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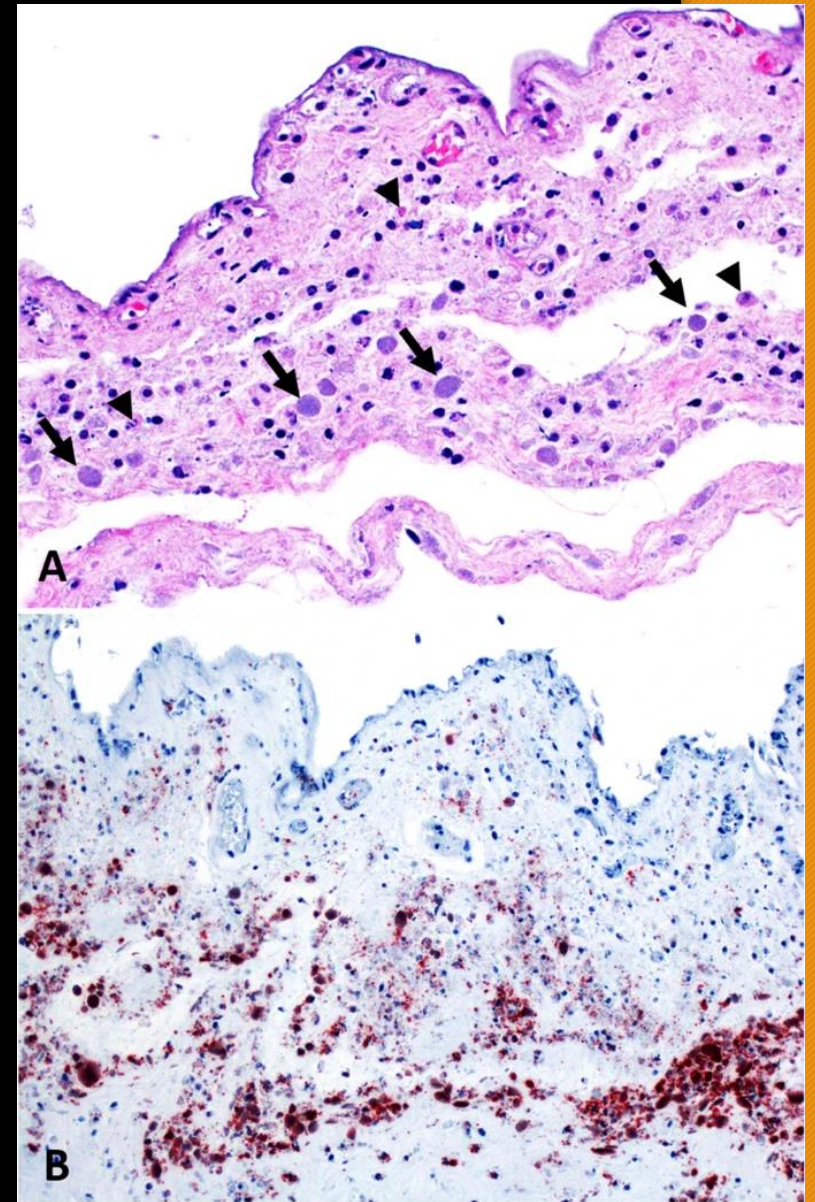
Evaluation of the prevalence of  
*Coxiella burnetii* in Scottish dairy cattle:  
A new spotlight on a neglected zoonotic disease in Scotland

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# *Coxiella burnetii*

- Bacteria that causes Q fever in humans & coxiellosis in animals
- Evidence of relationships with uterine disease in livestock e.g. metritis & endometritis (Agerholm, 2013)
- Second most frequently identified causative pathogen in French cattle abortions (10.2%) (OSCAR Report, 2020)
- *C. burnetii* detected in vaginal mucus by PCR (positive at least once per month) in 48.2% lactating French dairy cattle (Guatteo et al., 2007)
- 80.1-87.7% unvaccinated Scottish dairy herds seropositive (Velasova et al., 2017)



Microscopic lesions in placenta of an aborted Holstein cow (Rabaza et al., 2021)

