

HEIFERS, SHEEPS, AND GRASS ADAPT WELL TO ROTATIONAL GRAZING MANAGED WITH VIRTUAL FENCING

A. Fischer, D. Deleau, L. Depuille, G. Dufour, S. Fauviot, D. Gautier, T. Huneau, C. Lerond, P. Mangin, L.A. Merle, A. Philibert, A.S. Thudor, A. Jomier, A. Lebreton

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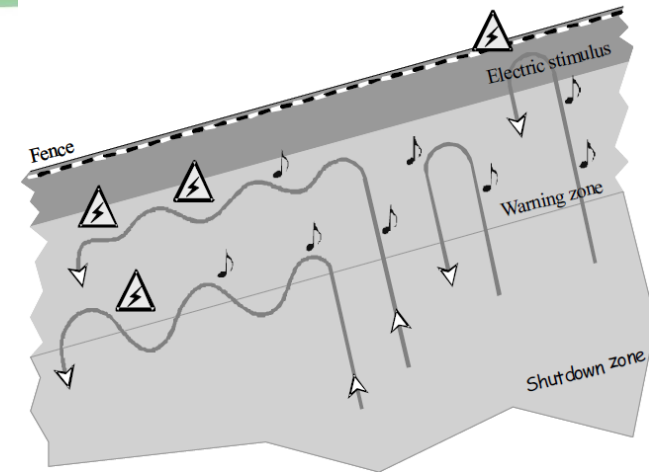
- Initial investment is costly
 - Initial set up + maintenance
 - Time-consuming
 - Strenuous work
- Fencing = Negative picture of livestock farming
 - Low appeal for future farmers
- Technicality of grazing management
 - Frequent moving of the fence
 - Watching animals
 - Grass growth control



Which alternative to physical fences ?

- **Burried fences + neck collars**

- Costly (€€ + time)
- Strenuous work
- Not movable

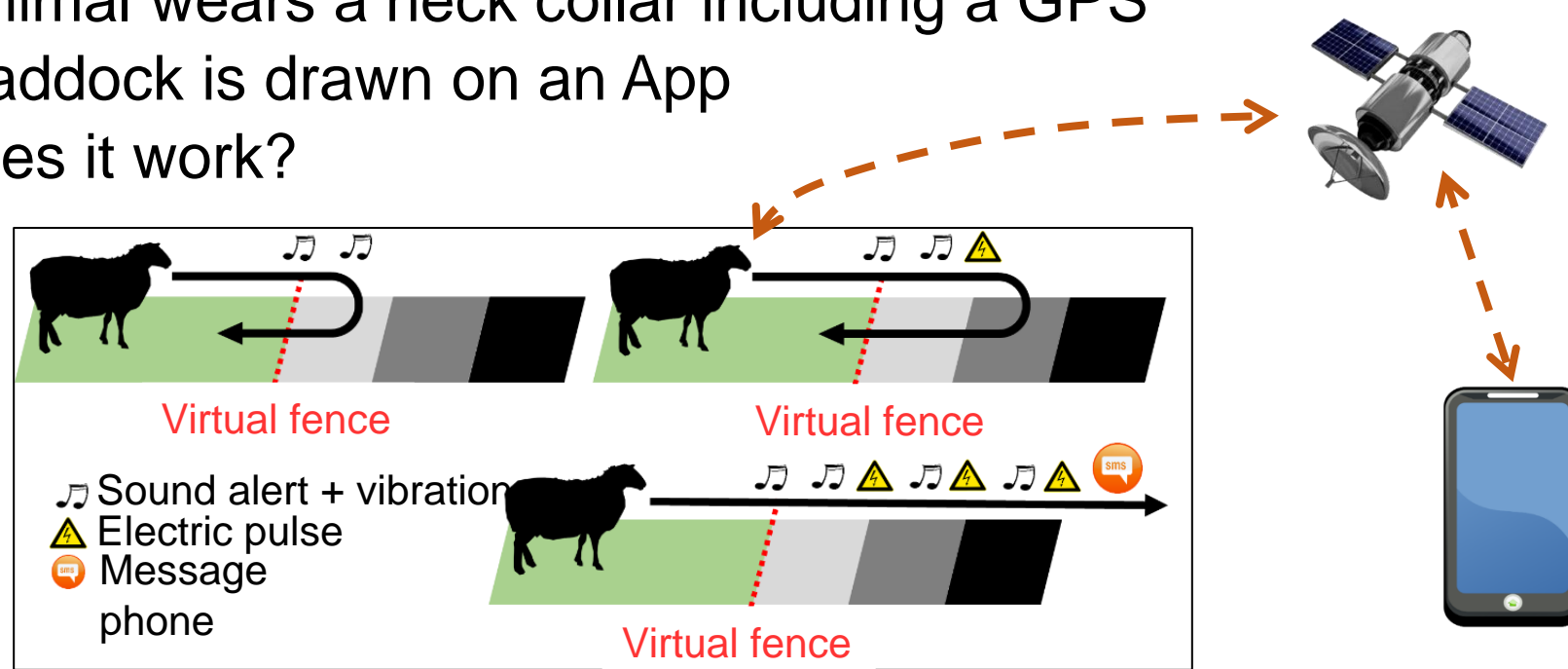


Source: Monod et al. (2009)

- **Virtual fences**

- No physical fences = no risk for wildlife, no change of landscape
→ **Better image of livestock?**
- No strenuous work
- Easier animal's monitoring from phone app'
- Possibility to graze in low accessible areas (mountains)

- Fence + each animal is located through satellite network
- Each animal wears a neck collar including a GPS
- Each paddock is drawn on an App
- How does it work?



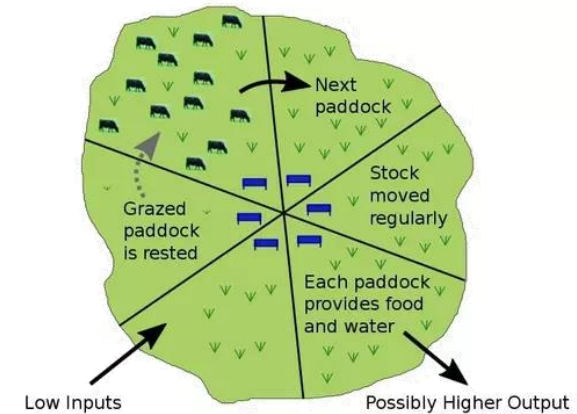
- Mainly validated for vast areas, extensive grazing, far from big cities

In plains: intensive grazing

- Rotational grazing = 1 plot subdivided into **several paddocks**
- Small paddocks
- Near villages/cities

In mountains: extensive grazing

- Stationnary grazing = **1 plot = 1 paddock**
- Large paddock
- Away from villages/cities



https://upload.wikimedia.org/wikipedia/commons/d/d4/Grazing%2C_rotational.svg

Are virtual fences adapted to the French intensive grazing context?

