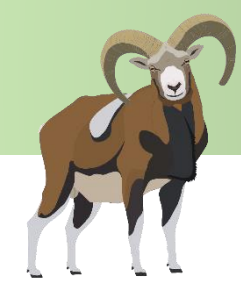


Corsican mouflon (*Ovis gmelini musimon* var.
corsicana), conservation of a threatened species on a
Mediterranean island



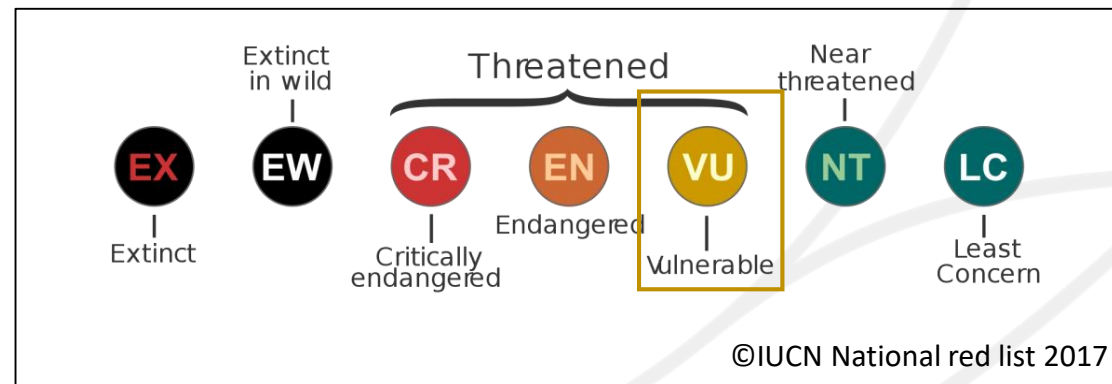
Allègre, C, Benedetti, P, Sanchis, F, Portanier, E, Comiti, G, Bourgoïn, G. and Garel, M.
claire.allegre@ofb.gouv.fr

Mid-year meeting of Taxon Advisory Group of Caprinae – 3rd to 5th April 2024



I. Protection status

- International and european regulations:
 - annexe III of the Berne Convention;
 - annexes II et IV of the directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora;
 - annexe II of the Washington Convention (CITES).
- Nationally protected by ministerial ruling since 1st march 2019 (before the corsican mouflon was an hunted species but with a « 0 quota »)

