



Introduction

- **Virtual fencing (VF):** wearable animal collars that control their dispersal using cues (auditory → electrical cues when animals approach and cross the VF boundary).
- **Knowledge gap:** acute stress responses immediately around VF cue events are poorly documented in small ruminants.

Objective:

Investigate (i) **acute stress** responses using bolus movement data
(ii) ewes' immediate **behavioural reactions** using video surveillance monitoring the VF polygon boundary.

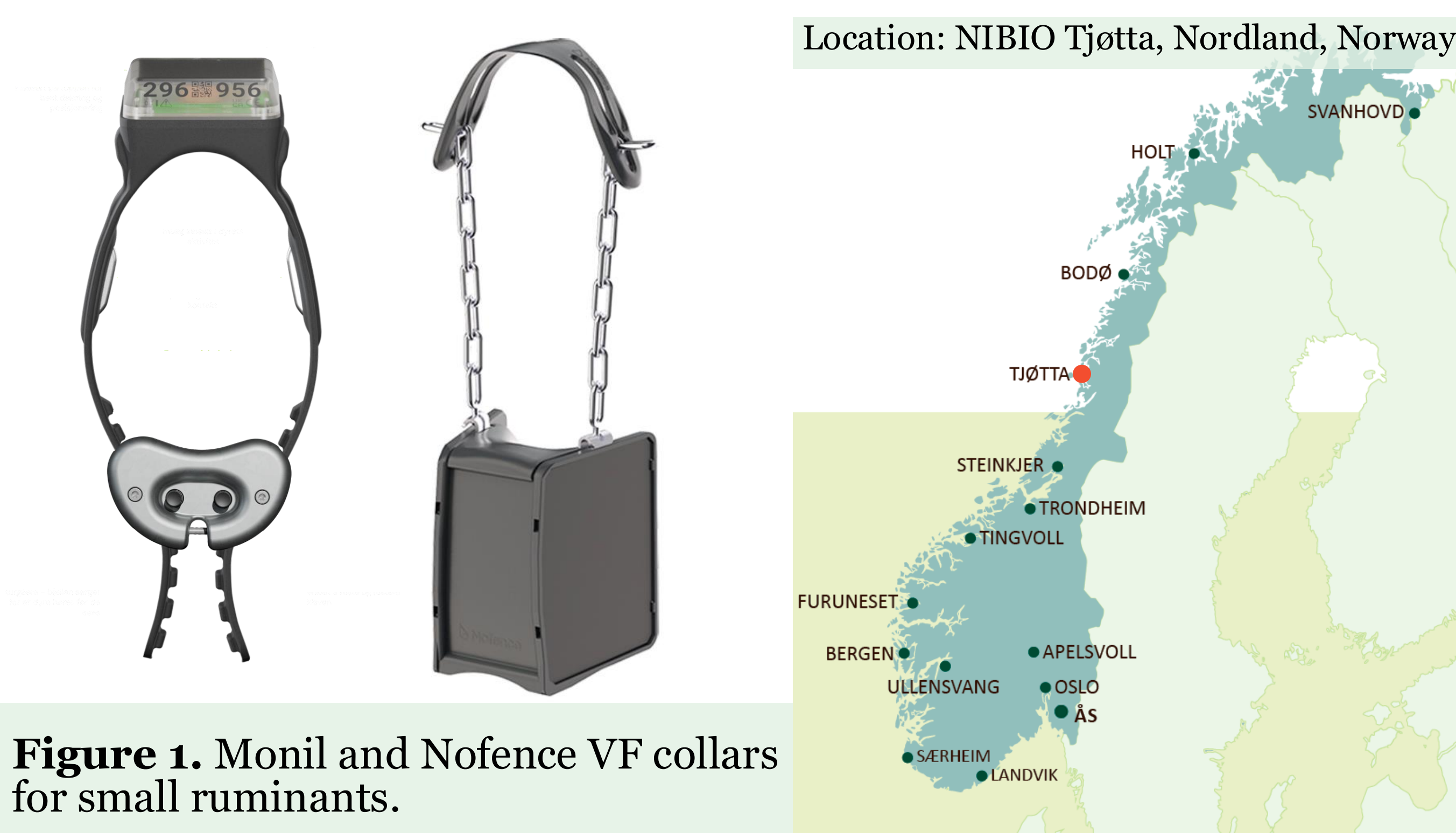


Figure 1. Monil and Nofence VF collars for small ruminants.

Methodology

Animals:

20 mature Norwegian White Sheep (ewes), VF-naïve equipped with either: Monil (n=10) or Nofence (n=10) VF collars

Virtual Fence Collars:

Monil VF (0.71 kg) with auditory & electrical cues (0.25 J/ 0.10 sec).

Nofence VF (0.51 kg) with auditory & electrical cues (0.10 J/ 0.25 sec).

Bolus Sensors:

Elotec Bolus Sensors (24 x 72 mm, 76 g) with activity sensors.

