

Understanding long-term hunting statistics: the case of Spain (1972-2007)

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Abstract

Hunting is assuming a growing role in the current European forestry and agroforestry landscape. However, consistent statistical sources that provide quantitative information for policy-making, planning and management of game resources are often lacking. In addition, in many instances statistical information can be used without sufficient evaluation or criticism. Recently, the European Commission has declared the importance of high quality hunting statistics and the need to set up a common scheme in Europe for their collection, interpretation and proper use. This work aims to contribute to this current debate on hunting statistics in Europe by exploring data from the last 35 years of Spanish hunting statistics. The analysis focuses on the three major pillars underpinning hunting activity: hunters, hunting grounds and game animals. First, the study aims to provide a better understanding of official hunting statistics for use by researchers, game managers and other potential users. Second, the study highlights the major strengths and weaknesses of the statistical information that was collected. The results of the analysis indicate that official hunting statistics can be incomplete, dispersed and not always homogeneous over a long period of time. This is an issue of which one should be aware when using official hunting data for scientific or technical work. To improve statistical deficiencies associated with hunting data in Spain, our main suggestion is the adoption of a common protocol on data collection to which different regions agree. This protocol should be in accordance with future European hunting statistics and based on robust and well-informed data collection methods. Also it should expand the range of biological, ecological and economic concepts currently included to take account of the profound transformations experienced by the hunting sector in recent years. As much as possible, any future changes in the selection of hunting statistics should allow for comparisons between new variables with the previous ones.

Key words: hunting; licenses; hunters; ranches; captures.

Resumen

Estadísticas oficiales de caza: el caso de España (1972-2007)

La caza está cobrando un creciente protagonismo en los terrenos forestales y agroforestales europeos actuales. Por ello, resulta esencial contar con unas fuentes estadísticas consistentes, en muchos casos inexistentes, que proporcionen la información cuantitativa necesaria para la elaboración de políticas, la planificación y la gestión de los recursos cinegéticos disponibles. La Unión Europea ha manifestado recientemente el interés por la mejora de las estadísticas de caza y la necesidad de establecer un protocolo común europeo para la recogida y uso de las estadísticas de caza. Este trabajo pretende contribuir al debate sobre la mejora de las estadísticas de caza europeas mediante un análisis crítico de las estadísticas oficiales nacionales de caza en España en los últimos 35 años. El análisis se centra sobre los tres grandes pilares que sustentan a la actividad cinegética: los cazadores, los terrenos y los ejemplares cinegéticos abatidos. En concreto, se facilita a investigadores, gestores y demás usuarios una mejor comprensión de la estadística oficial de la caza y, en segundo lugar, se ponen de relieve sus principales fortalezas y debilidades. Los resultados obtenidos indican que la estadística oficial de la caza en España es incompleta, se encuentra dispersa y no es homogénea a lo largo del periodo de estudio; hechos a tener en cuenta a la hora de utilizar estos datos. En consecuencia, en este trabajo se aclaran conceptos de la información disponible y se proponen posibles mejoras en la estadística cinegética que permitan contribuir en el futuro a un mejor conocimiento del sector. La principal medida que se propone es la adopción de un protocolo común de recogida de información para las diferentes regiones de España, que un futuro debería estar coordinado con los avances de las estadísticas de caza europeos. Este protocolo debería ba-

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sarse en una metodología consolidada y adaptarse a las profundas transformaciones experimentadas por el sector de la caza en los últimos años, tanto desde un punto de vista biológico como ecológico y económico. No obstante, se quiere resaltar que los cambios presentes y futuros de las estadísticas deberían siempre permitir las comparaciones entre las nuevas variables y las anteriores.

Palabras clave: cinegética; licencia; cazador; terreno; coto; captura.

Introduction

Hunting has acquired significant economic and environmental importance in recent decades in the context of growing social demand in Europe (Díaz *et al.*, 2008). Due to the increase in the quality of life experienced in most industrialized societies, hunting, and especially big-game hunting, has become a luxury expanding activity. These changes in the demand for hunting may be one of the factors that have led to dramatic increases in ungulates in Europe during the past several decades (Milner *et al.*, 2006). There have also been supply factors affecting hunting populations, such as the transformation of agricultural practices, institutional changes and biological factors (Ortuño, 1970; López, 1986; Delibes-Mateos *et al.*, 2009; Vargas *et al.*, 2006). Some species, particularly deer and wild boar, have become the main animal species in forestry and agroforestry systems (San Miguel, 1994; Carranza, 1999), and, throughout Europe these species commonly provide an important economic activity but also growing concerns (Côté *et al.*, 2004; Mysterud, 2010). This situation has implications for the economic, cultural and environmental changes taking place in rural areas.

