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## **Deliverable 4.7.**

**Salmonella data in extensive farming in Mediterranean scenario mapped and analysed.**

**JRP6 - NOVA - FBZ1 - 1<sup>st</sup> Call**

Responsible Partner: INIA-CISA



## GENERAL INFORMATION

<b>European Joint Programme full title</b>	Promoting One Health in Europe through joint actions on foodborne zoonoses, antimicrobial resistance and emerging microbiological hazards
<b>European Joint Programme acronym</b>	One Health EJP
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## DOCUMENT MANAGEMENT

<b>JIP/JRP Deliverable</b>	Deliverable 4.7. Salmonella data in extensive farming in Mediterranean scenario mapped and analysed.
<b>Join Integrative/Research Project</b>	JRP6 - NOVA - FBZ1 - 1 <sup>st</sup> Call
<b>JIP/JRP Leader</b>	Jenny FRÖSSLING (SVA)
<b>Other contributors</b>	<u>Leader</u> : INIA <u>Participants</u> : INIA, UCM-VISAVET
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<b>Type</b> <i>R: Document, report</i> <i>DEC: Websites, patent filings, videos, etc.</i> <i>OTHER</i>	R
<b>Dissemination level</b> <i>PU: Public</i> <i>CO: confidential, only for members of the consortium (including the Commission Services)</i>	CO



# Deliverable 4.7.

## Salmonella data in extensive farming in Mediterranean scenario mapped and analysed.

Salmonella has been selected as example of FBD as it is one of the most common public health problems, causing significant human morbidity and even mortality and consequently high economic losses in both developing and developed countries. Foods of animal origin are still one of the major sources of infection for the general public, with eggs, broiler chickens and pigs being consistently identified among the top attributed food sources. Whereas control programmes for Salmonella in poultry have been applied in the whole UE with high success, only few European countries have implemented eradication or control programmes of Salmonella in swine, beef, or dairy production. Results from efforts made in Denmark, Sweden, Finland, Norway, Ireland, Germany, Great Britain and Holland, are somewhat inconsistent. So far, there are no national control programmes established in any Mediterranean country, where >40% of the pig farms were positive to Salmonella (EFSA baseline study, 2009). In consequence, further efforts to implement control programs for reduction of the prevalence of Salmonella infection in swine in the near future are envisioned. Prerequisites to the implementation of such an approach; scientific efforts directed to improve our preparedness and develop an effective risk-based surveillance system should be carried out.

The deliverable D.4.7. “Salmonella data in extensive farming in Mediterranean scenario mapped and analysed”, belongs to Task-4.3 whose general objective is to investigate the overlap between habitats of suitable wildlife, e.g. wild boar, with primary production and other environmental variables, which may influence transmission of pathogens from wildlife to livestock farming. Salmonella transmission between wild boars and low biosecurity systems such as extensive farming-oriented systems or backyard farms will be selected as a working example. It will be studied in a selected Mediterranean countries, Spain, where this type of non-controlled housing is present and there is a high prevalence of infection in livestock.

The task 4.3 includes a total of three activities and three deliverables:

<b>T-4.3. ROLE OF THE ENVIRONMENT IN THE OCCURRENCE AND MAINTENANCE OF SALMONELLA INFECTION IN EXTENSIVE FARMING (M1-M36)</b>	
<b>ACTIVITIES</b>	<b>DELIVERABLES</b>
First, available data on infection and serotype prevalence in extensively managed pig farms (WP3) will be mapped and analysed to characterize its spatial distribution and identify patterns, processes, and relationships (e.g. smoothing technique, cluster analyses) [M1-M12].	D-4.7. Salmonella data in extensive farming in Mediterranean scenario mapped and analysed (M12)
Second, hot spot areas with higher potential for Salmonella transmission between wild boars and low biosecurity systems will be identified by overlapping wild boar distribution maps (Bosch et al., 2016), extensive farming systems geodata and known serotype spatial distribution (spatial autocorrelation analyses) [M13-M24].	D-4.8. Cartographic map of hot spot areas for Salmonella transmission between wild boars and low biosecurity systems (M24)



Finally, state-of-the art machine learning algorithms will be employed to correlate infection data with environmental drivers. They will be spatially explored and analysed through Bayesian classical and stochastic modelling approaches (correlating covariates, expert opinion, mapping techniques....) to assess their availability/competence as surveillance indicators [M25-M36].