# Study farm

- Large commercial dairy farm in Scotland
- Study initiated following reports of increased incidence of reproductive disease - uterine infections 1-3 months following parturition
- History of positive *C. burnetii* findings
  - Bulk tank milk (ELISA +PCR)
  - Individual testing (ELISA +PCR)
- Unknown intra-herd distribution or clinical / production impacts of *C. burnetii*



# Project Aims

Determine the prevalence of exposure (antibody) and infection (pathogen detection) across the herd

Estimate the prevalence of exposure and infection in post-partum animals

Determine prevalence reproductive diseases and define production parameters in post-partum animals

Quantify relationships between infection and disease or production metrics in post-partum animals

# Materials and Methods - Sampling

- Cross-Sectional Study
- ~30 animals in each of six management groups:
  - pre-bulling heifers at heifer unit 1 (H1\_PBH)
  - pre-bulling heifers at heifer unit 2 (H2\_PBH)
  - pre-calving heifers at unit 2 (H2\_PCH)
  - pre-calving heifers at the main farm (MF\_PCH)
  - heifers in milk (1-30 days) at the main farm (MF\_HIM)
  - animals in the main milking herd (MF\_MMH)
- Blood (serum) and vaginal swabs
  
- Post-Partum Animal Sampling
- Sampling during post-partum exam @ 1-7 days in milk
- Blood (serum) and vaginal swabs



# Materials and Methods - Diagnostics

- Serum samples
  - LSIVet Ruminant Q Fever- Serum/Milk testing performed at BioBest Laboratories
  - Seropositive with sample:positive ratio of > 40
- Swabs
  - collected into Zymo DNA/RNA Shield and heat inactivated at 70C for 1 hour
  - qPCR targeted IS1111
    - Sample positive for *C. burnetii* detection if Ct < 40
    - No amplification = Negative
    - Ct 35-40 = Inconclusive
    - Ct 27-35 = Positive
    - Ct <-27 = High load positive



# Materials and Methods - Post parturient data

- Individual health/production data
  - Observations at examination
  - Dairycomp305
- Data files compiled & analyzed using R
- Logistic regression - detection of *C. burnetii*
- Linear regression - Ct value
  - Most analyses restricted to multiparous population
- Final analyses ongoing - preliminary results included here



# Materials and Methods - Post parturient data

## Individual cow attributes

- Parity, age, days on farm, days in close up

Clinical variables - all refer to the period BEFORE or coincident with sampling - include presence/absence of:

- Pregnancy complications: Retained foetal membranes, abortion history, stillbirth, premature delivery, prolonged gestation, ease of calving
- Transition diseases: metritis, ketonuria, hypocalcemia, displaced abomasum

## Milk production

- Milk Yield AV305ME, first test Somatic Cell Count

## Fertility

- Previous days open, times 'AI'd' until conception, Heat interval, calving interval





