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First serological evidence of Q fever circulation in ruminant herds in French Guiana

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BACKGROUND

- High incidence of human Q fever in French Guiana.
- Incomplete knowledge about animal reservoir(s) of this bacterial zoonosis in a singular hyperendemic area.
- Presence of a sheep farm within 5 km is an exposition risk factor for human seropositivity in the department*.

*Flamand C, in press

OBJECTIVES

- Seroprevalence assessment of Q fever in ruminant herds in French Guiana
- Determine whether domestic ruminants may play a role as animal reservoir in the department

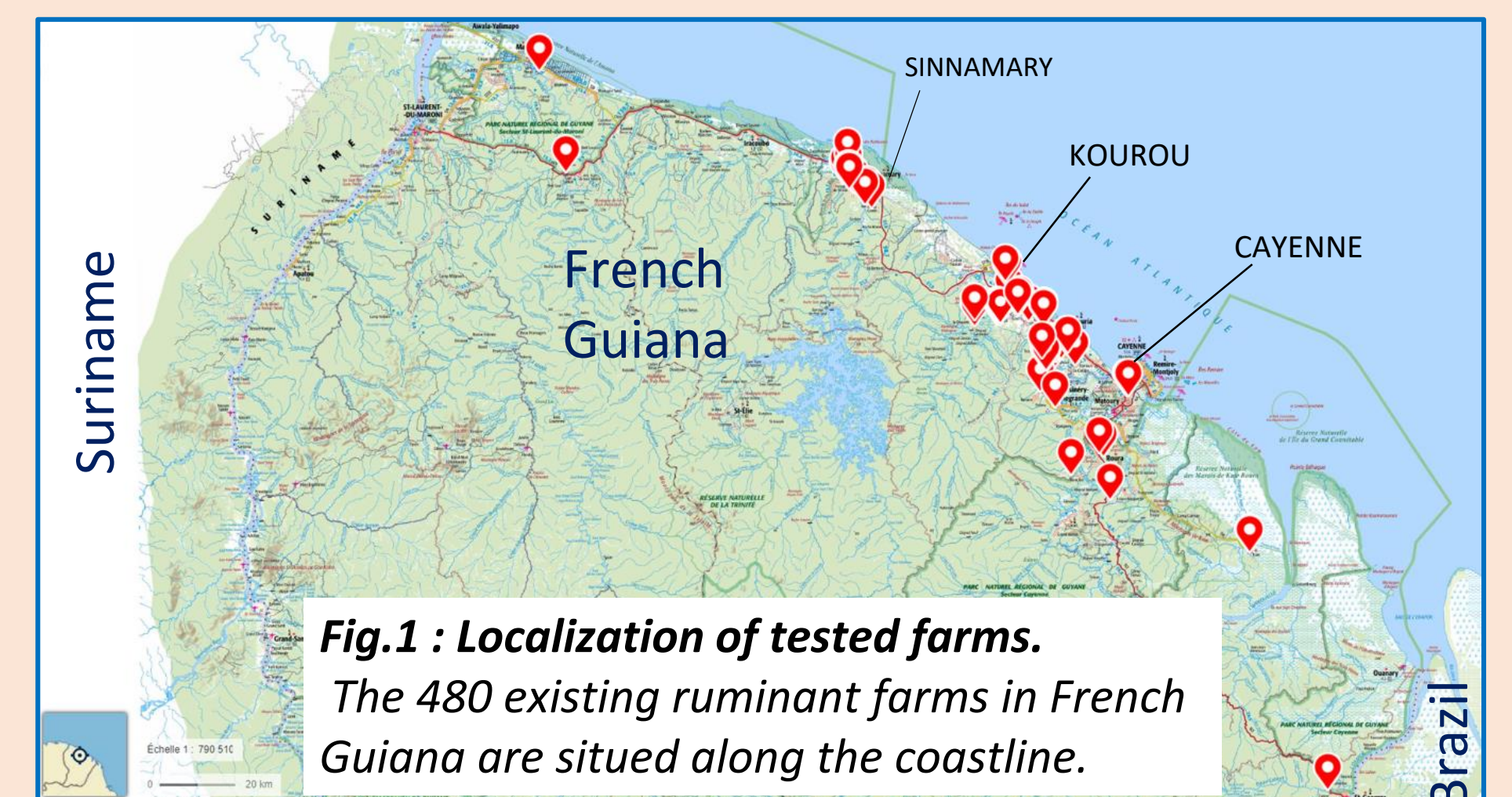


Fig.1 : Localization of tested farms. The 480 existing ruminant farms in French Guiana are situated along the coastline.

