of GIS file (shape file) of which kind of spatial unit, Municipality, Presence of fences around the hunting ground, Supplementary feeding, Hunting quota, number of wild boar shot per hunting event, Number of wild boar shot per season, Hunting modality, Number of hunters per hunt event, Hunted area in a hunting event, Availability of GIS file for hunted area, Total area hunted per season, Sex and Age of hunted animals recorded, and number of big game hunter licences.

We collected answers from respondent representative of most European countries (57 questionnaires from 32 countries, covering more than 95% of European territory). It should be stressed that, in some of the countries/regions that recorded few or no variables, the presence of wild boar has only occurred very recently (e. g. Scandinavian countries, Scotland), or hunting of wild boar is banned (Albania). When comparing which of the variables selected were collected by national/regional schemes, patterns are, overall, highly variable among countries, and there are always great differences among countries within each region of Europe. Several countries from Southern Europe (e.g. Italy, Spain), and particularly Southeast Europe (Bulgaria, Greece, Croatia, Moldova), are, according to the number of selected variables that are collected, more highly ranked than Northern European countries, except for the Netherlands, which is also highly ranked. Apart from the variable "Municipality", the most frequently recorded information in the official statistics regarding harvests of wild boar included (i) the quantity of animals shot per hunting ground and season (in 24 countries),

and (ii) the size of the hunting (management) ground (n=21). It should be emphasised that GIS files for the hunting grounds exist for at least 20 countries (totally, or partially, for some regions). The least frequently recorded variables concern hunting event level. A cluster analysis showed that a cluster comprising some Mediterranean countries plus the Netherlands and Lithuania is associated with very complete data collection frameworks, in which most of the data, and particularly data at the hunting ground and hunting event levels, are collected, if not for the entire country, then at least for part of it. Another cluster comprised countries in which little or no information was collected, including those in which the presence of wild boar has only occurred recently (e.g. Scandinavian countries) and some countries from the Balkans. A range of countries, mainly distributed in Central and East Europe, occupied intermediate positions between these two clusters.

We conclude that: (i) sources of hunting statistics that provide quantitative information on wild boar (and by extension, big game) are lacking or non-harmonised across European countries, which make national and/or regional hunting statistic data highly heterogeneous, incomplete and dispersed and, therefore, difficult to compare; (ii) however, a feasible effort in a short period would lead to almost 100% harmonisation for basic statistics at the hunting ground level, which would be very useful for analytical purposes on a large spatial scale; (iii) the coordination of the collection of hunting bag statistics must be achieved at first the national and then the European level, along with their scientific interpretation for proper use; (iv) a robust and well-informed data collection method developed by ENETWILD (link) is proposed as a basis for a simplified common framework, and (v) in some countries (e.g. East Europe) though the potential to share good quality data has been identified, ENETWILD's data collection activities have not been successful so far: this highlighted the need of further strategies to be developed to encourage and support these countries to share data.

In order to harmonise wild boar hunting data collection across European countries, we propose a sequential strategy, prioritising steps in the following order:

1. Several countries should collect data at the hunting ground level, particularly describing "Surface of the hunting ground" (8 countries) and "Total number of wild boar shot per hunting ground & season" (6 countries). We also recommend the creation and sharing of GIS files of the hunting grounds (management area).

2. Second, efforts should focus on countries and regions located in gap areas, i.e. some countries from Eastern Europe: Belarus, Romania, and countries from the Balkans region. There are probably also important gaps for countries that did not answer the questionnaire, such us the Ukraine and Turkey. It would also be strategic for Germany, given its geographical position, to improve its data collection framework, trying to collect and make available data at the hunting ground level (data are currently available to ENETWILD only at administrative level).

3. After steps 1 and 2, the objective of efforts should be to include data at the finest spatial and temporal resolution (hunting event level) in the data collection systems. This includes detailed measurements of hunting efforts. In this step, the effort to harmonize systems will be considerable, as only a minority of countries already collect these data and, normally, only in some regions.

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1.   Introduction

1.1.   Background and Terms of Reference as provided by the requestor

This contract was awarded by EFSA to: the Universidad de Castilla-La Mancha, contract title: Wildlife: collecting and sharing data on wildlife populations, transmitting animal disease agents, contract number: OC/EFSA/ALPHA/2016/01 – 01.

The terms of reference for this report were to analyse hunting statistics collection frameworks across Europe, including proposals for improving the harmonisation of data collection.

1.2.   Scope of the report

Risk assessments of certain pathogens that are of interest for the well-being of humans and livestock require the availability of presence and abundance data on wild species that may represent reservoirs for pathogens. The European Food Safety Authority (EFSA) has, therefore, provided the funding with which to set up ENETWILD, a project whose purpose is to collect comparable data at the European level in order to analyse the risks related to diseases shared between wildlife, livestock and humans - data that are also essential in conservation and wildlife management. ENETWILD has already begun to collect wild boar abundance data from the European continent for the analysis of the risk factors as regards the spread of African Swine Fever (ASF), and for the assessment of the effectiveness of wild boar management measures in the affected areas. This is being done on the basis of: (i) distribution (georeferenced) data, (ii) density, and (iii) hunting bag data compiled from different sources and at different habitat, management (e. g. hunting ground) and administrative unit levels. ENETWILD's eventual objective is to produce a reliable source of wild boar population data collected in a harmonised manner that can be regularly updated for further risk assessment. ENETWILD aims to contribute to the development of harmonised hunting statistics collection frameworks across Europe. In this context, the purpose of this report is to compare the hunting statistics collection frameworks across Europe as a basis on which to improve the harmonisation of data collection. We also suggest realistic improvements that may, in the short term, help to make data obtained from national and regional statistical sources comparable, and propose a common framework for future data collection across Europe.

The statistical analysis of data on game harvesting is a very useful tool when recording abundance, density and population trends in game species (Grotan et al. 2005, Mysterud & Ostbye 2006, Milner et al. 2006, Imperio et al. 2010, Cattadori et al. 2003, Willebrand & Hornell 2001, Ueno et al, 2015). The organization and collection of harvesting data and their subsequent analysis is, therefore, essential not only for sustainable hunting activity but also for policy-making in relation to various issues. If countries and organisations collect hunting data using their own specific procedures, thus acquiring different types of data that are later implemented in different repositories with variable accessibility, no comparison and common use of data will be possible. This process is even more complex since, over a large extent of land such as Europe with varying practices and legislation, additional data describing the hunting effort is required as a comparative benchmark with which to standardise counts, including a description of the hunting effort and the temporal and spatial information required to produce accurate annual estimates. No European-wide harmonised monitoring scheme with which to gather information on the numbers of big game shot annually, and particularly wild boar, currently exists, and there are even less data at fine spatial and temporal resolutions. In fact, hunting resources are still less well-known than other forest resources or livestock production, and the statistical information on hunting that is available is scarce, incomplete, not comparable and scattered (Apollonio et al. 2010; http://www.artemis-face.eu/), involving official and private initiatives with different aims. Unlike other agricultural and forest resources, hunting does not have a source of official statistics on the international scale.

On a large spatial scale, and in order to provide long-term trends, high quality hunting data (sampled on a local scale) should have a high availability and the potential for comparison across Europe if it is to be used in the predictive spatial modelling of wild boar abundance (ENETWILD consortium 2018a). However, hunting methods and the information available are too variable and do not allow comparisons across areas, among countries and over time, because they must account for hunting effort. Good documentation with which to characterise the hunting effort should be available in order to improve data harmonisation. Along with the number of animals hunted, other basic information should be included. The problems with hunting bags include bias owing to (1) different hunting traditions and hunting methods in each hunting area; (2) changes in the hunting effort, quotas, hunter saturation and legal restrictions; (3) environmental conditions (e.g. weather, food availability and population density) and (4) variability owing to non-hunted populations in urban and protected areas. Moreover, if a quota limits the hunting bag, it is no longer proportional to the local abundance and may be used as a target figure (or the *de facto* reported figure), particularly if it can affect the quota in the following year. In order to overcome these barriers, the hunting effort should be maintained/standardised and properly defined, and the use of quotas or targets fully described. Therefore, further steps are still required to harmonise, standardise, centralise and analyse hunting bag information that has already been collected in many European countries, so as to promote the collection of this data using common standards where it is absent.

2. Methods

2.1. Objectives of the questionnaire and report

A questionnaire (available at https://www.enetwild.com/2018/02/14/a-call-to-collect-and-sharing-data-on-wild-boar-distribution-and-abundance-in-europe/) together with an introductory letter (Appendix B) was distributed to the stakeholders listed in Appendix A in order to collect information on big game data collection systems across Europe. The questionnaire is subdivided into 5 sheets: I. General information, II. Hunters, II. Hunting ground, IV. Game animals and V. Wild boar carcasses. There is also a sheet indicating reference terminology for the administrative divisions: NUTS3, LAU1 and LAU2.

The objective of the questionnaire was to identify and describe the sources of wild boar (which can be expanded to big game) hunting data throughout European countries, which should be aggregated at a (the lowest) known spatial scale (ranging optimally from the hunting ground/management unit to Municipality/District level) in order to make them comparable across countries.

In the present report, we analyse the heterogeneities in wild boar data collection frameworks across Europe and highlight the major strengths and weaknesses of the statistical information that is collected. We list a number of realistic improvements to help make data from national and regional statistical sources comparable in the short term, and propose a common framework for wild boar hunting data collection across Europe.

