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Assessing the cross-transmission of resistant nematodes between wild ibex and transhumant sheep in French Alps

Gilles Bourgoïn, Camille Beaumelle, Carole Toïgo, Rodolphe Papet, Slimania Benabed, Mathieu Beurier, Léa Bordes, Anaïs Brignone, Nadine Curt-Grand-Gaudin, Mathieu Garel, et al.

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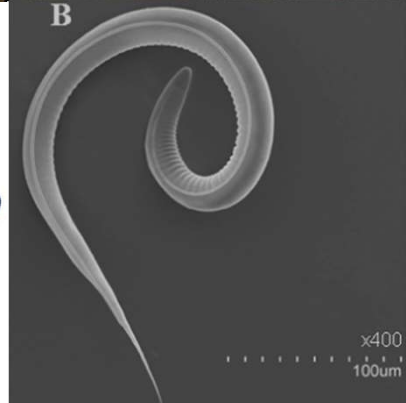
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VetAgro Sup



Assessing the cross-transmission of resistant nematodes between wild ibex and transhumant sheep in French Alps



G Bourgoin, C Beaumelle, C Toïgo, R Papet, S Benabed, M Beurier, L Bordes, A Brignone, N Curt-Grand-Gaudin, M Garel, J Ginot, P Jacquiet, C Miquel, M-T Poirel, A Serafino, E Vannard, G Yannic

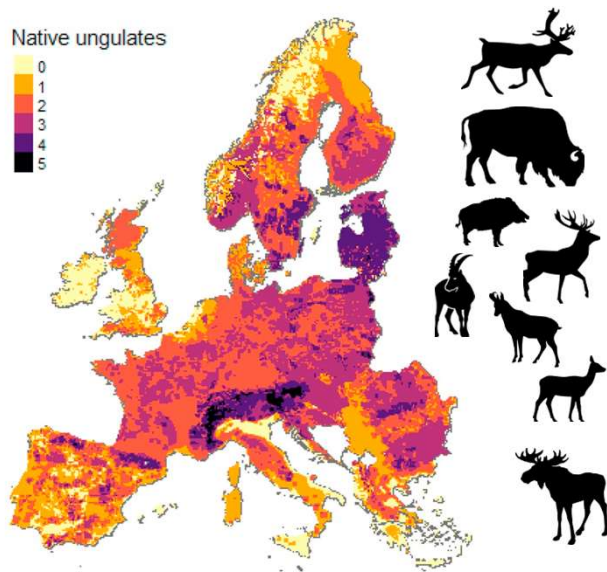
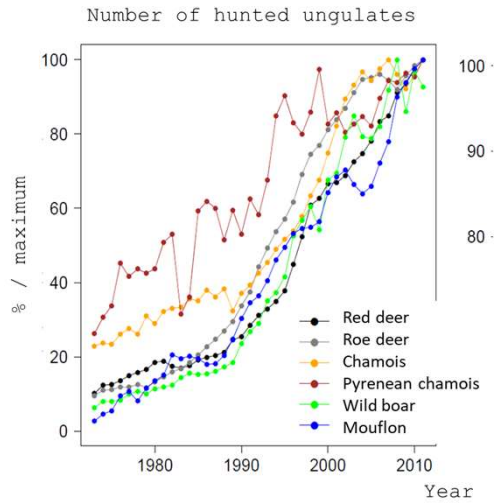
EVPC Paris 2023 congress (European Vet Parasitology Conference), 29-30 juin



Context

→ ↗ densities

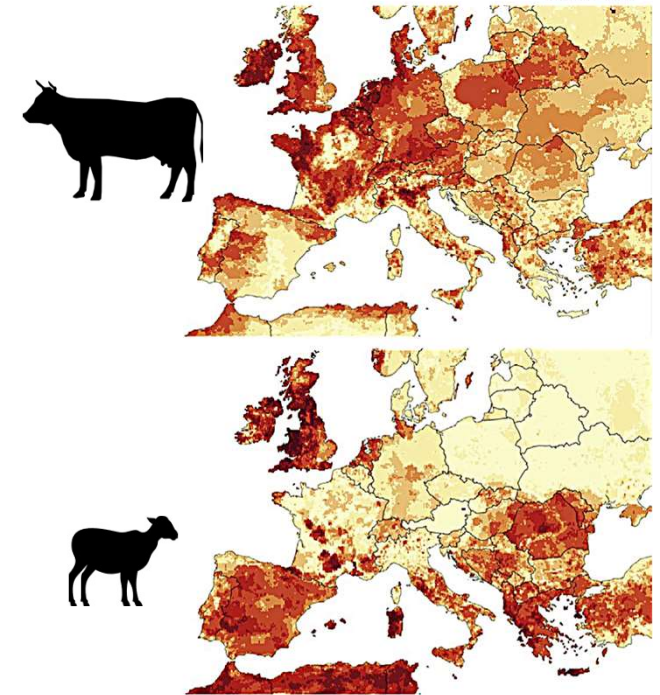
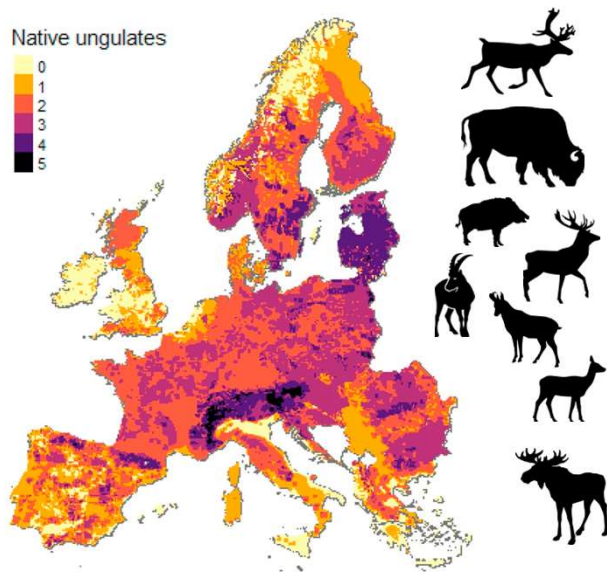
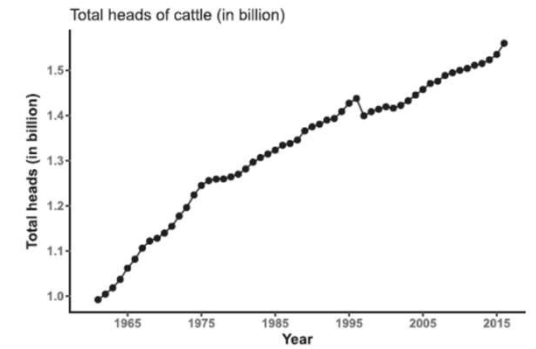
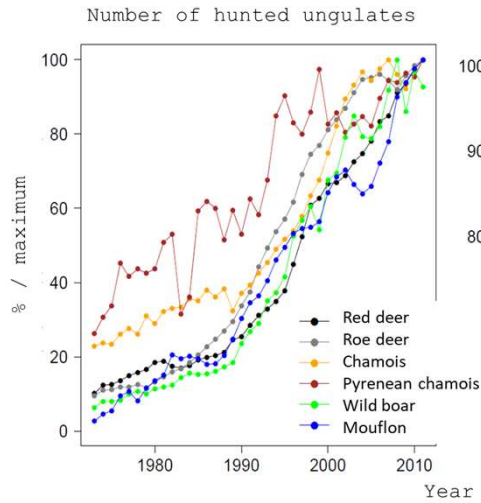
→ ↗ area covered



Linnell et al. 2020; Nicolas et al. 2018; Réseau Ongulés sauvages ONCFS/FNC/FDC - Graphs: P. Marchand

