# Keeping watch on lambing ewes

## New approaches to understanding lamb mortality

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27 August 2018

AGRICULTURE AND FOOD
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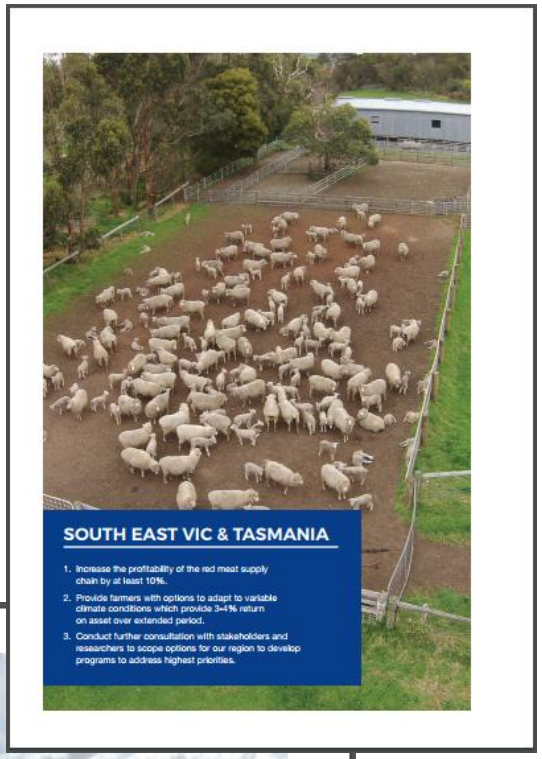
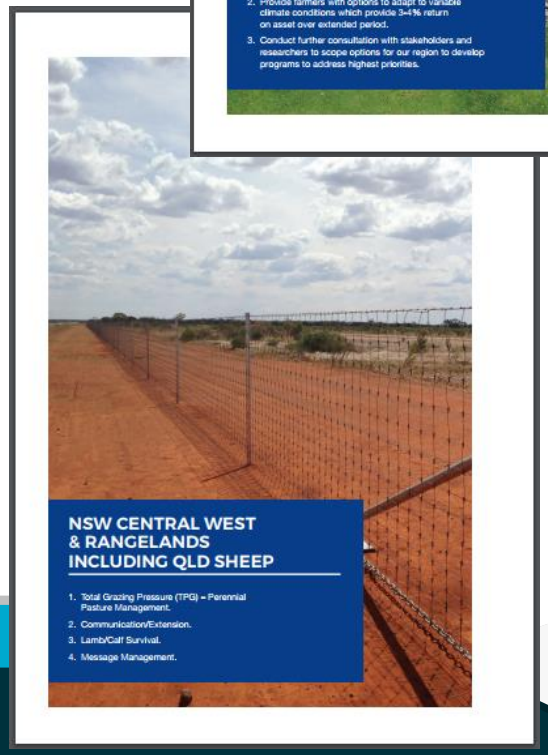
# Lamb survival in Australia

- South East Victoria & Tasmania
  - Animal Welfare top 3 priorities
    - Improved lamb survival
    - Continue research into foetal loss and lamb mortalities

- NSW Central West & Rangelands
  - Lamb/calf survival in top 3 priorities
    - Research into foetal loss/lamb mortalities

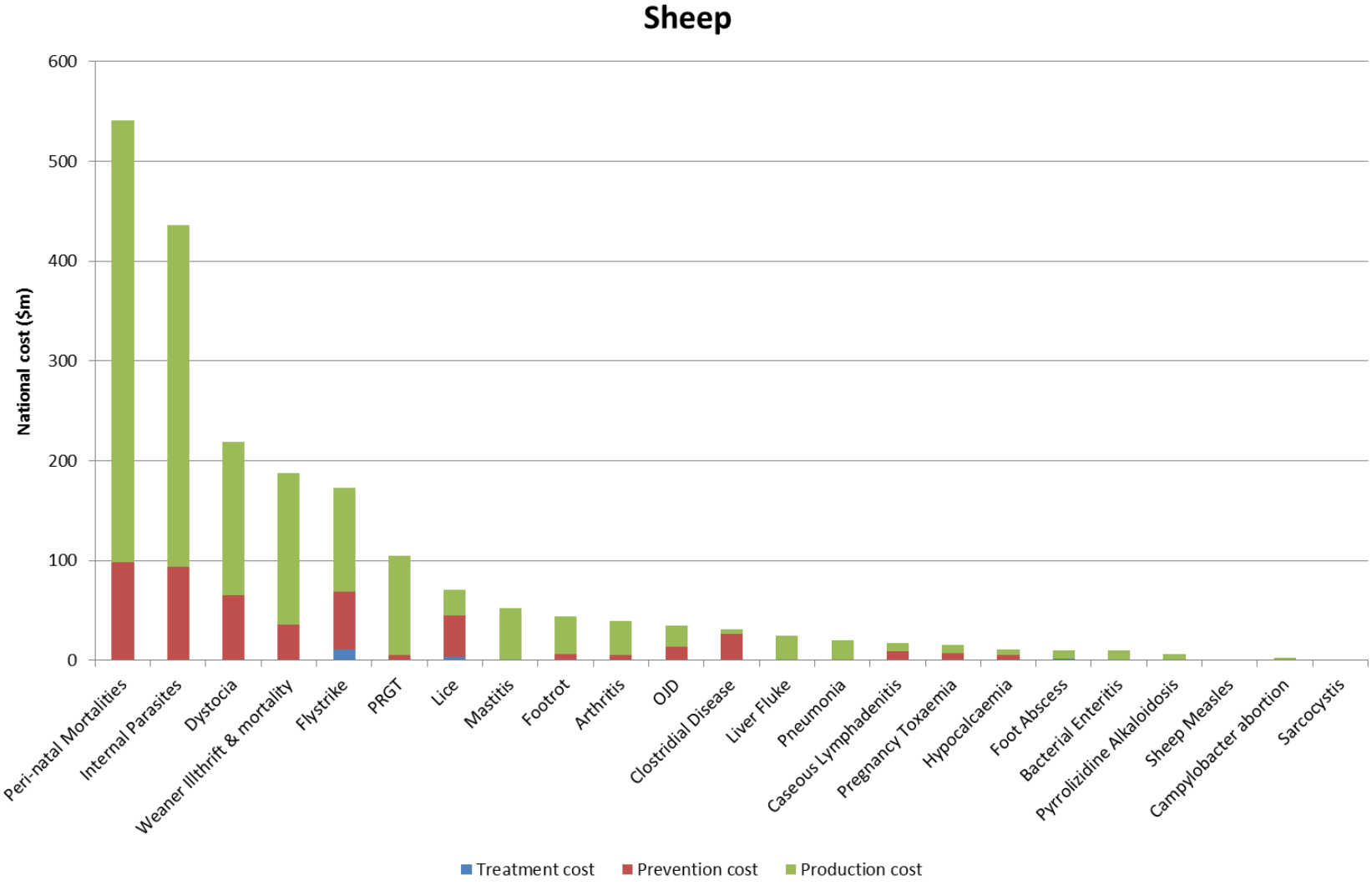


# Increasing lamb survival

Identifying lambing behaviours relating to neonatal mortality

# Estimated annual economic cost Australia




From Lane, J. (2015). Priority list of endemic diseases for the red meat industries, MLA.