Hunting must be considered in the conservation and management of natural resources in rural areas. This requires, in turn, precise and extensive statistical information on which to base possible indices and actions. In this sense, official hunting statistics are an important analytical tool for our society. They help decision-makers learn more about the economic, ecological and social situation of this sector. As a result, hunting statistics are essential for developing policies and effective planning and management of available hunting resources. Since the late 20th century, hunting legislation has explicitly reflected the importance of statistical information for the sound management of hunting resources (*e.g.*, from the late 1980s in Spain: Ley 4/1989, de 27 de marzo, sobre Conservación de Espacios Naturales y de la Fauna y Flora; Ley 43/2003, de 21 de noviembre, de Montes; y Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad). Recently, the European Commission (Athens on 3rd June 2006) has

declared the importance of high quality hunting bag statistics and the need to set up a common scheme in Europe for the collection, scientific interpretation and proper use of hunting statistics (http://ec.europa.eu/environment/nature/conservation/wildbirds/hunting/index_en.htm, consulted in February 2011). However, despite the legislative efforts, hunting resources remain less well-known than other products and forest resources (forest, timber or livestock production), and the available statistical information on hunting has been scarce and scattered (Apollonio *et al.*, 2010). The difficulty of obtaining information on a national scale 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. All of this has contributed to hunting being relegated to second place in the decision-making process concerning the production or protective role of forests (*e.g.*, for wood and other natural resources). Hence, it is important to obtain accurate statistics that will allow us to better describe and understand this sector.

Unlike other forest resources, and with the exception of information on foreign trade of meat (the database of statistics of EUROSTAT, FAO and FAOSTAT), hunting does not have a source of official statistics at the international scale. The absence of a shared international statistical protocol for hunting makes national hunting statistical data very heterogeneous and often difficult to compare, not only because of the type of information collected, but also because of the methodology employed to obtain it. For example, in France, Austria and Hungary, data on the demographic composition of captured big game (males, females and calves) is available, while in other European countries, such as Spain, Germany or Poland, this information is not available (Milner *et al.*, 2006).

Despite the limitations of hunting statistics, we find studies on the hunting sector that, for decades, have depended on them. For example, in Spain these studies have been carried out both in the social sciences, such as studies by López Ontiveros (1986), Cecilia and Martínez (1986), or Fernández-Cavada *et al.* (2008),

and in biology and the natural sciences, *e.g.*, Virgos *et al.* (2007). Over time, authors have been paying less attention to the analysis and assessment of the statistical sources used. In particular, we have detected reduced criticism about the significance and meaning of the collected variables, data quality and their reliability. This could lead to erroneous interpretations of the statistical information available, leading to inappropriate outcomes and conclusions.

The above situation suggests the need for studies such as this one that gathers, systematizes, analyzes and provides an in-depth evaluation of hunting statistics. Our main objective is to provide information and discussion for the current debate on the improvement of European hunting statistics as has been pointed out by the European Commission. To achieve this objective we first aim to facilitate a better understanding of official Spanish hunting data for researchers and other users. Second, we highlight the strengths and weaknesses of the currently used Spanish hunting statistics. We also suggest realistic remedies to some limitations of the statistics that we think could be easily introduced in the near future in order to contribute to a better understanding of the hunting sector and, consequently, provide better tools for its management. This work focuses on official Spanish hunting statistics in the period 1972-2007. This period was chosen for two reasons. First, it was from 1972 onwards that Spanish hunting statistics were systematically produced and the number of measured variables expanded (MA, 1973-1981b). Second, it was also during this period that the current Spanish hunting and game management model took shape. This study focuses on statistical data relating to the three cornerstones that underpin hunting: hunters, hunting grounds and wild game captures.

Material and methods

Sources for hunting statistics

In the first half of the 20th century, the collection of statistical information on hunting in Spain was scarce and was not characterized by a systematic approach. The first explicit official hunting information in Spain appeared in 1923 (INE, 1923). In 1936, the «Ministerio de Agricultura Industria y Comercio» published data on hunting licenses related to the period from 1930-1934 (Pardo, 1936). From 1940, statistical resources included a section on hunting in the annual reports of

the «Dirección General de Montes, Caza y Pesca Fluvial» (MA, 1955). More recently, *i.e.*, since 1965, game information began to be quantitative and more systematic (MA, 1956-1972; MA, 1973-1981b; MAPA, 1982-1984; MAPA, 1985-1988). It should also be mentioned that hunting guides have been edited by the «Ministerio de Información y Turismo» since 1960; the guide corresponding to 1969 presented comprehensive information on hunting species, methods of hunting and hunting grounds (MIT, 1969). In addition, hunting trophy catalogues have been continuously published since the early 1950s and contain data on trophy scores and awards of the species hunted (MA, 1951, 1959, 1960, 1962, 1973, 1979; MAPA, 1988, 1994, 1999; MARM, 2004).

