

## SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

The STSM applicant submits this report for approval to the STSM coordinator

**Action number: CA15116**

**STSM title: Risk assessment of introduction of ASFv into Western Europe through trade movements of live wild boar**

**STSM start and end date: 15/01/2018 to 14/04/2018**

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### PURPOSE OF THE STSM

This STSM regards epidemiology of African swine fever (ASF), a viral haemorrhagic disease of domestic pigs and wild boar (*Sus scrofa*) that causes massive loss of animals due to mortality and the essential eradication control policies. The disease gives rise to animal welfare problems as well as further economic loss from trade restrictions and there are no vaccines.

ASF has been present in Russia and neighbouring countries since 2007 and recently the disease has entered the EU. The evaluation of the risk of introduction of this virus in Europe is needed. For instance, previous European project (ASF-Risk) assessed several pathways in qualitative and quantitative ways: legal imports of live domestic pigs, illegal importation of meat and products, risks of trucks, waste and fomites. However, assessments on ASFv introduction by wild boar are crucial nowadays. Others studies have evaluated the risk of ASFv introduction into the EU by wild boar based on: “natural” movement, abundance rates of wild boar, habitat suitability, resource selection and the density of outbreaks in this species. Anyway, in accordance with the last ASF outbreaks -as those cases in Czech Republic-, wild boar trade by human may play an important role in the introduction pattern for this disease owing to the spatial spread within wild boar populations is slow: 1-2 km/month. In this sense, the proposal STSM was to focus in collection and manipulation of databases regarding the movements of wild boar and the use of this information to explore the risk of ASF virus (ASFv) introduction through legal trade of wild boar among Eastern Europe and some Western European countries.

There is some evidence that legal and illegal movements of live wild boar are happening between ASF infected or at risk countries in Eastern Europe (Hungary, Poland, Ukraine...) and some Western European countries such as France, Spain or Belgium. However, those movements of animals have never been adequately quantified. Quantifying the extent, origin and destination of legal movements is possible by collecting the relevant information and necessary in order to estimate the risk of ASF introduction through this activity in the countries receiving those animals.

According to CA COST Action CA15116 “Understanding and combating African Swine Fever in Europe (ASF-STOP)” main objectives, this proposal pretends (i) determine a methodology of movement surveillance in order to improve the knowledge live wild boar networks into ASF non-infected areas in an European context and (ii) clarify the potential risk of wild boar trade for hunting purposes in ASF spread and maintenance. This information is crucial to assess an activity that poses a serious risk of spread ASF into

Western Europe and that is highly relevant to the COST Action and several European institutions on Animal Health.

### DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

(max.500 words)

- Literature revision on the context of (i) wild boar trade and its sanitary surveillance in Europe, and (ii) the introduction risk of this virus in Europe. Regarding legal or illegal translocations of these animals, few information has been reported. In France, there is a review study to evaluate the sanitary risk associated to regular and legal introductions of live wild boar in hunting estates (Hars et al 2015). In Spain, exists only a study regarding a sporadic and illegal translocation of wild boar from French farms (Fernandez de-Mera et al. 2003).

- Selection, extraction and exploration of sources of information to obtain accurate and reliable data on the commercial movement of live wild boar to France and Spain. For this, I have selected potential databases at international (eg UN Comtrade Database -comtrade.un.org), European (eg COMEXT - epp.eurostat.ec.europa.eu/newxtweb- or TRACES -webgate.ec.europa.eu/sanco/traces) and national scales (eg Chambres de commerce - CCI.fr in France). I have extracted and compared all legal trade registered between the years 2014-2018 with destination to France and Spain. Spatial-temporal autocorrelations and subsequent validations were performed among data obtained by different sources of information.

- Identification and statistical characterization of the main patterns of wild boar trade among EU Eastern countries, France and Spain. Geographic information systems and time series analyses were used in order to explore and determine the trade dynamics. For each country, the response variable was the number of wild boar translocated. Then, the values of each predictor were summarized for each movement unit using 'zonal statistic tool' with Quantum GIS version 2.18

- Evaluation of the annual risk (PI) of ASFv introduction and exposure into Southern Europe due to the importation of live wild boar from Eastern Europe, assuming a binomial process such as the following:

$$PI = 1 - (1 - p_{cdfy})^{n_{cdfy}}$$

$p_{cdfy}$  = probability that an infected WB is introduced from country  $c$  into country  $d$  and effectively contacts a susceptible WB through use  $f$  at year  $y$ .

$n_{cdfy}$  = number of WB imported from country  $c$  into country  $d$  at year  $y$

- Development of "event pathways" on the commercial activity to break down the calculation of the risk probability; risk assessment approach. Discussion and improvement of these analytical schemes with European experts from WG2 - Cost Action ASF-Stop (group of scientists specialized in ASF in wild boar).

- Configuration and adjustment of stochastic quantitative risk models by using repeated Monte-Carlo iterations (@Risk version 7.5 Professional Edition) to estimate the probability of ASF introduction in France and Spain.