2.2. Target respondents and diffusion of the questionnaire

The questionnaire was distributed to stakeholders and potential data providers, representing all European countries and to international and national associations. These are mainly wildlife managers and/or researchers working for administrative and public institutions, which potentially have access to or directly manage hunting data or know their respective national/regional hunting data recording systems. We distributed the questionnaire by email using our network of contacts (see Appendix A), which includes more than 250 professionals. Of those, we included all the participants in the ENETWILD General Meeting (Parma, January 2018, ENETWILD consortium 2018b), who had already been informed of this intention during the meeting. We also used our network of ENETWILD partners

to reach the professionals responsible of big game data collection in their respective countries and/or regions. We attach the informative letter of presentation used to inform potential participants about the questionnaire (Appendix B).

An email address and a continuous help desk were made available to answer any queries regarding this questionnaire:

- Email: project.enetwild@uclm.es

- Help Desk at www.enetwild.com

A link to the questionnaire was included in the letter:

https://www.enetwild.com/2018/02/14/a-call-to-collect-and-sharing-data-on-wild-boar-distribution-and-abundance-in-europe/

The questionnaire was available in English and Spanish.

Figure 1. A questionnaire with which to collect and share data concerning screenshot of ENETWLD website). A link to the questionnaire on the ENETWILD website: https://www.enetwild.com/2018/02/14/a-call-to-collect-and-sharing-data-on-wild-boar-distribution-and-abundance-in-europe/. The questionnaire was available in English and Spanish.

2.3.   Structure of the questionnaire
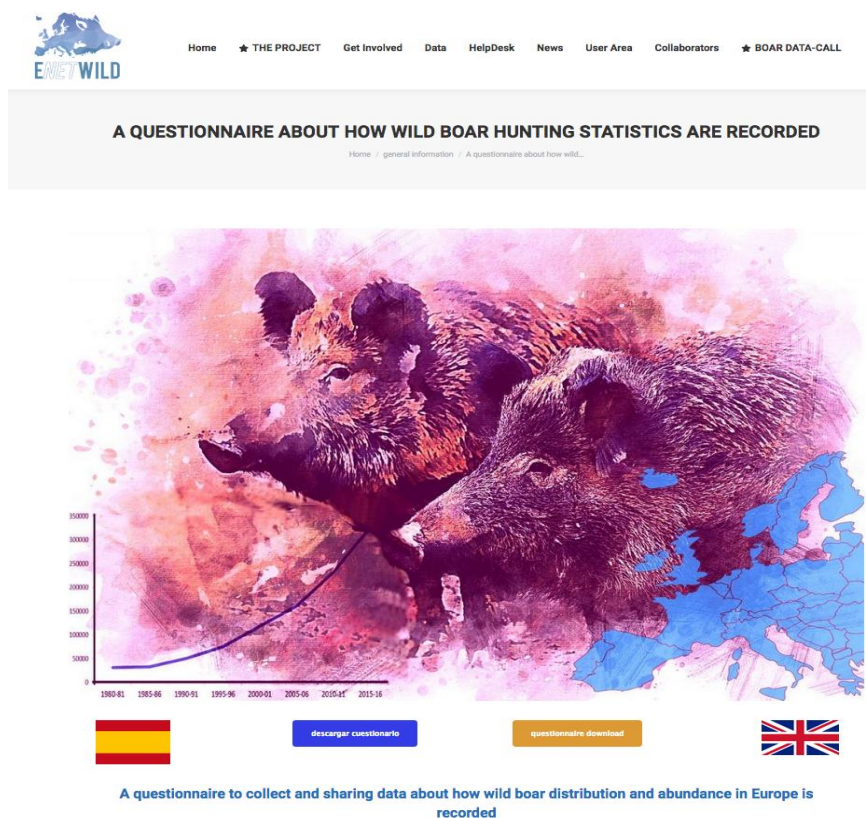
The questionnaire (https://www.enetwild.com/2018/02/14/a-call-to-collect-and-sharing-data-on-wild-boar-distribution-and-abundance-in-europe/) reflected three major subjects underpinning hunting activity and data collection systems:

- Hunters
- Hunting grounds
- Game animals

The questionnaire was presented in excel format, and subdivided into 5 sheets:

I. General

II. Hunters

III. Hunting ground

IV. Game animals

V. Wild boar carcasses

On each sheet, the questions were organised in sections (repeated blocks of questions), which referred to a specific country or region. The interviewees could copy as many blocks of questions as required for different regions or provinces, since the hunting collection systems may vary among them.

A reference terminology for administrative divisions was provided on a separate sheet entitled "NUTS Europe". NUTS3, LAU1 and LAU2 refer to the coding system for the administrative units used by EUROSTAT (see http://ec.europa.eu/eurostat/web/nuts/national-structures-eu). These codes are useful for database querying, but finer scale information are needed for data use.

For each question, the "Field description" column detailed exactly what information we were requesting. The "Values" column indicated the nature of the response (text, number, closed responses according to pre-defined categories, etc.). The respondents had to enter their responses in the "Response" column.

2.4. Data analysis

The data obtained were analysed at the country level, signifying that when several questionnaires were collected from the same country (answered by different people, or referring to different regions), they were merged at the country level.

First, descriptive statistics, graphs and charts were used to present variations in the wild boar hunting data collection systems across Europe, on the basis of a number of selected variables. Second, we employed inferential statistics to analyse the similarities/differences among these data collection systems among countries. The similarities among the data collection frameworks throughout the countries studied were, therefore, explored using hierarchical clustering analyses for qualitative variables. The information from a number of variables (see Table 1) was coded as presence/absence (i.e. the information is recorded/the information is not recorded). These clustering variables indicated whether or not certain data were collected in each country (at least, in certain regions of the country). After clustering the countries, we analysed each group in order to describe the data collection framework using a bi-dimensional plot. This was done using the SPSS V20.0 statistical software.

Table 1. Clustering variables used in the hierarchical clustering analyses for qualitative variables. They indicated whether or not data were collected in each country (at least in certain regions of the

Level of information	Variable
Hunting ground	Size (ha or km^2)
	GIS file available (e.g. shapefile) Y/N
	Municipality
	Fenced Y/N
	Supplementary feeding Y/N
Game animals and hunt	Hunting quota
	Nº WB shot per hunt
	Nº WB shot per season
	Hunt Modality
	Nº hunters hunt
	Hunted area hunt
	GIS file available for hunted area Y/N
	Total hunted area season
	Sex & Age
Hunters	Nº big game hunter licences

country) as categorical binomial variables.

3. Results

3.1. Response to questionnaire
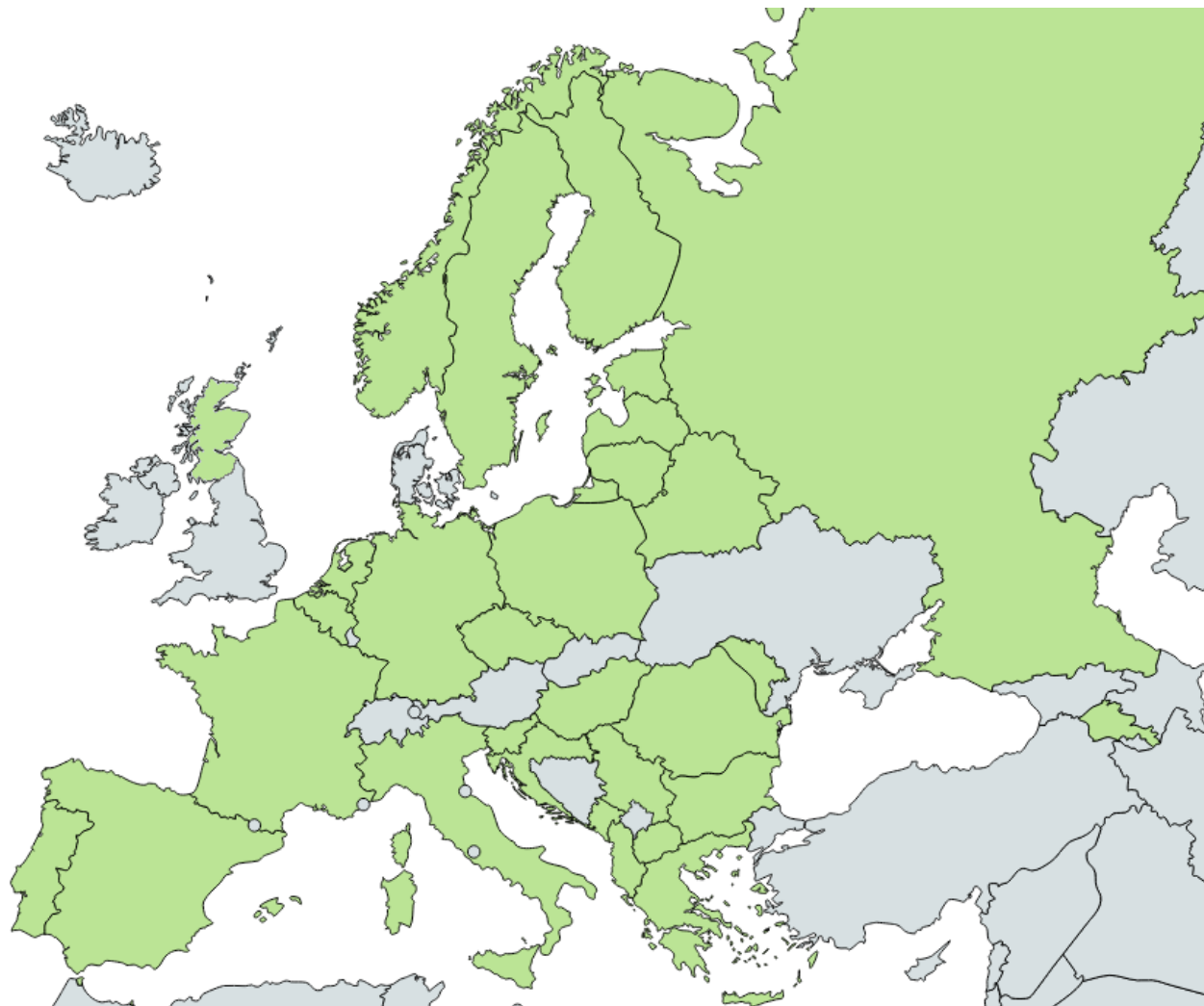
Figure 2. The 31 countries (in green, including Scotland) from which information on wild boar data collection frameworks was obtained using the questionnaire (at last one questionnaire was received from a given country).