However, it was not until the 1970s when an important advance in the official statistics of hunting in Spain took place. During this period, the collection of information was standardized and the number of variables was expanded to include hunting licenses, hunting grounds and captures. From 1972 to 2003, the core of these statistics were published in the yearbooks of agricultural and food statistics of the «Ministerio de Agricultura» (AEA) (MA, 1973-1981a; MAPA, 1982-1999; MAPA, 2000-2004) and in the following years until 2007 in the yearbooks of forestry statistics (AEF) (MARM, 2009). Additional information on hunting arms has been provided in the statistical yearbooks of the «Ministerio de Interior» (AEMI) (MI, 1995-2008). Hunting trophies were described in hunting trophy catalogues (MA, 1973, 1979; MAPA, 1988, 1994, 1999; MARM, 2004). Foreign trade statistics published by the «Ministerio de Economía y Hacienda» include information on game meat trade at the national level (MH, 1973-2008). In recent years, some Autonomous Communities have also published regional hunting statistics. A brief characterization of the main statistical sources is provided in Table 1.

Currently, hunting statistics in Spain are included in the National Statistical Plan 2009-2012 (Real Decreto 1663/2008 of 17 October) that includes, among many other statistics, those that are aimed at the evaluation of hunting products and additional economic benefits of this activity. These statistics are integrated in the Bank of Biodiversity Data.

Analysis

All variables related to the Spanish hunting sector found in official statistical sources have been studied.

Table 1. Characterization of the main official statistical sources available for the hunting sector

Agricultural Statistics Yearbook (AEA)	Forest Statistics Yearbook (AEF)
<i>Available dates:</i> 1972-2003, 2005 and 2006, although the 2005 and 2006 data are taken from the AEF.	<i>Available dates:</i> 2005, 2006 and 2007.
<i>Frequency:</i> Annual.	<i>Frequency:</i> Annual.
<i>Source:</i> Ministerio de Agricultura in its various incarnations over time, now Ministerio de Medio Ambiente y Medio Rural y Marino.	<i>Source:</i> Ministerio de Medio Ambiente y Medio Rural y Marino.
<i>Aim:</i> Food and agricultural activity.	<i>Aim:</i> Forest activity.
<i>General difficulties:</i> Lack of information on the methodology of data collection and explicit definitions. Lack of data in 2004. Digital since 1996.	<i>General difficulties:</i> Lack of information on the methodology of data collection and explicit definitions. Available data only until 2007. There is a significant delay in the statistics.
<i>Thematic areas:</i>	<i>Thematic areas:</i>
<ul style="list-style-type: none"> — Historical series and regional analysis of game hunting licenses issued. — Hunting grounds. — Number, weight and meat value of game animals shot. Regional analysis. — Number of game-farms (only available for 1972). 	<ul style="list-style-type: none"> — Historical series and regional analysis of hunting licenses issued. — Hunting grounds (2005 is not available). — Number, weight and meat value of game animals shot. Regional analysis. — Regional analysis of restocking (not available for 2005). — Number of game-farms (not available for 2005). — Hunting species production (not available for 2005).
Reports on Activities of the National Institute for the Conservation of Nature (M)	Reports about Forestry and Nature Preservation (M)
<i>Available dates:</i> 1972-1983.	<i>Available dates:</i> 1984-1987.
<i>Frequency:</i> Annual.	<i>Frequency:</i> Annual.
<i>Source:</i> National Institute for the Conservation of Nature (ICONA). Ministerio de Agricultura or Ministerio de Agricultura, Pesca y Alimentación.	<i>Source:</i> Regional Services of agriculture and environment and National Institute for the Conservation of Nature (ICONA). Ministerio de Agricultura, Pesca y Alimentación.
<i>Aim:</i> Forest activity.	<i>Aim:</i> Forest activity.
<i>General difficulties:</i> Not available in digital format. Very heterogeneous information.	<i>General difficulties:</i> Not available in digital format. Information is incomplete (missing data from some Autonomous Communities). Very heterogeneous information.
<i>Thematic areas:</i>	<i>Thematic areas:</i>
<ul style="list-style-type: none"> — Historical series, regional analysis of hunting licenses issued, distinguishing rates and surcharges. — Number and area occupied of the different types of hunting grounds subject to special arrangement. Additional information is sometimes available as the number of game preserves dedicated to big game or small game, restocking, expenses and incomes, Hunter hour periods, hunting methods, trophy awards granted, etc. — Number of hunting grounds, their animal inventory and production. 	<ul style="list-style-type: none"> — Historical series, regional analysis of hunting licenses issued, distinguishing rates and surcharges. — Number and area occupied of the different types of lands subject to special arrangement. Sometimes additional information is available as the number of game preserves dedicated to big game or small game, or expenses and incomes. — Number of hunter days, number of big-game and small-game captures associated with different hunting grounds.
Statistical Yearbook of the Regional Environment Services	Statistical Yearbook of the Ministry of Interior (AEMI)
<i>Available dates:</i> Varies by Autonomous Community.	<i>Available dates:</i> 1989-2007.
<i>Frequency:</i> Variable.	<i>Frequency:</i> Annual.
<i>Source:</i> Regional Environmental Services.	<i>Source:</i> Ministerio de Interior.
<i>General difficulties:</i> Diversity and heterogeneity in the databases of the various Autonomous Communities.	<i>Aim:</i> Various essential legal and social aspects.
	<i>General difficulties:</i> Digital format available since 1998. Information related to hunting only from 1994.
	<i>Thematic areas:</i>
	<ul style="list-style-type: none"> — Hunting weapon licenses. — Hunting firearms certificates.