Context

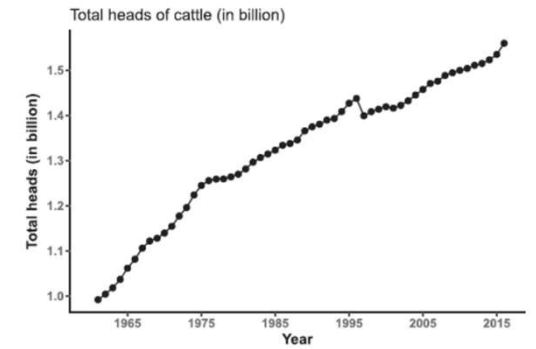
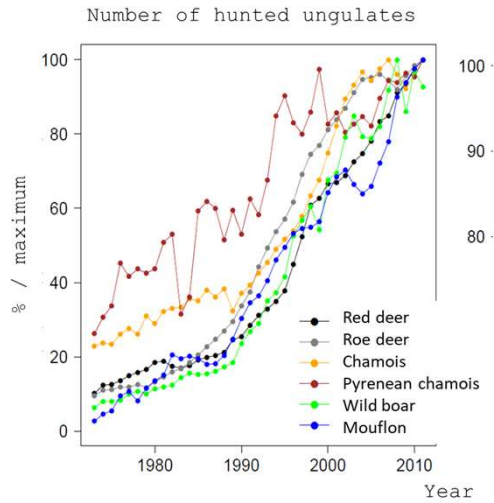
→ ↗ densities
→ ↗ area covered



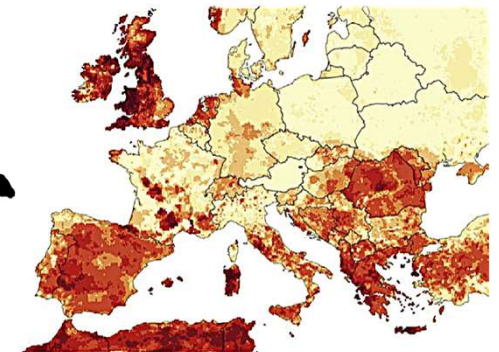
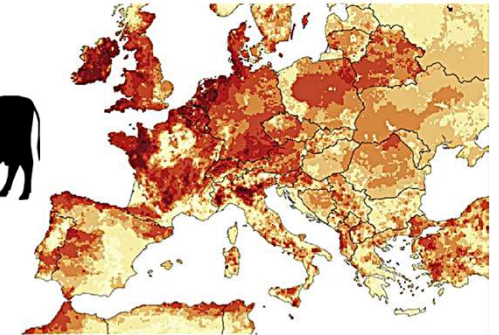
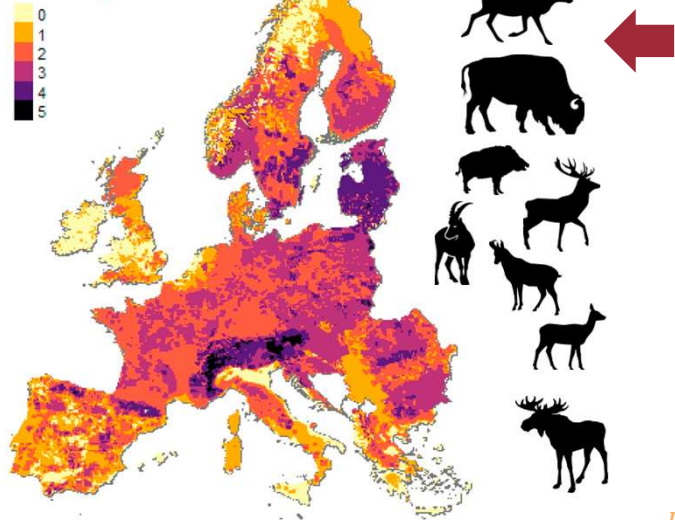
Linnell et al. 2020; Nicolas et al. 2018; Réseau Ongulés sauvages ONCFS/FNC/FDC - Graphs: P. Marchand

Context

- ↗ densities
- ↗ area covered
- ↗ species overlap

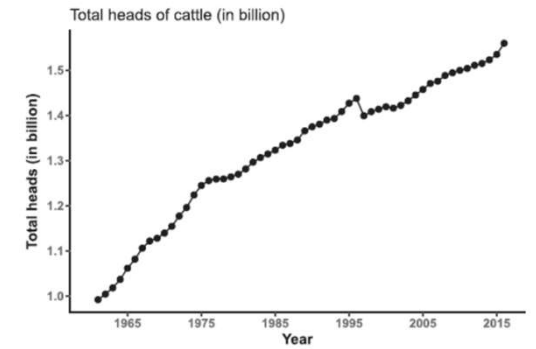
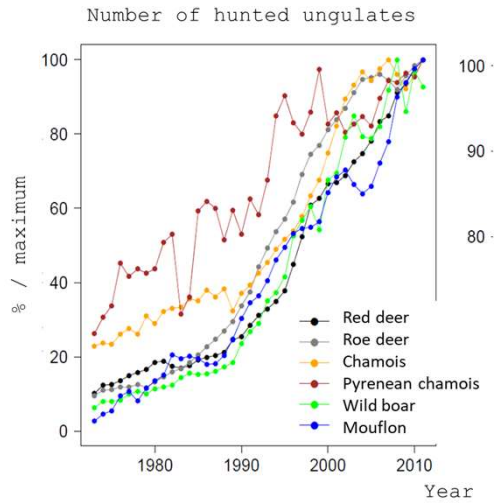


Native ungulates

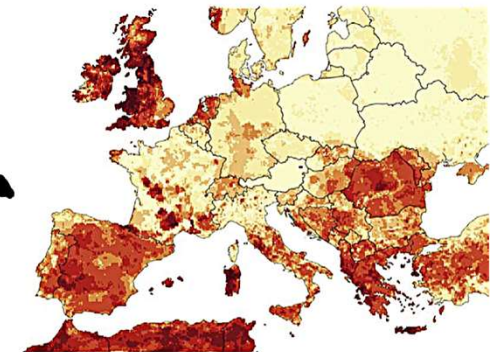
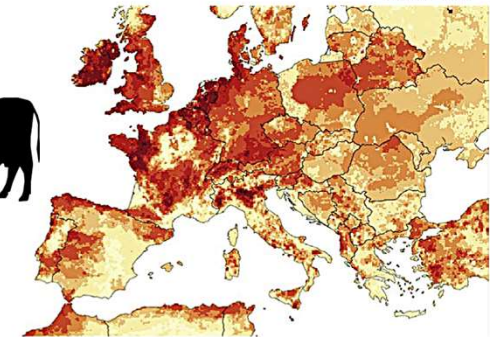
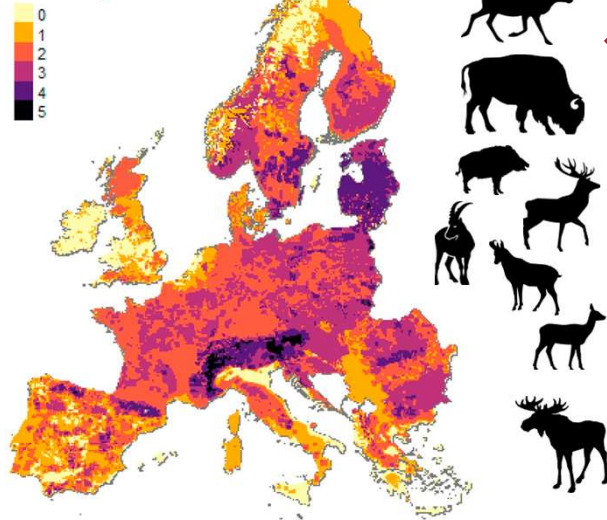


Context

- ↗ densities
- ↗ area covered
- ↗ species overlap



Native ungulates



↗ risk of pathogen transmission

Context

- Resistance to anthelmintics in wild populations in contact with livestock

Detection of GIN resistant to benzimidazoles in wild roe deer and feral goats in contact with livestock

Wild deer as potential vectors of anthelmintic-resistant abomasal nematodes between cattle and sheep farms

C. Chintoan-Uta¹

Šikuce² and G. C. Coles^{1,†}




Benzimidazole resistance within red deer, roe deer and sheep populations within a joint habitat in Hungary