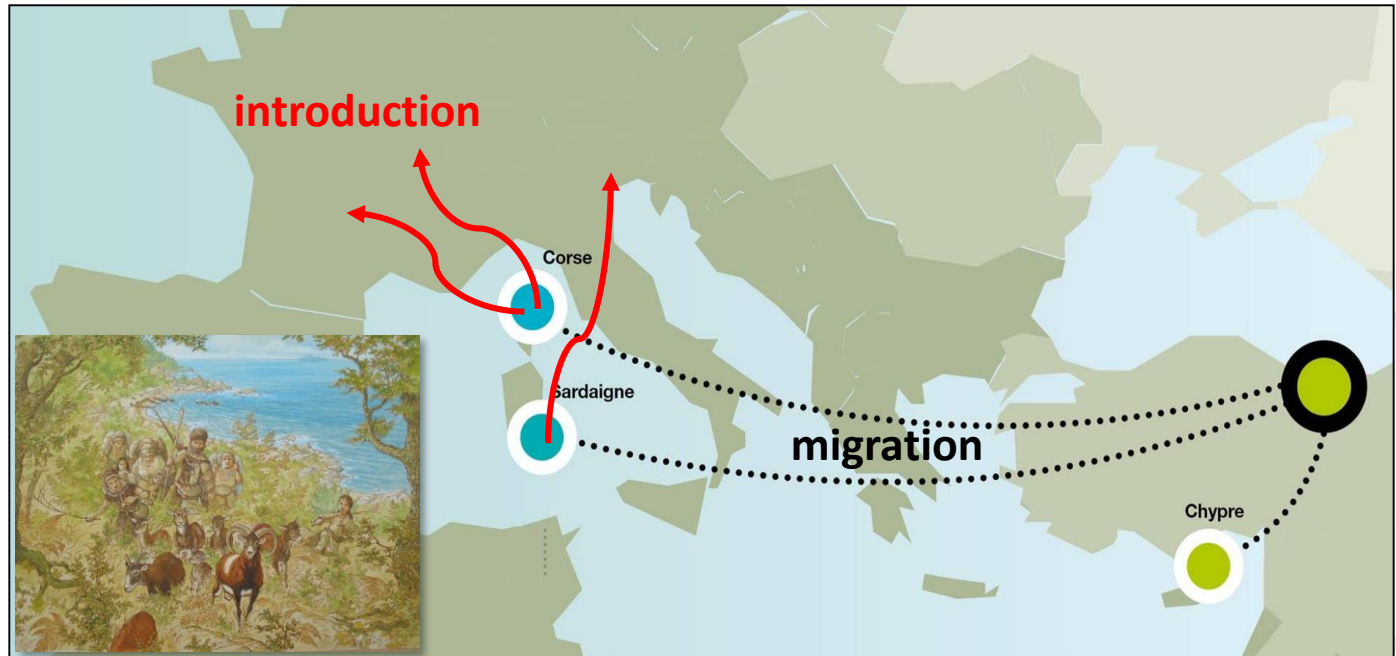




II. Origin

Species intimately linked to human history:

- on Corsica island
 - Introduced in the Neolithic period by people from Asia Minor (8 500 years ago);
- on the continent
 - Introduced and hybridized from the 18th century onwards.



(Uloth 1972; Vigne 1992; Zeder 2008)

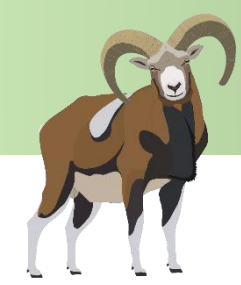
Strong genetic differentiation among Corsican populations and continental' ones leading to taxonomic distinction:

(Cugnasse 1994; Portanier 2018; Garel et al. 2022)