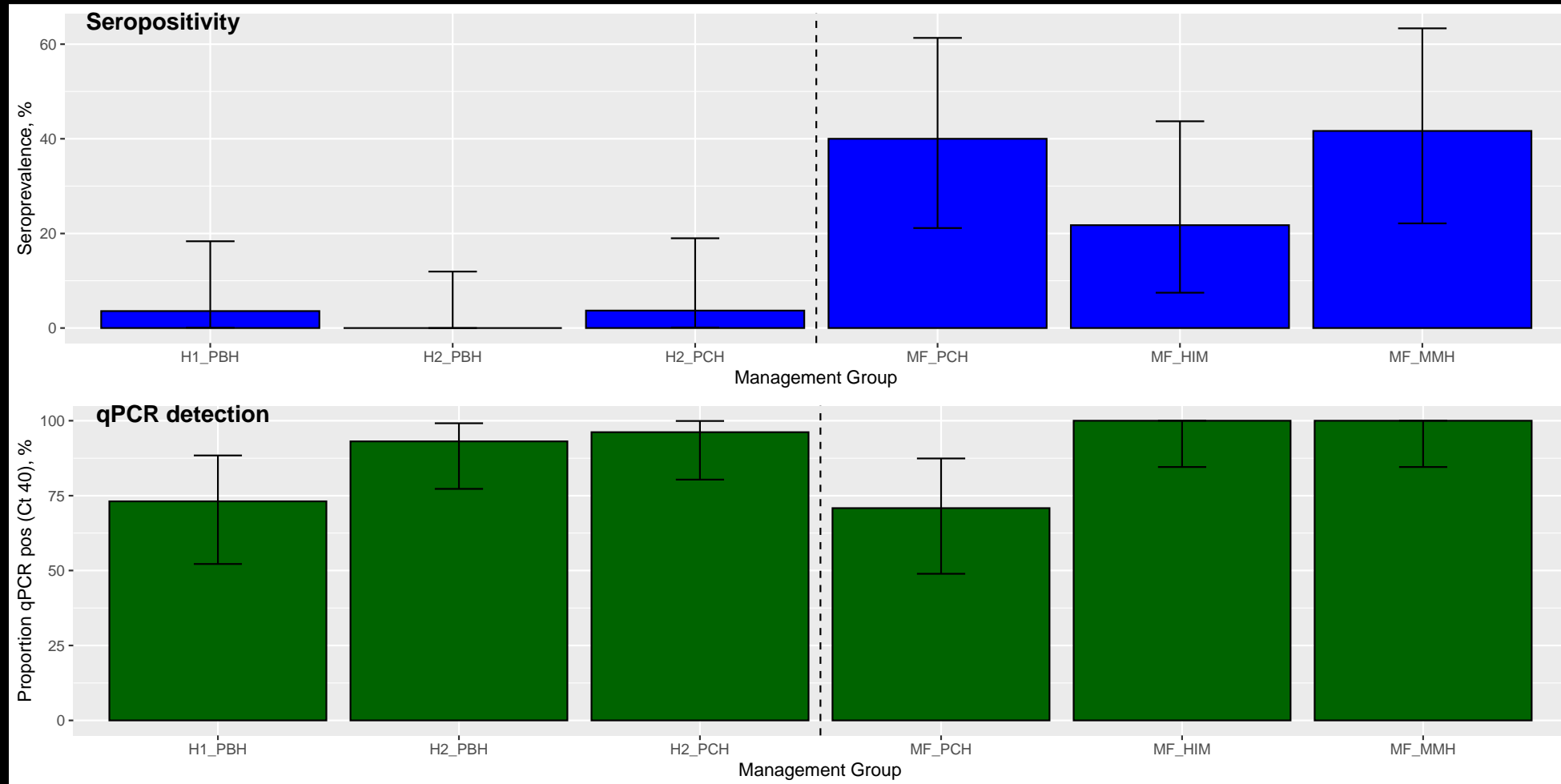
# Results: Herd Overview

Population profile	Target	Sample population: As of October 2023
Milk Yield AV305ME (av L/cow/day)	N/A	12,767 (av 37.4L)
4-Week Milk Yield	N/A	48.0 L
First Test Somatic Cell Count (FTSCC)	N/A	81.8 cells/ml
Abortions/Pregnancy (Jul22-23)	N/A	1.1 % (3/278)*
Transition diseases (DA, Ketosis, Milk fever, RP, Metritis)	< 10%	15.5% (43/278)
Perinatal mortality	< 5%	4% (11/278)

Table 1. Data table components taken from University of Glasgow SBOHVM SCPAHFS monthly herd health report. DairyComp 305 (Valley Ag Software, 2023) is used to calculate Key Performance Indicators (KPIs) and herd health parameters compared against Dairy Industry health, fertility, and production target rates.