Gábor Nagy^{a,*}, Ágnes Cservincsik^b, László Sugár^c, Attila Zsolnai^d



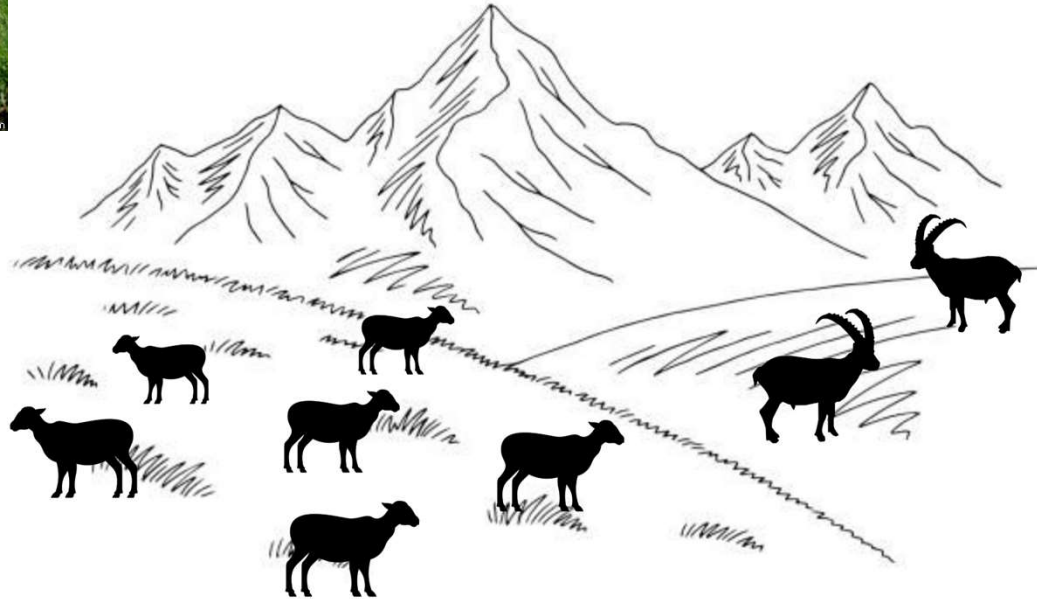
Refugia or reservoir? Feral goats and their role in the maintenance and circulation of benzimidazole-resistant gastrointestinal nematodes on shared pastures

Emily Kate Francis¹ and Jan Šlapeta^{1,2} 

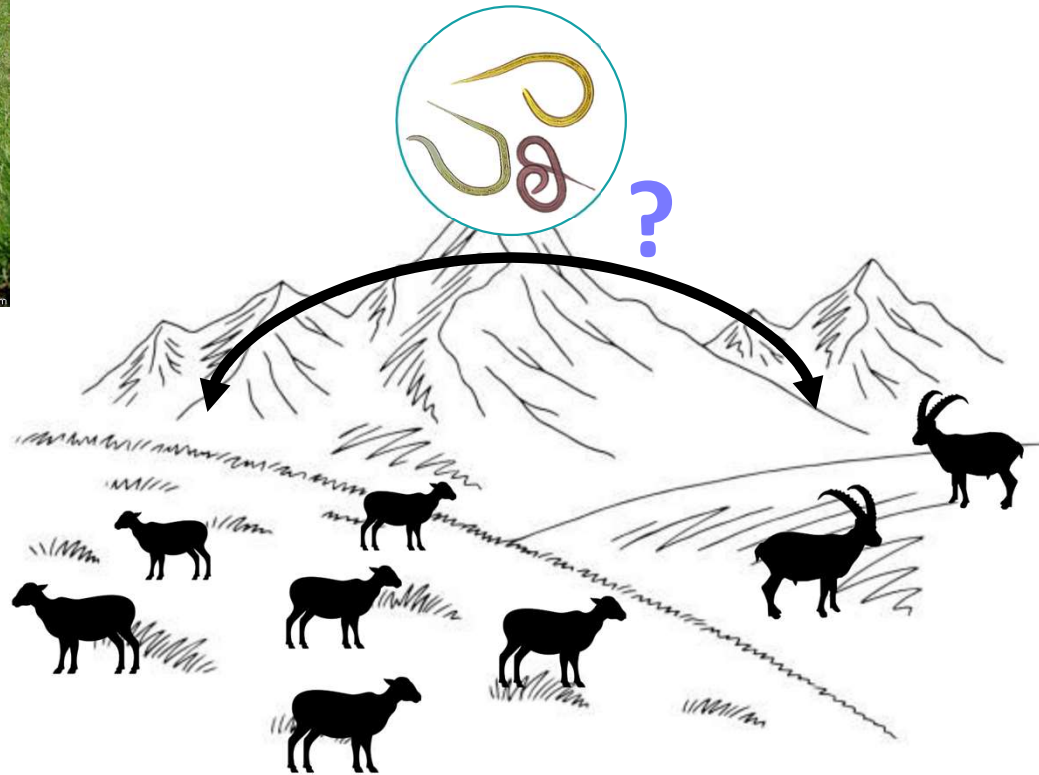


*Chintoan-Uta et al. 2014;
Cservincsik et al., 2017; Nagy et al. 2017
Francis & Šlapeta 2023*

Transhumant sheep and wild ibex

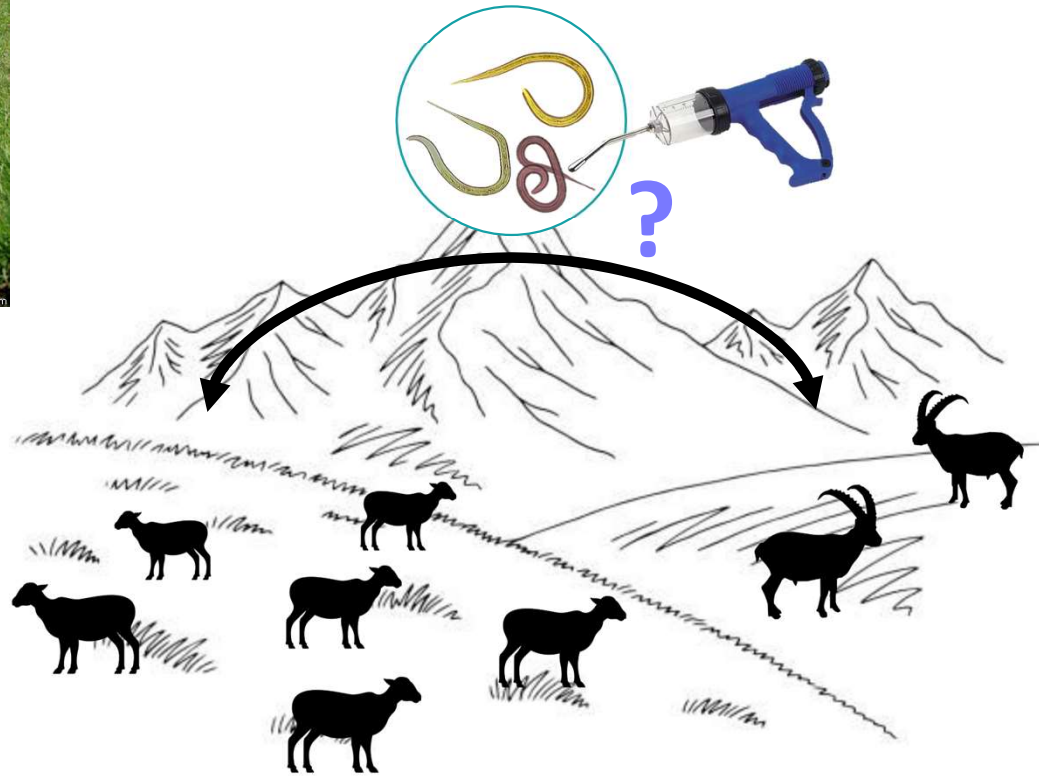


Transhumant sheep and wild ibex



Do domestic sheep and wild ibex have similar species of nematodes?