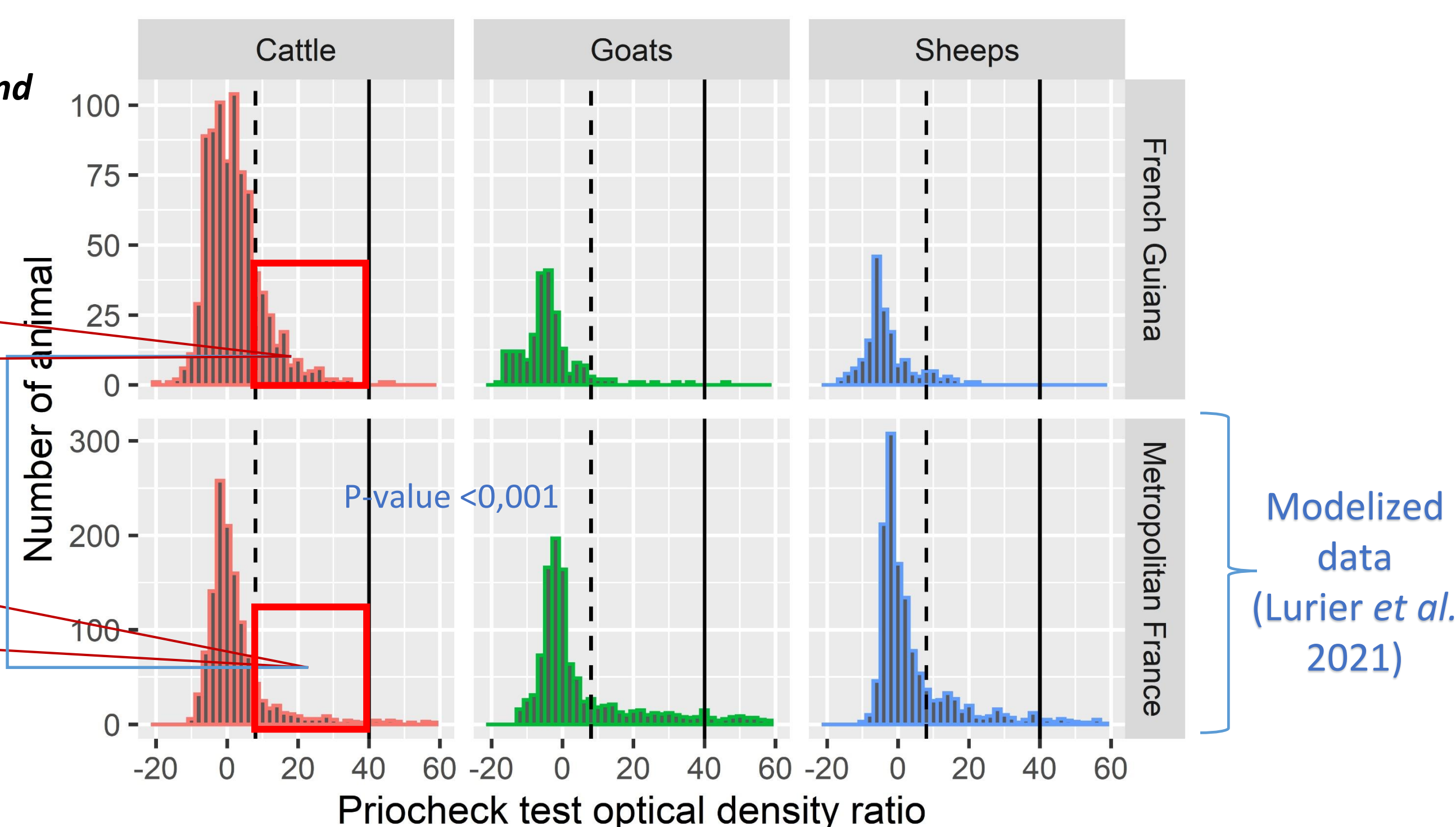
MATERIAL & METHODS

- **Sampling** : Blood from 834 cattle, 219 goats and 175 sheeps in 86 farms from 2015 to 2017 (over 480) conjointly with brucellosis prophylaxy (DGTM-DEAAF).
- **Analysis method** : Applied Biosystems PrioCHECK Ruminant Q fever Ab Plate Kit (Thermo Scientific™) was used, an indirect ELISA based on Phase I+II whole antigen prepared from an ovine strain isolated in metropolitan France. Analysis setting up and performances were verified in collaboration with Q fever NRL.
- **Statistical analysis** : Prevalence calculation and adjustment with test sensitivity and sensibility values were obtained from modelised metropolitan data**.