# Results: Cross Sectional Serology & qPCR

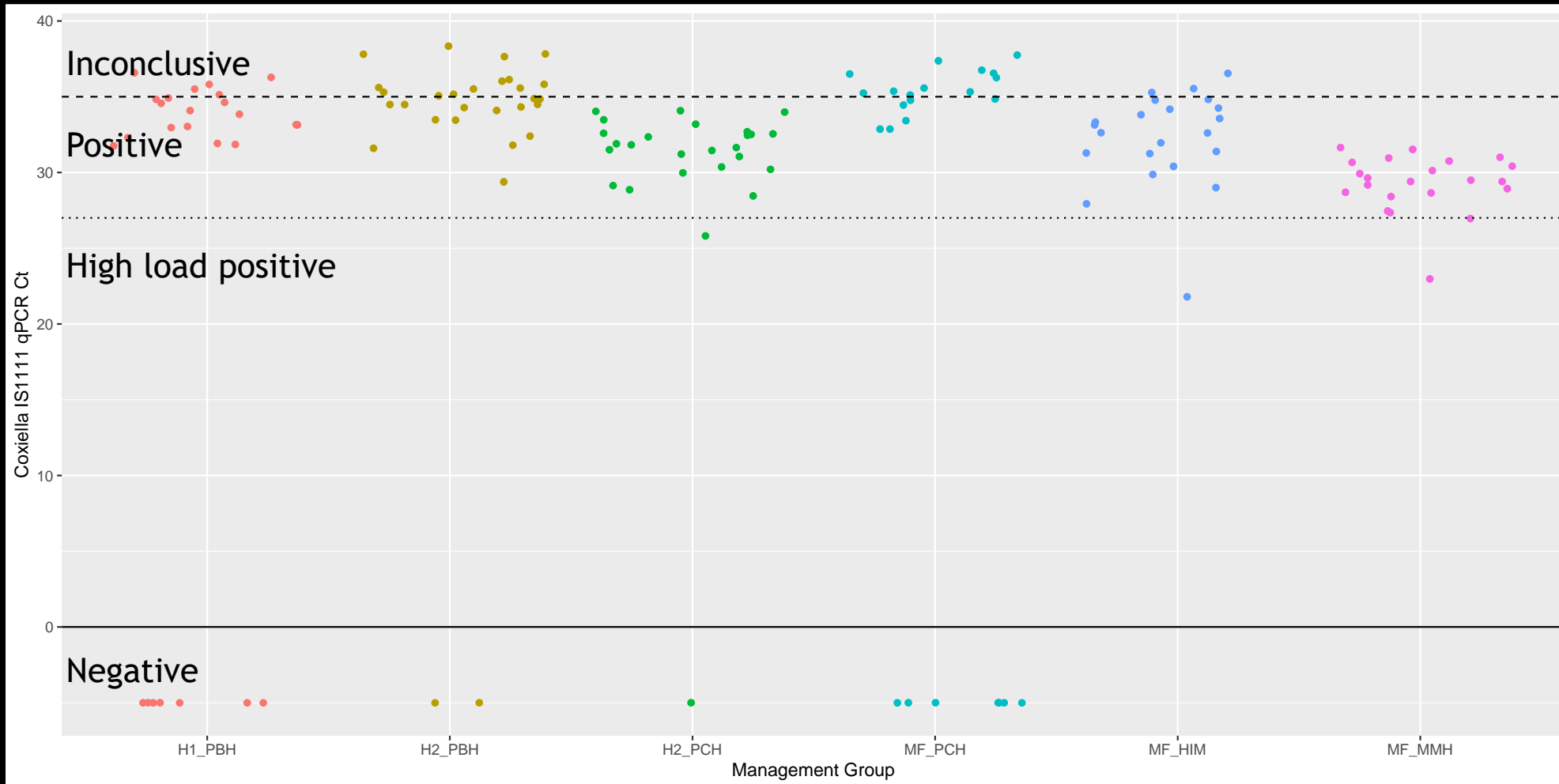
158 animals sampled in June 2023.



- Seroconversion during first pregnancy around time of transition to main farm
- qPCR detection in all groups (Ct < 40)

# Results: Cross Sectional & qPCR

158 animals sampled in June 2023.



- Most detections in the cross sectional population classified as “inconclusive” or “positive” but very few “high load positives”