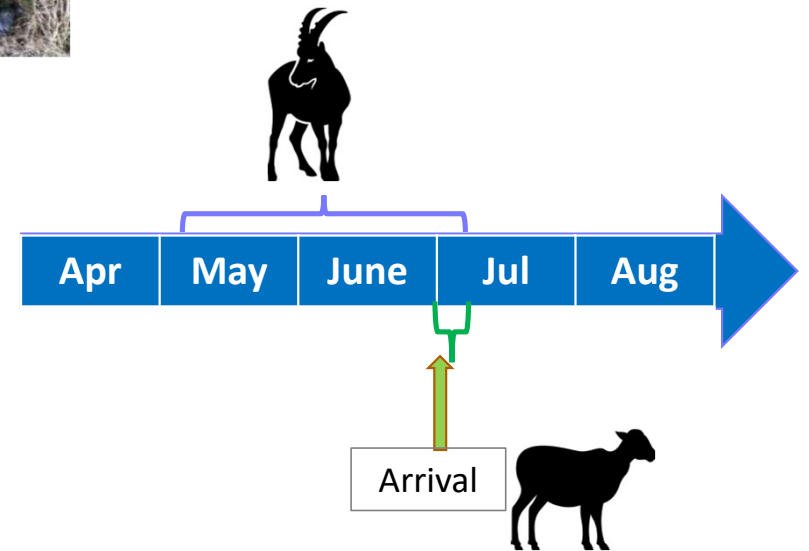
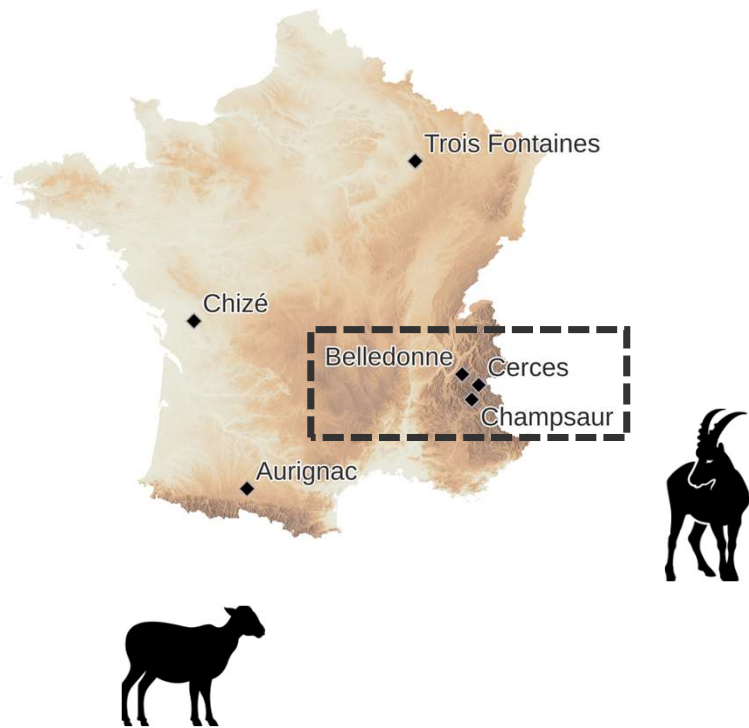
Transhumant sheep and wild ibex



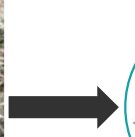
Are ibex contaminated by parasites resistant to anthelmintic?

Can ibex maintain these resistant parasites when sheep are absent from alpine pastures ?

Material & Methods



sampling up to 10 days after arrival



Coproculture



**DNA extraction
of a pool of L3
(10 – 1000 L3)**

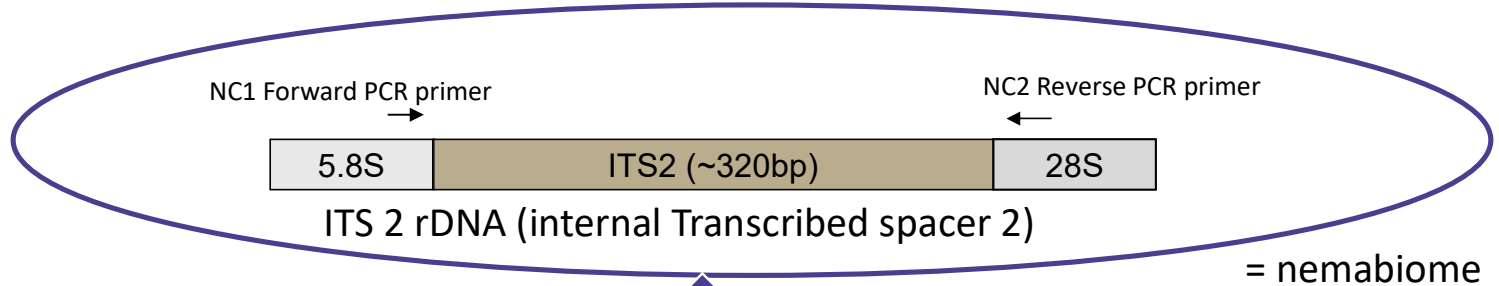


1) Species diversity

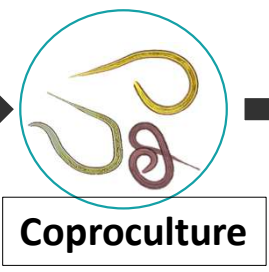
PCR



2) Resistance to BZ



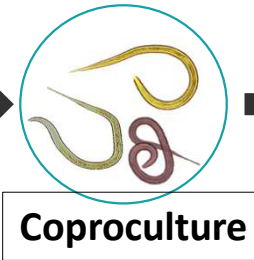
= nemabiome



- 1) Species diversity
- 2) Resistance to BZ

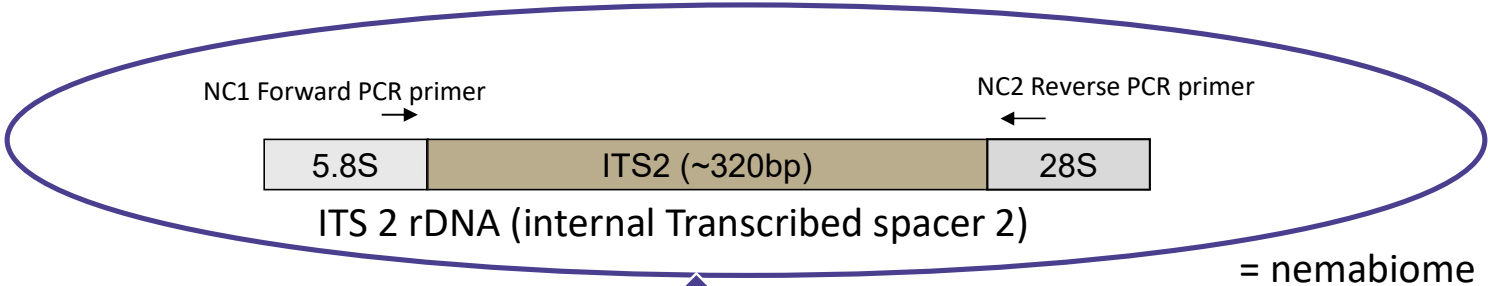
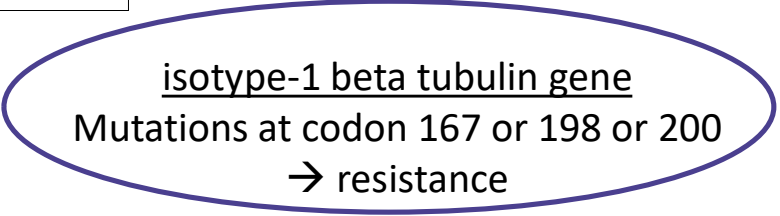
PCR