Are virtual fences adapted to rotational grazing on small paddocks?

- How fast will heifers and sheeps learn how to use the system?
- How sustainable is this learning routinely?
- Do all individuals behave the same over time?
- Is there an effect of virtual fences on
 - Average Daily Gain?
 - Grass growth?
 - Time-saving for the farmer?
 - Economic return?

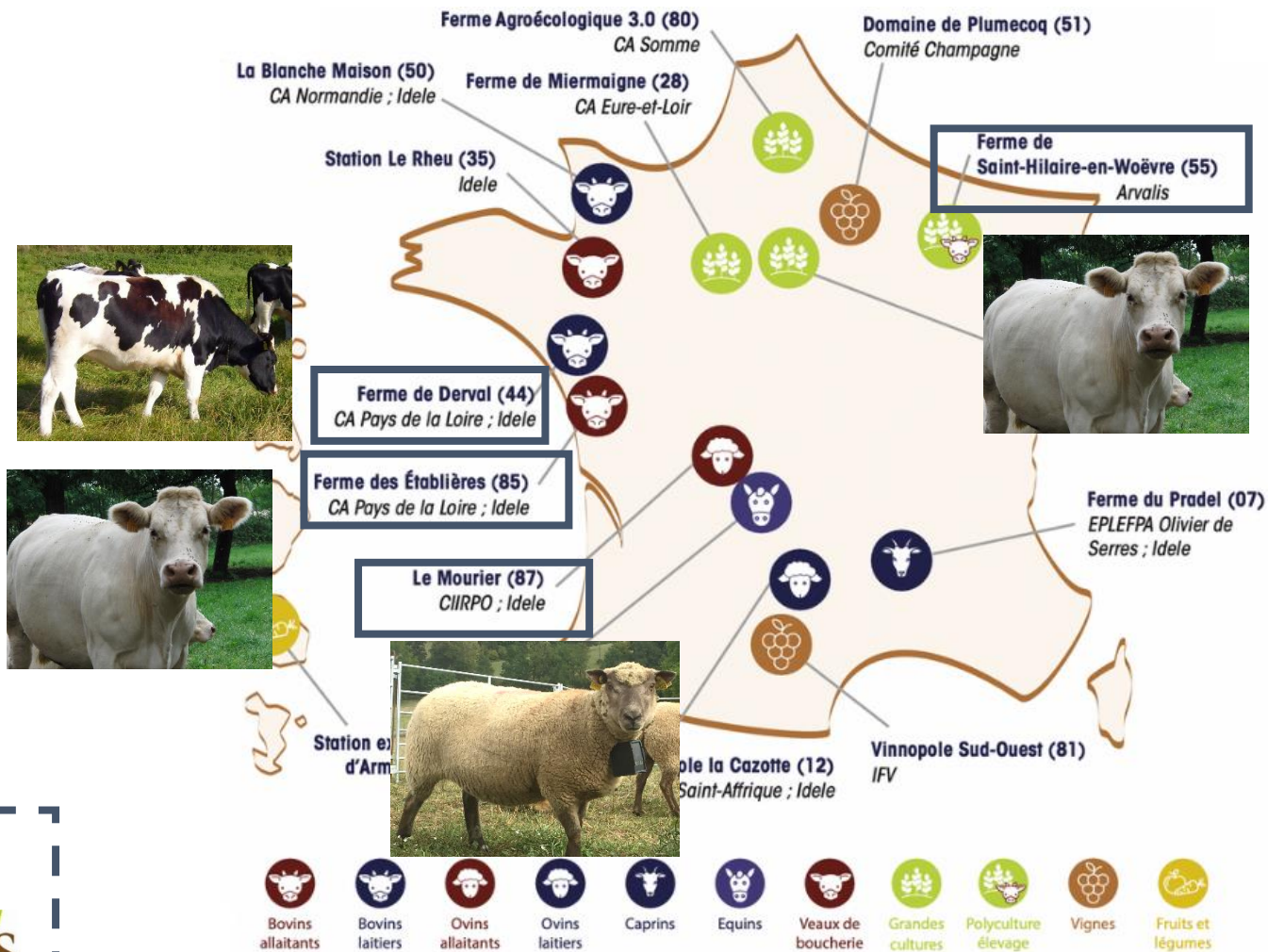
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Materials and Methods

• Tests in « end-users » conditions

- 4 « digifermes® »
- 3 species



Farm Name	Farm code	Animal	N	Paddock size (ha)	Average days/paddock
Derval	Dairy	Dairy Heifer	8	[0,44-1,32]	8,4
Les Etablières	Beef 1	Beef Heifer	12	[0,47-1,06]	1,4
Saint Hilaire	Beef 2	Beef Heifer	10	[0,47-0,52]	5,7
Le Mourier	Sheep	Sheep	19	[0,03 – 0,07]	3,2



Conductive chains that deliver electric pulse



2 solar panels for continuous charge of battery



- No commercialized virtual fencing system in France
- Testing the NoFence solution (Norway)
- **Analyses based on the sensors data**