# Biggest risk group in Australia

"Improving lamb survival had a large impact on profit.
AU$7.50 to AU$8.40 or AU$11.20 to AU$16.20, respectively,
could be spent per a single or twin-bearing ewe to increase the survival of single or twin lambs by 10%."

CSIRO PUBLISHING

*Animal Production Science*, 2014, 54, 645–655
http://dx.doi.org/10.1071/AN13269

**The critical control points for increasing reproductive performance can be used to inform research priorities**

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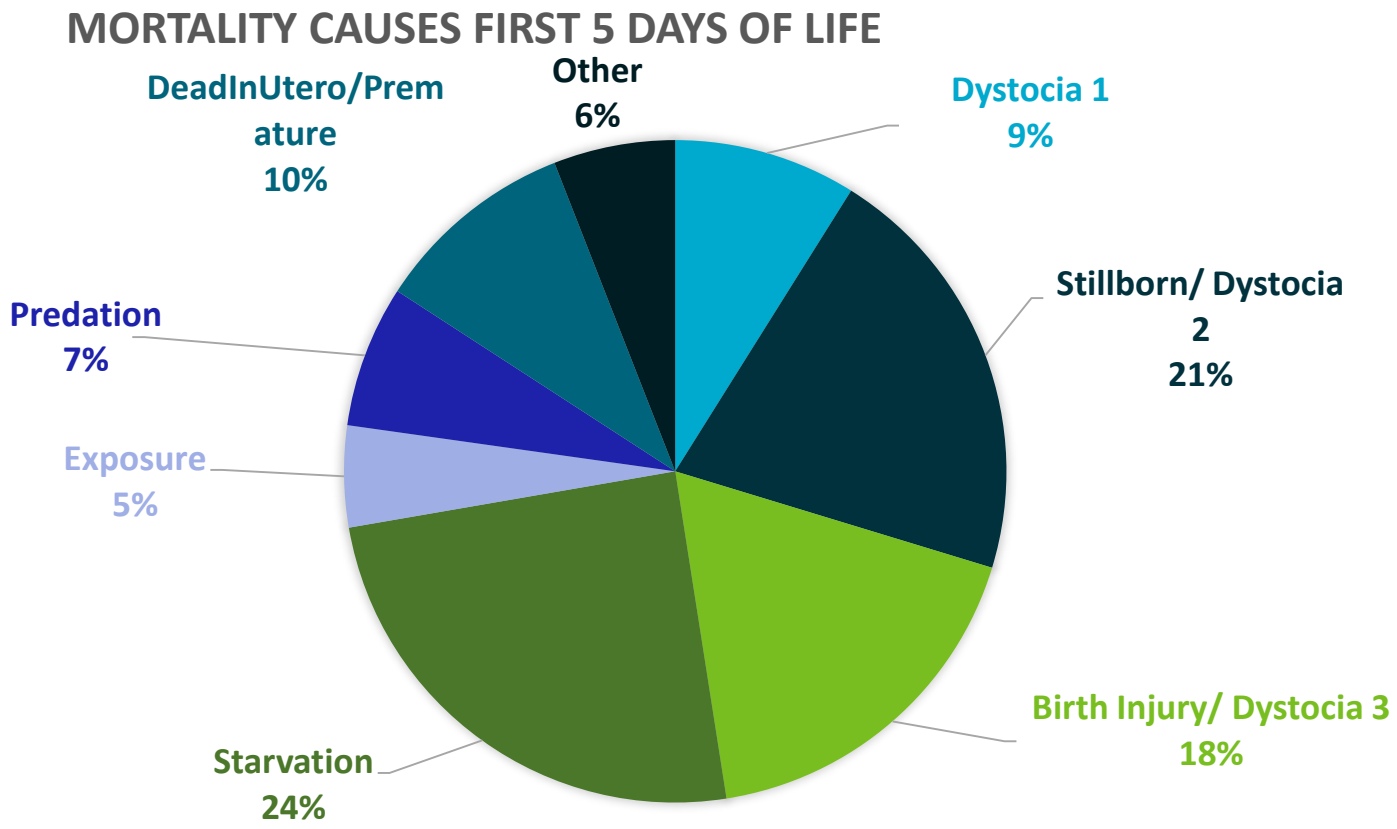
[F]Corresponding author. Email: andrew.thompson@murdoch.edu.au

# Causes of lamb loss – Information Nucleus Flock




Data from Refshauge *et al* (2016) Animal Production Science 56, 726-735.

# Causes of lamb loss cont.

| CAUSE OF DEATH | INFORMATION NUCLEUS FLOCK | SENTINEL FLOCK (VIC) |
|---|---|---|
| **Dystocia** | 47% (total) | 31% (likely does not include Dys3) |
| Dys1 | 8.8% | |
| Dys2 | 20.6% | |
| Dys3 (incl. starvation) | 18% | |
| **Starvation/Mismothering** | 25% | 45% (likely does include Dys3) |
| **Predation** | 6.7% | 4% |
| **Premature/dead in utero** | 10.6% | 11% |
| **Exposure** | 5.6% (distinct climatic events contribute most significantly) | 8% |
| **Infection** | 0.6% | 5% |

# Birth related injuries

- = prolonged labour = dystocia
- Increased risk for hypoxia
- Of greatest risk: high birthweight singles
- Any twins
- Any pure bred Merino

- Rate of twinning in Merinos greatly increased

# Our approach

- Sensors!