D-4.9. Potential new environmental surveillance indicators identified (M36)

Specifically, the **objective** of the deliverable D.4.7. was to map the Salmonella data in extensive farming.

## 1. Background

Wildlife often serves as a reservoir for (re-)emerging zoonoses. Infection of wildlife or vectors is frequently linked to environmental and climatic conditions, which largely take place outside the field of view of medical and veterinary experts and affect transmission in a complex manner. This lack of insight in the mechanisms that drive the occurrence and spread of wildlife zoonoses hinders appropriate risk assessment and the development of interventions to reduce public health risks, particularly in a changing environment. Specifically, the "Special report on Eradication, control and monitoring programmes to contain animal diseases" (EU, 2016) highlight a clear and urgent need to strengthen surveillance programmes including monitoring in wildlife and the environment.

## 2. Objectives

The objective of the deliverable D.4.7. was to map the Salmonella data in extensive farming. It integrates three activities:

- A) Identify available data on infection and serotype prevalence in extensively pig farms.
- B) Description of the outdoor pig production system in Spain. Available data on outdoor pig farm locations.
- C) Spatial characterization of Salmonella distribution and patterns in extensive pig farming.

## 3. Progress of the activities: main results.

### A) Identify available data on infection and serotype prevalence in extensively managed pig farms.

The information about Salmonella surveillance in Spain has been reviewed in the legislation and in EFSA's annual summary reports. We have also searched for additional information on Salmonella surveillance by contacting personally or navigating through the website of the institutions mentioned in Spain's country reports.

The official Spanish databases and sources reviewed are:

1. Monitoring program of Salmonella in SLAUGHTER PIGS according to the EU legislation (ranging between 160 and 400 farms sampled annually in 2002-2015). This programme involves the annual collection of a sufficient number of samples at the slaughterhouse following EFSA recommendations (EFSA 2012), so that ideally one or more samples (typically faecal samples) are collected from a variable number of farms



2. Baseline survey of Salmonella in SLAUGHTERHOUSES as part of a European-wide effort to determine the prevalence of Salmonella infection in pigs at slaughter (2006-2007). For this purpose 2,619 lymph node samples from pigs originating from different farms were collected in Spain from slaughterhouses accounting for > 80% of the of all slaughtered fattening pigs.
3. Baseline survey of Salmonella in BREEDING FARMS as part of a European-wide effort to determine the prevalence of Salmonella infection in sow farms (2008). Here, 3,660 fecal samples were collected from 366 farms (~10 samples/farm) from farms selected to include different sizes, management systems and regions in Spain.
4. Monitoring program of Salmonella on PORK MEAT AND MEAT PRODUCTS available at the annual country reports, provided to EFSA by the Regional Health Services.

From these three data sources, only the Monitoring program of Salmonella in BREEDING FARMS included information from extensive farms (n=560 samples from 56 farms). It included information on:

- Sampling date: 2008
- Farm register code
- Sample code (10 samples per farm)
- Pig age (6 weeks (n=36), 14 weeks (n=279) and 18 weeks (n=245)).
- Analyzed samples: feces (100%)
- Diagnostic result
- Poor information is available on serotype or phage.