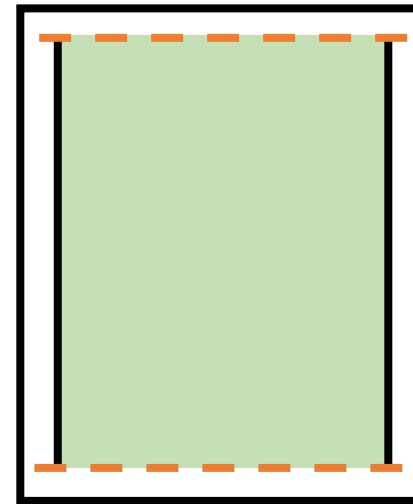
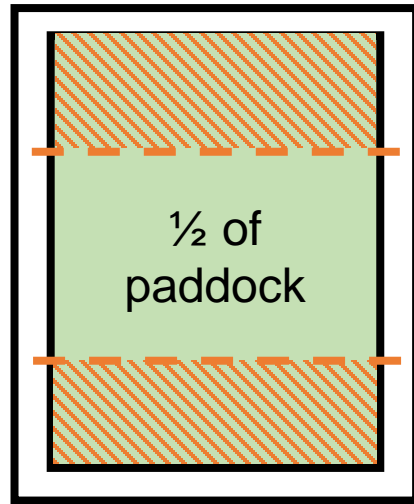
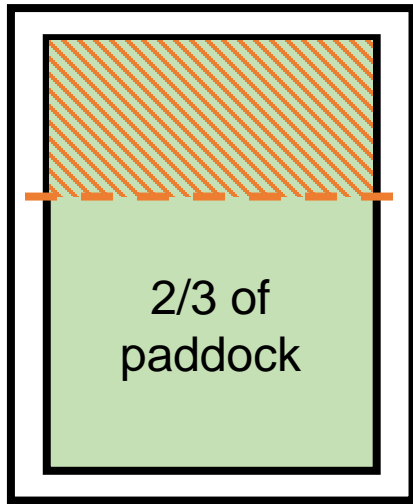
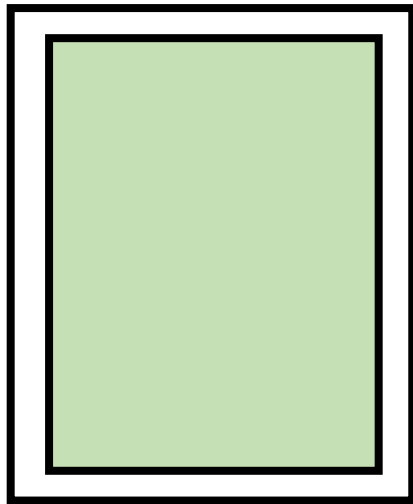
Physical Fence



Virtual Fence



Physical fences remain for the perimeters of the global plot



Heifers
Sheep

2-4 days

2-4 days

20-92 days

2 days

0 days

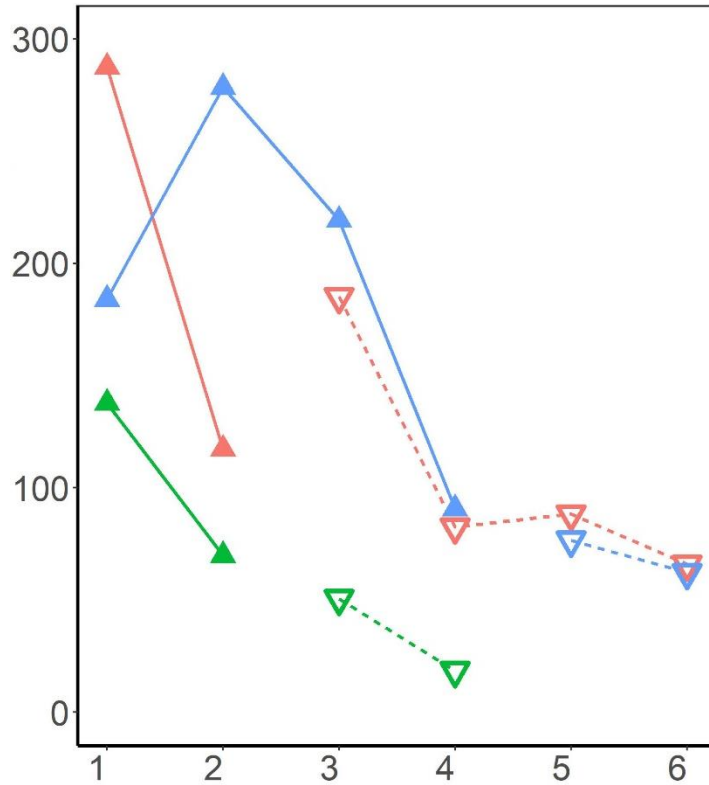
28 days



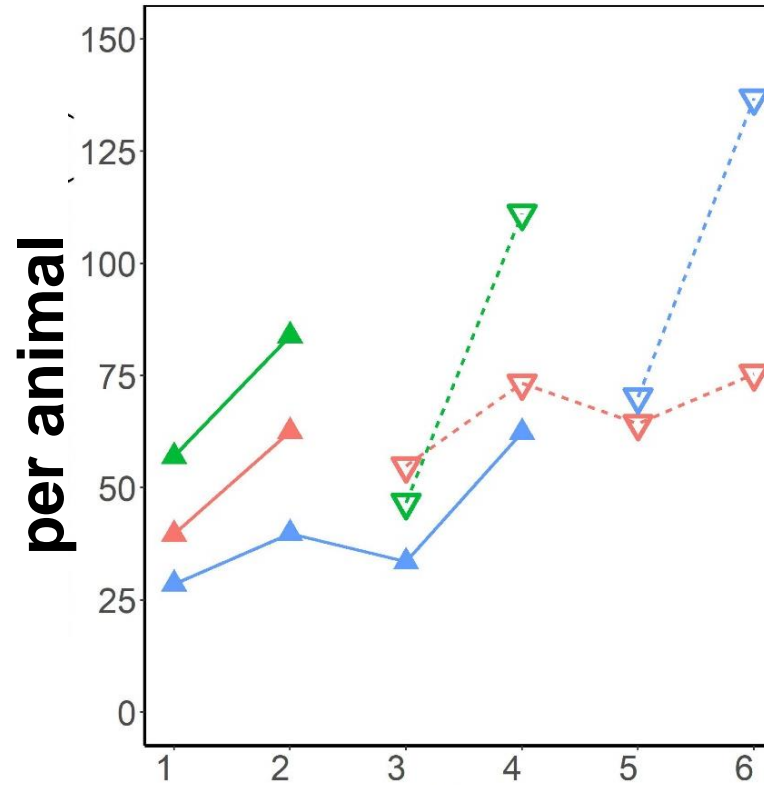
RESULTS

How fast will heifers and sheep learn how to use the system?