# Our approach

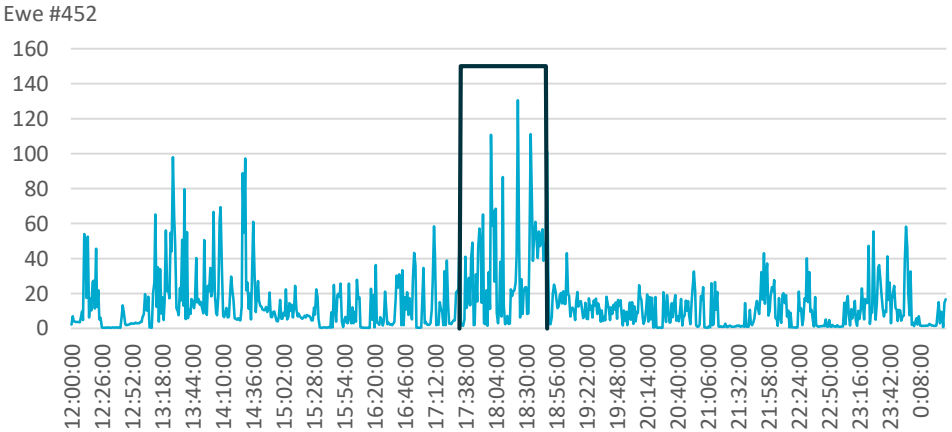
- Sensors!
- Measurement of parturition length
- Building on CSIRO investment
- Once established can be used to validate hypotheses for underlying causes, and estimate relative contributions
- Collaboration with INRA and AgResearch