The list of respondents, indicating organisation and country, are indicated in Appendix A. Figure 2 indicates the countries from which information on wild boar data collection frameworks was obtained using the questionnaire (at least one questionnaire from a given country). By 2nd September 2018, no questionnaires had been received from the UK (one was received from Scotland), Ireland (where wild boar is not present), Switzerland, Austria, Slovakia, Turkey and some countries from the Caucasus Region.

3.2. Descriptive statistics

3.2.1. Data collected by country
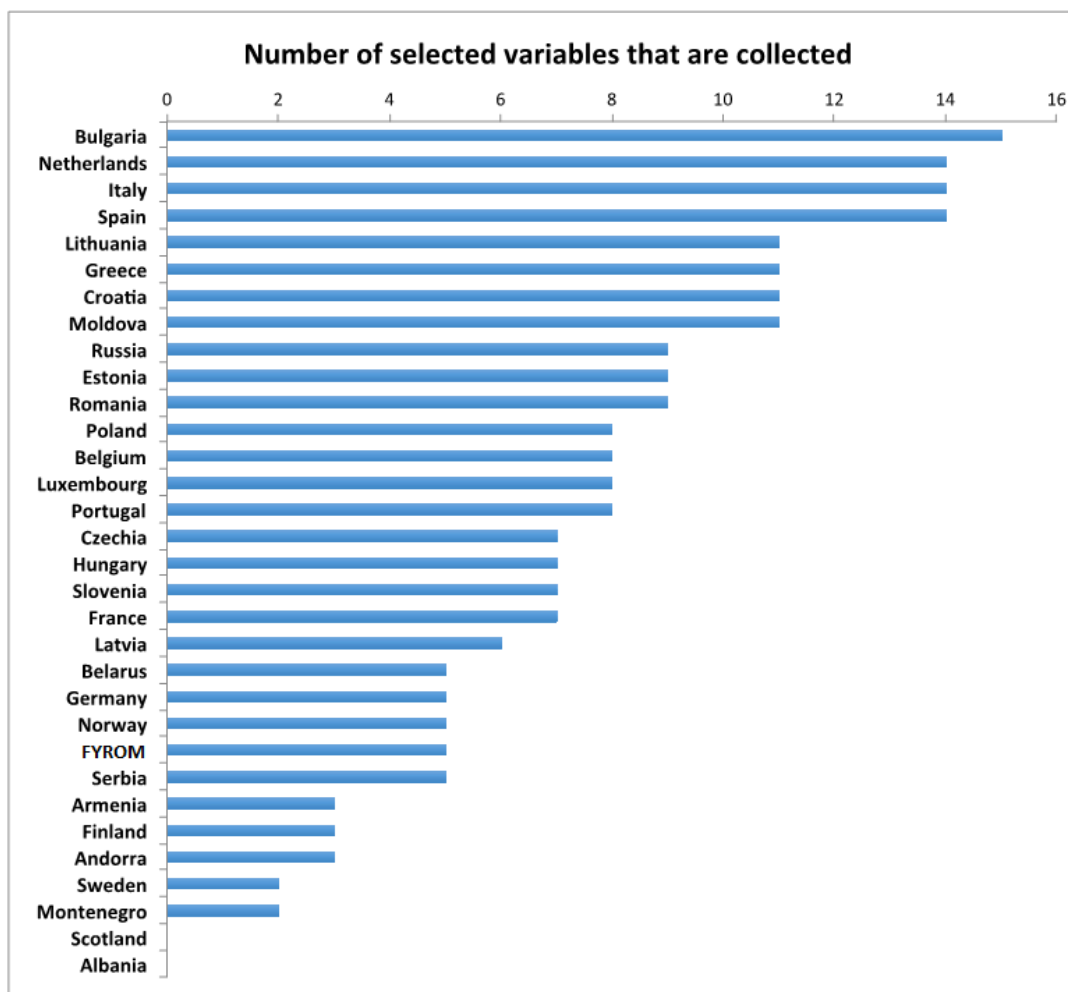
Figure 3. The selected variables collected by national/regional schemes for the countries (at least one region) that responded to the questionnaire.

Figure 3 indicates the number of selected variables (check also Table 1) that are collected by national/regional schemes, which is highly variable among countries, ranging from all of them (Bulgaria) to none. It is notable that in some of the countries/regions that do not record variables (or just a few of them), the presence wild boar has only occurred very recently (e. g. Scandinavian countries, Scotland), or hunting is banned (Albania). Table 2 indicates which variables were collected by national/regional schemes (the countries are organised by Region). Overall, the patterns are highly variable among countries, and there are big differences among countries within each region of Europe. Table 3 displays the same information, but the countries are ranked decreasingly according to the total scores (the sum of the number of variables that were recorded by data collection systems in each country). It will be noted that several countries from Southern Europe (Italy, Spain), and particularly Southeast Europe (Bulgaria, Greece, Croatia, Moldova), are highly ranked. One exception in the Northeast region is the Netherlands, which is highly ranked.

Table 2. The selected variables collected by national/regional schemes (black cells). Countries are organised by Region (first column). Variables (top row) are organised according to the type of information. The total scores per country (the sum of the total number of variables which were recorded) are indicated (last column). Similarly, the total scores per variable (number of countries in which it is recorded) are indicated (bottom row).

Country	Hunting ground (Managemnt unit)					Quota	Animals								Nº hunter licencies	Score
	Size	GIS HG	Munic	Fencing	Suppl food		Nº shot hunt	Nº shot season	Modality	Nº hunter hunt	Hunted area hunt	GIS hunted area	Hunted area season	Nº sex&age		
Lithuania	1	1	1	0	0	1	1	1	1	1	0	1	0	1	1	11
Russia	1	1	1	0	1	1	0	1	0	0	0	1	0	1	1	9
Estonia	1	1	1	0	1	1	0	1	0	0	0	1	0	1	1	9
Poland	1	1	1	0	1	1	0	1	0	0	0	1	0	0	1	8
Latvia	1	1	0	0	0	1	1	1	0	0	0	0	0	1	0	6
Belarus	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	5
Armenia	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	3
Finland	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	3
Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Czechia	1	1	1	1	0	1	0	0	0	0	0	1	0	1	0	7
Hungary	1	1	0	1	1	1	0	0	0	0	0	0	1	1	0	7
Germany	1	1	1	0	0	0	0	1	0	0	0	0	0	1	0	5
Norway	1	0	1	0	1	0	0	1	1	0	0	0	0	0	0	5
Sweden	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
Scotland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
Italy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Greece	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	11
Croatia	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	11
Moldova	1	0	1	0	1	1	1	1	1	1	0	0	1	1	1	11
Romania	1	1	1	0	1	1	1	1	0	0	0	0	0	1	0	9
Slovenia	1	1	1	0	0	1	0	1	0	1	0	0	0	1	0	7
Macedonia	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	5
Serbia	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	5
Montenegro	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2
Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	14
Belgium	1	1	1	0	1	0	0	1	0	1	0	1	0	1	0	8
Luxembourg	1	1	0	1	1	0	0	1	0	0	0	0	0	1	1	8
France	1	1	1	0	0	0	0	1	0	0	0	1	0	1	1	7
Portugal	1	1	1	1	0	0	0	1	1	0	0	0	0	1	1	8
Andorra	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Score	23	20	25	11	15	21	10	25	11	9	6	15	5	21	12	

Table 3. The selected variables collected by national/regional schemes (black cells). Countries are ranked decreasingly according to the total scores (the sum of the total number of variables which were recorded in a given country). Variables (top row) are organised according to the type of information. The total scores per country (the sum of the total number of variables which were recorded) are indicated (last column). Similarly, the total scores per variable (number of countries where it is recorded) are indicated (bottom row).