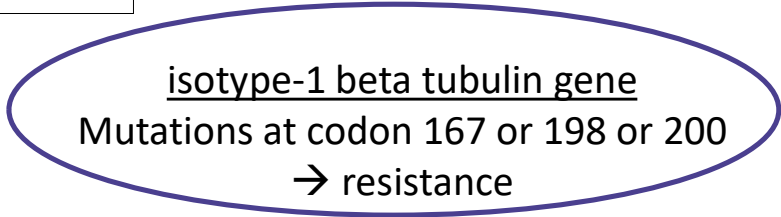
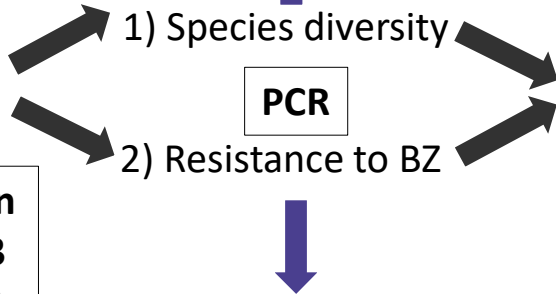
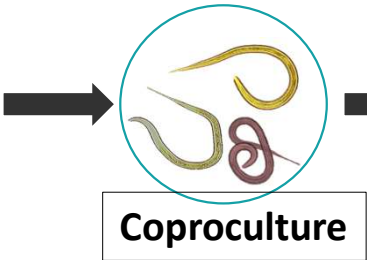
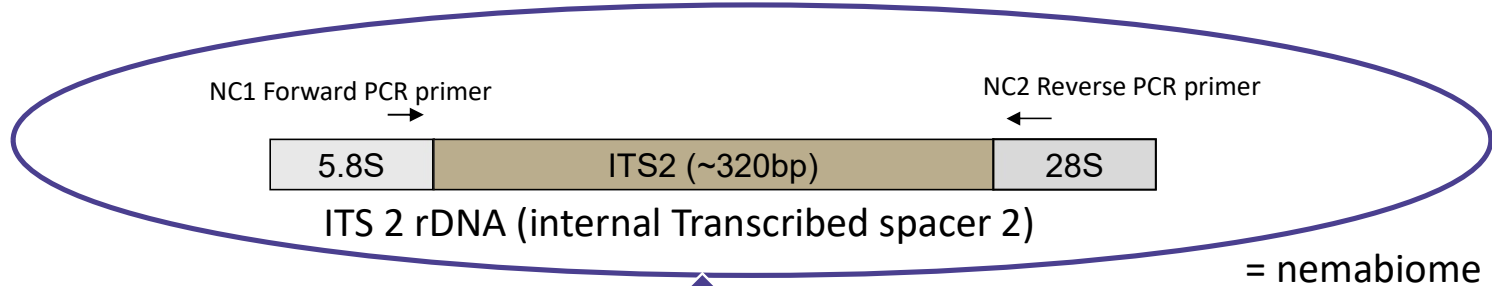




- 1) Species diversity
- 2) Resistance to BZ

PCR





```

GCTTCTGTATCGTTCTACTTCGAA
GCTTCTGTATCATTCTACTTCGAA
GCTCCTGTATAAATTCTACTTCGAA
GCTTCTGTATCCTACTACTTCGAA
GCTTCTGTATCGTTCTACTTCGAA
GCTTCTGTATCCTCCTACTTCGTC
GCTTCTGGATCGTTCTACTTCGTC
TCGTCTGTATCATTCTTTCTCGAA
TCGTCTGTATCTTTCTACTTCGAA
GCTTCTGTAGCTTTCTACGACGAA
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GCTTCTGTAGCTTTCTACTACGAA
GCTTCTGTAGCTTTCTACTACGAA

```

Results

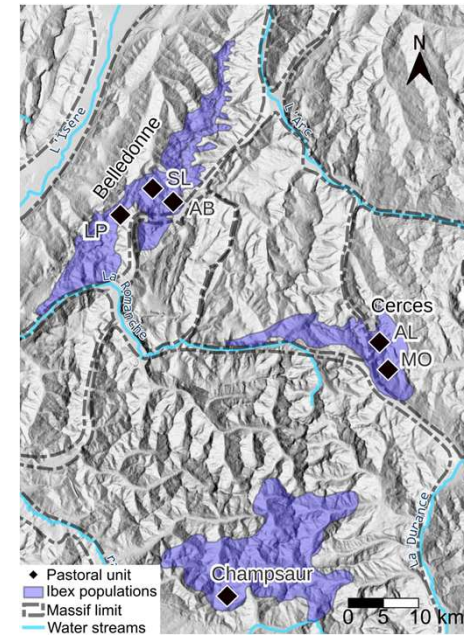
Shared species? Nemabiome ibex ≠ nemabiome sheep?



n=144

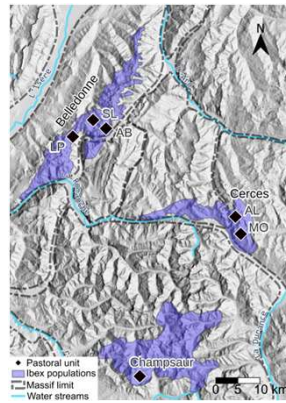
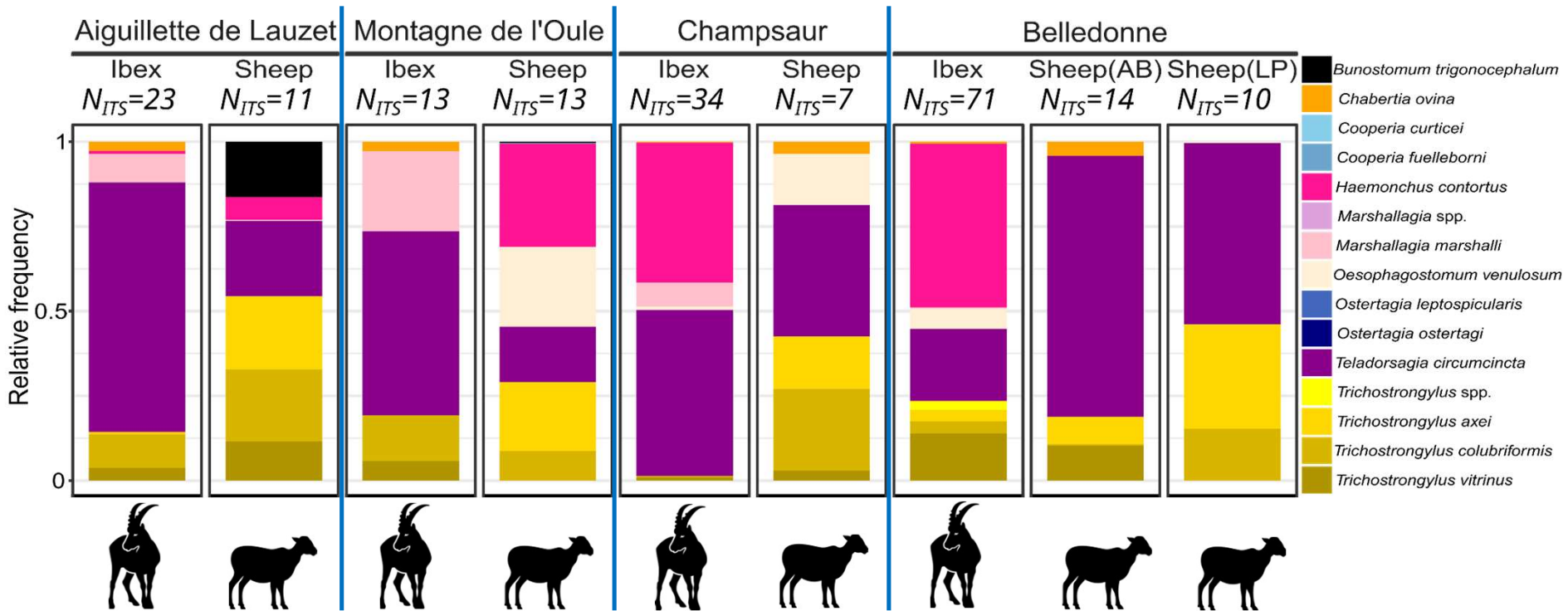


n= 55 (5)