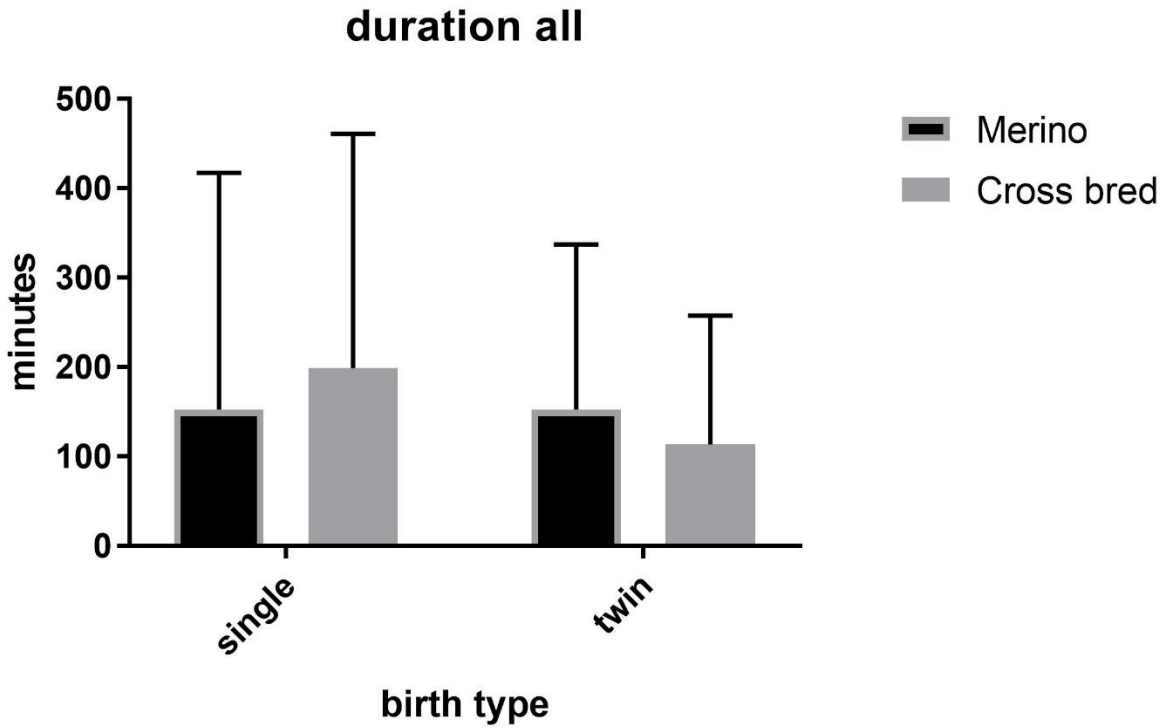

HIKVISION

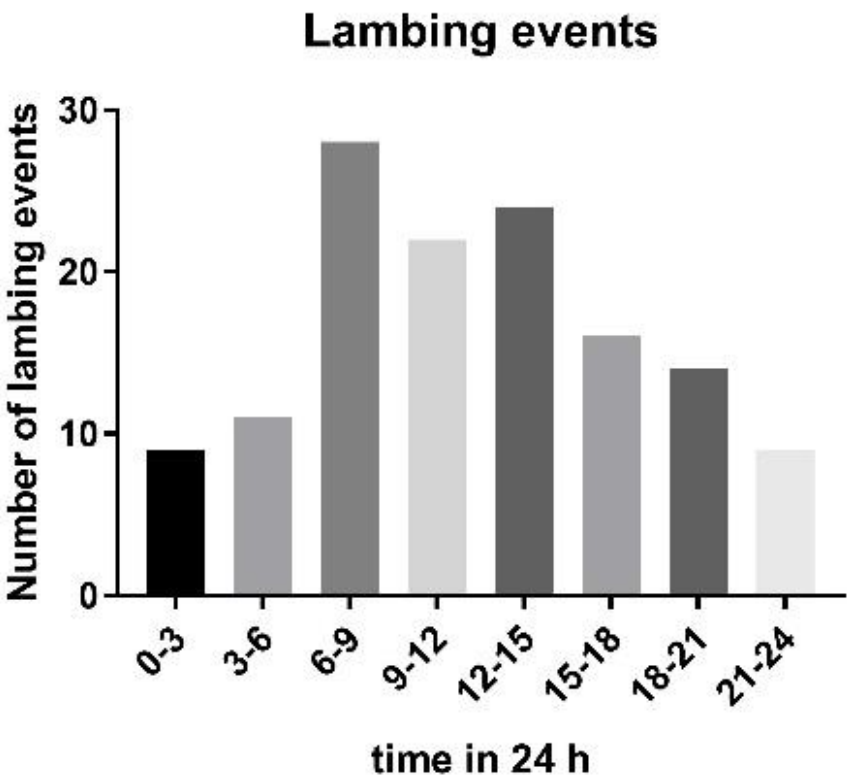



DATA-005.CSV - Excel

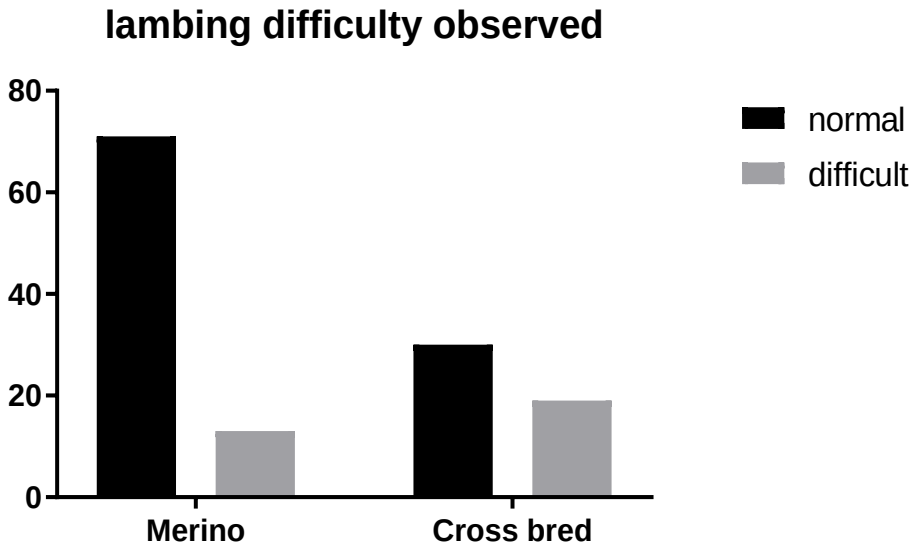
| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | ;Title | http://ww | HAM-x16 | ADXL345 | | | | |
| 2 | ;Version | 1102 | Build date | Oct 9 201 | SN:CCDC1016C151A0A | | | |
| 3 | ;Start_time | 2017-08-1 | 04:34:11.811 | | | | | |
| 4 | ;Temperat | -999 | deg C | Vbat | 3994 | mv | | |
| 5 | ;SampleRa | 12 | Hz | | | | | |
| 6 | ;Deadbanc | 0 | counts | | | | | |
| 7 | ;Deadbanc | 5 | sec | | | | | |
| 8 | ;Time | Ax | Ay | Az | | | | |
| 9 | 0.039 | -1790 | 949 | -177 | | | | |
| 10 | 0.117 | -1754 | 932 | -204 | | | | |
| 11 | 0.196 | -1777 | 874 | -174 | | | | |
| 12 | 0.274 | -1807 | 860 | -149 | | | | |
| 13 | 0.352 | -1781 | 915 | -218 | | | | |
| 14 | 0.43 | -1841 | 839 | -202 | | | | |
| 15 | 0.509 | -1806 | 840 | -184 | | | | |
| 16 | 0.587 | -1779 | 921 | -193 | | | | |
| 17 | 0.665 | -1809 | 857 | -147 | | | | |
| 18 | 0.743 | -1775 | 855 | -174 | | | | |
| 19 | 0.822 | -1811 | 914 | -211 | | | | |
| 20 | 0.9 | -1800 | 851 | -170 | | | | |
| 21 | 0.978 | -1786 | 855 | -177 | | | | |
| 22 | 1.056 | -1852 | 903 | -227 | | | | |

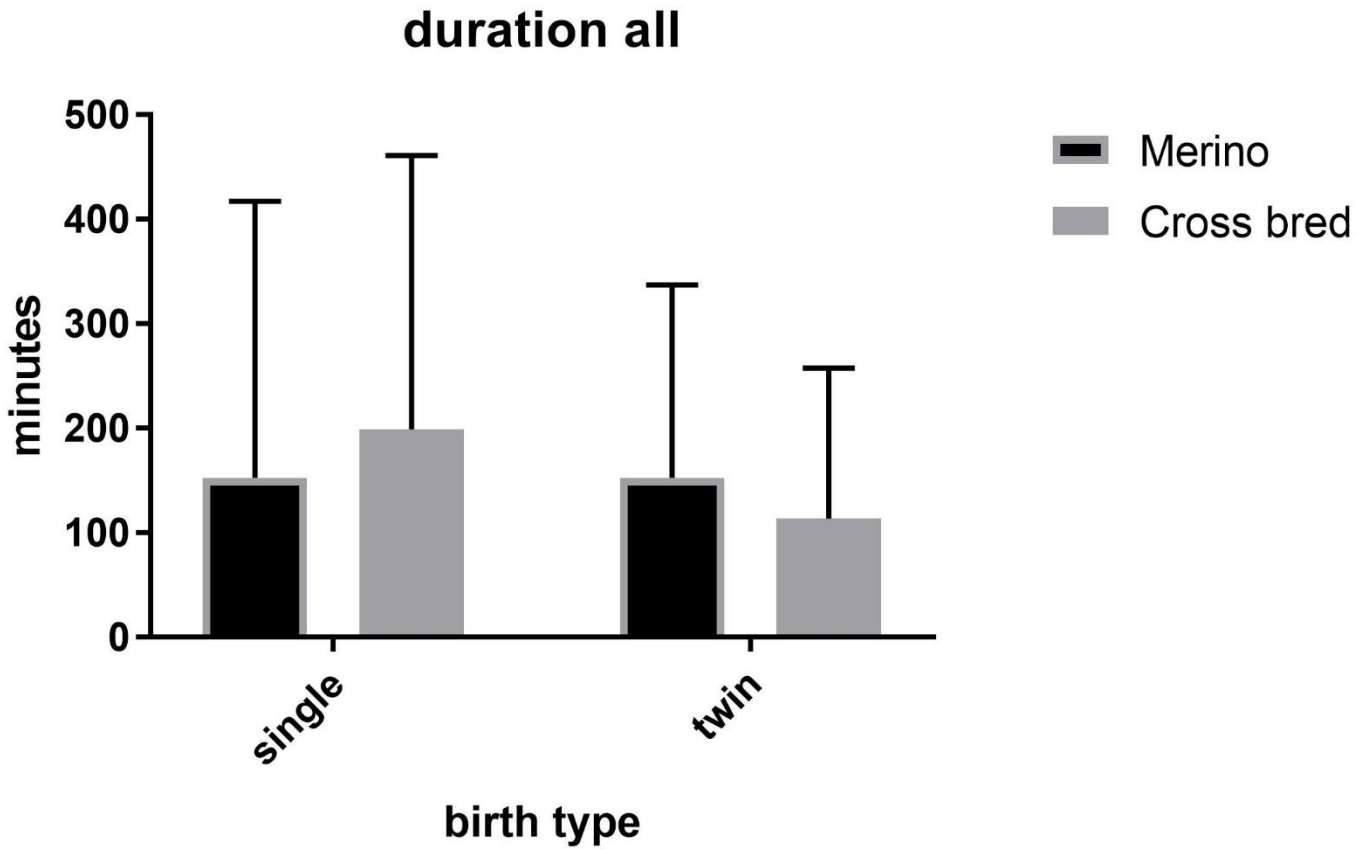



duration all
500
400
300
200
100
0
minutes
single
twin
birth type
Merino
Cross bred