Table 1 (cont.). Characterization of the main official statistical sources available for the hunting sector

Catalogues of Game Trophies	International Trade Statistics Yearbooks
<i>Available dates:</i> 1975-2000.	<i>Available dates:</i> Prior to 1972 to the present day.
<i>Frequency:</i> Multi-annual (1988, 1994, 1999 and 2004).	<i>Frequency:</i> Annual.
<i>Source:</i> Game trophies homologation board.	<i>Source:</i> Directorate General of customs. Ministerio de Economía y Hacienda.
<i>Aim:</i> Game trophy awards approved in Spain.	<i>Aim:</i> Record foreign trade statistics.
<i>General difficulties:</i> Difficulties in locating the area of precedence of trophies.	<i>General difficulties:</i> Changes in nomenclature headings over time.
<i>Thematic areas:</i> Game trophies awarded and scores.	<i>Thematic areas:</i> Imports and exports of game meat.

The meaning of these variables has been clarified, the methodologies of data collection have been assessed and the consistency of the data series has been analyzed.

Results

Hunting licenses, hunting weapons licenses and hunting arms certificates

Hunters are one of the three constitutive elements of hunting, along with hunting grounds and game. In Spain, there is no nationwide register of hunters, so the number of hunters has to be estimated indirectly through information provided by hunting licenses, hunting weapon licenses and hunting arms certificates (*guías de armas*).

Annual information on hunting licenses includes: number of licenses issued, license fees and number of renewed licenses (licenses issued in previous years but still active in the current year). In Spain, nobody can carry or own firearms without legal authorization, and a hunting weapon license is required for hunting firearms. This authorization is mandatory and non-transferable to other hunters. In addition, it is mandatory for hunting firearms to be registered at the Ministry of Interior and firearms are also subject to regular controls and revisions.

This information is not homogeneous over the study period due to the data collection procedures and changes in the definitions of variables (Table 2).

Hunting grounds

Recent legislation regulating hunting grounds in Spain include the «Hunting law» of 4 April 1970 (Ley 1/1970) and the Decree of 25 March 1971 (Decreto 506/1971). These pieces of legislation established two types of hunting areas: (1) *hunting grounds of common*

use, where hunting could take place during permitted seasons with no other limitations besides the possession of valid hunting and firearms licenses and other basic legal restrictions; and (2) *hunting grounds subject to special arrangements*, which included among them several types of game states (private, social, local and national game states), areas subject to hunting control schemes, national hunting reserves, hunting game refuges as well as national parks.

The integration of Spain into the European Economic Community (1986) implied changes in Spanish hunting legislation (Ley 4/1989, de 27 de marzo, de Conservación de los Espacios Naturales y de la Flora y Fauna Silvestre and Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad). Since the 1980s, the transferring of legal responsibility in the field of hunting to the Autonomous Communities has also produced an intense regional legislative process. Most Autonomous Communities have enacted regional hunting laws incorporating the new requirements on the use and conservation of nature. This has normally led to new classifications of hunting grounds in each region.