- Communication and preparation of recommendations on sanitary measures in the control of wild boar movements.

Hars, J., Rossi, S., Faure, E., Taconet, A. E., Gay, P., Landelle, P., & Richomme, C. (2015) Risques sanitaires liés à l'importation de gibier sauvage d'élevage et de repeuplement. Santé animale-alimentation, 48.

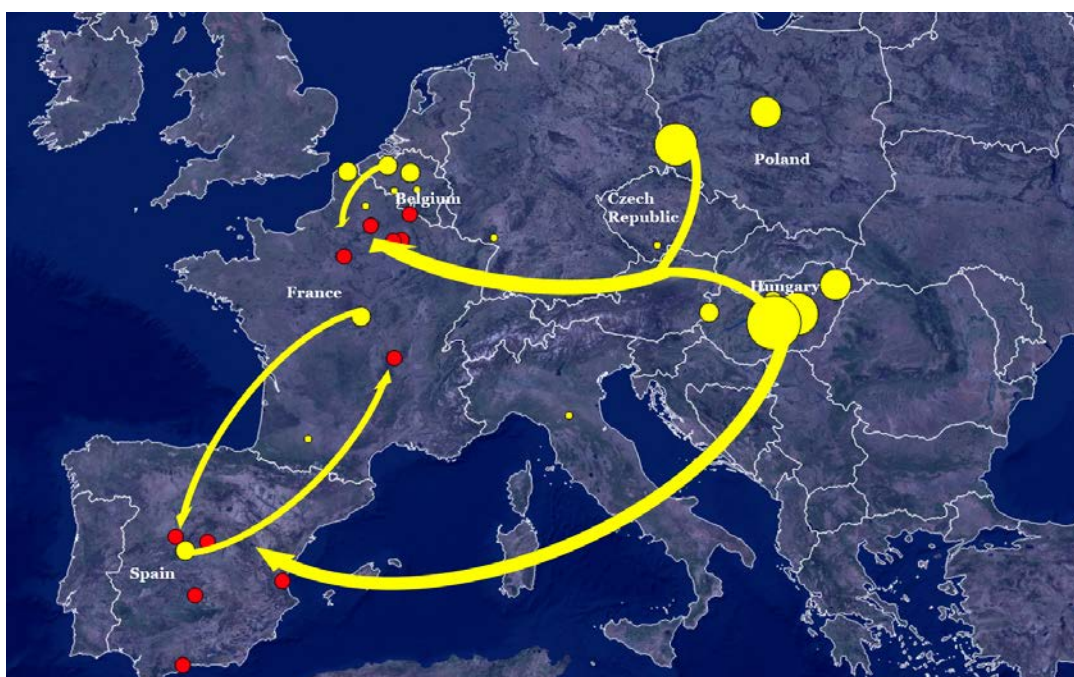
Fernandez-de-Mera, I. G., Gortazar, C., Vicente, J., Höfle, U., & Fierro, Y. (2003). Wild boar helminths: risks in animal translocations. Veterinary Parasitology, 115(4), 335-341.

### DESCRIPTION OF THE MAIN RESULTS OBTAINED

(max. 500 words)

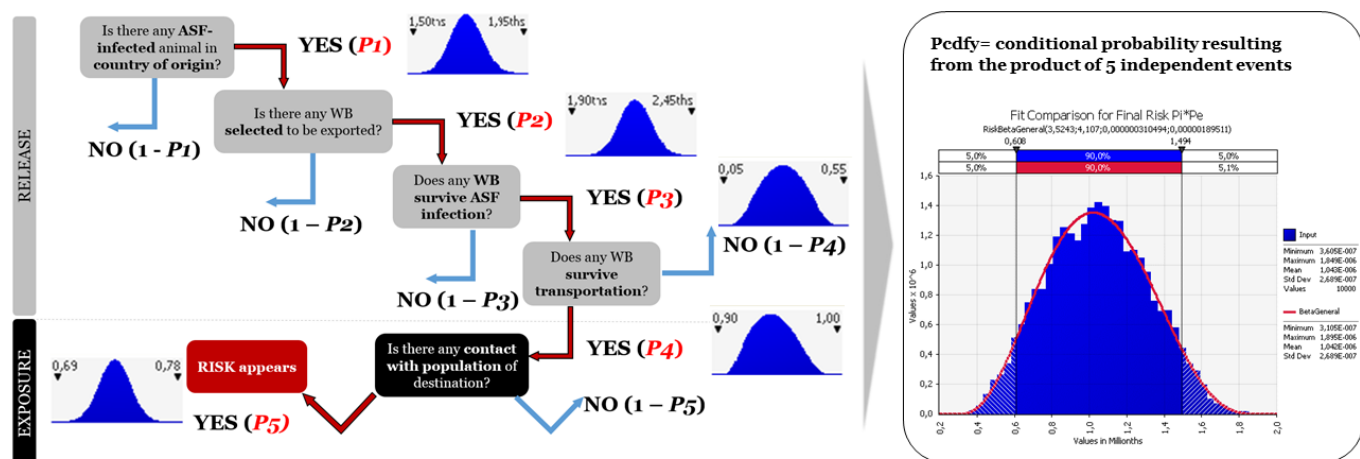
Overall, the main purpose of translocating those animals is to improve the genetic status of the local population -as an attractive hunting trophy for many hunters in France and Spain- and restocking wild boar populations in private hunting estates within the hunting industry networks. Searching on wild boar transactions, we have found contradictory information on legal trade among databases. At national and international level, foreign trade databases were previously used in several studies to quantify the risk of Classical swine fever through wild boar imports (Martinez-Lopez et al. 2009). For instance, an average of 200,192 wild boar were estimated to be imported into Spain per year (more than total national hunting bags). However, we have determined important mistakes in number estimations of these transactions owing to classification bias on searching live non-domestic swine. Therefore, we strongly recommend the use of TRACES database for monitoring this trade at European scale.