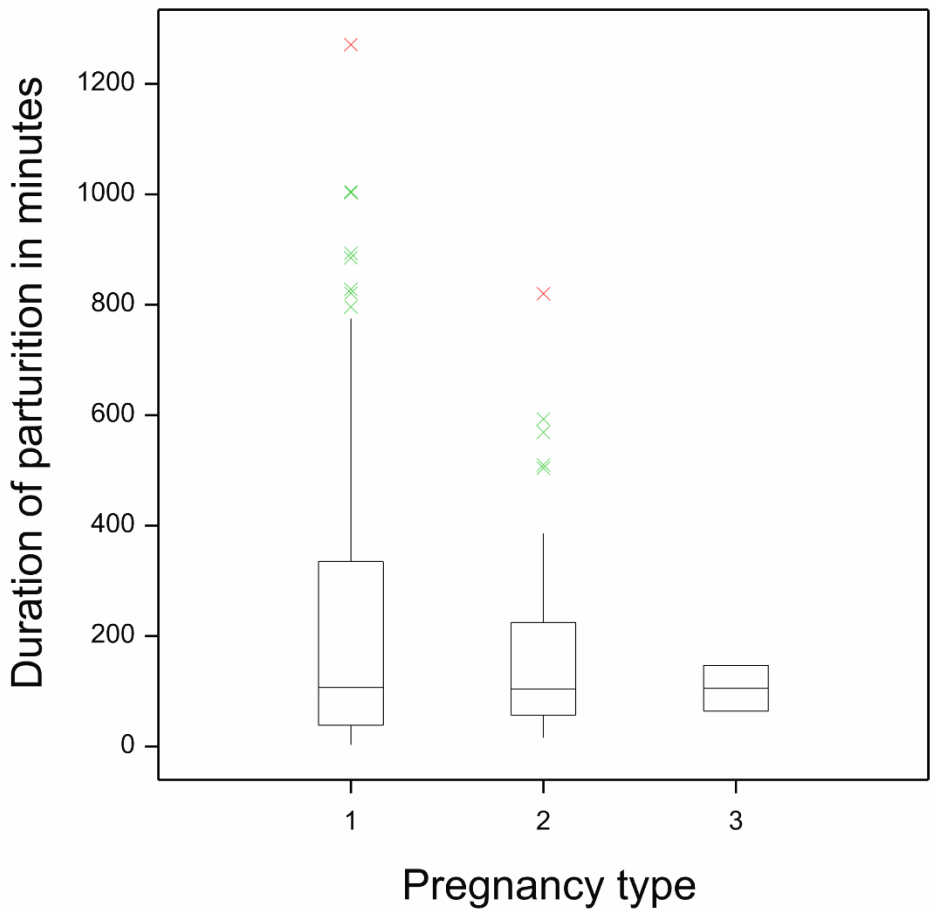

Discrepancy from expected tested with Chi-Square test; P value (two-tailed) 0.002415


lambing difficulty observed
80
60
40
20
0
Merino
Cross bred
normal
difficult

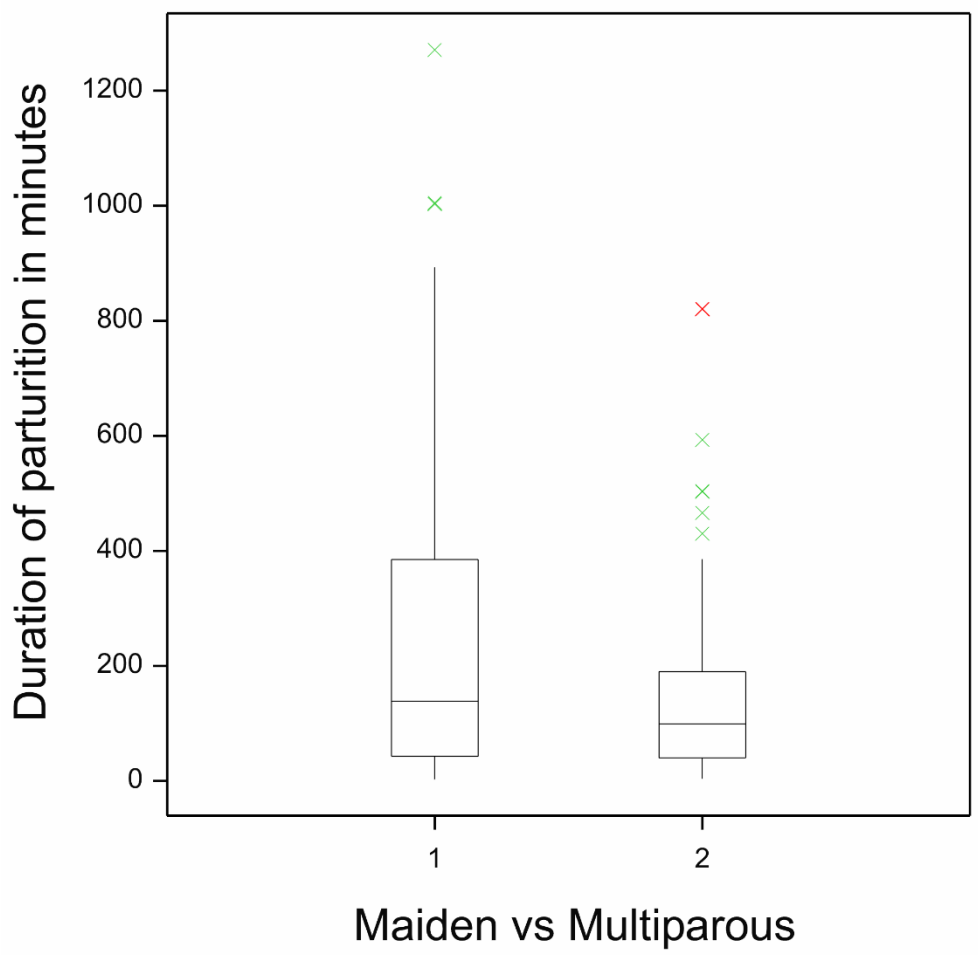

duration all
500
400
300
200
100
0
minutes
single
twin
birth type
Merino
Cross bred