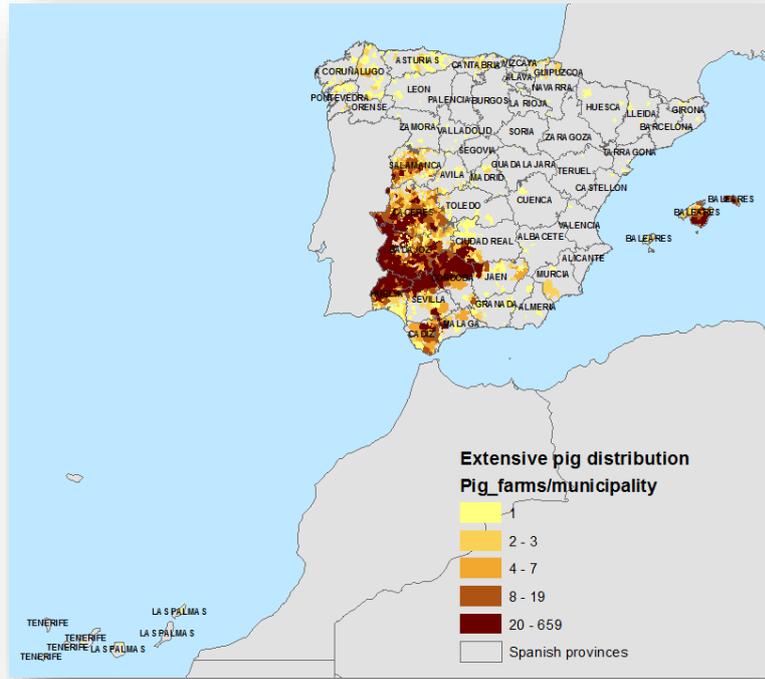
An Excel database has been created with the information retrieved.

## B) Description of the outdoor pig production system in Spain. Identification of available data on extensively managed pig farm locations.

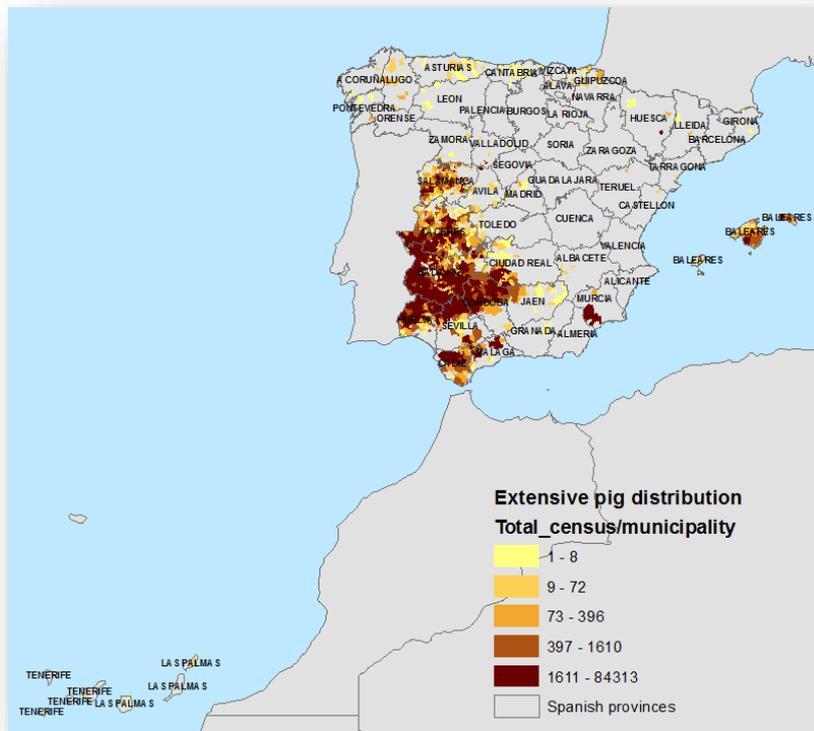
We have gather information about outdoor pig production system in Spain from the Official Register of Livestock Farms (REGA) and the Informative Registry of Iberian Pigs (RIBER) from the Agriculture Ministry (Law 8/2003 of April 24<sup>th</sup>). An Excel database has been created with the information retrieved. It included information on:

- Geographical coordinates
- Zootechnical classification
- Breeding type
- Census

Of the 83,703 pig producing farms in Spain, 46,218 (55.3%) are classified as commercial and 37,485 (44.7%) as own-consumption farms by the Ministry of Agriculture. 96% of the own-consumption farms are reared in an intensive system. However, commercial farms are reared both intensively (72% of farms) and extensively (28% of farms). In terms of census, the extensive system only represents 5% of the total number of pigs.