The results of data exploration on trade into France and Spain show that 4,361 wild boar were imported in the last four years. Regarding the origin of these animals, the following map represents the main countries exporting wild boar and direction of translocations. In this sense, Hungary is the main country exporting live wild boar (48 transactions; 2,689 animals) in Europe, but Poland is also important in movements to France (24 transactions; 1,153 animals):



Temporal trend analysis by generalized lineal models revealed a significant decreasing of these translocations from 2014 to 2017 ( $Z = -0.38$ ;  $SE = 0.14$ ;  $p = 0.008$ ), which could negatively be related to the ASF situation in exporting infected- and neighbour-countries. The monthly distribution shows a clear peak of movements during October to February, the main hunting period in destination countries.

Preliminary results of risk models suggest a mean (95% PI) annual probability of having at least one ASF outbreak in the France and Spain because of import of live wild boar by this way of  $1.04 \cdot 10^{-3}$  ( $3.83 \cdot 10^{-4} - 1.81 \cdot 10^{-3}$ ). The risk of ASFv introduction via live wild boar was highest in France, particularly for those movements driven for direct hunting (73.33%).



**Fig. Event pathways and general risk assessment:** It represents the analytical scheme to calculate each independent probability.

As expected, Poland is the country that most contributes to this probability, representing 78% of the overall annual risk. However, Hungary exportations needs special attention owing to the high volume of wild boar transactions and the risk of ASF outbreaks in the Ukrainian-Romanian border.

Regarding risk communication of these outcomes, a lecture was presented in the last WG2 Meeting of the Cost Action ASF-Stop (Tallinn, Estonia; 20/03/2018), where our recommendations on the sanitary measures in the control of wild boar movements were communicated.

Martínez-López, B., Perez, A. M., & Sanchez-Vizcaino, J. M. (2009). A stochastic model to quantify the risk of introduction of classical swine fever virus through import of domestic and wild boars. *Epidemiology & Infection*, 137(10), 1505-1515.

### FUTURE COLLABORATIONS (if applicable)

(max.500 words)

Methods and results presented here will be useful for informing risk - based surveillance and control programmes and, ultimately, for prevention and control of potential ASFv incursions into the European non-infected countries.

The information is considered of capital importance to assess the risk of an activity that poses a serious introduction of ASFv into Western Europe and that is highly relevant to several European institutions, as EFSA. This STSM has opened to me a collaboration opportunity with CIRAD institution, sharing ideas on field data collection and learning new analytical procedures. In fact, I'm actually preparing a postdoctoral

position (Alfonso Martín Escudero Foundation; [www.fundame.org/bases-de-la-convocatoria-de-becas-de-investigacion-en-universidades-o-centros-en-el-extranjero](http://www.fundame.org/bases-de-la-convocatoria-de-becas-de-investigacion-en-universidades-o-centros-en-el-extranjero)) in order to continue this collaboration with Dr. Ferran Jori and his research group in CIRAD and INRA institutions, France. In this sense, we would like to explore in detail the trade of wild boar, their products and their related hunting tourism in the European context to estimate the potential risk of ASFv spread. The main goals will be:

The hypothesis of next project is that the effect of trade related to wild boar hunting is (i) determinant in the probability of introduction of ASFv in non-infected countries, and (ii) the routes of exposure will depend directly on the spatio-temporal variation in that probability of risk.

The general objective will be to evaluate qualitatively and quantitatively the risk of introduction and exposure of the ASFv from the EU countries infected to the rest of the Member States by the trade of live wild boar, products and hunting tourism (hereinafter: JCPT ). To do this, it will be classified into the following specific objectives:

- Evaluate different databases to harmonize JCPT trade monitoring
- Describe and quantify the JCPT trade patterns between the countries infected and those free of ASFv.
- To evaluate the annual risk of introduction of the ASFv due to the entry of JCPT from infected countries, or at risk of infection, to other European non-infected countries.
- Determine the potential for exposure to ASFv and the main transmission risk practices in the countries of destination.
- Communicate the risk and make recommendations on health actions in the control of JCPT movements.