# Analysis

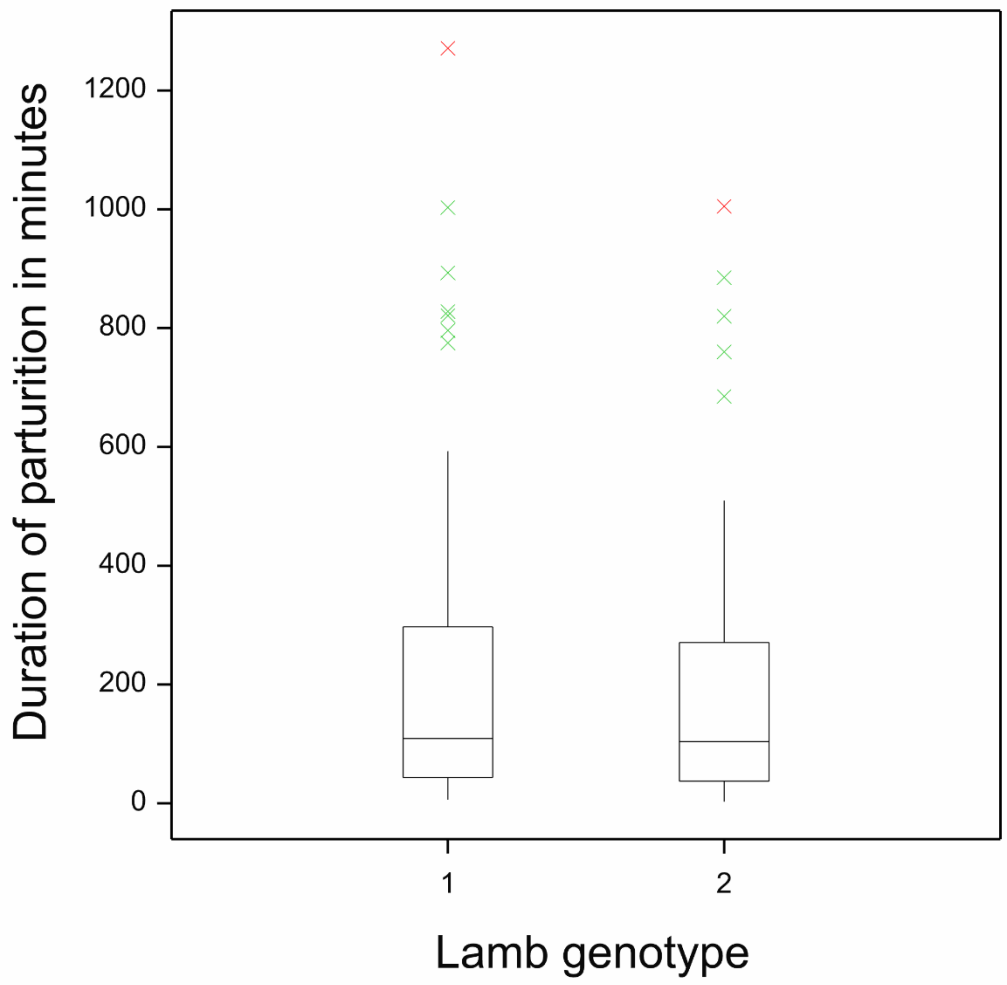
# Single vs twins



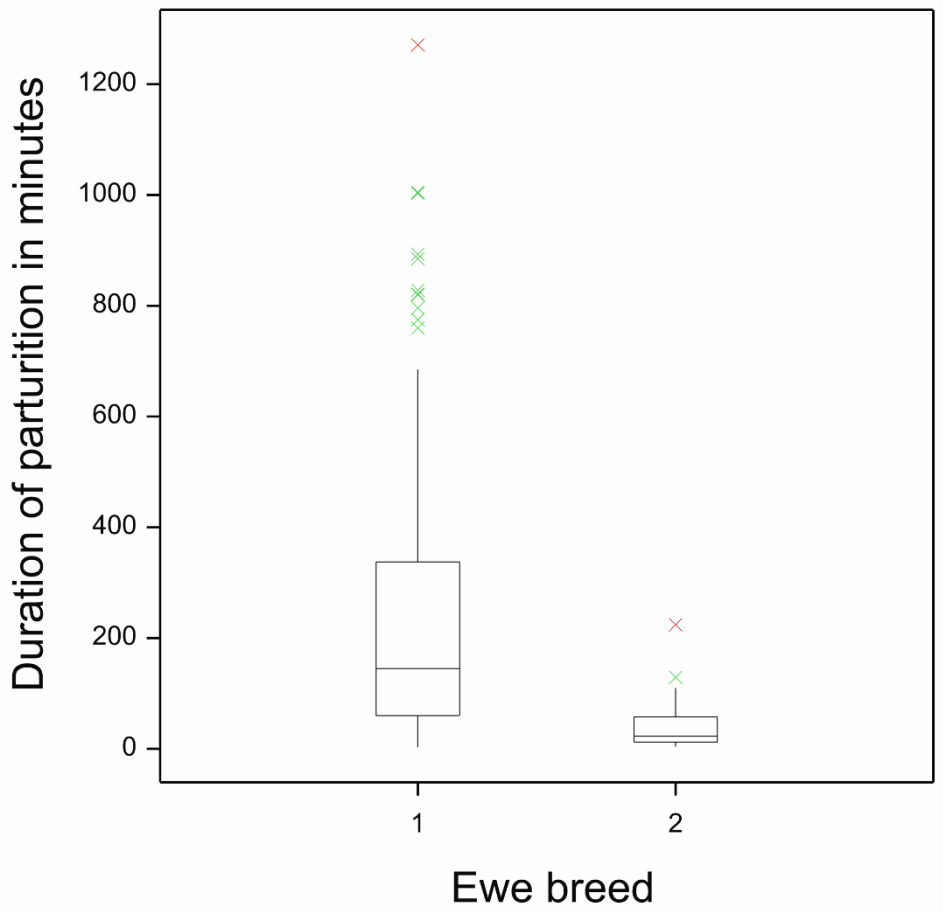
# Parity


Duration of parturition in minutes
1200
1000
800
600
400
200
0
1
2
Maiden vs Multiparous