Country	Hunting ground (Management unit)					Quota	Nº shot hunt	Nº shot season	Modality	Animals					Nº hunter licencies	Score
	Size	GIS HG	Munic	Fencing	Suppl food					Nº hunter hunt	Hunted area hunt	GIS hunted area	Hunted area season	Nº sex&age		
Bulgaria	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Italy	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Spain	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Lithuania	1	1	1	0	0	1	1	1	1	1	0	1	0	1	1	11
Greece	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	11
Croatia	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	11
Moldova	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	11
Russia	1	1	1	0	1	1	0	1	0	0	0	1	0	1	1	9
Estonia	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	9
Romania	1	1	1	0	0	1	1	1	0	0	0	0	1	1	1	9
Poland	1	1	1	0	1	1	0	1	0	0	0	1	0	0	1	8
Belgium	1	1	1	0	0	1	0	1	1	0	0	1	0	1	0	8
Luxembourg	1	1	1	0	1	1	0	1	0	0	0	0	0	1	1	8
Portugal	1	1	1	1	0	0	0	1	1	1	0	0	0	1	1	8
Czechia	1	1	1	0	0	1	0	0	0	0	0	1	0	1	0	7
Hungary	1	1	1	0	0	1	0	0	0	0	0	1	0	1	0	7
Slovenia	1	1	1	0	1	0	0	1	0	1	0	0	0	1	0	7
France	1	1	1	0	0	0	0	1	0	0	0	1	0	1	1	7
Latvia	1	1	0	0	0	1	1	0	1	0	0	0	0	1	0	6
Belarus	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	5
Germany	1	0	1	0	0	0	0	1	0	0	0	0	1	1	0	5
Norway	1	0	1	0	1	0	0	1	1	1	0	0	0	0	0	5
Macedonia	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	5
Serbia	1	1	1	0	0	0	0	1	0	0	0	1	0	0	0	5
Armenia	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	3
Finland	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	3
Andorra	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Sweden	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
Montenegro	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2
Scotland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Score	24	21	26	11	15	21	10	25	11	9	6	15	5	21	12	

3.2.2. Type of data collected

Table 4 ranks, in decreasing order, the frequency with which different variables were collected across countries.

Table 4. This table ranks, in decreasing order, the frequency with which different variables were collected across countries (green=collected). Variables (first column) are coloured according to the type of information). The total scores per variable are indicated (last column).

Data	BUL	NED	IT	SP	LIT	GRE	CRO	MOL	RU	EST	RO	PO	BE	LUX	POR	CZ	HUN	SL	FR	LAT	BEL	GER	NOR	MAC	SER	AR	FIN	AN	SW	MON	SCO	ALB	Score
Munic	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0	26
Nº shot season	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0	1	0	1	1	0	0	25
Size	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0	0	0	24
GIS HG	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	21
Quota	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	21
Nº sex&age	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	0	0	0	21
Suppl food	1	1	1	0	0	1	1	1	1	0	1	0	1	0	1	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	15
GIS hunted area	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	15
Nº hunter licencies	1	0	0	0	1	1	0	1	1	1	1	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	12
Fencing	1	1	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	11
Modality	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	11
Nº shot hunt	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Nº hunter hunt	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Hunted area hunt	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Hunted area season	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5

No variable was ever recorded by all countries. Apart from the Municipality, the information most frequently recorded in the official statistics concerning harvests of wild boar included: (i) the quantity of animals shot per hunting ground and season, and (ii) the size of the hunting (management) ground. For instance, Municipality and the number of wild boar shot per hunting ground and season were recorded in 24 countries out of 32 (Scotland included). It should be stressed that the GIS files for the hunting grounds are available for 20 out 32 countries (totally, or partially, for some regions). Those variables recorded least frequently appertain to hunting event information. The number of hunters, indirectly estimated from the number of hunter licenses, is available for less than half of the countries.

In order to provide more details, Fig. 4 highlights that the most frequently recorded variables (over two thirds of the countries) refer to hunting ground level (orange, bottom):

- Availability of GIS file for the Hunting ground

- Number of animals shot per hunting ground according to sex and age categories

- Existence of hunting quota

- Surface of the hunting ground, Municipality

- Total number of wild boar shot per season

A reduced number of countries (ranging from 20 to 50%, bars in green) recorded information at the hunting event level:

- Hunted surface per event (communal hunting)

- Modality of hunting

- Number of hunters per hunt

- Number of wild boar shot per hunt

- GIS file available for the hunted area during a given event

Number of selected variables that are collected
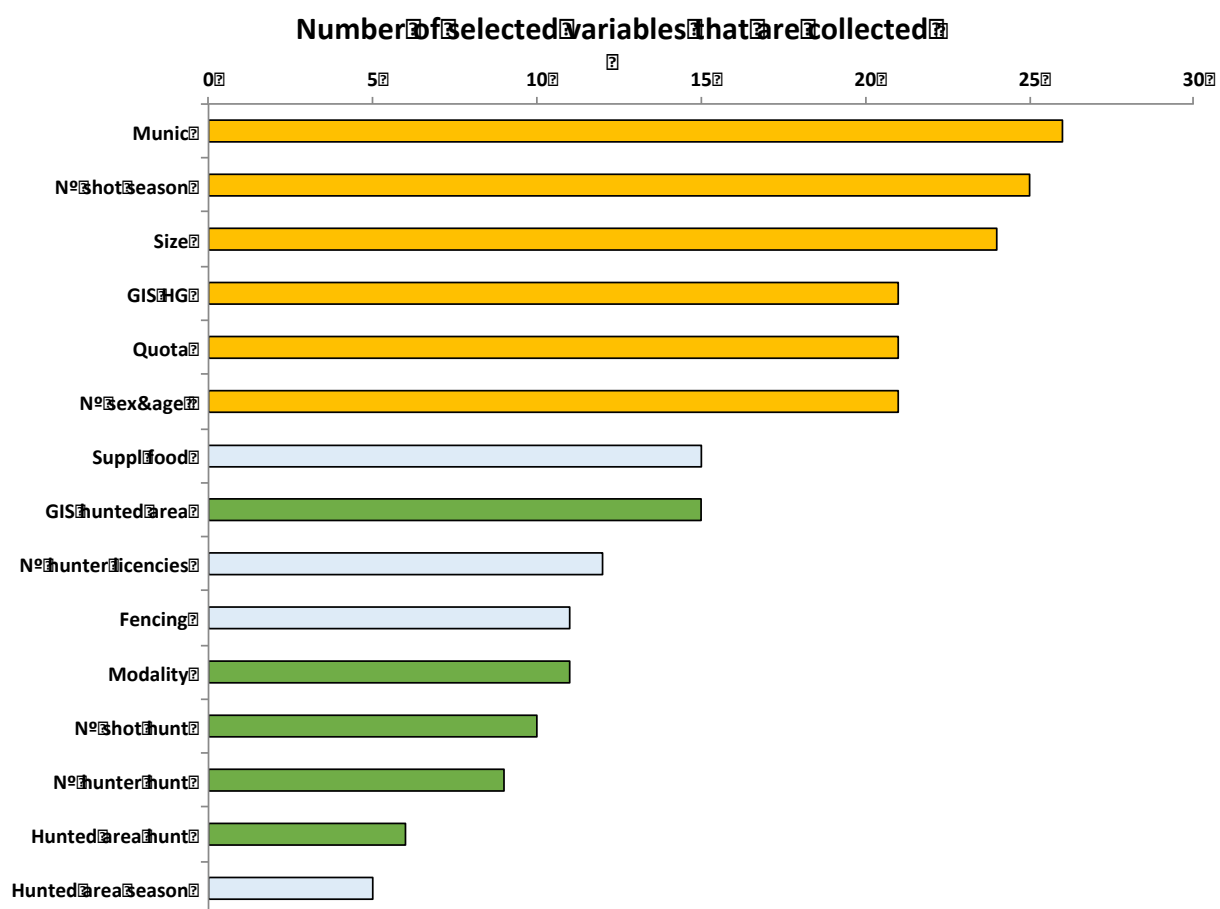
Figure 4. Illustration of the number of selected variables (Table 1) that are collected by national/regional schemes for the countries providing responses to the questionnaire. The most

frequently recorded variables referring to hunting ground level are highlighted in orange (top), while information at hunting event level was recorded by a reduced number of countries (bars in green).