Results

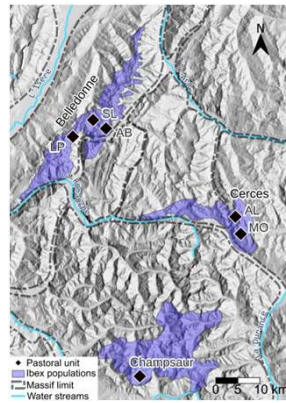
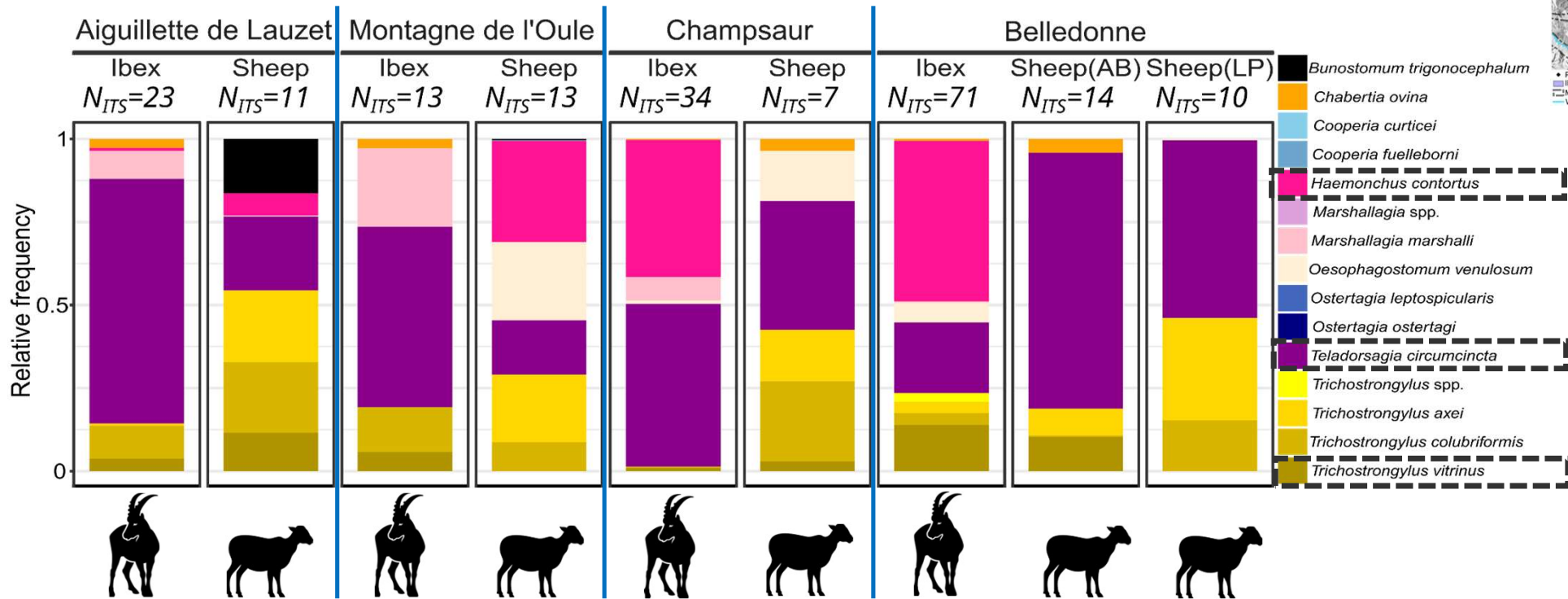
Shared species? Nemabiome ibex ≠ nemabiome sheep?



→ 13 species
→ 2 genus

Results

Shared species? Nemabiome ibex ≠ nemabiome sheep?

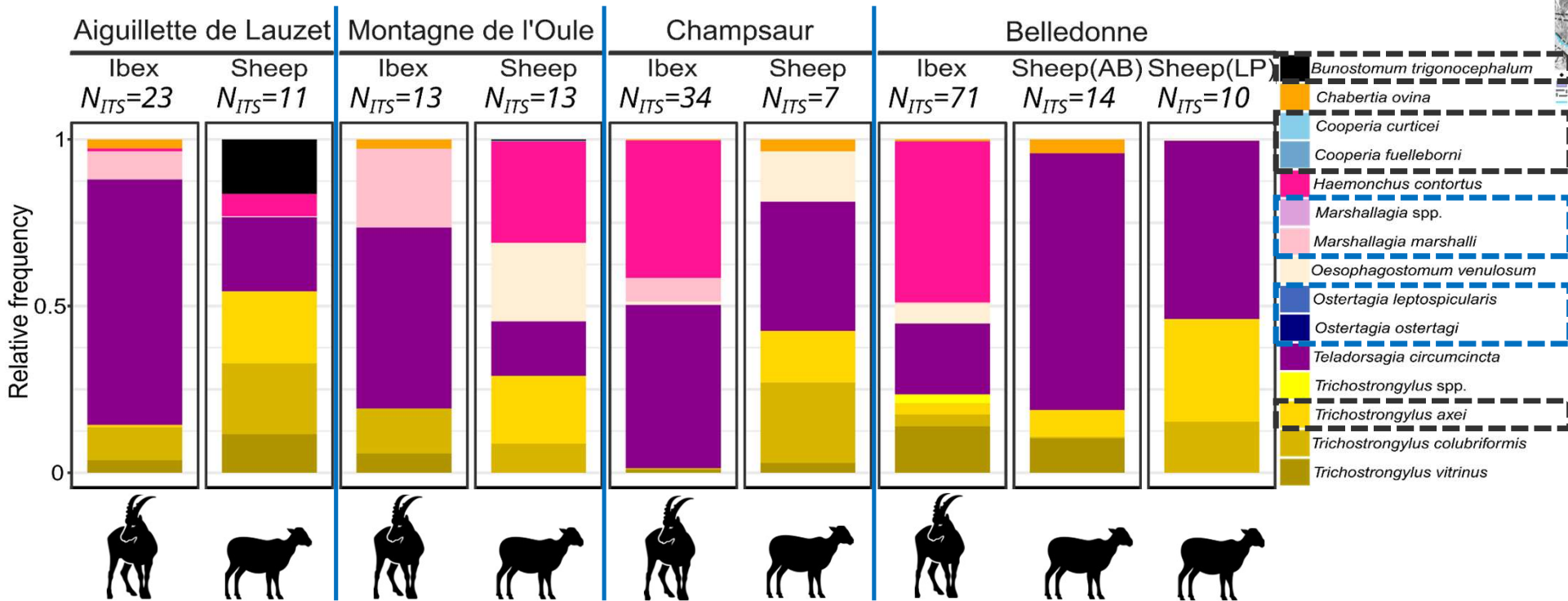


Most prevalent and in both sheep and ibex:

- *Teladorsagia circumcincta*: 85% of the samples
- *Trichostrongylus vitrinus*: 63%
- *Haemonchus contortus*: 56%

Results

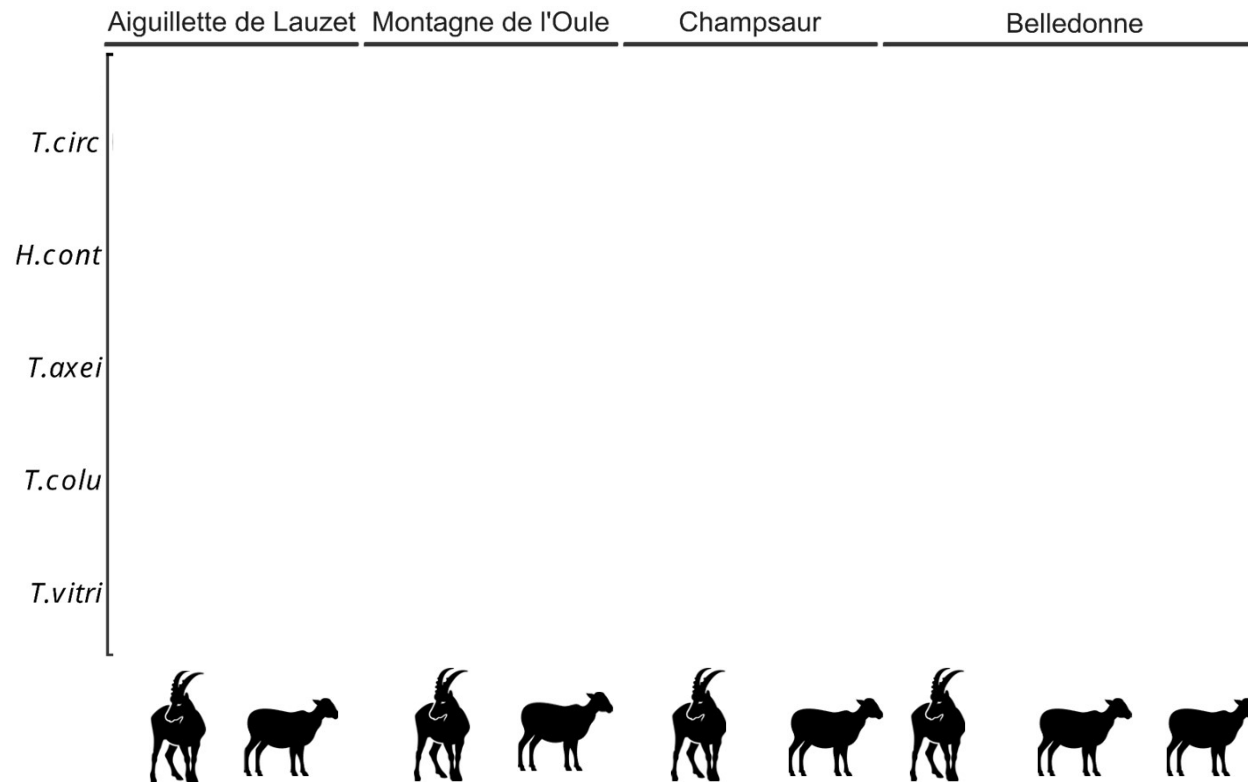
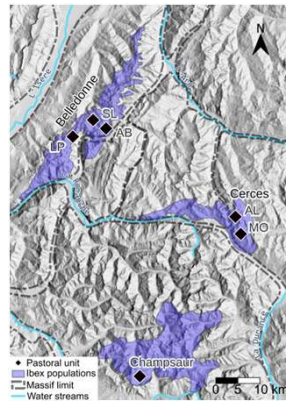
Shared species? Nemabiome ibex ≠ nemabiome sheep?