**Figure.** Extensive pig farms distribution by municipality



**Figure.** Extensive pig census distribution by municipality

Spain's commercial outdoor pig production is mainly represented by the Iberian pig breed. The native Iberian pig breed, from the south-west of the Iberian Peninsula, uses the natural



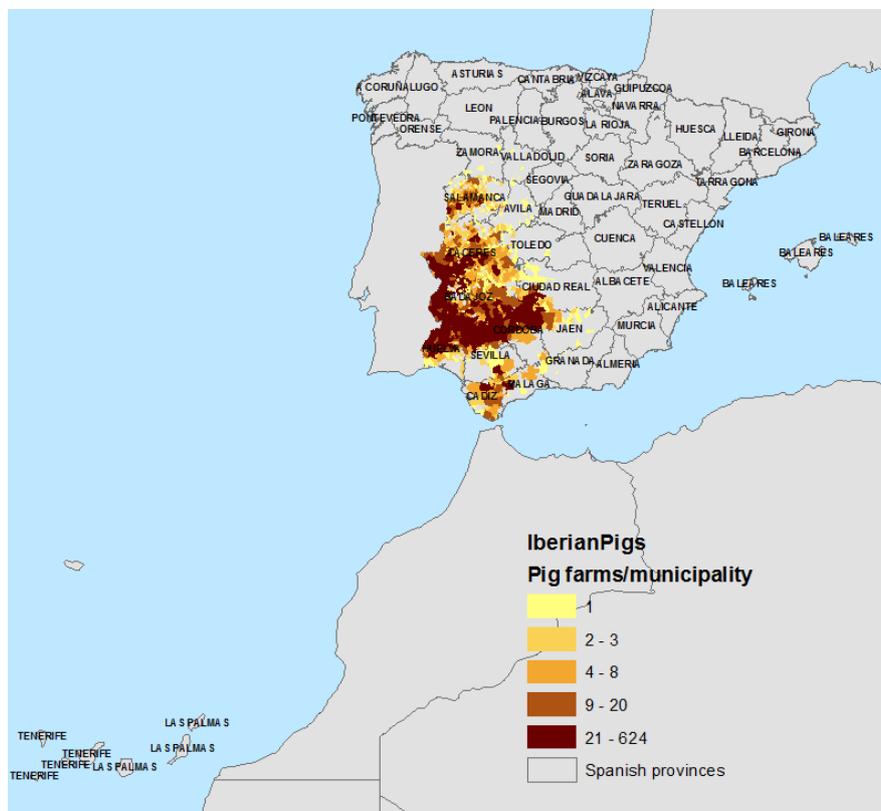
meadowland resources of pastures and acorns of holm oaks, cork oaks and gall oaks, during at least 60 days. The typical fattening grazing system lasts from October (most frequently, November) up to January (some up to February or even March, which are fed on cork oaks' acorns).

The national Royal Decree 4/2014, of January 10<sup>th</sup>, establishes the requirements that pig meat and pork products need to comply with to be considered Iberian pig products, including the way pigs are kept, animal feed or weight at slaughter, among other requirements.