3.3. Clustering analysis of similarities

Upon observing the dendrogram (Fig. 5) in order to visualise the hierarchical clustering analysis, 3 clusters as four branches that occur at about the same horizontal distance are noted.
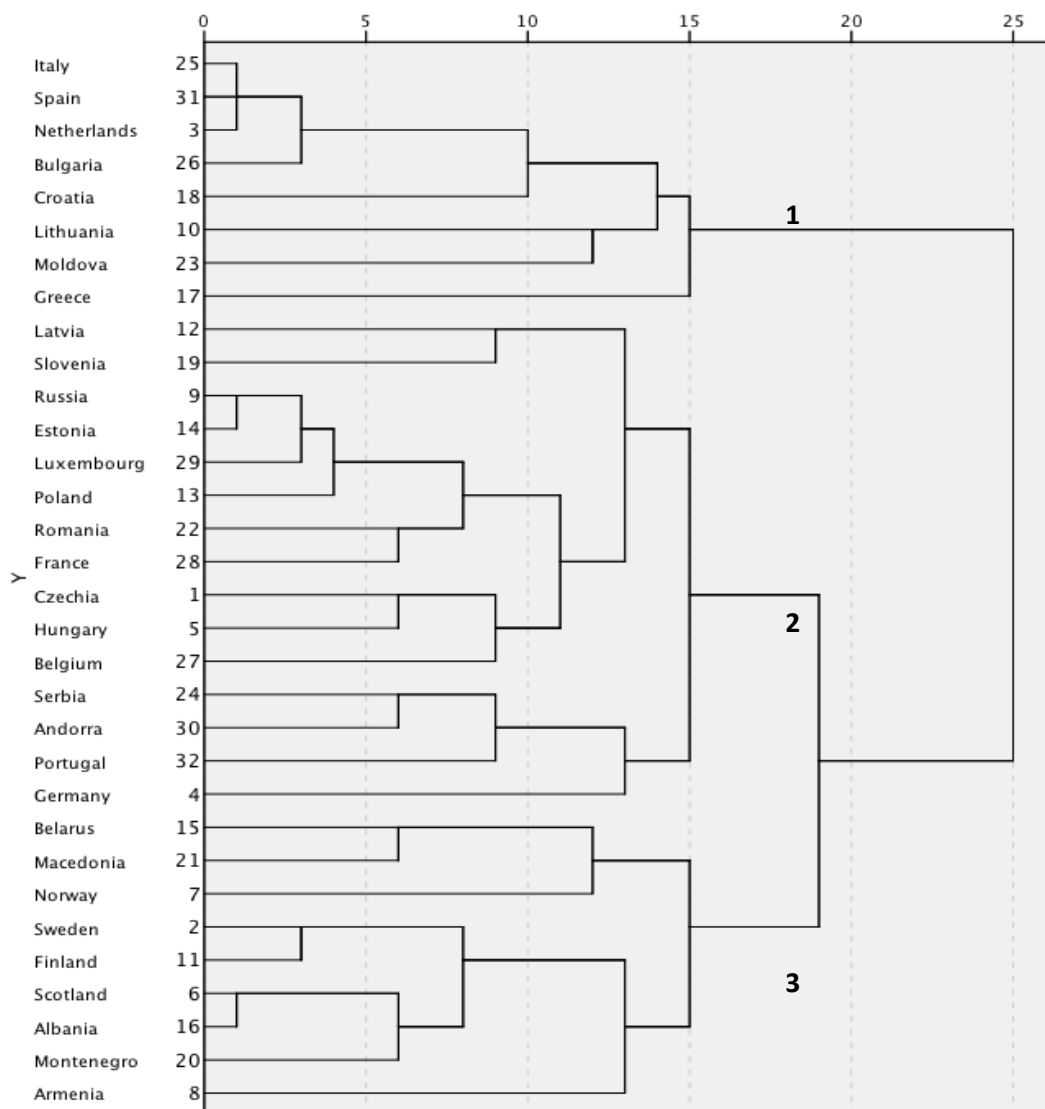

Figure 5. Visualisation (dendrogram) of the hierarchical clustering analysis, which identified four main clusters. The horizontal axis of the dendrogram represents the distance or dissimilarity between clusters. The vertical axis represents the countries and clusters. Each union (fusion) of two clusters is represented on the graph by splitting a horizontal line into two horizontal lines. The horizontal position of the split, shown by the short vertical bar, shows the distance (dissimilarity) between the two clusters.

Fig. 6a indicates the clusters identified by a hierarchical clustering analysis, identifying spatial patterns. After clustering the countries, we analysed each group in order to describe the data collection framework using a bi-dimensional plot (Figure 6b) in the principle component space.
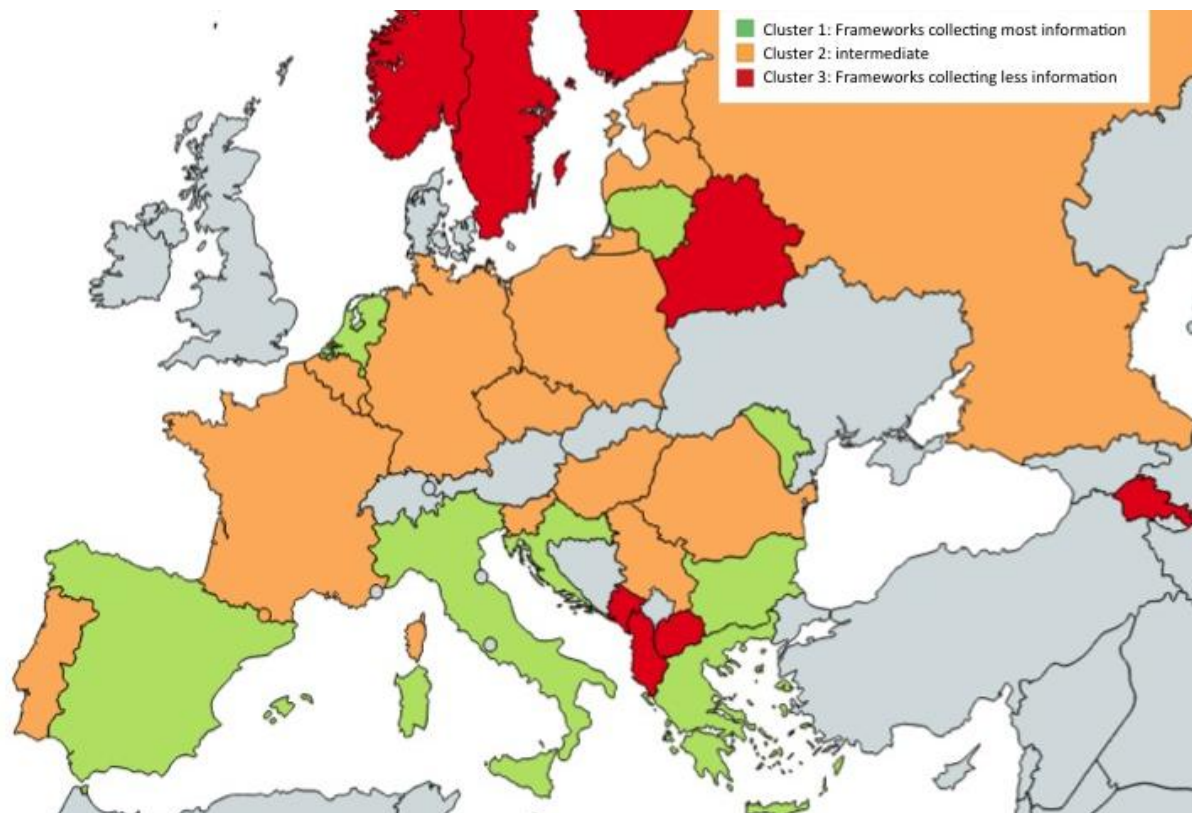
Figure 6a. Clusters of countries identified by means of the hierarchical clustering analysis.
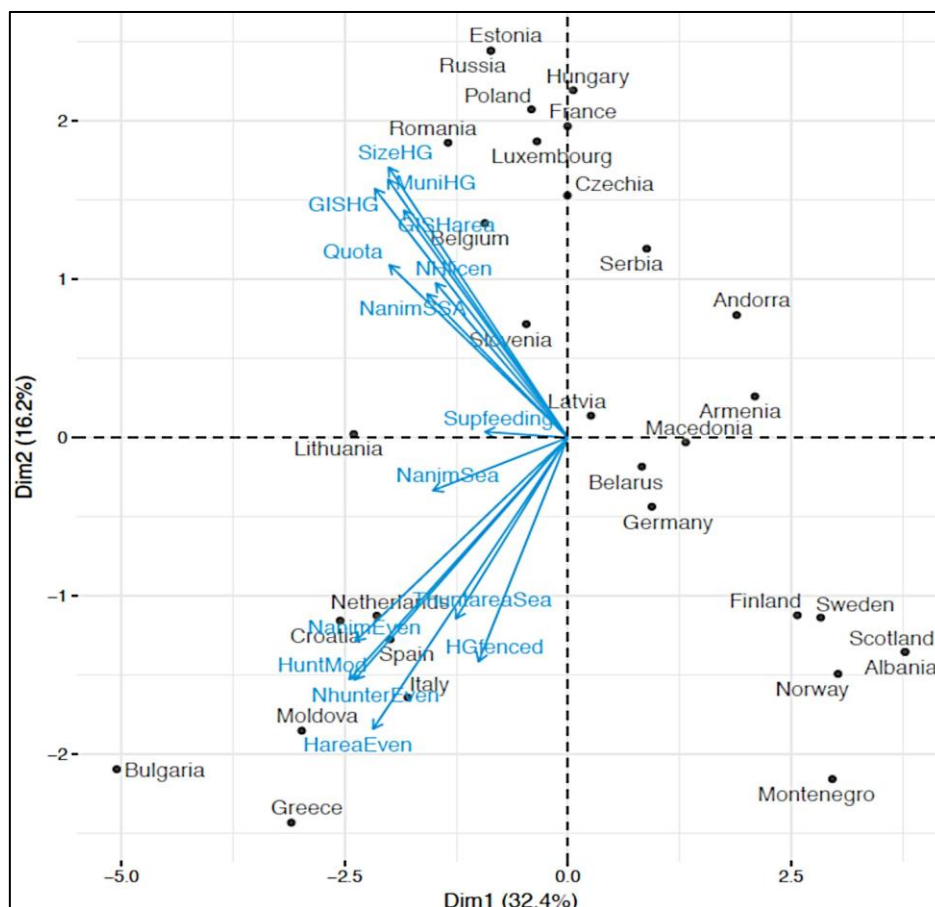
Each data point represents a country and each vector represents a hunting variable. Arrows indicate the directions of the original variables in relation to the principal components.

Figure 6b. Biplot indicating country grouping of the 2 dimensions in the principal component analysis of hunting variables.