Sum of warning sound duration per animal



Sum of warning sound duration / electric pulse per animal



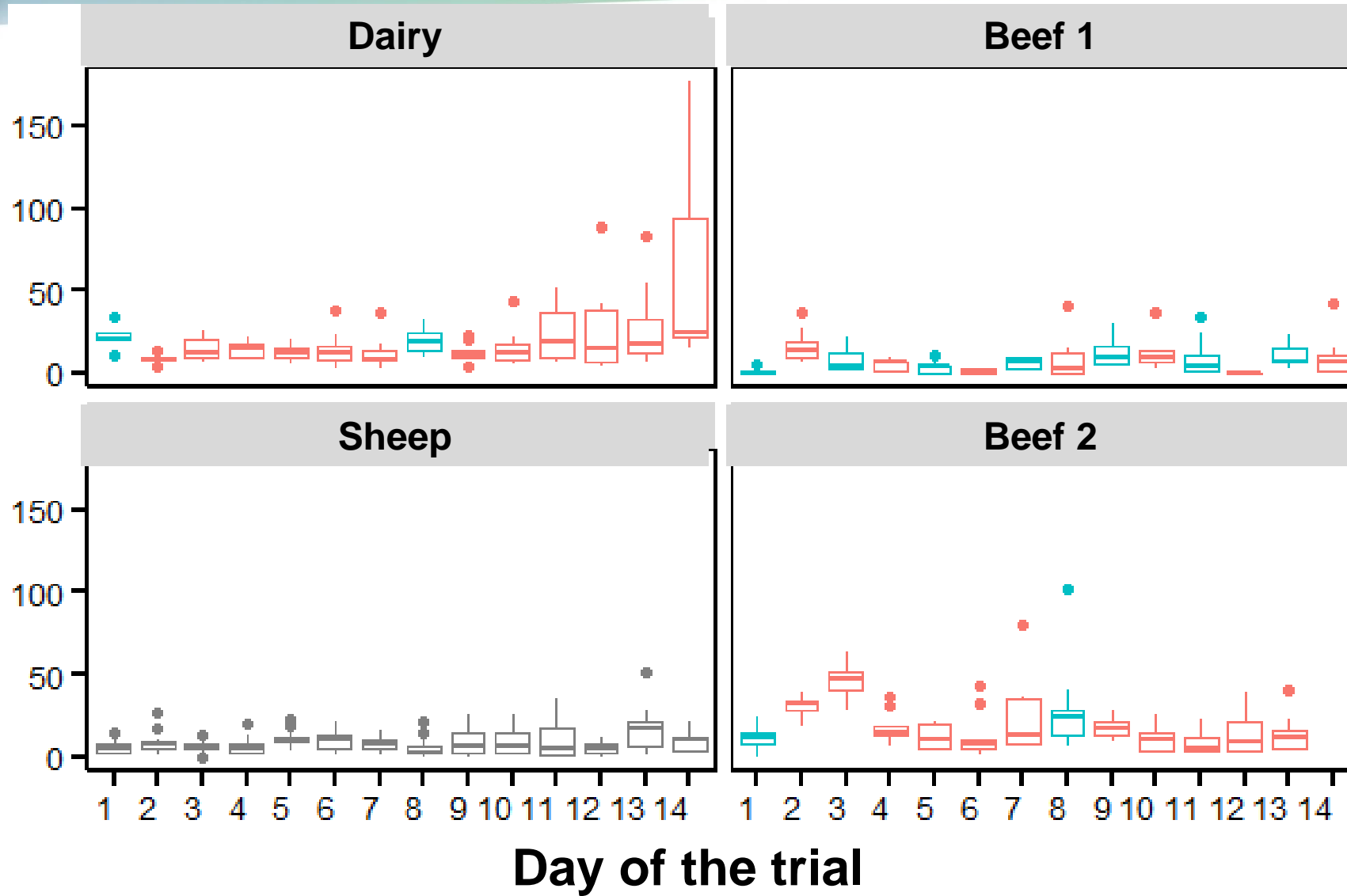
Day of the learning

- Decrease of the duration of the Sound Alerts over the Learning Stage
 - Increase of ration between time spend in sound alerts VS electric pulse
- ➔ On going learning process on the 3 farms