Corsican mouflon : *Ovis gmelini musimon* var. *corsicana*

Mediterranean mouflon : *Ovis gmelini musimon* x *Ovis* sp



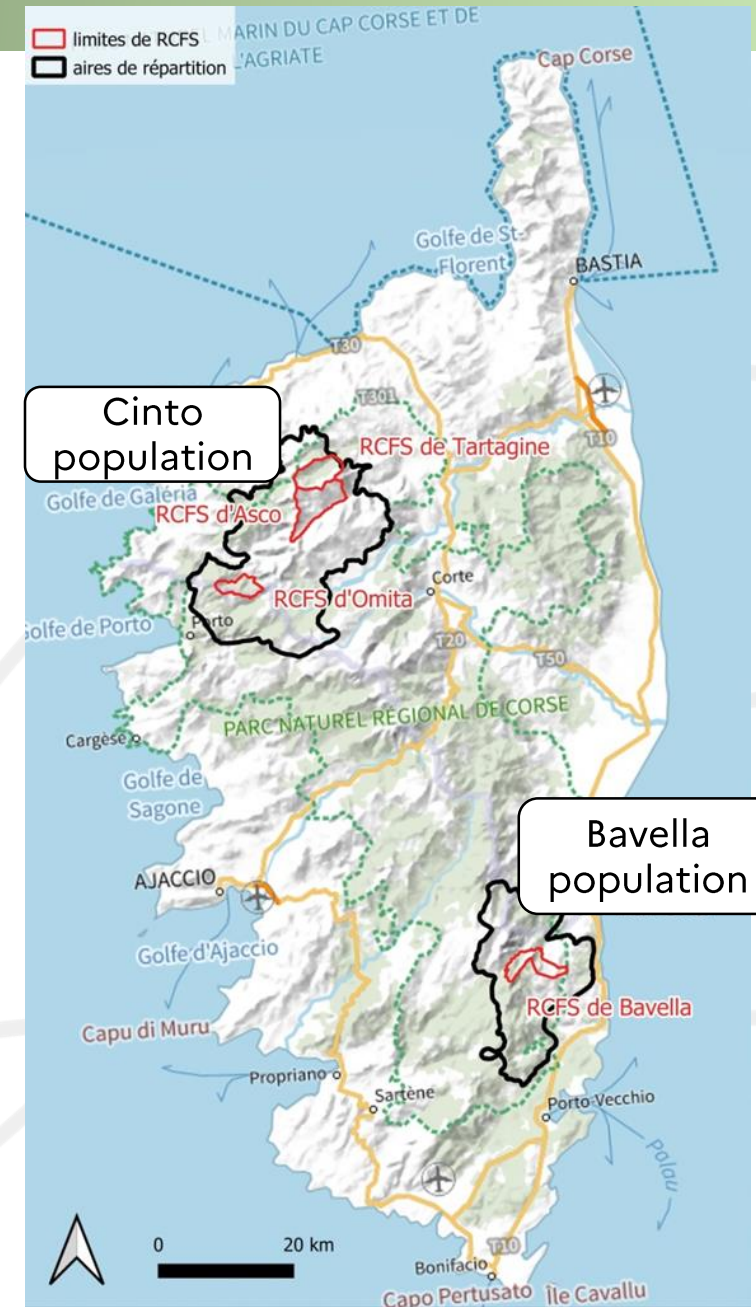
III. Spatial distribution

- Two remote populations with no gene flow
 - high genetic differentiation ($F_{st} = 0,23 [0,13;0,32]$ 95%, $p < 0,0001$);
 - genetic structuration established nearly 2 000 years ago.

(Portanier et al., 2022)

- Corsican mouflon is genetically and phenotypically well preserved as a descendant of the Asiatic mouflon.

(Barbato et al., 2017 ; Portanier et al., 2022)





IV. Population dynamic

A) Population size

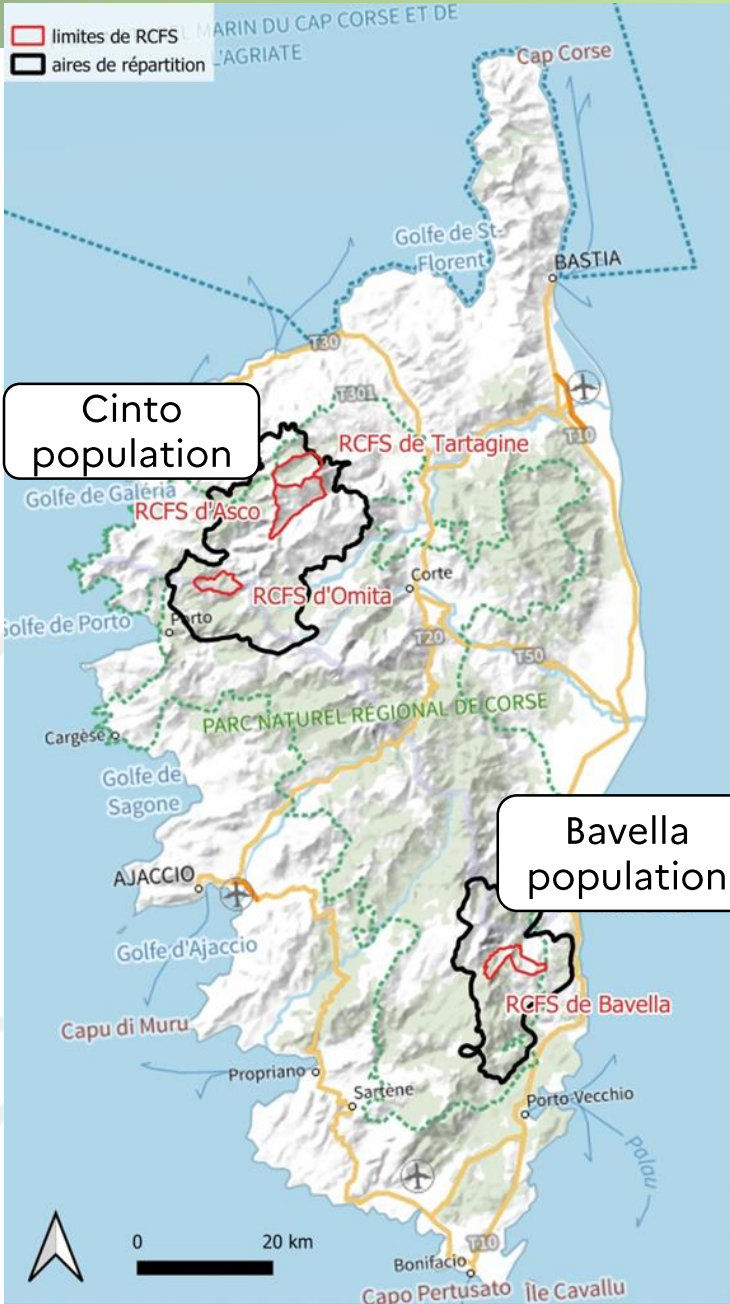
- Cinto
 - Population size: 879 animals (based on an aerial count covering 62% of the range in 2009);
 - Distribution area: 525 km².