Cluster 1 (Fig. 6b) corresponds to certain Mediterranean countries plus the Netherlands and Lithuania, and is associated with very complete data collection frameworks, in which most of the data, and particularly data at the hunting ground level, are collected (see biplot), if not for the entire country, at least for part of it or for a region. Conversely, cluster 4 (Fig. 6b, biplot) refers to countries in which the data collected are scarce (or inexistent) at hunting ground level. It includes countries in which the presence of wild boar has occurred only recently (Scandinavian countries, the UK), some countries from the Balkans or those in which hunting is banned (Albania). A range of countries, mainly distributed in Central and East Europe, occupies an intermediate position. An example of these is France, which records many variables at an administrative unit higher than municipality, but not at hunting ground level. Cluster 3 countries could be classified together with those in cluster 4, given its position in the dendrogram. Scotland pertains to cluster 3.

4.   Discussion

We obtained answers to the questionnaire from respondents who were representative of the vast majority of European countries (57 questionnaires from 32 countries, covering more than 95% of European territory), which allowed us to carry out a comparative study of wild boar data collection systems across the continent. This study, therefore, describes the current status of data collection and is consequently valuable as regards developing proposals aimed at harmonising schemes. This description was obtained by selecting a minimum number of variables (Table 1) and different levels of spatio-temporal aggregation of data (hunting event *vs.* season; municipality *vs.* hunting ground) that are relevant to the use to which hunting data will be put: the spatial modelling of distribution and abundance of wild boar. We should stress that the results obtained here are based on the contributions of the respondents, who were instructed to respond only if they were absolutely certain as to the veracity of their answers.

The number of data variables that are collected by hunting collection frameworks is highly variable among countries. It is notable that few data were collected from countries in which the presence of wild boar is recent, such as the Scandinavian region. Countries from this area have good data collection systems for big game (mainly cervid species, e.g. Ueno et al. 2014; Milner et al. 2006) and we can, therefore, assume that good hunting statistics will be officially collected in due course. In fact, the Consortium is collecting high quality data from this area. In the case of the UK, which has not yet decided whether recently established wild boar will be subject to hunting management, data collection schemes must still be developed.

In order to harmonise wild boar hunting data collection across European countries, we propose a sequential strategy, whose steps will be prioritised in the following order:

1. Several countries should collect data at the hunting ground level (Fig. 4). Considering the countries included in this study, in order to achieve harmonisation, the necessary level of implementation is indicated in table 5.

   Table 5. This table summarizes the number countries included in this study where the indicated variables should be collected to achieve harmonization of data collection frameworks.

Variable	Nº countries* to be collected
Availability of GIS file for the Hunting ground	10
Number of animals shot per hunting ground according to sex and age categories	10
Existence of hunting quota	9
Surface of the hunting ground	8
Municipality	6
Total number of wild boar shot per hunting ground & season	6

   * See the specific countries referred to in Table 4.

   Those data marked in bold type are of special priority. ***Achieving this objective will result in the total harmonization of data collection at the hunting ground level by season*** (at least, when considering the countries covered by this report).

2. Second, we must focus on the countries and regions located in gap areas, i.e. Eastern Europe: **Belarus, Romania, the Balkans**. There are probably also important gaps for those countries that did not answer this questionnaire, such us **the Ukraine** and **Turkey**. Some **Central Europe countries** (e.g. Germany) are strategic given their geographical position and large surface area, and improving the data collection frameworks (by recording and making data available at the hunting ground level) will, therefore, have a great impact.

3. After steps 1 and 2, efforts should be made to include **data provided at the finest spatial and temporal resolution (hunting event level) in the data collection systems**. This includes a detailed measurement of hunting effort. In this step, the effort to harmonise systems will be considerable, as only a minority of countries already collect these data. In order to harmonize the systems (considering the countries included in this study), the necessary level of implementation is indicated in table 6.

Table 6. Countries included in this study where the indicated variables should be collected to achieve harmonization of data collection frameworks.

Variable	Nº countries to be implemented
Hunted surface per event (communal hunting)	25
Modality of hunting	23
Number of hunters per hunt	22
Number of wild boar shot per hunt	21
GIS file available for the hunter area at a given event	16

* See the specific countries in Table 4.

The information provided in the questionnaires submitted by some countries indicated that most of the data are collected (Bulgaria, Spain, Italy, Netherlands, Lithuania, Greece). Nonetheless, ENETWILD's data collection activities were not entirely or were only partially successful in the case of certain other territories. As an indication of this, the following figure (bottom) depicts the wild boar hunting data collected by ENETWILD at a good spatial resolution (Municipality or higher resolution by season) when compared to the clusters of countries identified in this report (top). With regard to the countries in cluster 1 (high quality data collection systems), it is evident that some countries still have the potential to share data (e.g. Bulgaria, Greece, Moldova, the Netherlands, part of Italy and Portugal). Further strategies should, therefore, be developed to encourage these countries to share these data and support them in doing so.

We also found that 21 countries reported that they set quotas on the total number of wild boar harvested. As noted above, this will influence the numbers shot, or the number reported. In order to partly mitigate this, it is important to collect data on how these quotas are set. We are aware that quota levels may change in response to the outbreak of ASF, and that hunting in part or all of a region may consequently be suspended, or even increased. Thus improving wild boar data will allow understanding their representativeness and subsequent interpretation of temporal trends within a region.

In order to identify those areas at which data collection should be targeted, figure 7 compares the results of the questionnaire clusters established according to the quality of the data collection frameworks (a, see Fig. 7) and the data collection performed by ENETWILD (b), indicating those countries in which hunting statistics are available.
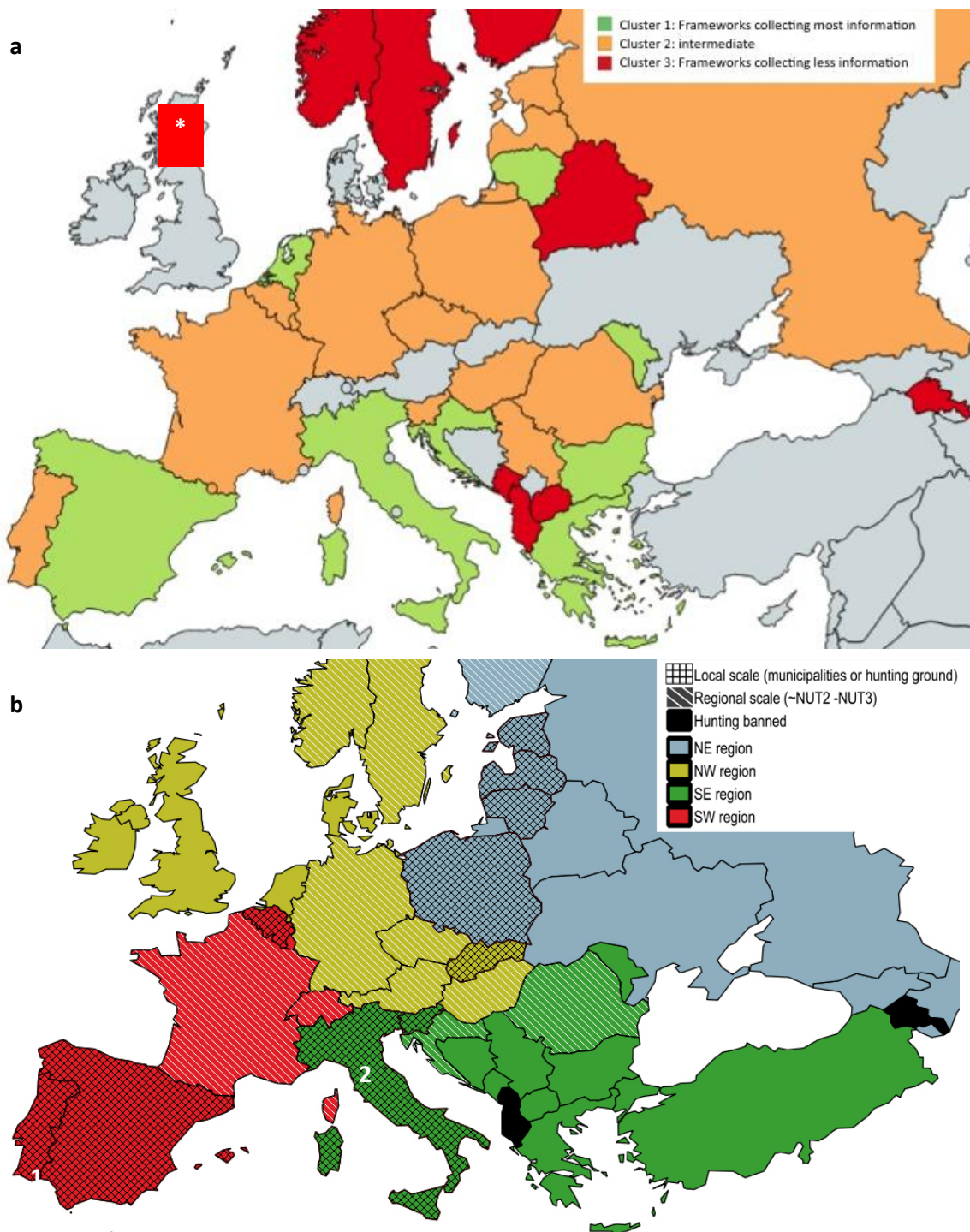
Figure 7. Results of the questionnaire clusters established according to the quality of the data collection frameworks. (i) records from hunting grounds to small management units or municipalities (black mesh), and (ii) from NUTS 2-3 (provincial or regional scale, shaded with white stripes). Countries in which wild boar hunting is banned are indicated in black. Scotland (*) pertains to cluster 3. Notes: 1) Only a reduced number of hunting grounds reported by district are collected, 2) only some provinces in this country have been reported. The 4 background colours indicate the regions into which ENETWILD divides Europe for the purpose of data collection activities.