- Higher species diversity in ibex vs sheep
- Mostly or only in sheep: *Trichostrongylus axei*, *Bunostomum trigonocephalum*, *Cooperia* spp.
- Only in ibex: *Marshallagia* spp., *Ostertagia* spp.

Results

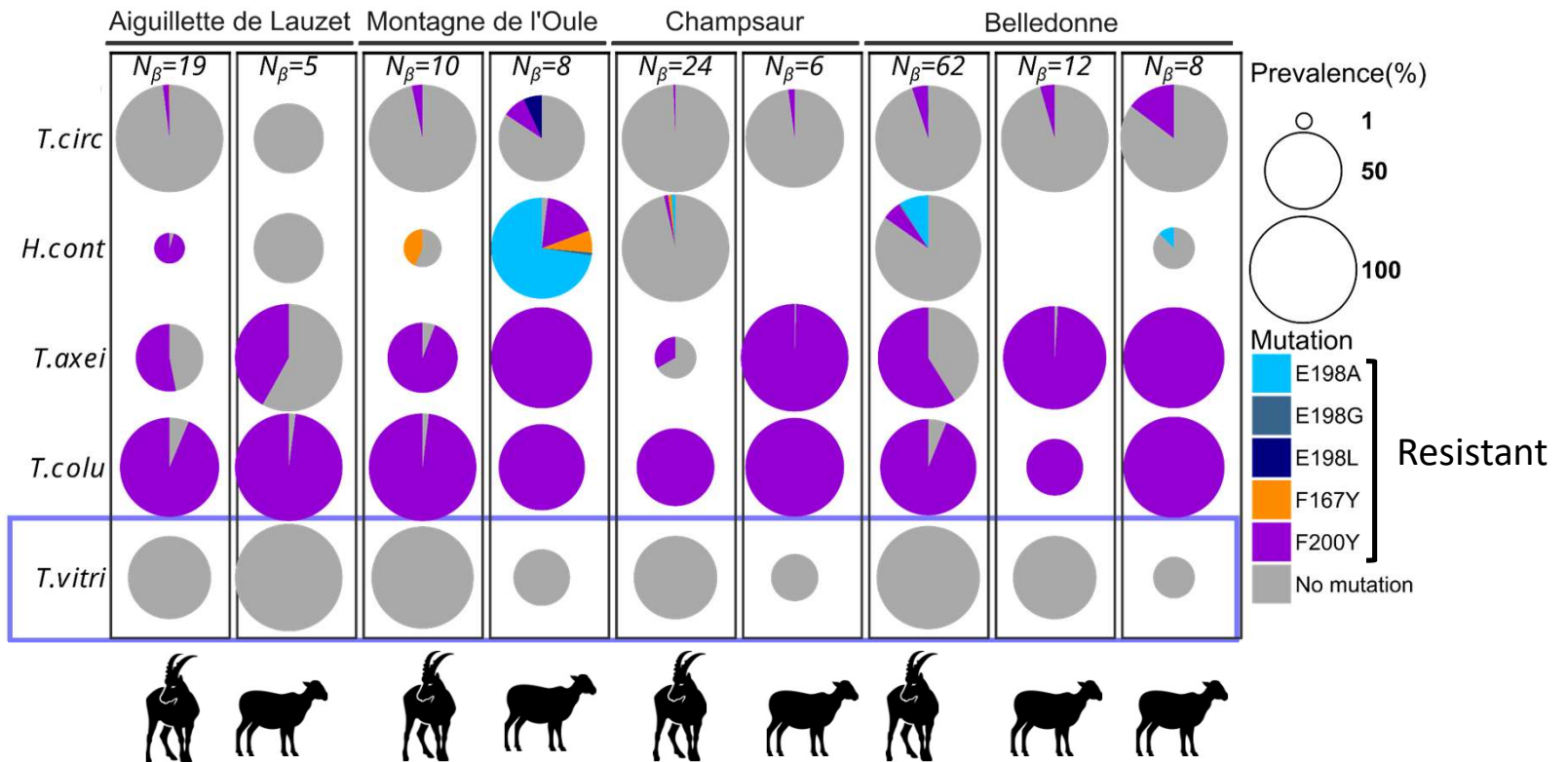
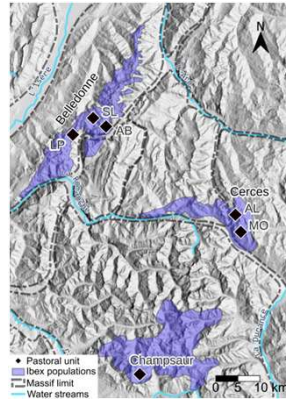
Parasites resistant to benzimidazoles in sheep and wild ibex?
(sheep > ibex)



Results

Parasites resistant to benzimidazoles in sheep and wild ibex?
(sheep > ibex)

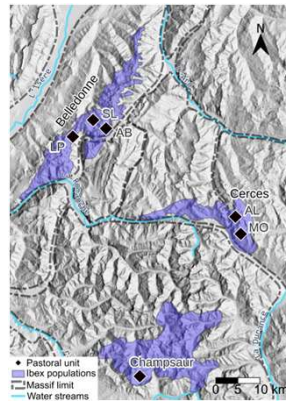
Resistance mutations were highly frequent (93.5% of the samples; n=144/154)