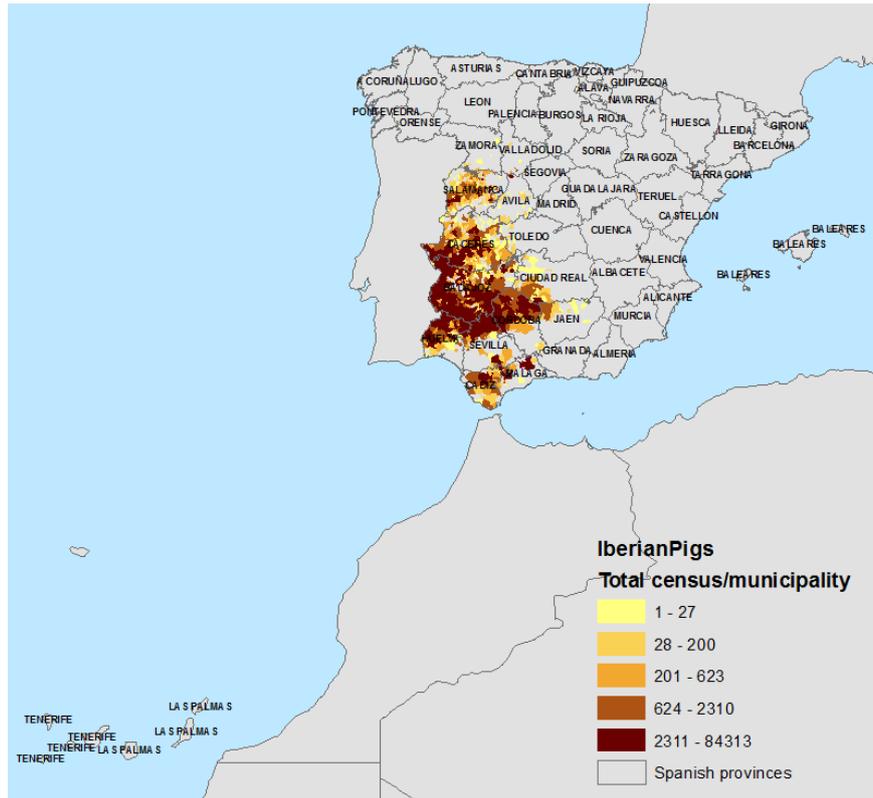
This breed is widespread in the south-west of the Iberian Peninsula, concretely in the Spanish autonomous region of Extremadura (Caceres and Badajoz), western Andalucía (mainly in Seville, Córdoba, Huelva, followed by Cádiz, Malaga and north of Jaen, as well as a few sites in Granada), the south-west of Castile-Leon (mainly in Salamanca, and in parts of Avila, Valladolid and Zamora), and Castile - La Mancha (Toledo and Ciudad Real).

There were 973,732 Iberian pigs fed on acorn in 2016 according to the Ministry of Agriculture's Informative Registry of Iberian Pigs (RIBER), which represent 64% of the pigs raised in extensive systems in Spain. The rest of Iberian pigs reared in an extensive system correspond to those not fed on acorn but which also are fattened in pastures with the same temporal pattern as those fed on acorn. The distribution of sites with Iberian pigs fed on pastures is represented in Figs. 5a and 5b below.

Other extensive-reared pigs are mainly located in northern Spain and the Balearic Islands and generally relate to local breeds which use natural resources effectively.



**Figure.** Number of Iberian pig farms by municipality



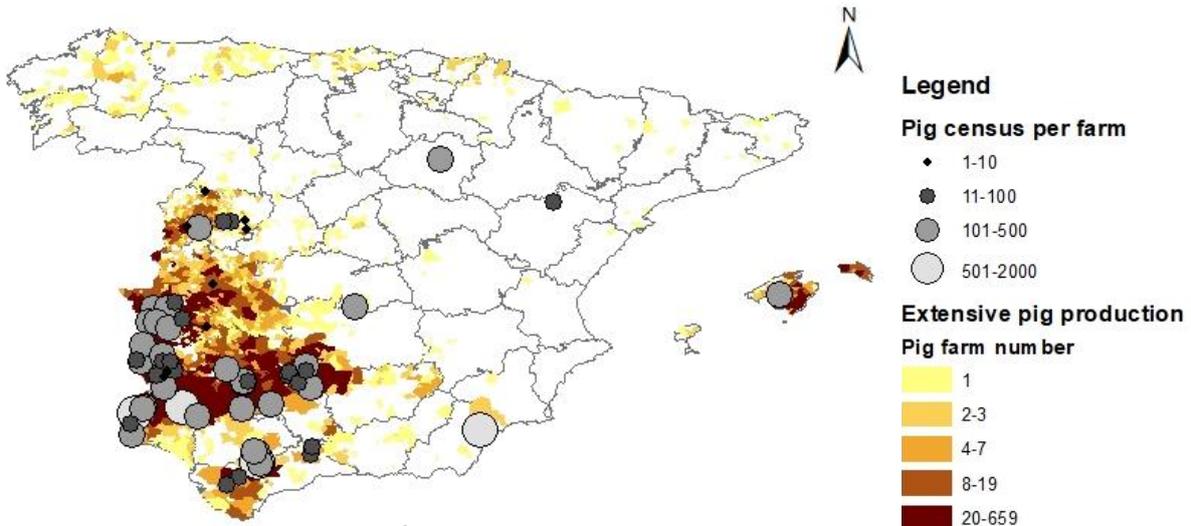
**Figure.** Iberian pig census by municipality