RESULTS



Number of warning sound
per animal

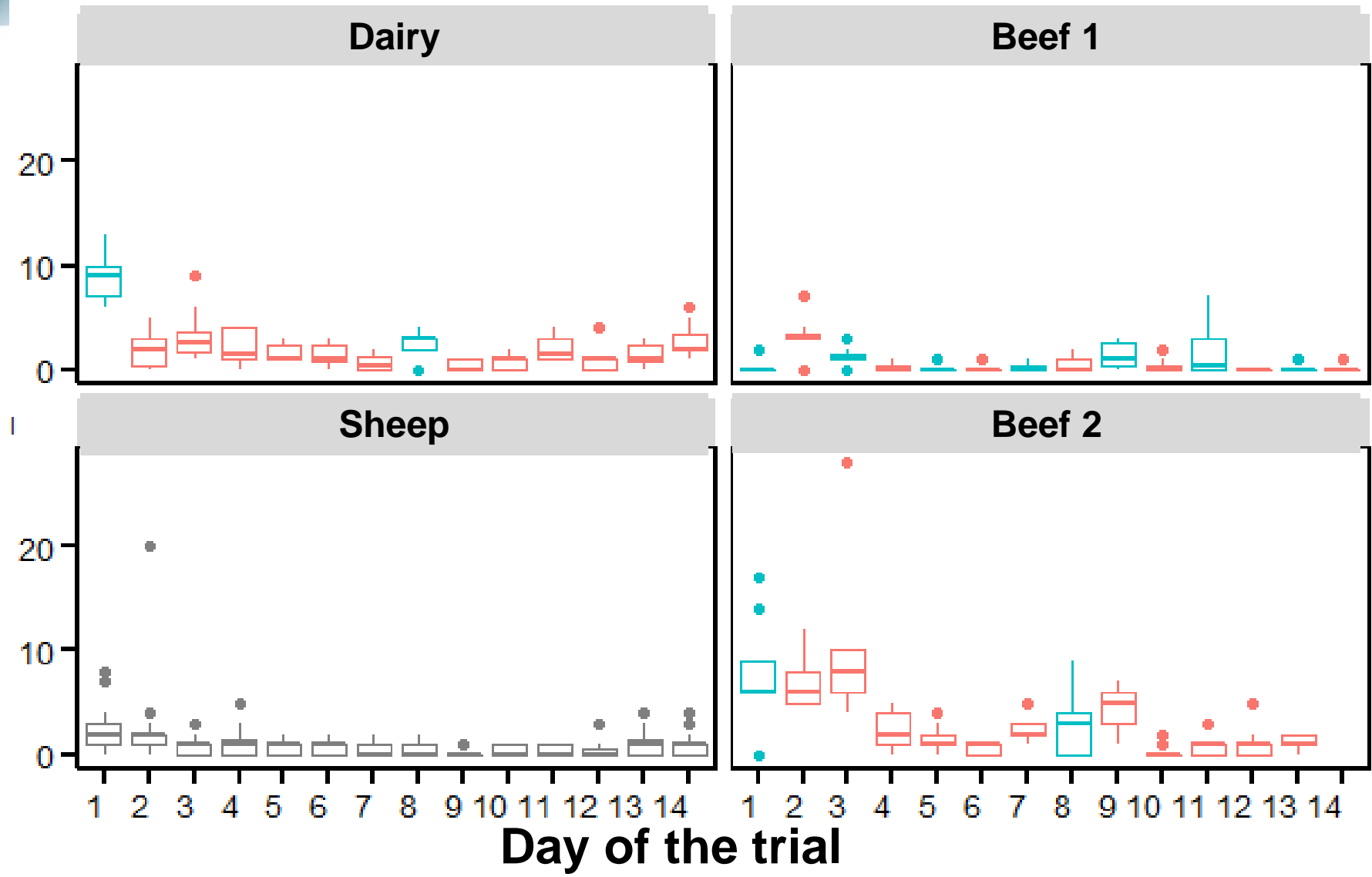


Day with a change of paddock
Regular day
Data missing



RESULTS

Number of electric pulse per animal

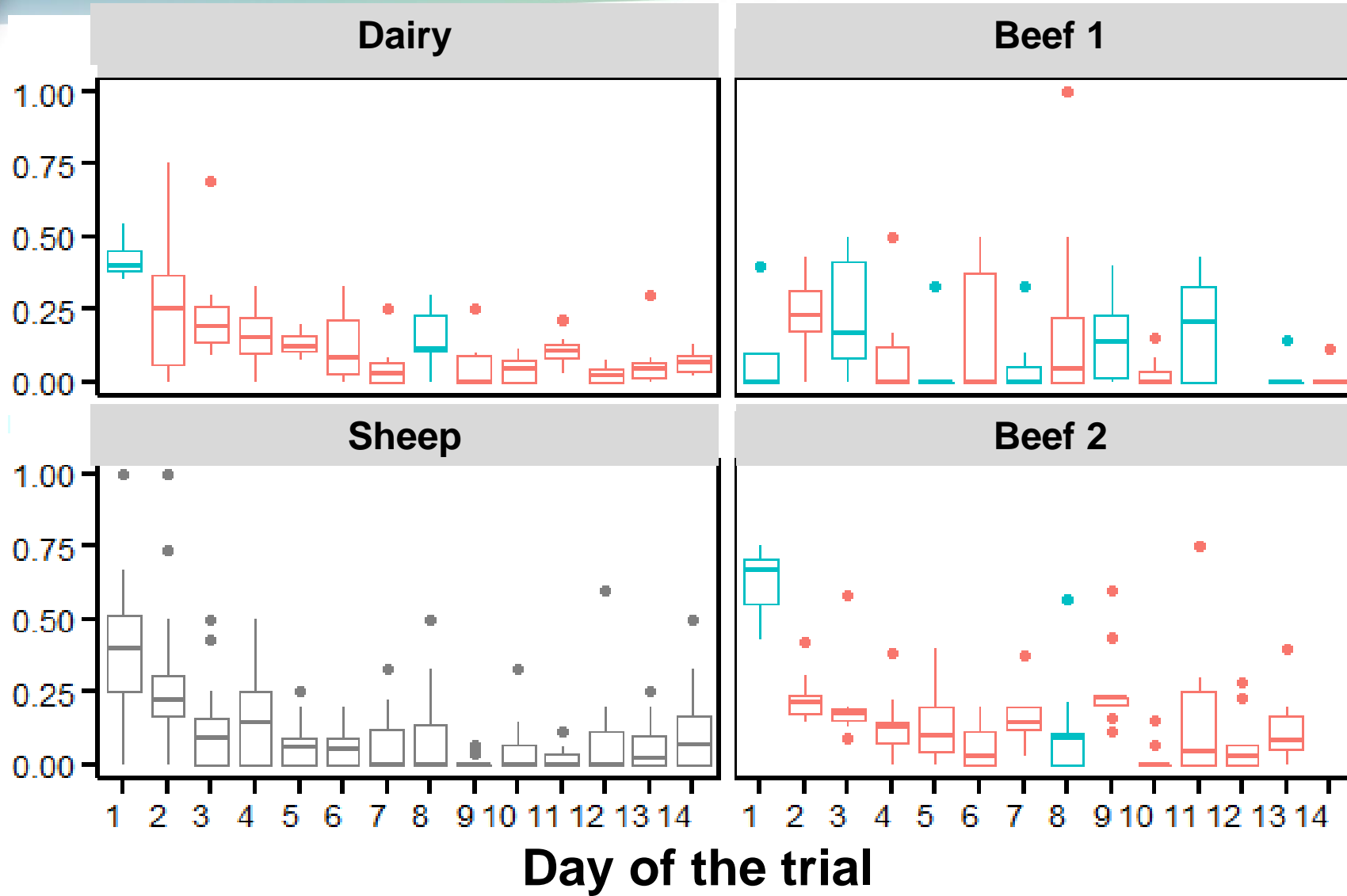


Day with a change of paddock
Regular day
Data missing