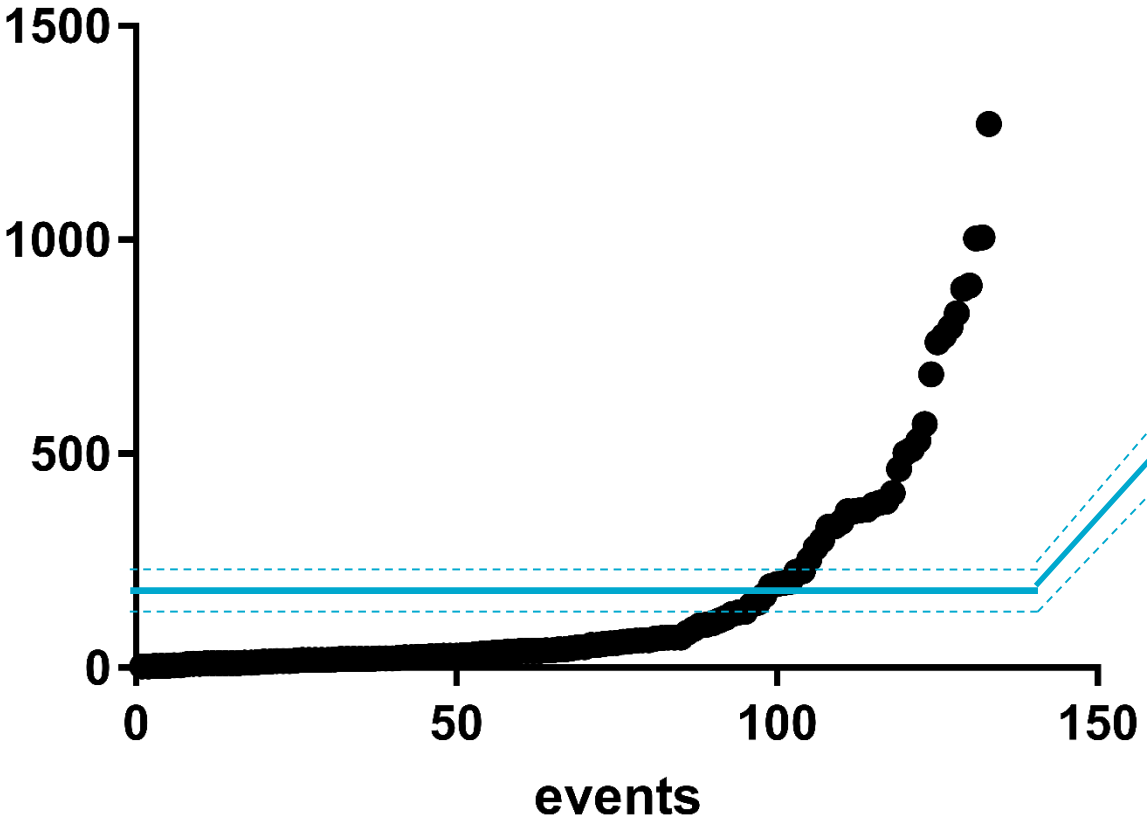
# Ram breed


Duration of parturition in minutes
1200
1000
800
600
400
200
0
1
2
Lamb genotype

# Merino vs cross bred



| Duration in min | Difficulty | Discrepancy | | count | twins |
|---|---|---|---|---|---|
| 1271.00 | difficult | | | | |
| 1005.00 | difficult | | | | |
| 1002.90 | difficult | | | | |
| 893 | difficult | | | | |
| 885.60 | difficult | | | | |
| 827.90 | difficult | | | | |
| 795.93 | normal | long normal | false negative | 12 | 3 |
| 775.00 | normal | long normal | false negative | | |
| 760.00 | difficult | | | | |
| 685.00 | difficult | | | | |
| 569.00 | normal | long normal | false negative | | |
| 530.00 | normal | long normal | false negative | | |
| 510.00 | difficult | | | | |
| 502.00 | difficult | | | | |
| 464.90 | normal | long normal | false negative | | |
| 407.93 | normal | long normal | false negative | | |
| 388.00 | normal | long normal | false negative | | |
| 385.00 | difficult | | | | |
| 380.00 | difficult | | | | |
| 369.00 | difficult | | | | |
| 368.00 | difficult | | | | |
| 366.00 | normal | long normal | false negative | | |
| 366.00 | normal | long normal | false negative | | |
| 340.00 | normal | long normal | false negative | | |
| 330.00 | normal | long normal | false negative | | |
| 329.00 | difficult | | | | |
| 297.90 | difficult | | | | |
| 281.00 | difficult | | | | |
| 253.00 | normal | long normal | false negative | | |
| 225.00 | difficult | | | | |
| 224.00 | difficult | | | | |
| 201.00 | normal | | | | |
| 198.00 | difficult | | | | |
| 196.22 | difficult | | | | |
| 191.00 | normal | | | | |
| 169.00 | normal | | | | |
| 152.00 | normal | | | | |
| 147.00 | normal | | | | |
| 130.00 | normal | | | | |
| 129.02 | difficult | short difficult | false positive | 11 | 2 |
| 125.00 | difficult | short difficult | false positive | | |
| 117.00 | normal | | | | |
| 110.00 | difficult | short difficult | false positive | | |
| 104.00 | normal | | | | |
| 101.00 | normal | | | | |
| 99.60 | difficult | short difficult | false positive | | |
| 90.88 | difficult | short difficult | false positive | | |
| 82.00 | normal | | | | |
| 71.00 | normal | | | | |
| 70.00 | normal | | | | |
| 70.00 | normal | | | | |
| 69.95 | difficult | short difficult | false positive | | |
| 68.00 | normal | | | | |
| 64.00 | normal | | | | |
| 64.00 | normal | | | | |
| 63.00 | normal | | | | |
| 62.00 | normal | | | | |
| 60.00 | normal | | | | |
| 58.02 | normal | | | | |
| 57.00 | difficult | short difficult | false positive | | |
| 56.00 | normal | | | | |
| 53.40 | normal | | | | |
| 53.00 | difficult | short difficult | false positive | | |
| 48.05 | normal | | | | |
| 48.00 | normal | | | | |
| 45.00 | difficult | short difficult | false positive | | |
| 43.00 | normal | | | | |
| 42.75 | normal | | | | |
| 41.00 | normal | | | | |
| 40.00 | difficult | short difficult | false positive | | |
| 39.42 | difficult | short difficult | false positive | | |
| 39.00 | normal | | | | |
| 39.00 | normal | | | | |
| 39.00 | normal | | | | |
| 38.00 | normal | | | | |
| 37.67 | normal | | | | |
| 36.00 | normal | | | | |
| 36.00 | normal | | | | |
| 33.00 | normal | | | | |
| 33.00 | normal | | | | |
| 32.00 | normal | | | | |
| 29.00 | normal | | | | |
| 28.82 | normal | | | | |
| 28.00 | normal | | | | |
| 28.00 | normal | | | | |
| 28.00 | normal | | | | |
| 27.00 | normal | | | | |
| 27.00 | normal | | | | |
| 26.00 | normal | | | | |
| 25.07 | normal | | | | |
| 24.45 | normal | | | | |
| 24.00 | normal | | | | |
| 23.00 | normal | | | | |
| 22.37 | normal | | | | |
| 22.00 | normal | | | | |
| 22.00 | normal | | | | |
| 21.13 | normal | | | | |
| 21.05 | normal | | | | |
| 21.00 | normal | | | | |
| 20.53 | normal | | | | |
| 20.03 | normal | | | | |
| 20.00 | normal | | | | |
| 18.98 | normal | | | | |
| 18.73 | normal | | | | |
| 18.57 | normal | | | | |
| 17.72 | normal | | | | |
| 17.72 | normal | | | | |
| 17.60 | normal | | | | |
| 17.00 | normal | | | | |
| 16.03 | normal | | | | |
| 15.77 | normal | | | | |
| 15.20 | normal | | | | |
| 14.87 | normal | | | | |
| 14.00 | normal | | | | |
| 13.00 | normal | | | | |
| 12.47 | normal | | | | |
| 12.35 | normal | | | | |
| 11.00 | normal | | | | |
| 10.22 | normal | | | | |
| 10.22 | normal | | | | |
| 10.00 | normal | | | | |
| 10.00 | normal | | | | |
| 10.00 | normal | | | | |
| 9.07 | normal | | | | |
| 8.80 | normal | | | | |
| 7.60 | normal | | | | |
| 6.17 | normal | | | | |
| 6.00 | normal | | | | |
| 4.97 | normal | | | | |
| 4.75 | normal | | | | |
| 4.00 | normal | | | | |
| 3.05 | normal | | | | |
| 3.05 | normal | | | | |