Results indicated that commercial extensive pig farming in Spain represents 28% and 5% of the Spanish commercial farms and pig census, respectively. They are mainly located in the southwestern region of Spain.

It is mainly represented by the Iberian pig breed which accounts for up to 64% of the pigs raised in extensive systems in Spain.

### C) Spatial characterization of Salmonella distribution and patterns in extensive pig farming.

In 2008 a total of 560 samples originating from 56 farms (10 samples each) were sampled (Figure).



**Figure.** Location of sampled farms (farm's pig census in grey).

Sampled farms were located in 6 Autonomous Communities with extensive pig farming according to the Official Register of Livestock Farms (REGA) and the Informative Registry of Iberian Pigs (RIBER) from the Agriculture Ministry (Law 8/2003 of April 24th): Castilla y León (n=4), Castilla y La Mancha (n=1), Baleares (n=1), Aragón (n=1), Extremadura (n= 18) and Andalucía (n=31).

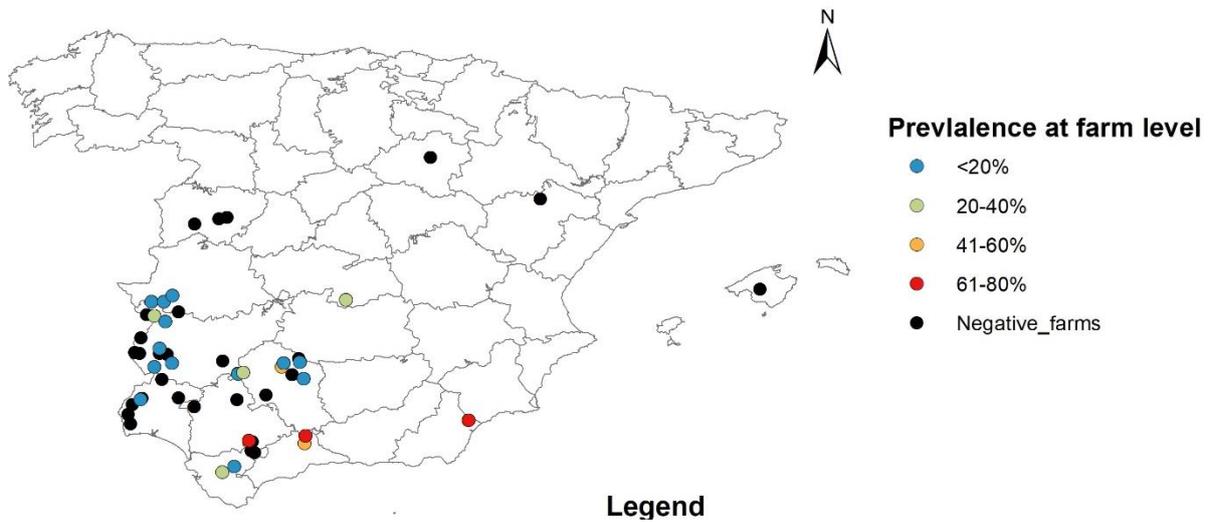
The sample collected at the farm was feces. Results were positive for 72 samples from 24 farms and negative for 488 samples from 32 farms, indicating that 43% of the extensive pig farms sampled in 2008 were positive to Salmonella and 57% were negative. However the sampling should not be considered as representative of salmonella situation in extensive farming in Spain as the percentage of sampled farms was very low (<1% of the total extensive farms registered in Spain).