RESULTS



Ratio electric pulse /
warning sound per animal

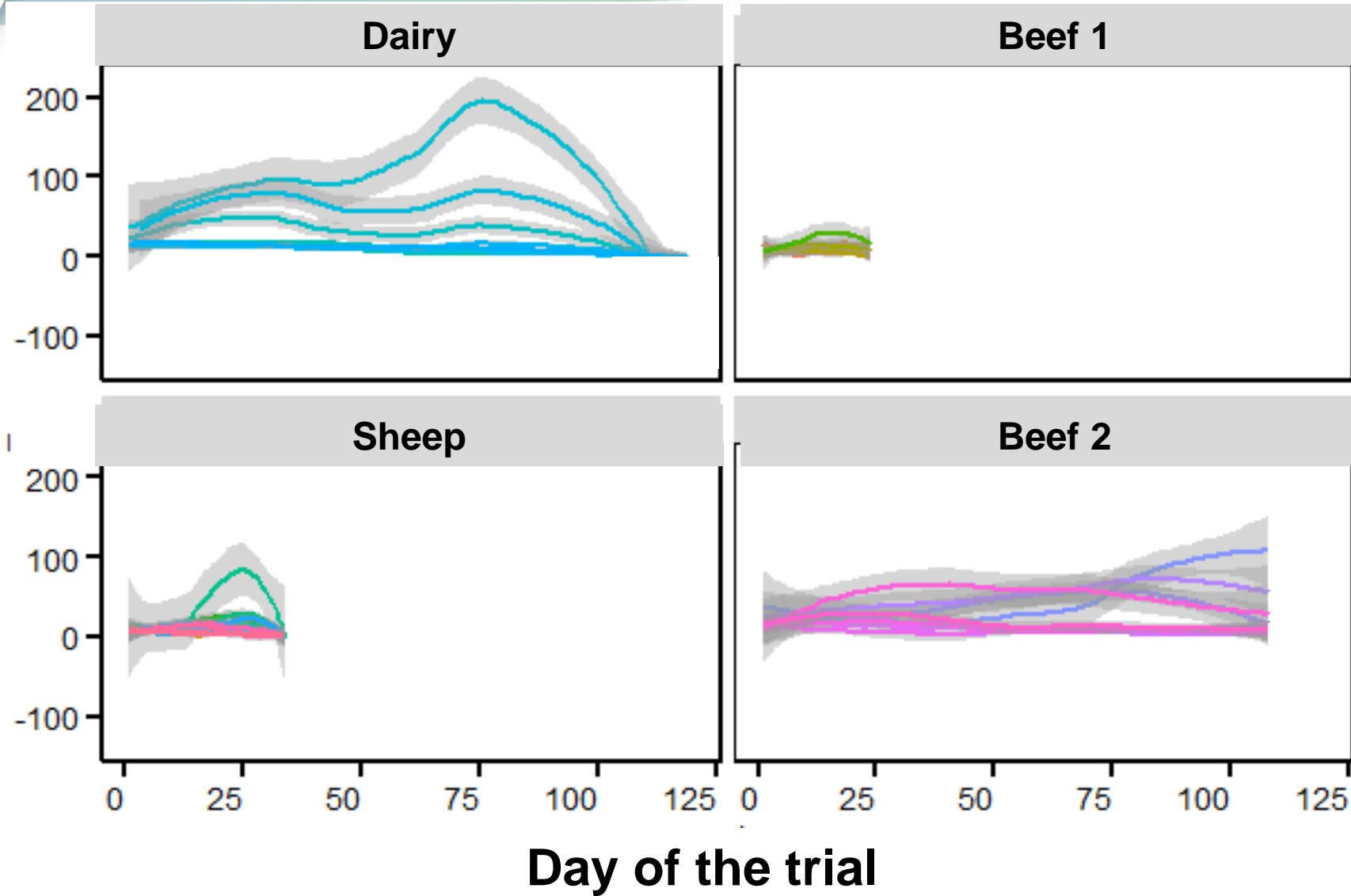


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RESULTS

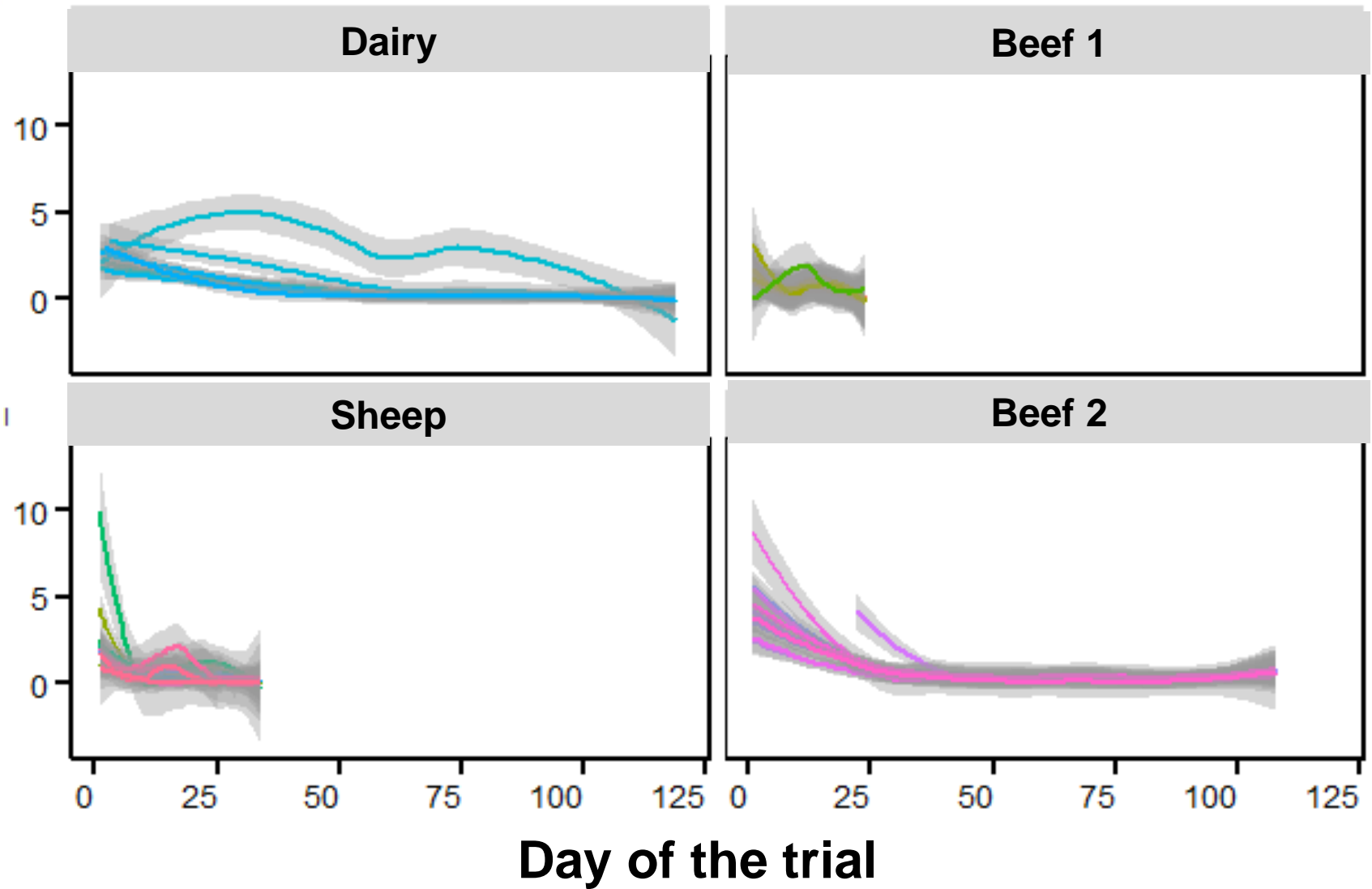
**How sustainable is this learning routinely?
Do all individuals behave the same over time?**