- Bavella
 - Population size: 93 animals (mean value based on aerial counts covering 15% of the range between 2011 and 2020);
 - Distribution area: 295 km².



© Boone M., Mella L., Graziani P.

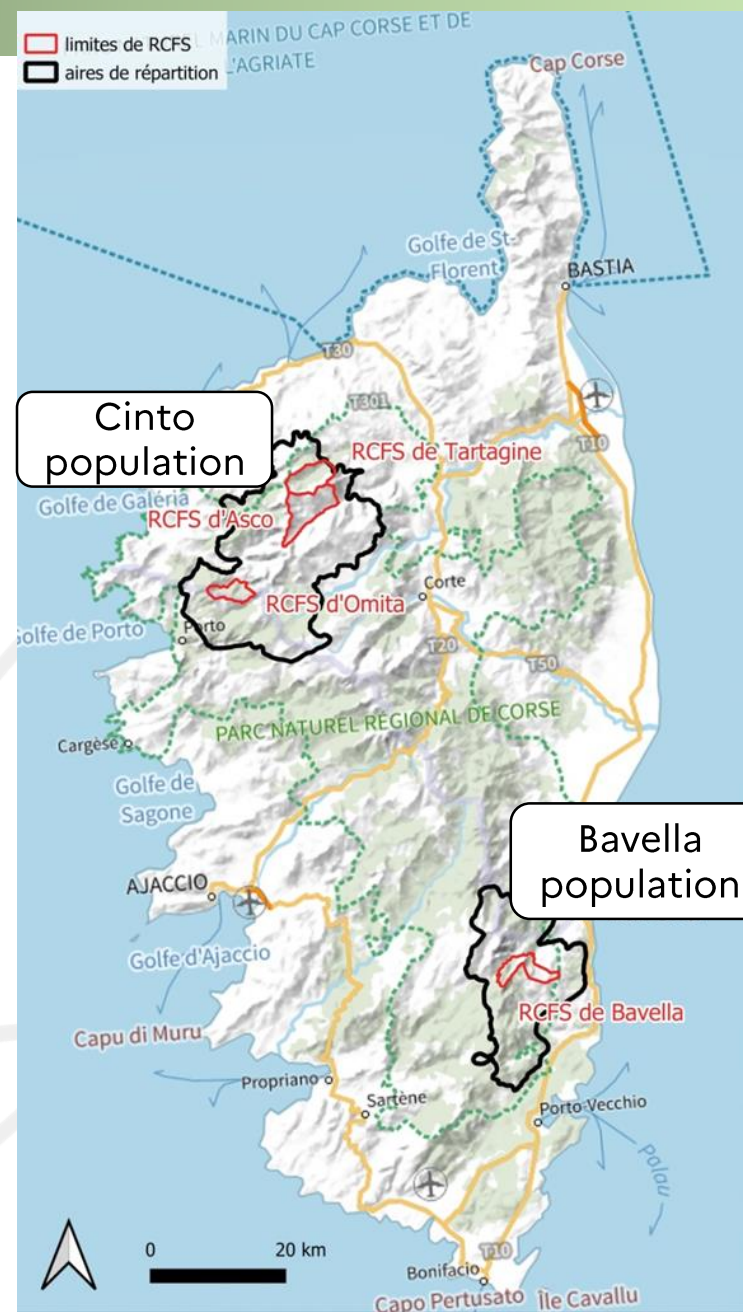
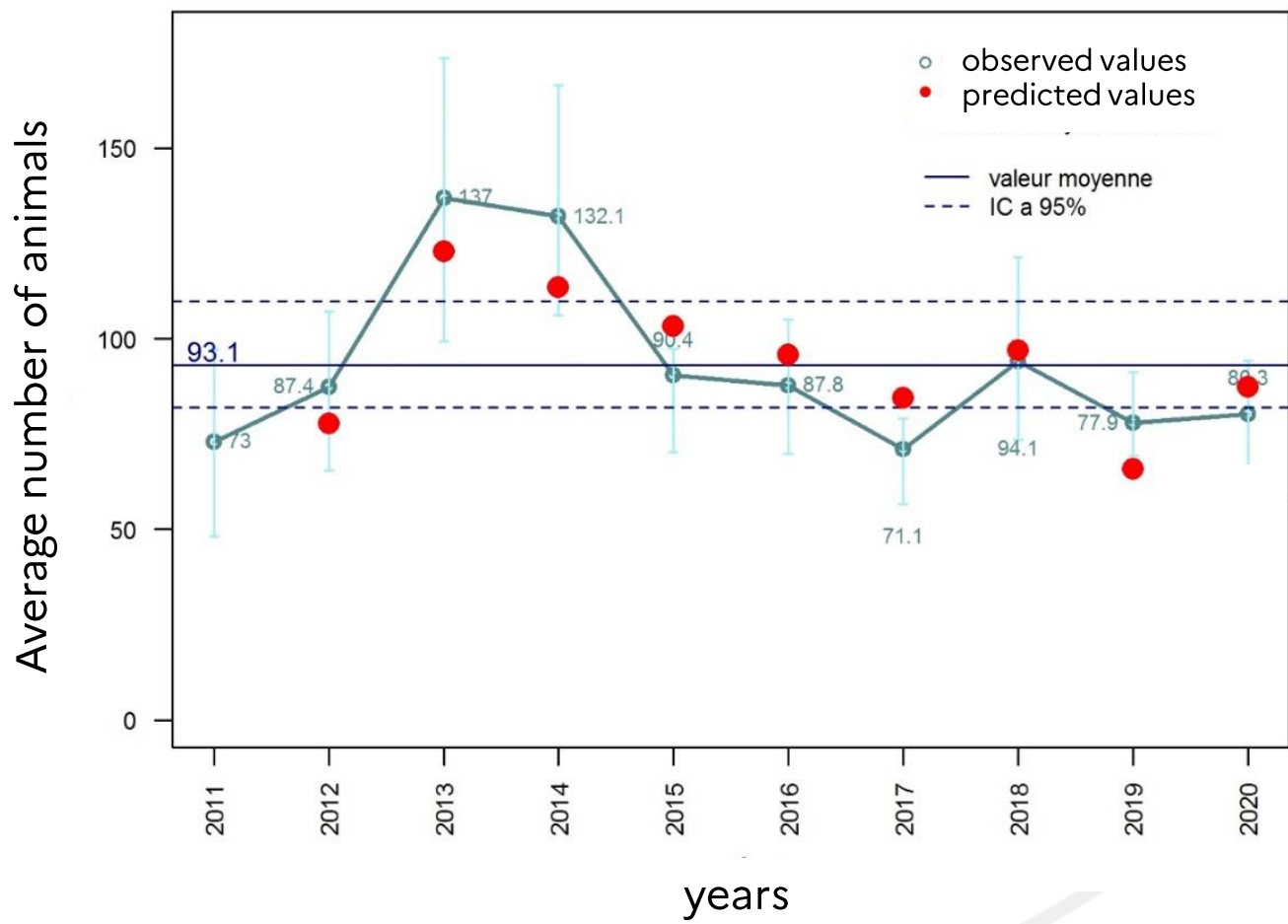