**Lurier T, Rousset E, Gasqui P, Sala C, Claustre C, Abrial D, Dufour P, de Crémoux R, Gache K, Delignette-Muller ML, Ayrat F, Jourdain E. Evaluation using latent class models of the diagnostic performances of three ELISA tests commercialized for the serological diagnosis of *Coxiella burnetii* infection in domestic ruminants. Vet Res. 2021 Apr 14;52(1):56. See Poster # 231.

RESULTS

Fig.2 : ODR distribution in ruminants in French Guiana and metropolitan France



17,7% of bovines in French Guiana

11,9% of bovines in metropolitan France

Modelized data (Lurier et al. 2021)

- Few positive results regarding Q fever ELISA kit manufacturer's 40% ODR threshold.

- Many results on bovine sera at ODR > 8% and < 40% vs. metropolitan data

⇒ Hypothesis 1 : High ODR from seronegative sera

A background noise and cross reactions with other bacteria species no or less present in metropolitan France

⇒ Hypothesis 2 : Low ODR from seropositive sera

The serological antigenic strain used is not recognized by antibodies produced against *C. burnetii* circulating in Guiana



Sensitivity and specificity estimation setting the threshold at 8% ODR

Reliable Se & Sp values

for Metropolitan France

| Species | Sensibility | Specificity |
|---------|--------------------|--------------------|
| Cattle | 0.86 [0.71 ; 0.93] | 0.92 [0.9 ; 0.94] |
| Goat | 0.92 [0.87 ; 0.96] | 0.95 [0.93 ; 0.96] |
| Sheep | 0.91 [0.83 ; 0.96] | 0.92 [0.9 ; 0.94] |

Accounting for the Se and Sp at the 8% threshold

Table 1 : Apparent seroprevalence (manufacturer's threshold) and real seroprevalence (according to modelisation)

| Year | Species | Number | Number of positives (OD>40%) | Apparent prevalence [CI 95%] | Number of positives (OD>8%) | Real prevalence [CI 95%] |
|---------|---------|--------|------------------------------|------------------------------|-----------------------------|--------------------------|
| 2015 | Cattle | 275 | 1 | 0.4 [0 ; 2.3] | 48 | 13.2 [7 ; 20.3] |
| | Goat | 86 | 0 | 0 [0 ; 5.3] | 4 | 0.9 [0 ; 6.7] |
| | Sheep | 46 | 4 | 8.7 [2.8 ; 21.7] | 6 | 4.8 [0 ; 19.1] |
| 2016 | Cattle | 296 | 2 | 0.7 [0.1 ; 2.7] | 85 | 28 [20.6 ; 37.5] |
| | Goat | 31 | 0 | 0 [0 ; 13.7] | 6 | 16.2 [2.9 ; 35] |
| | Sheep | 62 | 0 | 0 [0 ; 7.3] | 8 | 4.4 [0 ; 16.8] |
| 2017 | Cattle | 263 | 2 | 0.8 [0.1 ; 3] | 19 | 0.7 [0 ; 4.9] |
| | Goat | 102 | 2 | 2 [0.3 ; 7.6] | 5 | 0.9 [0 ; 6.2] |
| | Sheep | 67 | 0 | 0 [0 ; 6.8] | 7 | 2.5 [0 ; 12.7] |
| 2015-17 | Cattle | 834 | 5 | 0.6 [0.2 ; 1.5] | 152 | 14.2 [10 ; 19.4] |
| | Goat | 219 | 2 | 0.9 [0.2 ; 3.6] | 15 | 1.8 [0 ; 6.6] |
| | Sheep | 175 | 6 | 2.3 [0.7 ; 6.1] | 21 | 3.7 [0 ; 10.8] |

CONCLUSION

- First large-scale study of ruminant livestock in French Guiana for Q fever seroprevalence.
- Evidence of a potential important *Coxiella burnetii* exposition, which had not been shown until now:
 - Highest real prevalence in 2016 in cattle and goats. (dotted box in Table 1)
 - 66,3 % of sampled herds have been exposed to *Coxiella burnetii*.
 - Real prevalence estimated at 14,2 % in cattle with confidence interval [10 ; 19,4].
- Differences observed between guyanese data and metropolitan data with higher prevalence in cattle than in goats and sheep in French Guiana

