

Movement of Bighorn Rams: Implications for Disease Risk

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BACKGROUND

- Bighorn sheep (*Ovis canadensis*) once numbered 500,000 to 2,000,000 in North America, declining to ~25,000 by 1950.
- Bighorns now number ~85,000, but recovery has been impeded by diseases transmitted from domestic sheep & goats (*Caprinae*).
- The highly contagious bacterium *Mycoplasma ovipneumoniae* (*M.ovi*) facilitates polymicrobial respiratory infections with high initial mortality (30-90%) and long-term suppression of lamb recruitment.
- Bighorn rams undertake rapid summer movements (forays) that can increase risk of contact with domestic *Caprinae*.
- Understanding where and when bighorn ram forays occur will help us reduce the risk of contact with domestics.

(Beuchner 1960, Besser et al. 2014; Cassirer et al. 2018)



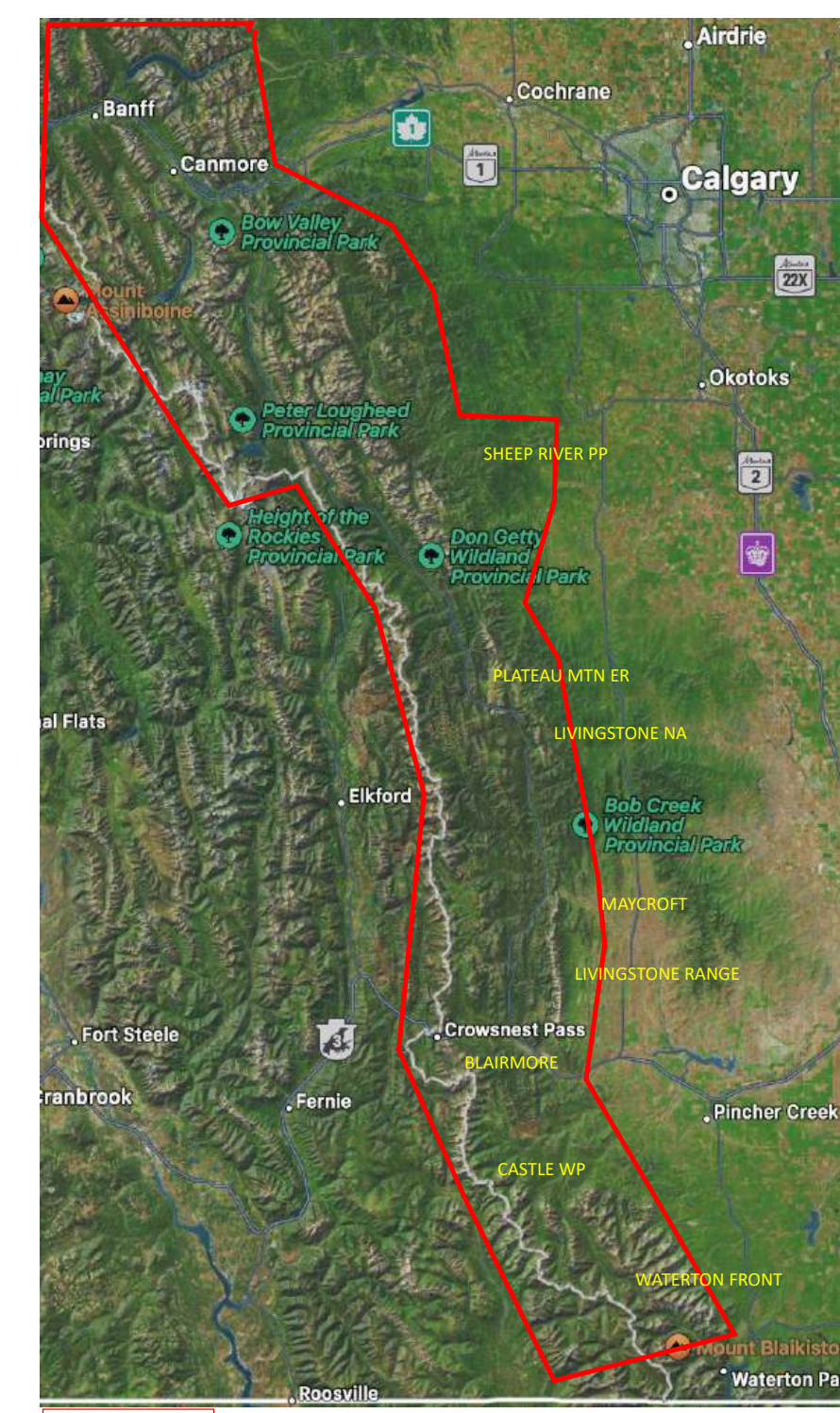
METHODS

Collared Rams

- Net-gun captures (n=61), chemical immobilization (n=9)
- 64 GPS collars deployed on rams aged 2-10 years (Avg 5)
- >28,500 animal days, 10 locations / day, 2hr fix rate (04:00-22:00)
- 10 herds (based on winter range)
- Deployment period = ~29 months (2022-2025)

METHODS

Study Area covers all areas west of Highway 22, south of Ghost River to the US border, including Banff & Waterton National Parks.



