Estimation of the sensitivity of the surveillance system used to inform actions against African swine fever in northern Italy

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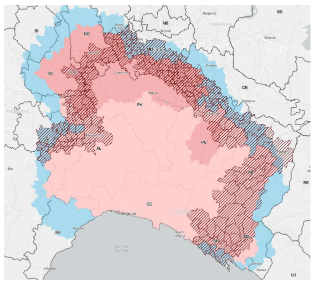
Global African Swine Fever Research Alliance (GARA) Roma | 28-30 April 2025

1 Introduction

African swine fever (ASF) is still circulating in wild boar populations in Northwestern Italy. To contain its spread, a Control Zone for Viral Expansion (ZCEV) was established as a buffer between infected and ASF-free areas (Fig. 1). Hunting is banned in the ZCEV to avoid virus spread. Depopulation is permitted only after confirming the absence of virus circulation based on the estimated sensitivity of the surveillance system.

Figure 1. The map shows the municipalities of ZCEV

Control Zone for Viral Expansion



▶ Aim of the study: To support informed decision-making, we developed a data-driven, spatially explicit approach for estimati**ng** the sensitivity of the ASF surveillance system across wild boar management units (WBMUs). This structured method helps answer a key question for disease control:

▶ **If the virus were present, would surveillance have detected it?**

Summary

🛑 **ASF containment strategy:** ZCEV as buffer zone

🚫 **Controlled depopulation:** after official evaluation

📊 **Surveillance-based decisions**: Surveillance sensitivity to guide targeted control measures.

2 Methods/Approach

A scenario tree approach was applied to estimate the Surveillance sensitivity (SeP) i.e. the probability of detecting ASF infection, integrating:

Risk stratification based on detection method (risk groups i.e. found dead, roadkill, hunted/culled)

Differential infection probabilities among population groups, informed by relative risks

Relative Risks (RR) estimated via Poisson regression (adjusted for age and seasonality)

$$SeP = 1 - \prod (1 - EPI_i)^{ni}$$

Where:

EPIi = DP × ARi = Effective probability of Infection

DP = Design Prevalence

ARi = $\frac{(RRi)}{\sum(RRi \times (PPri))}$ = Adjusted Risk

RRi = relative risk of group i

PPri = proportion of tested animals in group i

ni = number of samples in group i

3 Results

📍 **Geographical scope:** ASF surveillance was evaluated across 5 Italian regions (Piedmont, Liguria, Emilia-Romagna, Lombardy, Tuscany).

📈 Median sensitivity: **0.90** IQR: **0.78**

✅ % of WBMUs with sensitivity ≥ 0.95: 41.2%

📖 **Mapping approach**:

Monthly updated surveillance sensitivity, visualized by WBMU (Fig.2), guides depopulation decisions.

Areas with sensitivity below 0.8 are flagged for enhanced surveillance.

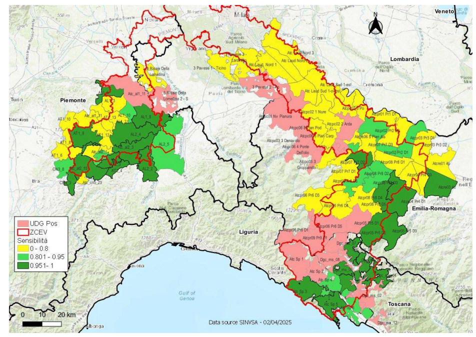


Figure 2. Surveillance sensitivity for African Swine Fever .

The map shows the **sensitivity of the surveillance system** for ASF, expressed as values ranging 0-0.80 (low), >0.80-<0.95 (intermediate), 0.95-1.0 (high). Areas highlighted in pink indicate zones where at least, one ASF-positive sample was detected in the past six months.

Intensive depopulation can be applied where virus absence is confirmed based of surveillance sensitivity exceeding 0.95.

4 Discussion

🔍 **Risk-based method**

The risk-based sensitivity estimation method has been instrumental in guiding ASF control strategies.

📅 **Operational for 2+ months**

For over two months, it has supported the authorization of wild boar depopulation in ZCEV areas.

🎯 **Targeted interventions**

Depopulation employs targeted techniques and trapping.

⚖️ **Evidence-based decisions**

This approach ensures that interventions are proportionate and grounded in scientific evidence.

✅ **Enhanced effectiveness**

It enhances the effectiveness of ASF surveillance and control efforts.

5 Conclusion

🔬 **Surveillance sensitivity**

✓ is essential to demonstrate disease absence.

🧠 **Risk-based modeling**

✓ improves surveillance interpretation.

📚 **Scientific foundation**

✓ increases effectiveness of decisions on ASF control.

🎯 **Targeted action**

✓ facilitated in a context of limited resources

6 References & Aknowledgements

- FAO. (2014). Risk-based disease surveillance – A manual for veterinarians on the design and analysis of surveillance for demonstration of freedom from disease. FAO Animal Production and Health Manual No. 17. Rome, Italy.

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