Phenomenon in cattle to explore

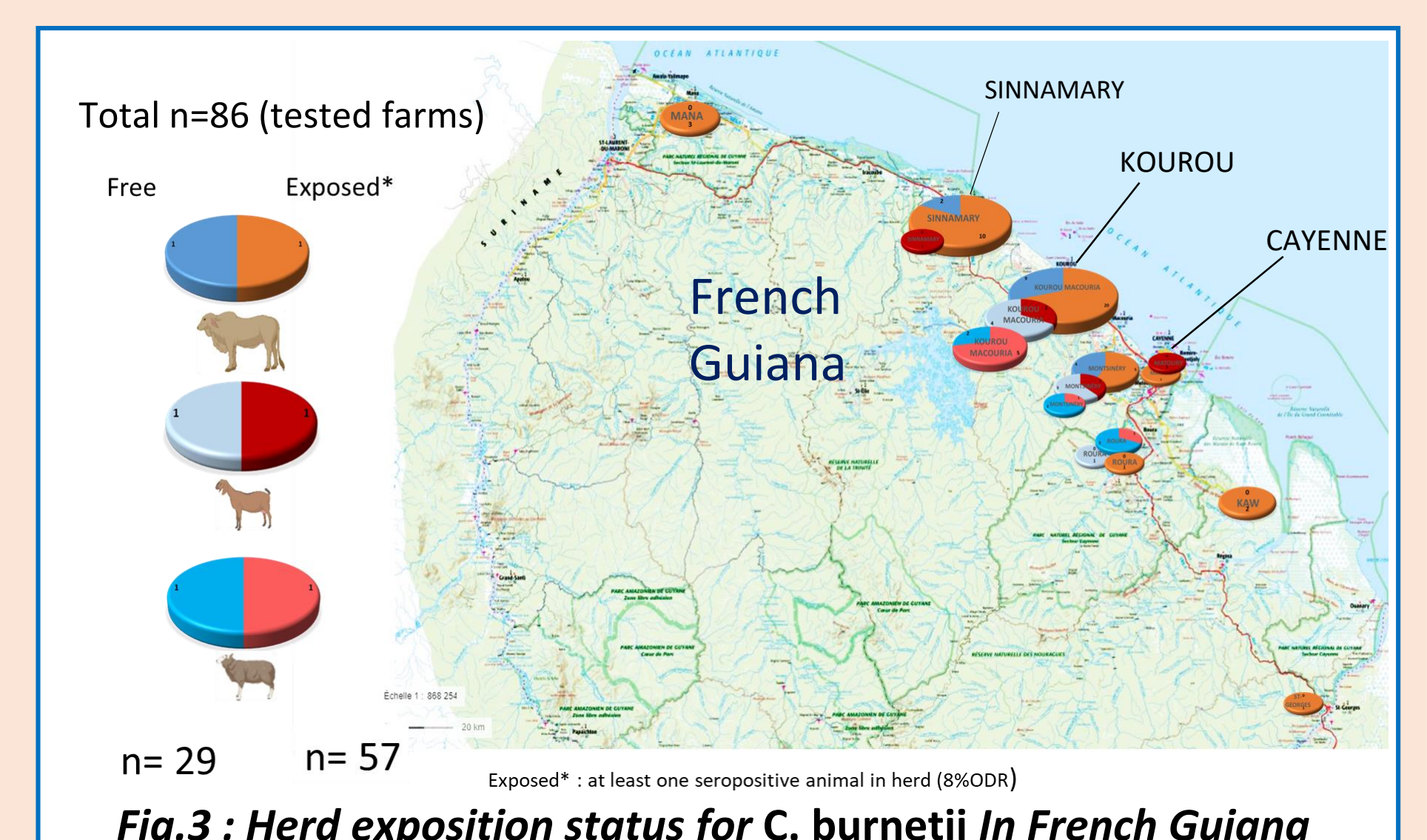


Fig.3 : Herd exposition status for *C. burnetii* In French Guiana

PERSPECTIVES

- Consolidate the evaluation of Q fever serological tests (on Guianese sera).
- Deepen studies on the epidemiological situation in ruminants: serology and PCR detection, diagnosis of abortion, spatio-temporal studies, search for risk factors.
- Improve and/or develop diagnostic tools suitable for epidemiological investigations in various animal reservoirs and environmental sources in French Guiana.
- Study the diversity of strains circulating in Guiana, harbouring probably antigens different to the antigen used in the Applied Biosystem Priocheck commercial kit.