Research Objectives

- Define 'foray' in the context of individual bighorn movements (time/rate/distance).
- Parameterize movement characteristics and behaviours that may increase risk of contact and disease transmission.
- Develop analytical approach to identify, quantify, and model habitat selection during forays and migration.
- Understand the role of demographics, social structure, and landscape on foray behaviour.

RESULTS (Migration and Movement)

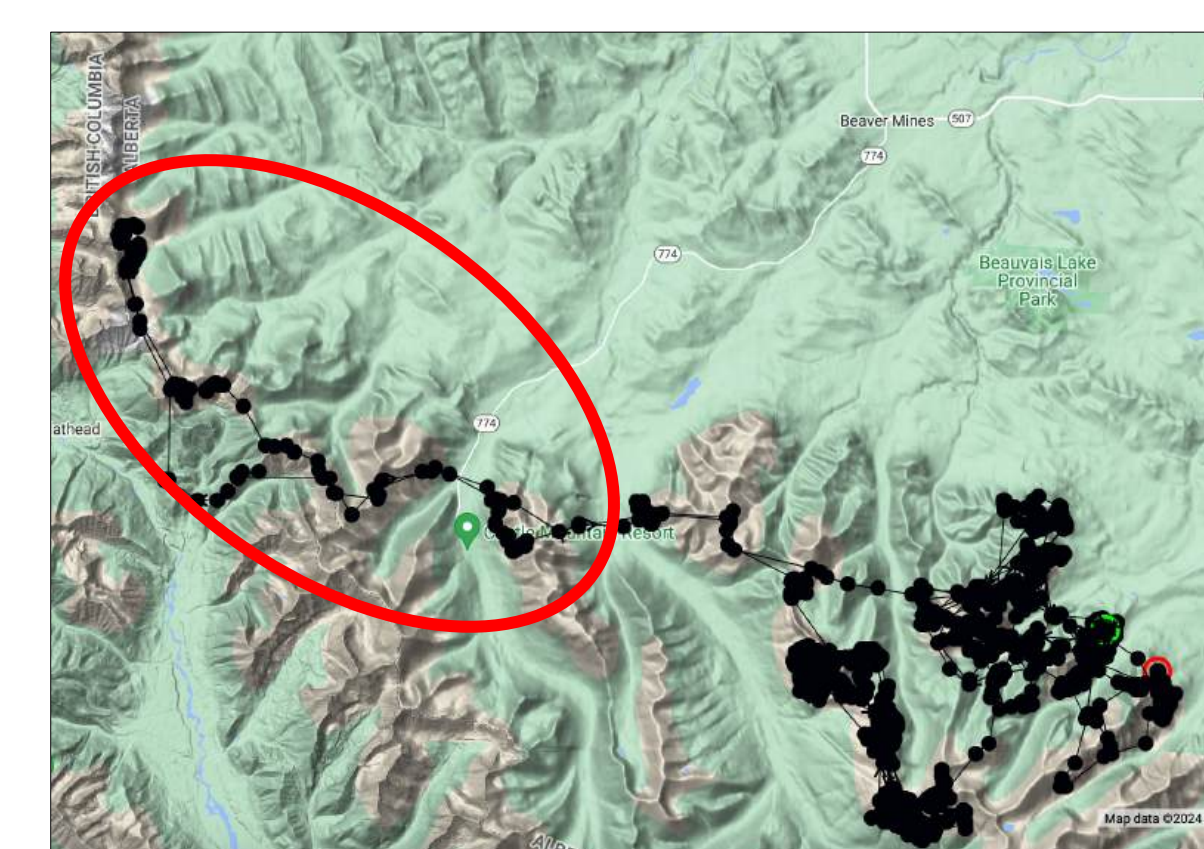
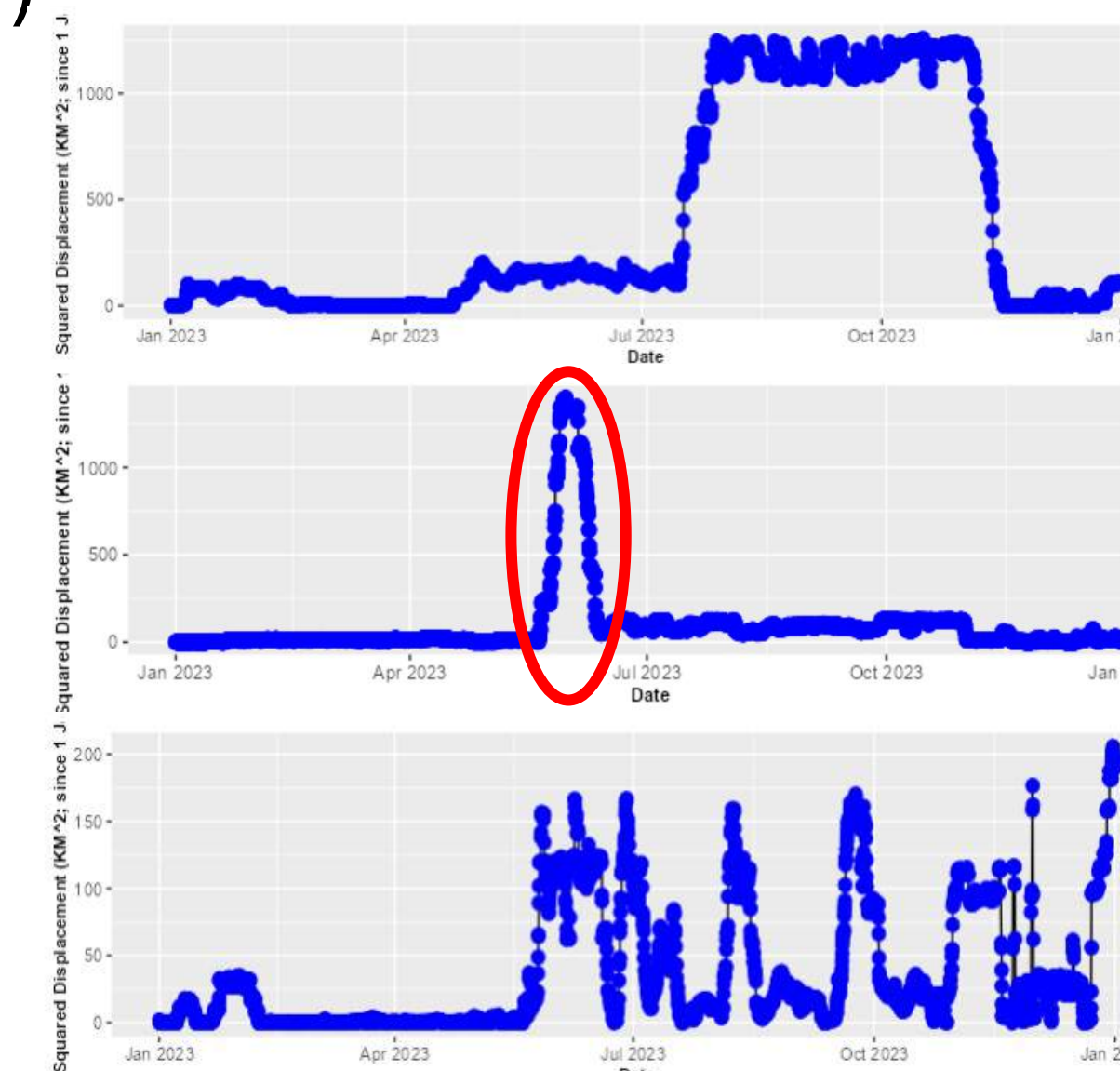
Migration Behaviour (animal years = 89)

- Migrator (n=27) : Resident (n=32) : Vacillator (n=30)
- Migration Behaviour ~ Population

Movement Rates

- Annual avg = 3.55 km/day
- Summer avg = 749.6 km (>1000km)
 - 3.50 km/day (2.03-4.65)
- Winter avg = 452.1km
 - 3.14 km/day (1.07-5.66)