Upper 95% CI of mean = 205.6

Mean = 162.6

Lower 95% CI of mean = 119.9

| Duration in min | Difficulty | Discrepancy | | count | twins |
|---|---|---|---|---|---|
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| 464.90 | normal | long normal | false negative | | |
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| 388.00 | normal | long normal | false negative | | |
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| 380.00 | difficult | | | | |
| 369.00 | difficult | | | | |
| 368.00 | difficult | | | | |
| 366.00 | normal | long normal | false negative | | |
| 366.00 | normal | long normal | false negative | | |
| 340.00 | normal | long normal | false negative | | |
| 330.00 | normal | long normal | false negative | | |
| 329.00 | difficult | | | | |
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| 53.40 | normal | | | | |
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| 48.00 | normal | | | | |
| 45.00 | difficult | short difficult | false positive | | |
| 43.00 | normal | | | | |
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| 41.00 | normal | | | | |
| 40.00 | difficult | short difficult | false positive | | |
| 39.42 | difficult | short difficult | false positive | | |
| 39.00 | normal | | | | |
| 39.00 | normal | | | | |
| 39.00 | normal | | | | |
| 38.00 | normal | | | | |
| 37.67 | normal | | | | |
| 36.00 | normal | | | | |
| 36.00 | normal | | | | |
| 33.00 | normal | | | | |
| 33.00 | normal | | | | |
| 32.00 | normal | | | | |
| 29.00 | normal | | | | |
| 28.82 | normal | | | | |
| 28.00 | normal | | | | |
| 28.00 | normal | | | | |
| 28.00 | normal | | | | |
| 27.00 | normal | | | | |
| 27.00 | normal | | | | |
| 26.00 | normal | | | | |
| 25.07 | normal | | | | |
| 24.45 | normal | | | | |
| 24.00 | normal | | | | |
| 23.00 | normal | | | | |
| 22.37 | normal | | | | |
| 22.00 | normal | | | | |
| 22.00 | normal | | | | |
| 21.13 | normal | | | | |
| 21.05 | normal | | | | |
| 21.00 | normal | | | | |
| 20.53 | normal | | | | |
| 20.03 | normal | | | | |
| 20.00 | normal | | | | |
| 18.98 | normal | | | | |
| 18.73 | normal | | | | |
| 18.57 | normal | | | | |
| 17.72 | normal | | | | |
| 17.72 | normal | | | | |
| 17.60 | normal | | | | |
| 17.00 | normal | | | | |
| 16.03 | normal | | | | |
| 15.77 | normal | | | | |
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| 14.00 | normal | | | | |
| 13.00 | normal | | | | |
| 12.47 | normal | | | | |
| 12.35 | normal | | | | |
| 11.00 | normal | | | | |
| 10.22 | normal | | | | |
| 10.22 | normal | | | | |
| 10.00 | normal | | | | |
| 10.00 | normal | | | | |
| 10.00 | normal | | | | |
| 9.07 | normal | | | | |
| 8.80 | normal | | | | |
| 7.60 | normal | | | | |
| 6.17 | normal | | | | |
| 6.00 | normal | | | | |
| 4.97 | normal | | | | |
| 4.75 | normal | | | | |
| 4.00 | normal | | | | |
| 3.05 | normal | | | | |
| 3.00 | normal | | | | |

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| 63.00 | normal | | | | |
| 62.00 | normal | | | | |
| 60.00 | normal | | | | |
| 58.02 | normal | | | | |
| 57.00 | difficult | short difficult | false positive | | |
| 56.00 | normal | | | | |
| 53.40 | normal | | | | |
| 53.00 | difficult | short difficult | false positive | | |
| 48.05 | normal | | | | |
| 48.00 | normal | | | | |
| 45.00 | difficult | short difficult | false positive | | |
| 43.00 | normal | | | | |
| 42.75 | normal | | | | |
| 41.00 | normal | | | | |
| 40.00 | difficult | short difficult | false positive | | |
| 39.42 | difficult | short difficult | false positive | | |
| 39.00 | normal | | | | |
| 39.00 | normal | | | | |
| 39.00 | normal | | | | |
| 38.00 | normal | | | | |
| 37.67 | normal | | | | |
| 36.00 | normal | | | | |
| 36.00 | normal | | | | |
| 33.00 | normal | | | | |
| 33.00 | normal | | | | |
| 32.00 | normal | | | | |
| 29.00 | normal | | | | |
| 28.82 | normal | | | | |
| 28.00 | normal | | | | |
| 28.00 | normal | | | | |
| 28.00 | normal | | | | |

Upper 95% CI of mean = 205.6

Mean = 162.6

Lower 95% CI of mean = 119.9

False negative; range 253 - 795

False positive; range 69 - 129

# Conclusions

- Parturition length depends on breed
- Observed lambing ease doesn’t match parturition length in all case
- More detailed annotation desirable
- Physiological parameters will help interpretation
- On our way to develop algorithm detecting lambing event


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ANIMAL WELFARE
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# Thank you

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