Variables that describe hunting territories in official Spanish statistics are generally limited to the number and area occupied by the different types of hunting grounds. However, in the period 1972-1987, more detailed information is available concerning some of these hunting territories, although the data are more irregular and heterogeneous. For example, the number of individuals introduced, captured or the number of hunting permits associated within a hunting territory (MA, 1973-1981b; MAPA, 1982-1984; MAPA, 1985-1988) are available. This latest information is not included in Table 3.

Harvest estimates

One of the key aspects of interest in the study of the hunting sector is the number of game animals shot, as

Table 2. Main information available in official Spanish sources on hunting licenses, surcharges, hunting weapon licenses and hunting firearms certificates

Variables	Scale variable**	Years of collected information	Official statistic source
Number of hunting licenses issued ¹	Regional and national	1972 ² , 1973-2002, 2003 ³ , 2005-2007	M, AEA y AEF M, AEA y AEF
Number of hunting licenses issued by license type ⁴	Regional and national	1973-1989	M, AEA
Surcharges to hunting licenses issued ⁵	Regional and national	1975-1987	M
Economic value of hunting licenses issued	Regional and national	1972-2002, 2005-2007	M, AEA y AEF
Economic value of hunting licenses issued by license type ⁴	Regional and national	1973, 1984, 1988, 1989	M ⁶ , AEA
Economic value of surcharges to hunting licenses issued ⁵	Regional and national	1984	M
Number of renewed hunting license ⁶	Regional and national	2005-2007	AEA y AEF
Economic value of valid hunting licenses ⁶	Regional and national	2005-2007	AEA y AEF
Number of rifle and shotgun with rifled barrel licenses issued and renewed	National	1994-2007	AEMI
Number of smoothbore shotguns and rimfire rifles issued and renewed	National	1994-2007	AEMI
Number of weapons active by weapon type	National	1994-2007	AEMI

¹ In most sources (M and AEA), a historic number of hunting licenses issued nationwide is provided. The oldest date collected is 1948. ² In 1972 there is only data at the national scale. ³ In 2003 there is only information available about the number of hunting licenses issued at the national scale. ⁴ A Type A license is for hunting by any authorized process including firearms; a Type B license is for hunting with any approved procedure except with firearms and a Type C license is for any procedure requiring specific authorization. ⁵ Before the transfer of responsibilities for the regulation of hunting to the Autonomous Communities, surcharges were needed at the national scale for some types of hunting. ⁶ Renewed licenses issued in previous years but still active in the current year. M: reports on activities of the National Institute for the Conservation of Nature and reports about forestry and nature preservation. AEA: Agricultural Statistics Yearbook. AEF: Forest Statistics Yearbook. AEMI: Statistical Yearbook of the Ministry of Interior.

they are the final object of hunting. What is more, each game animal shot entails costs and returns, as animals are alive in the forest before being hunted, and in turn revenues may also be derived from their capture, such as the sale of goods (meat, trophies) and services (commercial hunting). In addition, utility may also be derived from non-commercial recreational hunting (hunting self-consumption).

Information about harvests of game animals gathered in the official Spanish statistics include the quantity of animals shot, the quality of trophies, economic variables and game meat purchase and sold in foreign trade. In particular, the variables for which official information is provided are the following: (a) shot animals: number and total carcass weight; (b) trophies: number, scores and awards (*medallas*); (c) value of meat from shot animals; (d) complementary revenues: income received by the use of land in hunting, excluding the value of game meat and (e) game meat trade: weight and value of exports and imports of game animal meat.

This information comes from various sources and is not homogeneous across time (Table 4). Apart from the sources described in these Tables, there is supplementary information for the period 1972-1987 (MA, 1973-1981b; MAPA, 1982-1984; MAPA, 1985-1988).

Discussion

Hunters

Until the Autonomous Communities began to issue their own hunting licenses in the late 1980s (entitled by Ley 4/1989, de 27 de marzo, de Conservación de los Espacios Naturales y de la Flora y Fauna Silvestres), it was possible to accurately approximate the number of hunters nationwide by the number of national licenses issued. Since then, it has been necessary to hold more than one hunting license to hunt across Spain. Thus, statistical figures on the number

Table 3. Main information available about hunting grounds subject to special arrangement for the period 1972-2007