Video Surveillance:

Two camera pairs observing the VF boundary in each arena.

Sites and Period:

Mirror arena 30 x 60 m² each with physical fence

Experiment period 26 May to 13 June 2025

Linear mixed models with repeated measures were used to test differences in movement counts surrounding the cue event and changes in behavioural responses over weekly periods.

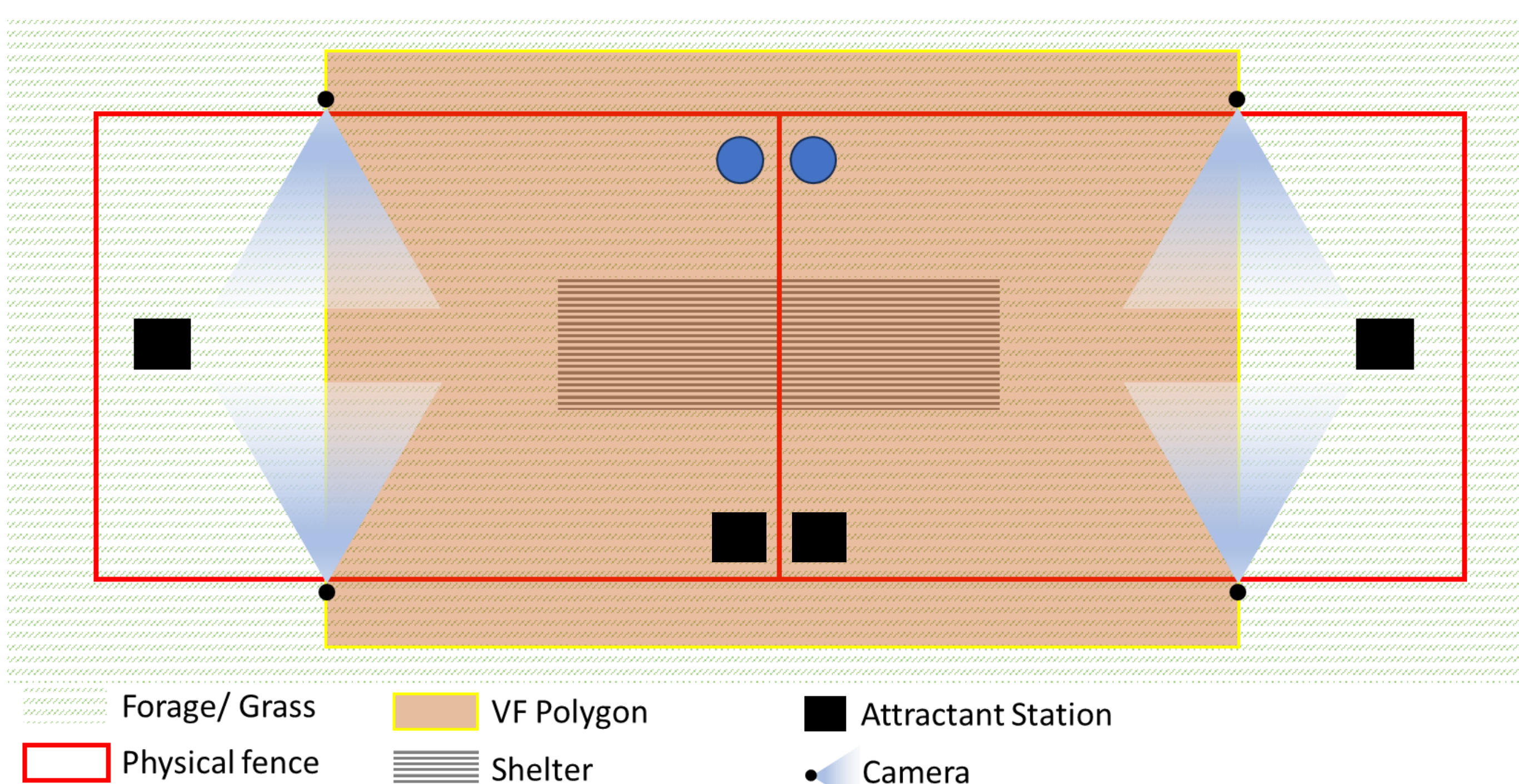


Figure 2. Mirrored 30 × 60 m arenas, each containing a separate group of ewes (n = 2x10) fitted with either Monil or Nofence VF collars. The figure illustrates the VF in activated mode, where animals are restricted to three-quarters of the arena area.

Results

- Over **2 weeks**, **1,032 cues** received (904 auditory, 128 electrical).
- **Acute Stress:**
Movement counts **increased during cue events** and then **returned to baseline**, indicating that physiological responses were short-lived.
Pre12min and Post12min movement counts were similar, further supporting recovery after exposure.
- **Behavioural Reaction:**
Fear responses decreased from week 1 to week 2.
No-response or Mild reactions decreased.
Fear reactions decreased.
Desired responses, such as calm turning away, **increased** from 54.4% to 73.3% from week 1 to week 2.