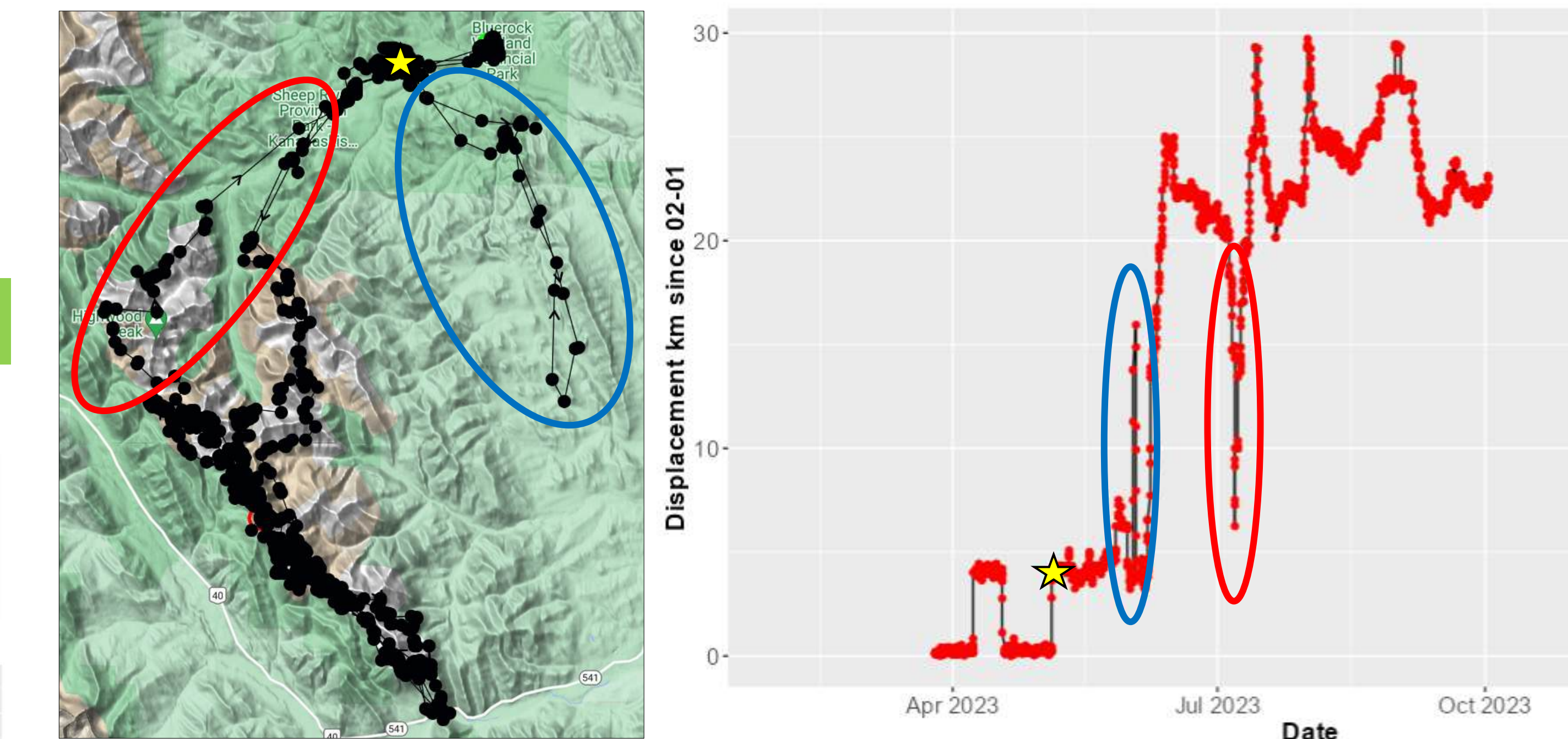
At right: Net squared displacement (NSD) plots for 3 rams showing patterns of seasonal movement; Migrator (top), Resident (with summer foray – centre) and Vacillator (bottom). Red ovals show corresponding location data for a summer foray west into BC in June 2023.



RESULTS (Forays)

Foray Behaviour

- 40 summer forays observed ('22 \bar{x} : June 6, '23 \bar{x} : May 17)
- 58 animal years with zero forays.
- 31 animal years with 1-3 summer forays.
- Foray ~ Age ($\beta = -0.95, p = <0.01$)
- As rams age they are less likely to foray in a year and less likely to undertake multiple forays in a year
- Quick out-and-back movement (many <72 hrs).
- Summer foray return distance range <5 km to >70 km.
- Many rams returned to foray destination in rut season(s).



Coloured ovals show corresponding data for two summer forays, each >36km round trip, completed in <36 hours (blue) and ~ hours near Sheep River Provincial Park.

NEXT STEPS

- Incorporate demographic information into foray analyses.
- Develop region specific habitat selection model.
- Develop method to identify and delineate forays.
- Conduct habitat selection analyses on foray, dispersal and migration routes, as well as connectivity corridors.
- Perform herd specific Risk-of-Contact analyses (O'Brien et al. 2014)

All photos: Ian F. Gazeley