Classification of hunting grounds	Years of collected information	Variable collected for each type of hunting ground	Information scale	Official source
National hunting reserves, national hunting states, social hunting states, private hunting states, local hunting states, hunting controlled zones (in charge of the ICONA), hunting controlled zones (in charge of corporate partners) and refuges of hunting.	1972	Number	National	M, AEA
		Area	National	M, AEA
National hunting reserves, national hunting states, social hunting states, private hunting states and local hunting states	1973	Number	Regional and national	M, AEA
		Area	National	M
National hunting reserves, national hunting states, social hunting states, private hunting states, local hunting states, hunting controlled zones (in charge of the ICONA, hunter societies or Autonomous Communities) and refuges of hunting.	1974-1985 ¹ , 1986-2003 ¹	Number	Regional and national	M, AEA
	1974-1991 ¹	Area	National	M, AEA
National hunting reserves, private hunting states, regional-local hunting states, social hunting states, social-sportive hunting states, local-sportive hunting states, intensive hunting states, refuge of fauna, game refuge, hunting controlled zones and security areas	2006 and 2007	Number	Regional and national	AEA, AEF
		Area	Regional and national	AEA, AEF

M: reports on activities of the National Institute for the Conservation of Nature and reports about forestry and nature preservation. AEA: Agricultural Statistics Yearbook. AEF: Forest Statistics Yearbook. ¹ Since 1984, information in many years has not been updated.

of hunting licenses issued at the national scale do not currently reflect the actual number of hunters in Spain. However, for the same reason, it is possible to identify

the number of people (local, national and foreign) hunting in one Autonomous Community from the number of active licenses issued in that Autonomous Community.

Table 4. Main information available on shot animals for the period 1972-2007

Classification of shot animals	Variables	Level of detail and information scale	Years of collected information	
Up to 2003: Deer, wild boar, hare, rabbit, partridge, quail, other big game, other game smaller mammals and other game birds. From 2005: Deer, roe deer, Spanish ibex, fallow deer, mouflon, Barbary sheep, wild boar, hare, rabbit, partridge, quail, other big game, other game smaller mammals and other game birds ¹	Number	Regional and by species National and by species	1973-2003, 2005-2007 1973-2003, 2005-2007	
	Carcass weight	Regional regardless of species	1975-2003, 2005-2006 1988-2003, 2005-2006	
	Value of game meat	Regional and by species	Regional and by species	1974-2003, 2005-2006
		Regional regardless of species	Regional regardless of species	1972-2003, 2005-2006 1988-2003, 2005-2006
		Regional and by species	Regional and by species	1973-2003, 2005-2006
Complementary revenues	Regional regardless of species	Regional and by species ²	1988-2003 1973-2003, 2005	
All the species available	Trophy information ³ : score and awards	By regions and species	1975-2006 ³	

¹ In 2006 and 2007, more species are considered. ² Number of regions that do not declare the complementary revenues increase over time. ³ Information relating to the years 2001-2006 is preliminary because the trophy catalogue is still in development.

It is important to note that until the early 1990s, hunting licenses in Spain were only valid for the year that they were issued. This suggests that the number of hunting licenses issued in one year coincided with the number of active hunting licenses. However, shortly thereafter in some Autonomous Communities it was possible to obtain hunting licenses for periods longer than one year. For example, in Castilla-La-Mancha this was possible starting in 1993, and in La Rioja, this was possible beginning in 1994. This new situation regarding the concession of hunting licenses posed a problem in interpreting official statistics for more than a decade, as the number of hunting licenses published annually in the AEA (1972-2003) referred exclusively to the license issues in that year and not to the number of active licenses, which also included previously issued licenses. Fortunately, this deficiency has been remedied since 2005, and now the variables «active licenses» and «issued licenses» are distinguished in the AEF. This problem that derived from failing to consider both variables can be illustrated by looking at the data corresponding to 2005. According to AEF, during that year the number of hunting licenses issued was 1,069,804 licenses, while the number of active hunting licenses amounted to 1,654,308. By only looking at issued licenses, the number of hunters is reduced to 64% of the actual number. The recent movement towards promoting a single hunting license for groups of Autonomous Communities (such as Cataluña, Castilla y León, Aragón, Andalucía, Baleares and Valencia in 2009) may create new difficulties for identifying the actual number of hunters in Spain.

Information published on hunting licenses in Spain does not allow for a clear distinction to be made between big-game hunters and small-game hunters. In some Autonomous Communities, this distinction has been attempted for the latest years of data available (*e.g.*, in Extremadura, Andalucía, Castilla-La-Mancha and Baleares). For previous years, there is scattered information on surcharges added to hunting licenses for hunting with firearms. These surcharges indicate those hunters that are interested in the most commercial types of hunting (big-game hunting, small-game driving hunting, *e.g.*, *ojeos*, and waterfowl hunting) (MA 1973-1981b; MAPA, 1982-1984; MAPA, 1985-1988). The best information for ascertaining broad tendencies in big-game and small-game hunting comes from the data on hunting firearm licenses issued by the «Ministerio de Interior», although these data are restricted to the period 1994-2007. The «Ministerio de Interior» yearbook