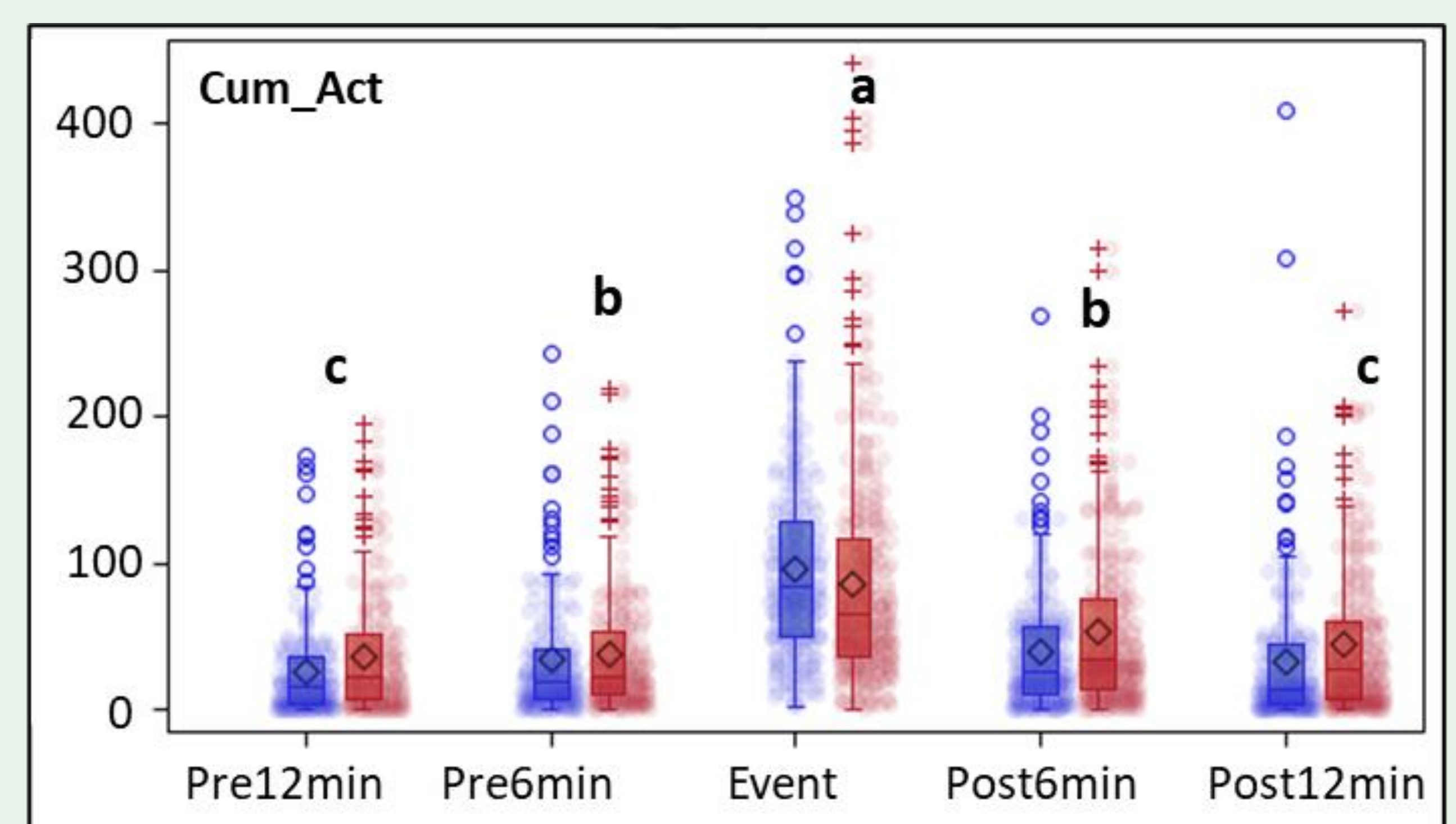


Figure 3. Bolus movement count data (Blue and Red indicate VF Collars) during VF cueing across time windows representing 12 and 6 minutes before (Pre12min, Pre6min) and after (Post12min, Post6min) the event. Letters denote pairwise comparison between the time windows.

Table 1. Scoring behavioral reactions as a percentage occurrence using video surveillance monitoring the VF polygon boundary over a two-week period.

Behaviour %	Week		P-value
	First	Second	
No reaction (unwanted)	10.45	4.07	0.01
Perks up ears/stops	8.95	2.47	<0.01
Turns around calmly (desired)	54.44	73.34	<0.01
Trots back (approved)	9.45	7.64	
Fear reaction (unwanted)	10.17	4.41	<0.01
Extreme reaction (unwanted)	0	0	

Conclusion

- Overall, the results suggest that **acute stress responses to VF cues are brief**, and that ewes **adapt quickly** and respond more predictably over time.
- These findings support the view that Nofence and Monil VF systems are associated with short-lived acute stress and improved controllability as animals learn the system.

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