# 5.	Conclusions and recommendations

- Hunting statistics providing quantitative information on wild boar population (and by extension, big game) are lacking or non-harmonised across European countries.

  - Most European countries collect big game hunting data, including those concerning wild boar, but each one has its own specific data collection framework (data model) with regard to the amount, type and resolution of data acquired.

  - The absence of a shared international data model for hunting makes national and/or regional hunting statistical data highly heterogeneous among countries, incomplete and dispersed and, therefore, difficult to compare among countries.

- The major strength identified for the hunting statistics data collection framework across Europe was:

  - A feasible effort, consisting of several countries collecting data at the hunting ground level, would lead to the achievement of almost 100% harmonisation for basic statistics that would still be useful for analytical purposes at the European level.

- The major weaknesses identified for the hunting statistics data collection frameworks across Europe were:

  - Official hunting statistics are incomplete and are not harmonised across countries.

  - A great effort is required to include fine spatial and temporal resolution (hunting event level) in data collection. This includes the detailed measurement of hunting effort (i. e. number hunters and dogs, beaten area) and efficiency (animals sighted *vs* animals shot during communal hunts).

  - Uncertain effects of setting quotas on the reported hunting bag data, which must be taken into account to interpret spatial and temporal trends across large areas.

- The hunting data available in the official statistics are often incomplete, dispersed and heterogeneous. Hunting statistics must, therefore, be used with caution when employed for their analysis at large-scale, and we must adopt a critical position as regards their interpretation and use. A further evaluation of hunting data quality is being carried out by ENETWILD.

- The coordination of the collection of hunting bag statistics must be achieved at first the national and then the European level, along with their scientific interpretation for their proper use.

- ENETWILD has made progress towards the harmonisation, standardisation, centralisation and analysis of hunting bag information that has already been collected in many European countries. However, in order to mitigate the problems resulting from the non-harmonised/standardised data collection schemes of the official statistics from European countries and regions, we recommend that communication among the countries be improved and an agreed-upon common scheme for data collection be established in the future.

- This protocol should be in accordance with the future needs of European hunting statistics and based on robust and well-informed data collection methods, for which we propose the adoption of a simplified version of the ENETWILD data collection model (available at http://www.enetwild.com/2018/04/25/release-model-collect-data-on-wild-boar-distribution-and-abundance-europe/). This model provides clear definitions of the concepts and variables and would allow new variables to be compared with those included in current schemes.

- Countries need detailed information on procedures for the calculation of statistics, data sources, sampling, the collection of data, control and revision, estimation, etc. This will support the adoption of a common data collection framework for hunting statistics.

- The present report identified countries that do have the potential to share good quality data, although the data collection activities promoted by ENETWILD has not succeeded in these countries so far, (i. e. Eastern Europe). Therefore, further strategies should be developed to encourage these to share data.

- While we have focused on official data collection systems, there are also voluntary schemes run by non-governmental organisations and working on a relatively small scale that need to be identified, contacted and engaged, and invited to join official systems. We must also raise awareness amongst hunters about the importance of collecting and then sharing data.

- A methodology that can be used to implement common schemes should also be agreed on by all the countries in question in order to collect hunt statistics at the annual or at the event level. We propose that this system should operate by asking the hunters providing details of their bag returns.

- The collection of hunting statistics has important shortcomings throughout Europe, many of which are specific to each case (presented in the comparative tables shown in this report).

- The standardisation of data recording will also make it possible to use correctly validated statistical information.

- There is a need for more studies expanding on the range of the data potentially collected and analysing and providing an in-depth evaluation of hunting statistics. This also includes how to address the difficulty involved in obtaining information on a national scale owing to the complexity of hunting organization: different types of hunting techniques, heterogeneity as regards hunting grounds characteristics, types, and management practices (in addition to the large amount of species involved if the intention is to implement a multi-species system).

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7. Appendix

Appendix A – List of ENETWILD collaborators (Institutions) organised by country, which directly received the questionnaire.

Albania
Agricultural Universityof Tirana, Kamez Tirana Albania
Protection and Preservation of Natural Environment in Albania

Andorra
Ministeri de Medi Ambient, Agricultura i Sostenibilitat
Unidad de Fauna / Ministeri de Medi Ambient, Agricultura i Sostenibilitat

Armenia
Department of Zoology, Faculty of Biology, Yerevan State University, Yerevan, Armenia

Austria
Food Safety Agency
Institut für Wildbiologie und Jagdwirtschaft, University of Natural Resources and Life Science, Vienna
Research Institute of Wildlife Ecology, University of Veterinary Medicine, Vienna
University of Natural Resources and Life Sciences Vienna
University of Veterinary Medicine Vienna, Research Institute of Wildlife Ecology

Belarus
Department on Control for Antiepyzootic and Preventive Work
Ministry of Forestry
Scientific and Practical Center for Bioresources, National Academy of Sciences of Belarus, Minsk

Belgium
Governmental offices: Federal Level
Governmental offices: Regional Level - Brussels
Governmental offices: Regional Level - Flanders
Governmental offices: Regional Level - Wallonia
Research Institute Nature and Forest, INBO
Veterinary and Agrochemical Research Centre

Bosnia-Herzegovina
Association of Hunting Societies in Bosnia and Herzegovina
http://www.slobih.ba/v1/index.php/contacts
Association of Hunting Societies of Tuzla Canton http://www.lovackisavez-hb.ba/kontakt.asp
Hunter's Association of Herzeg-Bosnia http://www.lovackisavez-hb.ba/kontakt.asp
Hunter's Association of Republic of Srpska: https://lovcirs.com/
Ornithological Society "Našeptice"
Ministry of Agriculture, Forestry and Water Management

Bulgaria
Bulgarian Food Safety Agency
Executive Agency for Forest
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Science
Regional forestry directorate
Regional veterinary office in Varna

Croatia
Faculty of Veterinary Medicine, University of Zagreb
University of Zagreb, Faculty of Agriculture
Veterinary Service

Czech Republic
Czech University of Life Sciences Prague
Faculty of Forestry and Wood Technology, Mendel University in Brno

Hepia / Filière Gestion de la Nature
Institute of Vertebrate Biology
Veterinary Service
VÚZV Institute of Animal Science, Prague

Denmark

Danish Agriculture and Food Council
Department of Bioscience - Wildlife Ecology, Aarhus University

Estonia

Department of Zoology, Institute of Ecology and Earth Sciences, University of Tartu
Estonian Environment Agency, Nature Department
Estonian University of Life Sciences
Veterinary and Food Board, Animal Health, welfare and feeding stuffs department
Wildlife Department, Estonian Environment Agency

EU

Centre for Ecology and Hydrology
EFSA
European Alien Species Information Network / Joint Research Centre
European Bird Census Council
European Centre for Disease Prevention and Control
European Commission DG-SANTE
European Commission, Directorate-General for Health and Food Safety. G.3. – Official controls and eradication of diseases in animals
European Environment Agency
European Federation of Hunting Associations and Conservation
European Infrastructure for Biodiversity and Ecosystem Research
EUROUNGULATE (EURODEER, EUROBOAR) / Fondazione Edmund Mach
FACE - Federation of Associations for Hunting and Conservation of the EU
Research and Innovation (RTD) European Commission: OPEN science and Citizen Science
Vectornet Consortium / Environmental Research Group Oxford

Finland

EVIRA
Executive Manager Of Game Management, Finnish Wildlife Agency
Finnish Wildlife Agency, Tenala
Natural Resources Institute Finland
Natural Resources Institute, Joensuu

France

ANSES
CIRAD
Museum National d'Histoire Naturel
Office National de la Chasse et de la Faune Sauvage
France National Hunter Federation (FÉDÉRATION NATIONALE DES CHASSEURS)

Georgia

Ilia Chavchavadze State University, Faculty of Life Sciences, Tbilisi, Georgia

Germany

Department of Ecological Modelling/Helmholtz Centre for Environmental Research GmbH - UFZ
Federal Ministry of Food and Agriculture
Friedrich-Loeffler-Institut (FLI)
German Hunting Association (Deutscher Jagdverband)
Institut für Terrestrische und Aquatische Wildtierforschung (ITAW) - Stiftung Tierärztliche Hochschule Hannover (TiHo)
Landwirtschaftliche Zentrum Baden-Württemberg

Max Planck Institute, Germany
Thünen Institut

Greece

Department of Forestry and Environmental Management and Natural Resources, Democritus University of Thrace, Greece
University of Patras, Department of Environmental and Natural Resources Management
University of Thessaly, Greece

Hungary

Hungarian Game Management Database Szent István University, Faculty of Agricultural and Environmental Sciences, Institute for Wildlife Conservation
Institute of Wildlife Management and Vertebrate Zoology, University of Sopron
Ministry of Agriculture
Department of Food Chain Control
Division of Animal Health and Coordination
National Food Chain Safety Office in Hungary

Iran

CIBIO-UP
Toxoplasmosis Research Center, Mazandaran University of Medical Sciences, Sari, Iran.