provides data on the number of hunting firearm licenses issued every year and distinguishes between different types of firearms. There are two main types of hunting gun licenses: (1) those for rifles and shotguns with rifled barrels used for big-game hunting (*armas rayada*) and (2) those for smoothbore shotguns and rimfire rifles, such as the .22 long rifle, that are mostly used for small-game hunting. However, this data also presents interpretation problems as shotguns may also be used for wildboard hunting. Thus, distinguishing between both types of hunting, big-game or small-game, by looking at the number of firearms licenses is not so clear. Finally, it must also be considered that having a hunting weapon license or certificate does not necessarily indicate that the hunter is active during that year.

Hunting grounds

Available information in the AEA (1973-2003) on hunting grounds is incomplete. First, no information is provided about the total area covered by *hunting grounds of common use*. Second, although at the national scale there are data on the total area occupied by the *hunting grounds subject to special arrangements*, rarely is that information available at the provincial or Autonomous Community scale. An additional problem is that after 1988 (with the exception of 1992), coinciding with the transfer of legal competence in the field of hunting to the Autonomous Communities, information about hunting grounds has not been updated. As the Autonomous Communities began to implement their own hunting legislation by the beginning of the 1990s, they introduced new classifications of hunting grounds in their territories. Nowadays the amount of hunting ground denominations in Spain exceeds 40, a large increase from the ten denominations established in the previous national hunting legislation (Ley 1/1970, de 4 de abril, de Caza and Decreto 506/1971, de 25 de marzo). The analysis of hunting areas is further complicated because different hunting ground denominations with the same hunting arrangements have been found, as well as the opposite situation.

The classification of hunting grounds in the most recent database of the AEF (2006 and 2007) already takes into account the new types of terrain that have appeared as a result of the enactment of the regional legislation on hunting. However, the classification adopted in the AEF is not entirely accurate. Thus, this

complex situation should be clarified by developing a means of clarifying the relationships among all of the different types of hunting ground denominations currently existing in the country.

Apart from conceptual problems derived from the inadequate clustering of current hunting lands, it is impossible to combine the former hunting ground data (that existed before the transfer of legal responsibility for hunting to the Autonomous Communities) with new data (available in AEF). This is because some of the new hunting ground denominations in some Autonomous Communities legislation encompass several of the former national legislation denominations (Ley 1/1970, de 4 de abril, de Caza and Decreto 506/1971, de 25 de marzo). For example, the current definition of a private hunting state in Andalucía (*coto privado de caza*) includes those areas classified in the former national legislation under private, social, local and national states.

One final problem that we detected is the lack of data on hunting grounds for some Autonomous Communities or provinces in recent years. We identified this problem in Galicia, Navarra and Almería in 2005, Valencia and Navarra in 2006, and Toledo, Lugo, Pontevedra and Vizcaya in 2007.

Harvest estimates

Until 2005, harvest estimates of game animals in Spain were only specified for deer, wild boar, hare, rabbit, partridge, and quail, as they were the main game species in the country at the beginning of the seventies. Harvests of other game species appeared grouped under designations such as «other big-game», «other game smaller mammals» and «other game birds». This has been an important limitation because in the period 1972-2003, other species as roe deer or Spanish ibex gained greater economic and social importance in Spain. Although separate harvest information is now provided for a larger number of game species, data at national scale provided in the AEF appear to be reliable only for 2005, as in the two following years important errors have been identified. For example, in 2006 there was a lack of data on game animals shot in the Autonomous Community of Andalucía, one of the most relevant hunting communities in the country. Harvest figures for Andalucía from 2006 were apparently added to next year's harvest figures in the 2007 edition of AEF. Another statistical limitation regarding game species is the lack

of demographic information concerning big-game animals. Information about the percentage of males, females and calves shot is provided in the official hunting statistics in other European countries such as the National Office of the Chasse et Faune Sauvage of France or the Hungarian Game Management Database in Hungary (Milner *et al.*, 2006). The cost of compiling this information in Spain should be low; every Autonomous Community already has access to this information because a mandatory report of harvest is required to manage hunting grounds.

Regarding other variables that characterized game animals, we found that carcass weight is heterogeneous between provinces and often varies greatly in certain years. For example, in 2005 low big-game carcass weight values could not be justified by unfavorable weather conditions.

Information about the quality (size and beauty) of big-game trophies is published regularly in the national catalogues of game trophies. However, trophy evaluation is a voluntary formality on the part of hunters, so not all of the trophies of high quality are necessarily evaluated and recorded. On the other hand, a positive feature of trophy statistics is that they include all big-game hunting species.