Of greater importance is the prevalence at the farm level in the positive farms only that showed a mean value of  $30 \pm 0.9\%$ . It showed to be slightly correlated with the farm size ( $p > 0.05$ ; Spearman test) but a deeper evaluation is needed.

Salmonella Prevalence	Number of farms
10%	8
20%	6
30%	3
40%	1
50%	2
60%	1
70%	1
80%	2
90%	-
100%	-

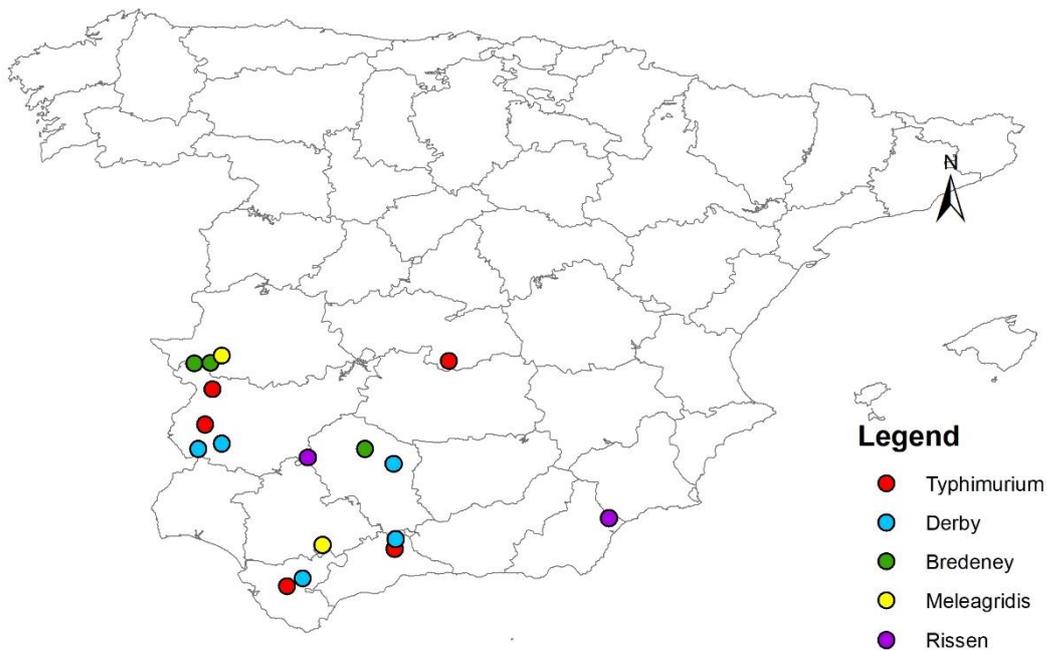


**Figure.** Salmonella prevalence in positive farms among those sampled as part of the Salmonella monitoring program in Swine in 2008.



Most samples were investigated for serovars. The most common serovars found, namely Typhimurium (n=276), Derby (n=12), Bredeney (n=9), Meleagridis (n=7) and Rissen (n=4). Results did not seem to be particularly associated to geographical specific areas at province level.

**Figure.** Salmonella isolates belonging to the most common serotypes





### 3. Conclusions

**Degree of achievement:** Deliverable D.4.7. has been achieved.

**Dissemination results:**

- De la Torre, A. 2018. Role of the wildlife-livestock interface in zoonosis spreading. Risk assessment research assembly. Utrecht. The Netherlands. 7th February, 2018.

**Main conclusions:**

Salmonella data in extensive farming in Spain are very scarce and represents less than 1% of total extensive production in the country. Available data showed that prevalence at the farm level was low with a mean value of  $30\pm 0.9\%$ , being Typhimurium, Derby, Bredeney and Meleagridis the main serovars present.