Number of warning sound
per animal



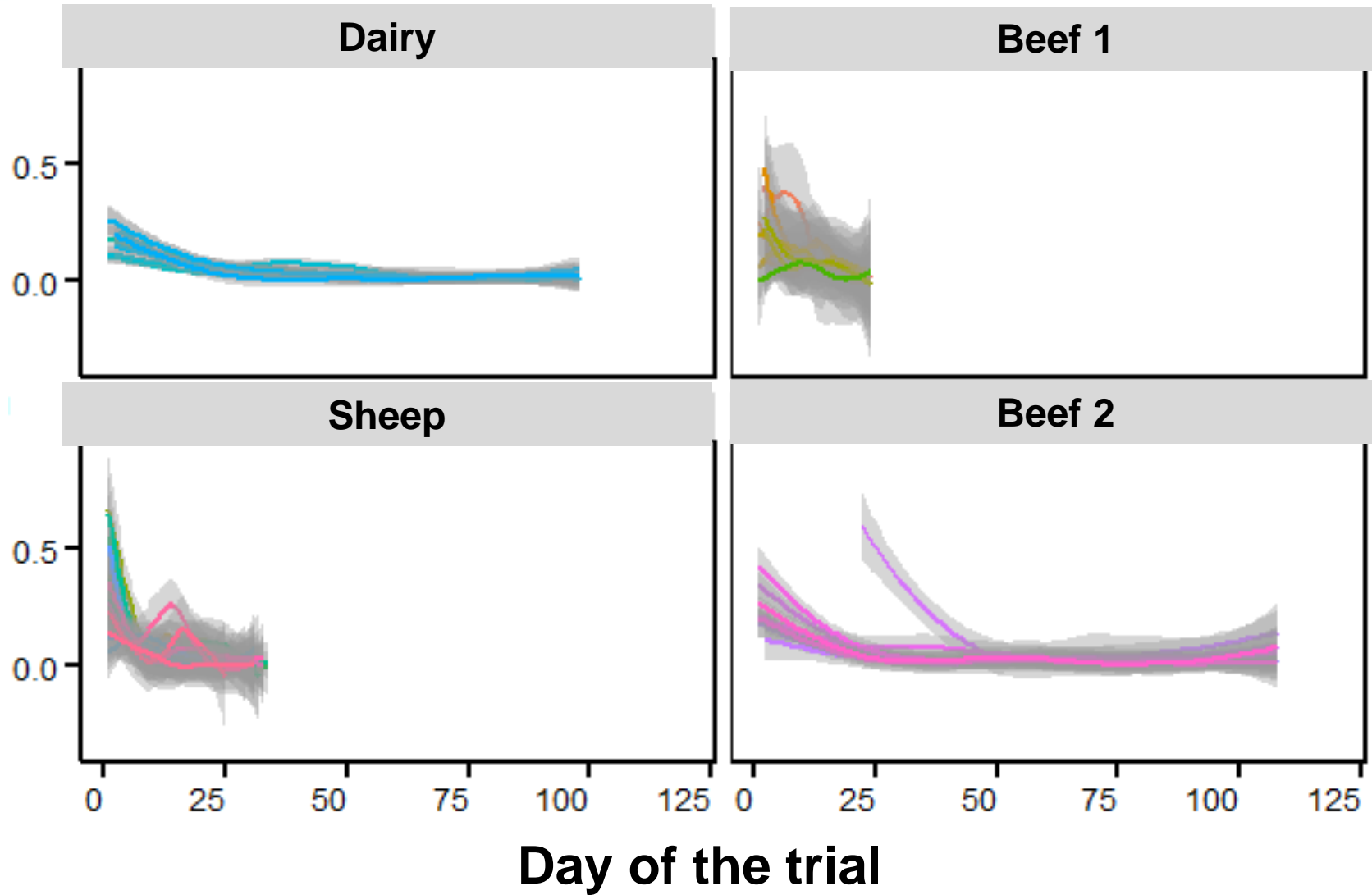
One smooth
line per animal

Number of electric pulse
per animal



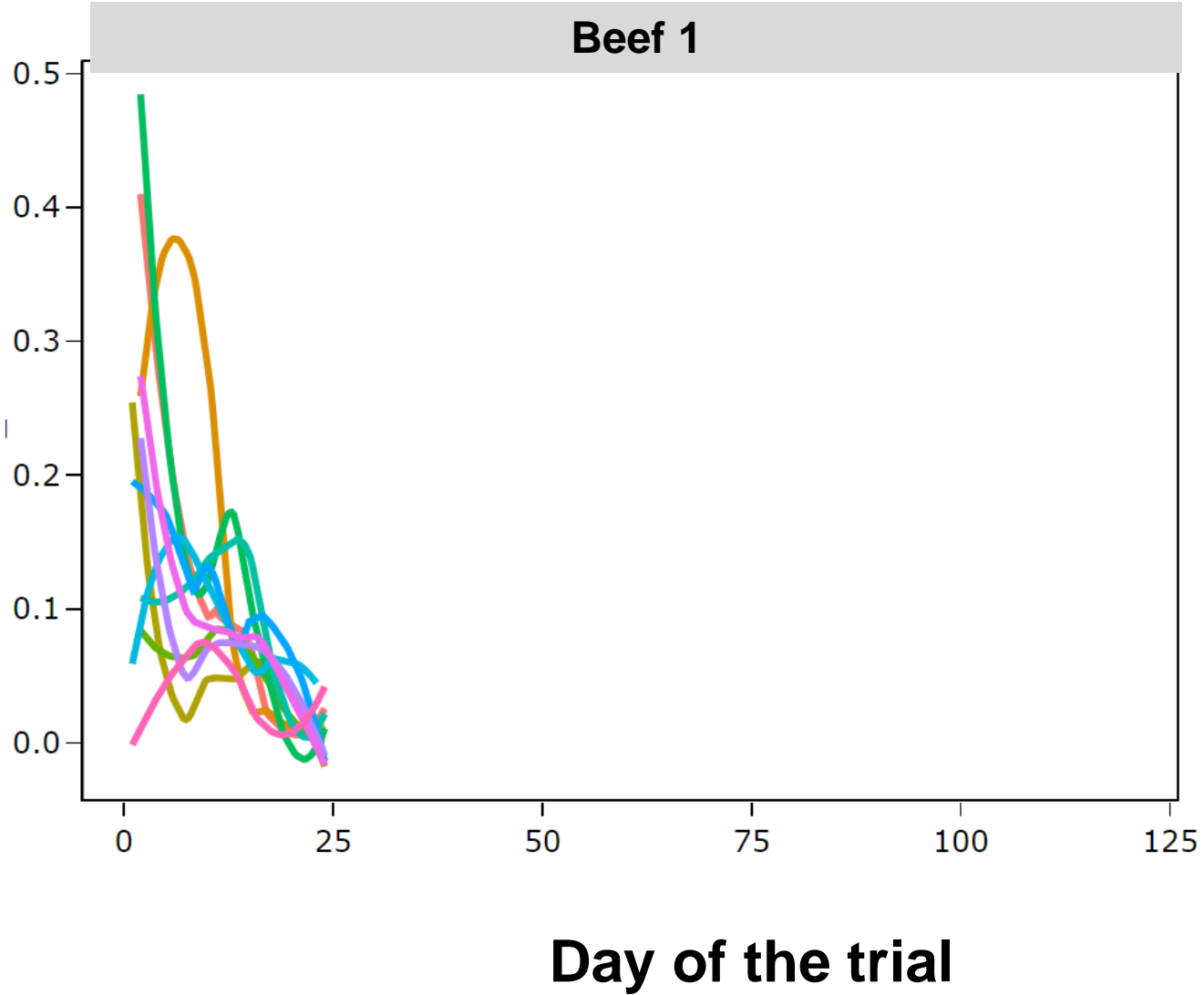
One smooth
line per animal

Ratio electric pulse /
warning sound per animal



One smooth
line per animal

Ratio electric pulse /
warning sound per animal



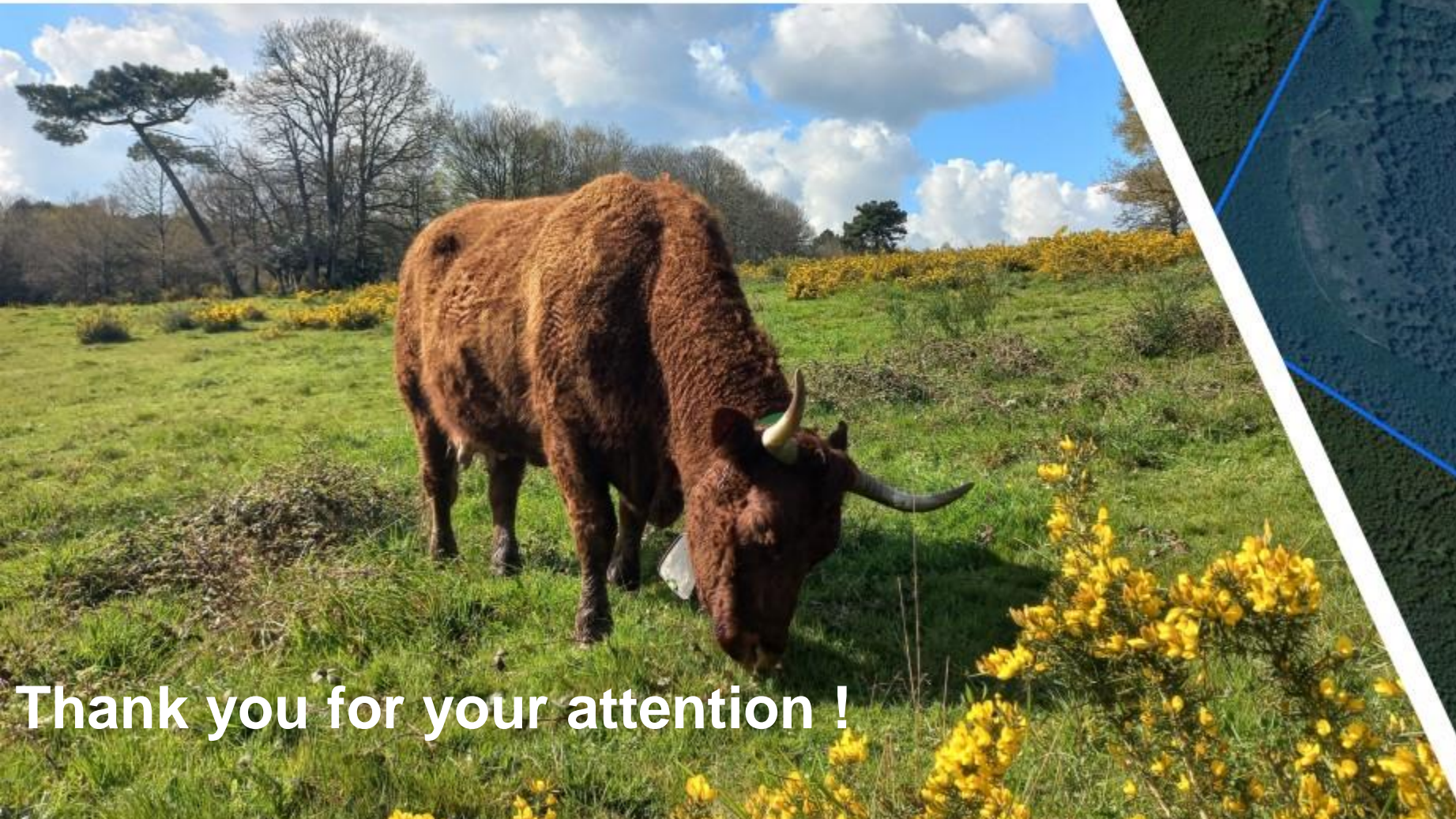
One smooth
line per animal



- Animals learn fast to graze with virtual fencing and the learning is sustainable
- Manage animals in intensive grazing systems is possible with virtual fencing
 - Only one escape on farm Beef 1 during a storm
- Intensive context = Many more interactions with the virtual fences
 - Many more warning sound than in the literature
 - Aaser *et al.* (2022) observed from 0.7 to 2.2 warning sound per day per animal and a ratio Electric pulse / Warning sound = 0.1
 - 10 more warning sound per day per animal, but a ratio electric pulse / warning sound similar in the farms Dairy, Sheep and Beef 2
 - Inter-individual variability is enhanced
- The sheep trial needs to be replicate closer to end-user conditions : more animals, bigger paddocks
 - Research collaboration ?



- Dairy and beef heifers, sheeps adapt well to rotational grazing managed with VF
- There are strong inter-individual variability of interacting with VF
 - Research should focus on the personality and role of the animal on a long-term use of VF and not only on the learning stages
 - Is there a welfare level different regarding the personality or the role of the animal ?
- Economic models seems difficult to find in intensive context
 - Evaluation of the technology should investigate the impact on work (skills needed, work organization ...) and the technical and economic impact of using VF on the whole farming system
 - **More results to come**



Thank you for your attention !

Contact : amelie.fischer@idele.fr ; adrien.lebreton@idele.fr

References :

Aaser MF, Staahltoft SK, Korsgaard AH, Trige-Esbensen A, Alstrup AKO, Sonne C, Pertoldi C, Bruhn D, Frikke J, Linder AC. Is Virtual Fencing an Effective Way of Enclosing Cattle? Personality, Herd Behaviour and Welfare. *Animals*. 2022; 12(7):842. <https://doi.org/10.3390/ani12070842>