Ireland

Queens University, Belfast

Israel

Israel Nature and Parks Authority

Italy

Animal and Plant Health Agency
Consiglio Nazionale delle Ricerche, Institute of Ecosystem Studies / Societas Europaea Mammalogia
ISC-CNR
ISPRA
Istituto Zooprofilattico Sperimentale delle Venezie (www.izsvenezie.it)
Italian Institute for Environmental Protection and Research - ISPRA
National Reference Centre Wildlife Diseases
Università degli Studi di Torino
University of Sassari

Kazakhstan

Department on Animal Species of the Forestry and Hunting Committee
Institute of Zoology, Ministry of Education and Science
Naurzum National Nature Reserve
Advisor for GIS and research at Association for Conservation of Biodiversity of Kazakhstan
Association of game area managers "Kansonar", which most likely collect all data and provide them to the a.m. agency.
Committee for Forestry and Wildlife under the Ministry of Agriculture of Kazakhstan / wildlife/hunting department.
The Department of Theriology of the Institute of Zoology

Kosovo

Food and Veterinary Agency

Latvia

Latvian Food and Veterinary Service
Latvian State Forest Research Institute
State Forest Research Institute 'Silava', Salaspils, Latvia
State Forest Service, Republic of Latvia

Lithuania

Lithuanian Research Centre for Agriculture and Forestry

Luxemburg

Administration de la nature et des forêts, Luxembourg. Service de la nature

former Yugoslav Republic of Macedonia

Faculty of Forestry, Skopje, former Yugoslav Republic of Macedonia

Moldova

Food Safety Subdivision of Floresti District

Forestry Agency of Moldova

Veterinary Service

Montenegro

Biotechnical Faculty, MihailaLalića 1, 81000 Podgorica

Center for Protection and Research of birds of Montenegro (CZIP)

Netherlands

Dutch Wildlife Health Centre (UU)

Erasmus MC

Royal Dutch Hunting Association

Universiteit Utrecht

Wageningen University and Research

Zoogdiervereniging

Norway

Miljodirektoratet (Norwegian Environment Agency)

Norwegian Institute for Nature Research (www.nina.no)

Poland

Institute of Nature Conservation, Polish Academy of Sciences

Mammal Research Institute, Polish Academy of Sciences

National Veterinary Research Institute PIWet

Veterinary Service, Chief Sanitary Inspectorate

Portugal

Aveiro University

CIBIO-InBio and Porto University

Romania

Fauna & Flora International

Food Safety Agency

National Sanitary Veterinary and Food Safety Authority of Romania

Transylvania University of Brasov

Russia

A.N.Severtsov Institute of Ecology and Evolution of Russian Academy of Sciences, Moscow, Russian Federation

Department Zoo- and Zoo-anthroponotic diseases of FSBSI Saratov SRVI,

Institute of Plant and Animal Ecology

Ministry Environment

Molecular virology lab, VNIIVViM, Pokrov, Russia

Reference Laboratory for African Swine Fever FGBI "ARRIAH"

Russian Research Institute of Game Management and Fur Farming of RAAS, Kirov, Russian Federation

Serbia

University of Belgrade, Faculty of Forestry

Slovakia

State Advisor |Department of Food Safety and Nutrition |Section of Food and Trade | Veterinary Service

Slovenia

Environmental Protection College, Velenje, Slovenia

Slovenian Museum of Natural History

Spain

CAP DEL SERVEI DE CAÇA I PESCADG Medio Natural i Avaluació Ambiental
Dirección General de Medio Natural/ Murcia
Junta de Comunidades de Castilla la Mancha
Jefatura de caza y pesca de Zamora
Jefatura del Servicio de Caza y Pesca CyL
SEFaS (UAB)
Servicio de Fauna y Flora Silvestre Diput Foral Guipúzcoa
Subdirector adjunto de Política Forestal en el MAPAMA
Universidad Barcelona /IUGB
Universidad de Alcalá de Henares
Universidad de Málaga
University of Cordoba
Vet SECEM-Cataluña
Servizo de Caza e Pesca Fluvial, Galicia

Sweden

National Veterinary Institute (SVA), Sweden
Swedish University of Agricultural Sciences
Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences

Switzerland

Centre de Cartographie de la Faune, Neuchâtel, www.cscf.ch
Centre for Fish and Wildlife Health, University of Bern
Federal Office for the Environment - FOEN
Research Group Wildlife Management (WilMa), Zürcher Hochschule für Angewandte Wissenschaften
ZHAW, Institut Umwelt und Natürliche Ressourcen IUNR (Institute of environment and natural resources), Wädenswil, www.zhaw.ch
U Bern

Tajikistan

Head of the State Enterprise of Natural Protected Areas of Committee of Environmental Protection

Turkey

Department of Biology, Faculty of Arts and Sciences, Kırıkkale University

Turkmenistan

Deputy Minister Ministry of Nature Protection

Ukraine

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Monitoring Department
and the Protection of the State Hunting Fund, State Forest Resources Agency of Ukraine
Unit for animal health and welfare

United Kingdom

APHA
MammalWeb / Durham University
National Biodiversity Network
Scottish Natural Heritage
University of Edinburgh, Royal (Dick) School of Veterinary Studies
University of Exeter

USA

UC Davis, USA
USDA APHIS

Uzbekistan

Committee for Nature Protection of the Republic of Uzbekistan

State Committee for Nature Protection

World

FAO

Global Biodiversity Information Facility

International Union of Game Biologists / Administration de la Nature et des Fôrets, Luxembourg

United Nations Environment Programme

Wetlands international

World Wild Fund for Nature

OIE

Appendix B – Informative letter of presentation used to provide information on the questionnaire.

stionnaire to identify where wild boar (big game) disaggregated hunting statistics are compiled through Europe

Send to project.enetwild@uclm.es

The European Food Safety Authority (EFSA) aims at using wildlife abundance data obtained from the European continent for the analysis of the risk factors related to pathogens transmissible to humans and livestock. Currently, the Consortium ENETWILD (established through a framework contract funded by EFSA) is focusing on the collection of wild boar abundance data from the European continent for the analysis of the risk factors of African Swine Fever (ASF) spread, and for the assessment of effectiveness of wild boar management measures in the affected areas. Moreover, EFSA is in need to analyse the situation more in details and to assess the risks of ASF introduction and spread to neighbouring countries. A normalized model to collect data on wild boar distribution and abundance data; and its evolution in the ASF affected countries and in the countries at risk could facilitate epidemiological analysis and risk assessment. Therefore, the ultimate aim of ENETWILD is to produce a reliable source of wild boar population data collected in a harmonized way and regularly updated. The wild boar population density in Europe (the number of animals per area unit of suitable habitats) has to be estimated across European countries as close as possible to the true values of wild boar abundance. It will be done on the basis of: (i) distribution (georeferenced) data, (ii) density, and (iii) hunting bag data compiled from different sources and at different habitat, management (e. g. hunting ground) and administrative unit levels.

The available statistical information on hunting has been scarce and scattered throughout Europe. The difficulty of obtaining information not only on a national scale, but also regional, has been exacerbated by the complexity of hunting due to the different types of hunting, the large amount of species involved and the heterogeneity in hunting grounds and management practices. The collection of hunting statistics presents important shortcomings across Europe, many of them specific to each case. In general, the problems associated are:

— Hunting data available in the official statistics are often incomplete, dispersed and heterogeneous. Therefore hunting statistics must be used with caution, and we must adopt a critical position in their interpretation and use.
— Qualitative changes in the definitions of important concepts and variables collected across countries, regions and time.
— The lack of harmonised? Procedures for calculation of statistics, data sources, sampling, collection of data, control and revision.

Objectives of this questionnaire

ENETWILD aims at collecting information on wild boar hunting statistics with the intention of producing a reliable source of harmonized and comparable population data at high spatial resolution. A wild boar Distribution and Abundance Data Model (DADM) will be adopted by ENETWILD to collect available data sets, which can be useful to model distribution and abundance information across Europe. The DADM is intended to be distributed next March 2018 to all Annual General Meeting attendants, other stakeholders and possible data providers, representing all European Countries.

Hunting statistics are the most important source of potentially comparable data on wild boar abundance across Europe. In absence of more systematic comparative studies, as a first step, this questionnaire aims at identifying and describing the sources of wild boar hunting data through European Countries, which should be aggregated at (the lowest) known spatial scale (ranging optimally from hunting ground/management unit to Municipality/District level) to made them comparable across countries.

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The questionnaire

The questionnaire is presented in excel format, and subdivided into 5 sheets:
i) General
ii) Hunting ground
iii) Game animals
iv) Hunters
v) Wild boar carcasses

Within each sheet, the questions are organized in sections (repeated blocks of questions), which refer to a specific Country or region. Interviewees can copy below as many blocks of questions as needed for different regions or provinces since the hunting collection systems may vary among them.

A reference terminology for administrative divisions is provided in a separate sheet name "NUTS Europe". NUTS3, LAU1 and LAU2 refer to the coding system of administrative units in use by EUROSTAT (see http://ec.europa.eu/eurostat/web/nuts/national-structures-eu). These codes are useful for database querying, but finer information are needed for data use.
For each question, the column "Field description" details what exactly what we are asking. The column "Values" indicates the nature of the response (text, number, closed responses according to pre-defined categories, etc.). You must enter your response in the column "Response".

This questionnaire must be sent to:
- **Email: project.enetwild@uclm.es**

For questions, please, contact project.enetwild@uclm.es.