No resistance detected

Results

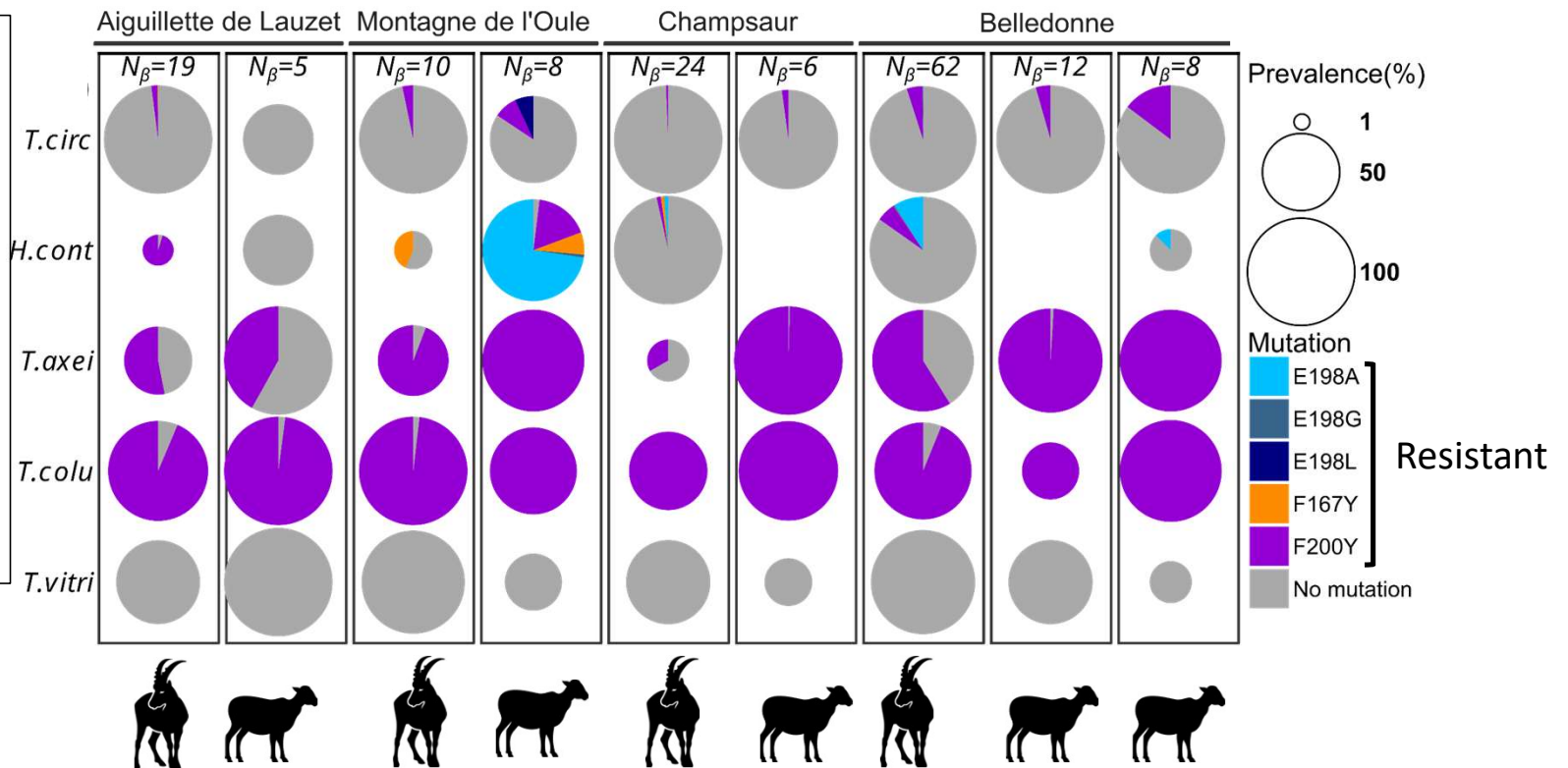
Parasites resistant to benzimidazoles in sheep and wild ibex?
(sheep > ibex)



→ *T. colubriformis* & *T. axei*:
highest proportion of resistance (96 & 70%)

→ F200Y = most frequent resistance mutation

→ Less resistance in ibex vs sheep

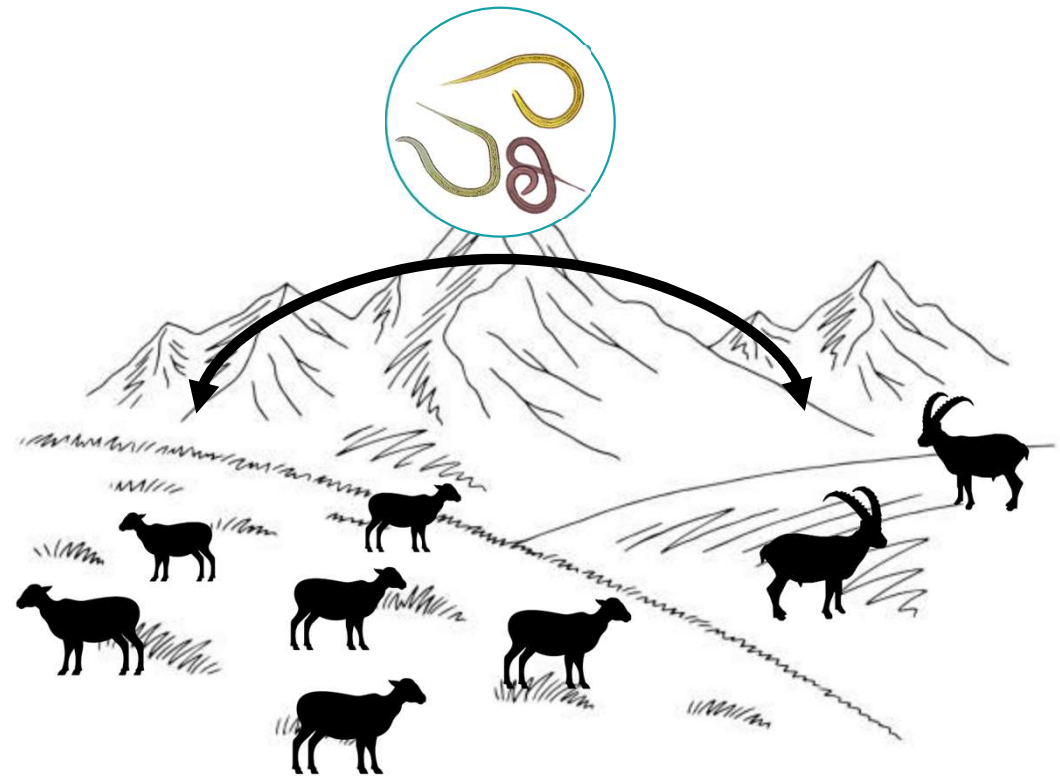


Discussion

Do domestic sheep and wild ibex have similar species of nematodes?



Includes pathogenic parasites (e.g. *H. contortus*)
→ Consequences on population dynamic of ibex?



Discussion

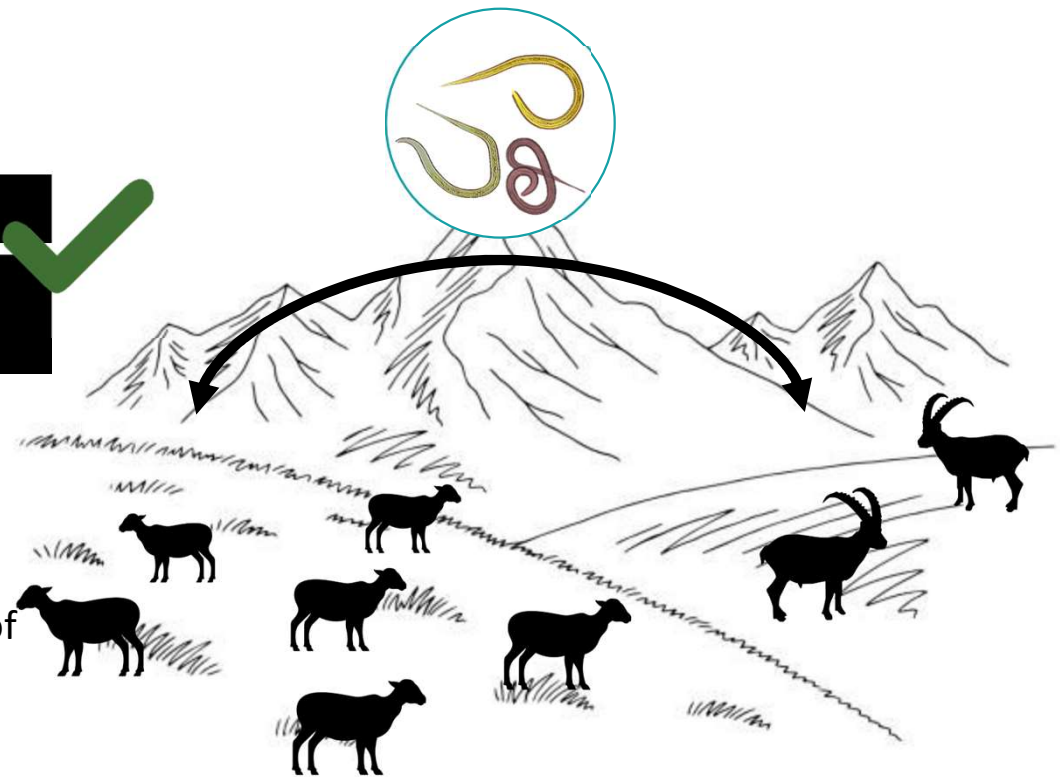
Do domestic sheep and wild ibex have similar species of nematodes?

Includes pathogenic parasites (e.g. *H. contortus*)
→ Consequences on population dynamic of ibex?

Are ibex contaminated by parasites resistant to anthelmintic?

Can ibex maintain resistant parasites when sheep are absent from alpine pastures ?

- Ibex never treated → contaminated by sheep
- Ibex shed eggs of resistant nematodes despite no sheep >8-10 months
- Relative contribution of each species in the dynamic of parasites?





Thanks !