# Results: Post-Partum Sampling

Study Herd – 829 lactating cows

598 calving events

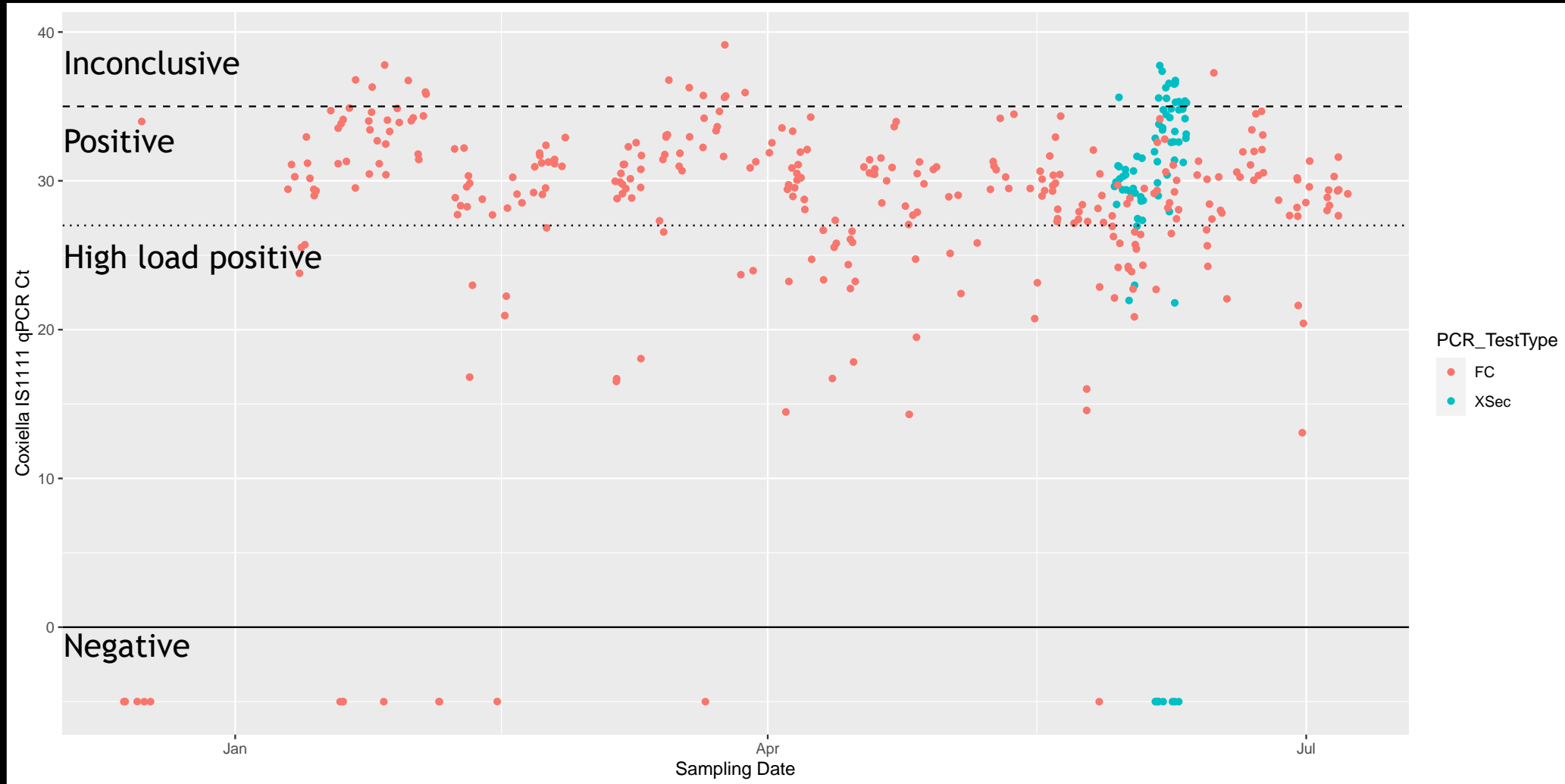
324 (54.2%) postpartum cows sampled

38/172 (22%) Primiparous

286/426 (67%) Multiparous

- Sampling performed 13 Dec 2022 to 06 July 2023
- Limited sampling of primiparous animals vs multiparous
- Several analyses restricted to multiparous animals