IV. Population dynamic

A) Population size

■ Bavella

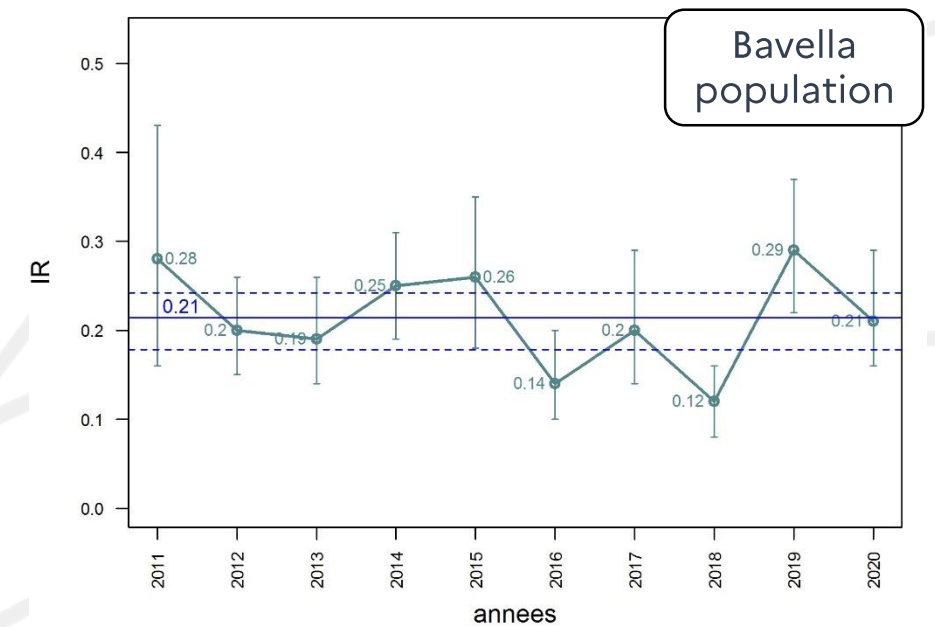
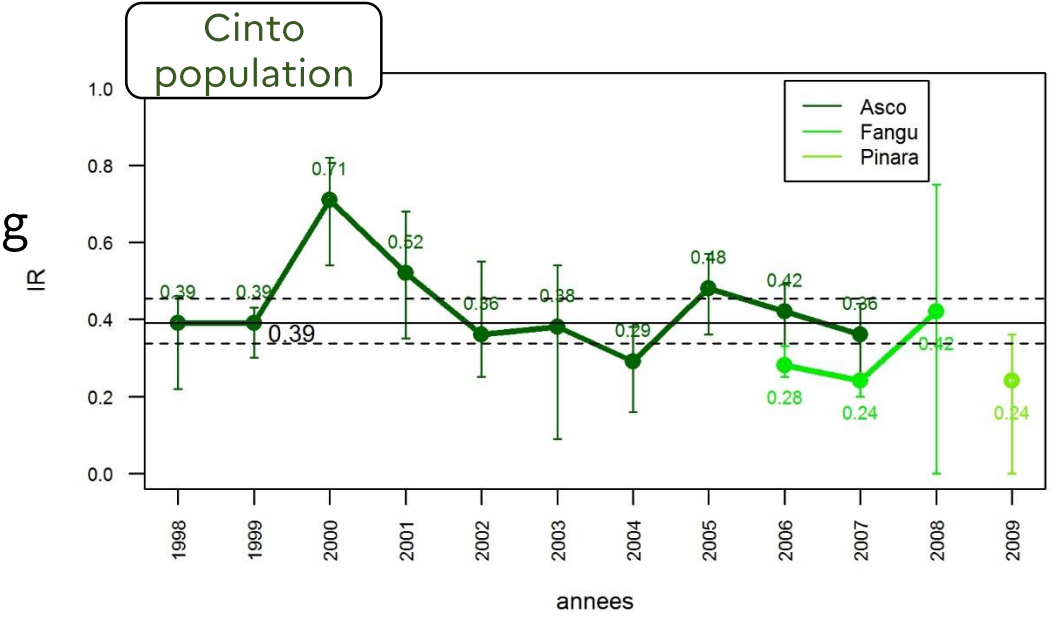