The value of game meat recorded in the official Spanish statistics refers to the value at the hunting ground level of the meat from game animals shot. It is not clear whether the figures provided exclude the meat from game animals shot and used for self-consumption. In addition, it is unknown if the price attached to each kilogram of meat is a real market price or a price estimated by expert staff, although it seems more likely to be the latter. Anomalies found in the carcass weight statistics (already explained above) may also affect game meat value data.

As mentioned in the previous section, the concept of game-complementary revenues in the official Spanish hunting statistics refers to an «estimate for the income received by the hunting use of land, excluding the value of shot animals». Bernabeu (2002) states that the value of game-complementary revenues is supposed to be an indicator of the supplementary income that a landowner derives from the hunting practiced on his or her land, as estimated at the provincial level by expert staff. However, the scheme to collect this information and the methodology used to calculate the revenues is not provided. As with the value of game meat, it is not possible to identify whether this variable is limited to the income derived from commercial hunting

or also includes an estimate of the utility derived from non-commercial hunting. Regardless of conceptual problems, caution should be taken when using data for game-complementary revenues at the national scale because the total figures do not always include the data from all the Autonomous Communities. For example, in 1988 data from 18 provinces were missing, and in 2002, the number of provinces that did not provide data increased to 38.

Over time, there have been significant changes in the classification and grouping of products covered by the Spanish foreign trade statistics. Thus it is not an easy task to track foreign trade in game meat for any particular game species, or even to clearly distinguish between the big-game and small-game meat trades. A detailed analysis of foreign trade statistics would be required to understand the meaning of changing foreign nomenclatures so that a sound correspondence could be established with individual or groups of game species.

Conclusions

Hunting statistics are an essential analytical tool for understanding the economic, ecological and social reality of the hunting sector. However, results from the present study for Spain indicate that hunting data available in the official statistics are often incomplete, dispersed and heterogeneous. Therefore, although they are useful for analytical purposes, Spanish hunting statistics must be used with caution, and a critical stance must be adopted in their interpretation.

Besides the problems associated with the initial degree of incompleteness of the data being collected, the use of Spanish hunting statistics faces an additional difficulty. Since the transfer of responsibilities for the regulation of hunting to the Autonomous Communities took place during the 1980s, data collection on hunting has been subject to qualitative changes in the definitions of important concepts and variables previously collected. This suggests that, to correctly interpret the official hunting statistics in certain countries over time and space, it may be necessary to also consider political and legislative changes. In the case of Spain, the classification of hunting grounds changed drastically in some Autonomous Communities after the transfer of responsibilities for the regulation of hunting and the enactment of different laws relevant to hunting at the regional level. To mitigate the problems arising from heterogeneous collection procedures of the official sta-

tistics, it is recommended that communication among the Autonomous Communities and the Central Government be improved and an agreed-upon common scheme for data collection be established. This protocol should be in accordance with future European hunting statistics and based on robust and well-informed data collection methods.

In addition, as it has already been suggested by other authors (Naredo, 1983), official statistics should include modifications and adaptations of biological, ecological and economic concepts to cover transformations experienced by the hunting sector over time. We suggest therefore that the methodology for the collection of data should be dynamic and adaptable to new situations in the hunting sector. For example, due to the increasing economic and ecological importance of hunting in recent decades, it should be of great interest to improve economic and environmental data related to the hunting sector. However, as far as possible, any changes in the data collected should be able to allow for comparisons to be made between new variables and previous ones.

Spanish hunting statistics also present more specific shortcomings. Some of these limitations could be remedied without too much difficulty in the near future. A major weakness of official statistics of hunting in Spain is the lack of definitions for concepts and variables and the lack of information on the procedures for the calculation of statistics, data sources, sampling, collection of data, control and revision, estimation, etc. Therefore, we suggest that this information is provided to potential users. Another possible improvement is to enlarge the number of variables collected and particularly to provide the demographic composition of big-game data, which is essential to track changes in populations over time, and the realization of a tighter economic valuation. In addition, it is suggested that a hunter census should be developed to allow for a precise quantification of the national hunting demand. It is also necessary to develop a new classification scheme for hunting grounds according to the new concepts and definitions provided by the regional hunting laws indicating the correspondence among the different designations of hunting grounds adopted in each Autonomous Community. Finally, it would also be of interest to modify the nomenclature of game meat items considered in the statistics of foreign trade to be able to distinguish between foreign meat transactions of different game species and groups of species, as is the case, for example, in livestock.

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