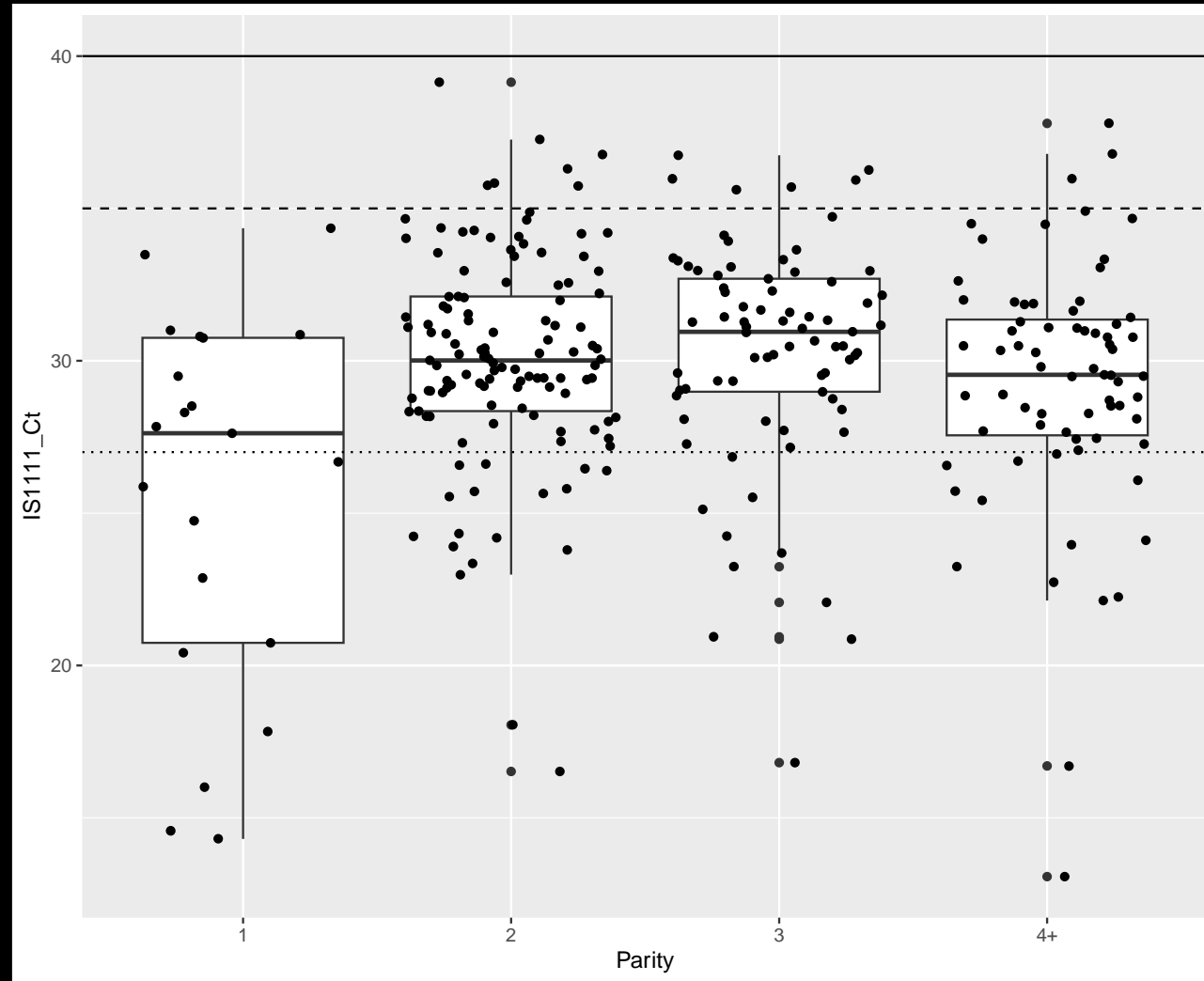
# Results: Cts in XSec and Post parturient populations



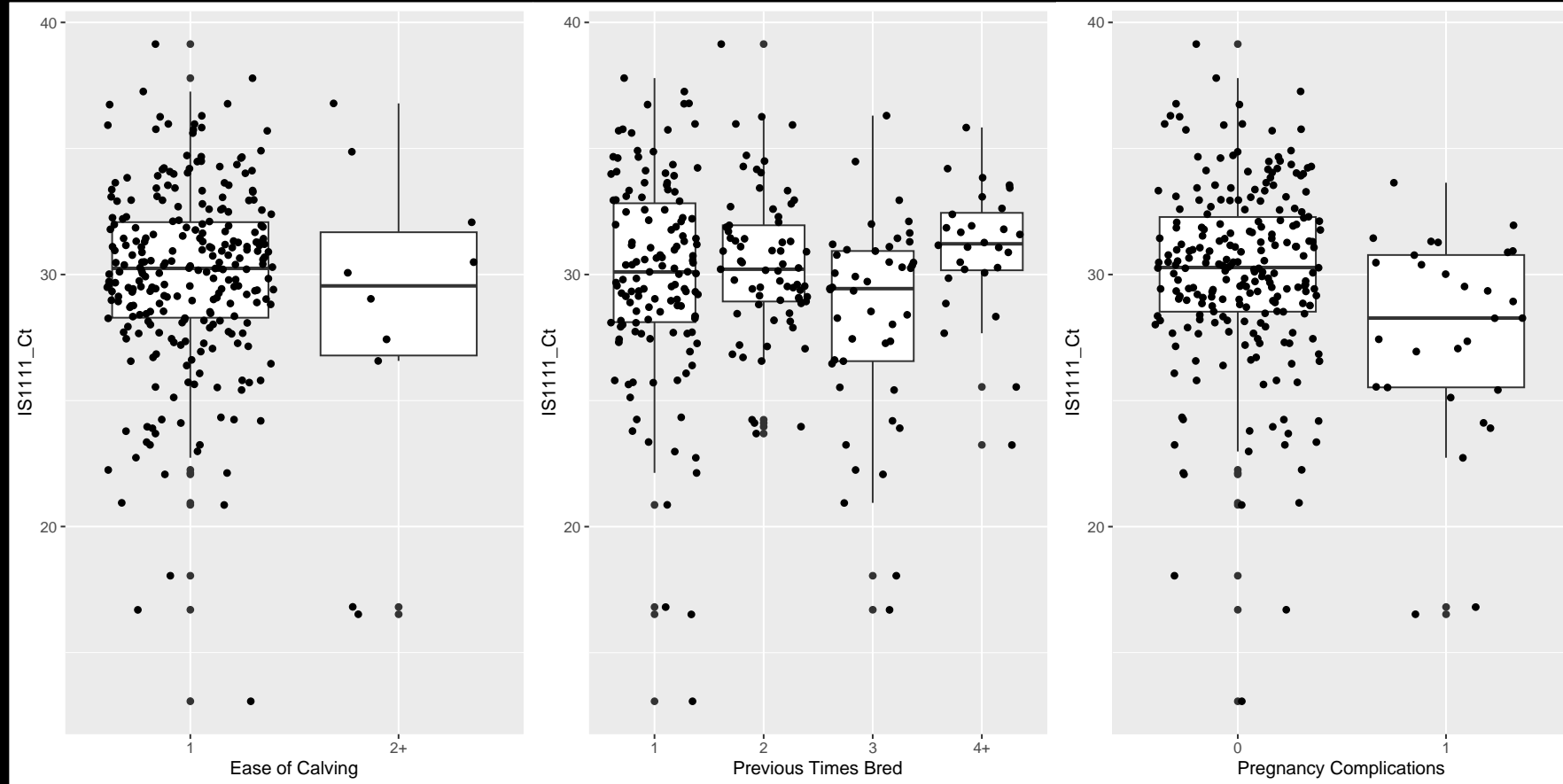
18.5% of the post-parturition (red) & 3.1 % cross sectional (blue) populations classified as “high load positives” with Ct<=27

# Results - Parity

- No influence of parity on odds of *Coxiella burnetii* detection by parity
- Parity 1 (primiparous) cows were more likely to have lower Cts (shedding more *Coxiella burnetii*)



# Results: *Coxiella* association with clinical & production measures



Lower Ct's (high bacterial shedding) associated with:

- Challenges in calving
- 3 previous breeding attempts to conception
- Occurrence of 1+ pregnancy complications

# Key Findings

- *C. burnetii* detection throughout the herd
  - ‘Detection’ by qPCR in all management groups
  - Most high load shedders in post-partum population
  - Primiparous animals shedding highest bacterial concentrations
  - Seroconversion during first pregnancy? (Garcia-Ispuerto, 2011, Nogereda et al 2012)
- Statistically significant associations with amount of *Coxiella* detected in multiparous animals
  - Amount of bacteria shed (Ct) associated with ‘less’ calving ease, occurrence of pregnancy complications and higher numbers of breeding attempts pre-pregnancy
  - Analyses ongoing....





# Ongoing Work

- Assessment of associations between *Coxiella* detection / amount and production / clinical outcomes determined in the 3 months AFTER sampling
- Survival analyses for clinical & production outcomes
- Assessment of variation in shedding by different routes (milk, urine and faeces)
- Molecular typing of high load positives
- Ongoing evaluation of 'case definitions' based on Ct values
- Implications for management....





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and you for  
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