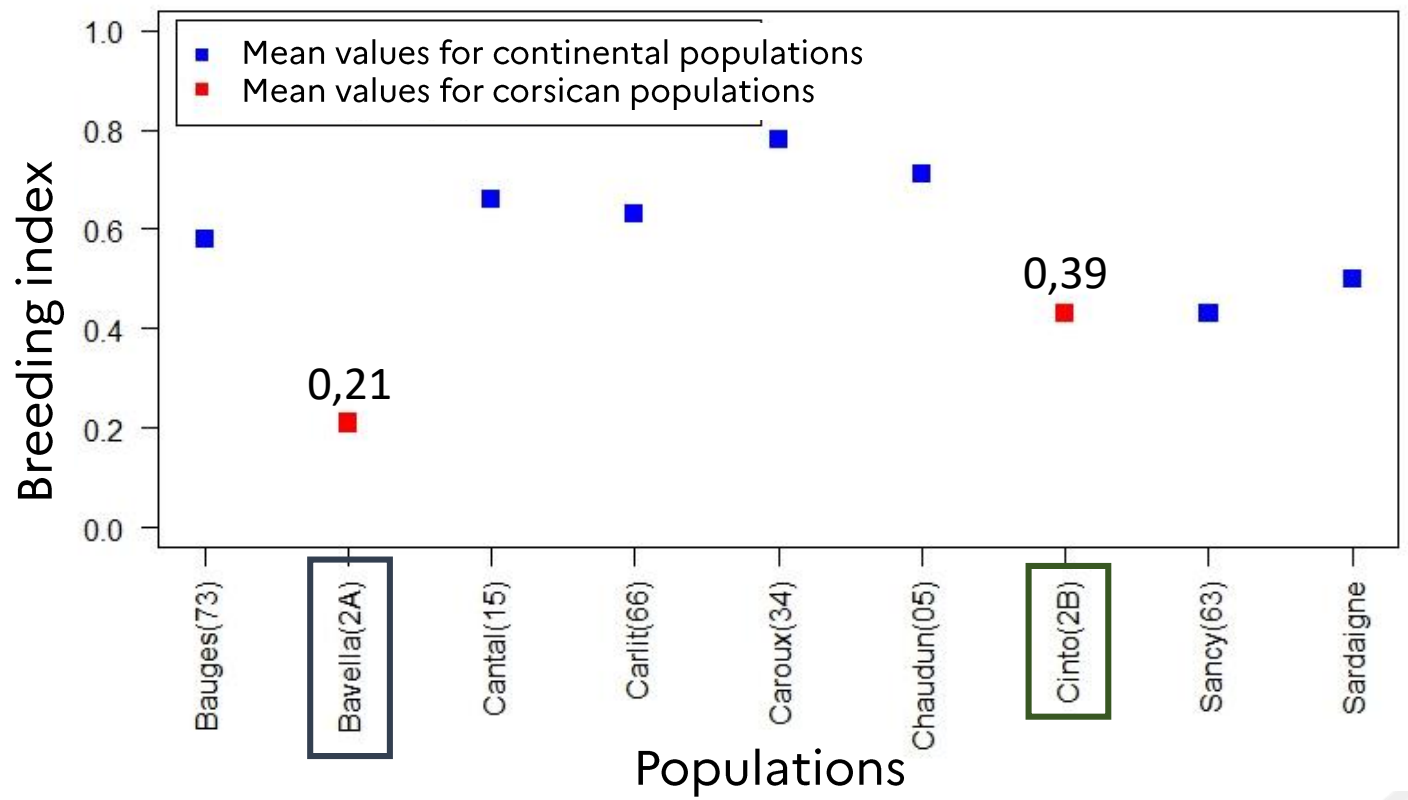




IV. Population dynamic

B) Breeding

Breeding index = (number of young/number of females) in spring



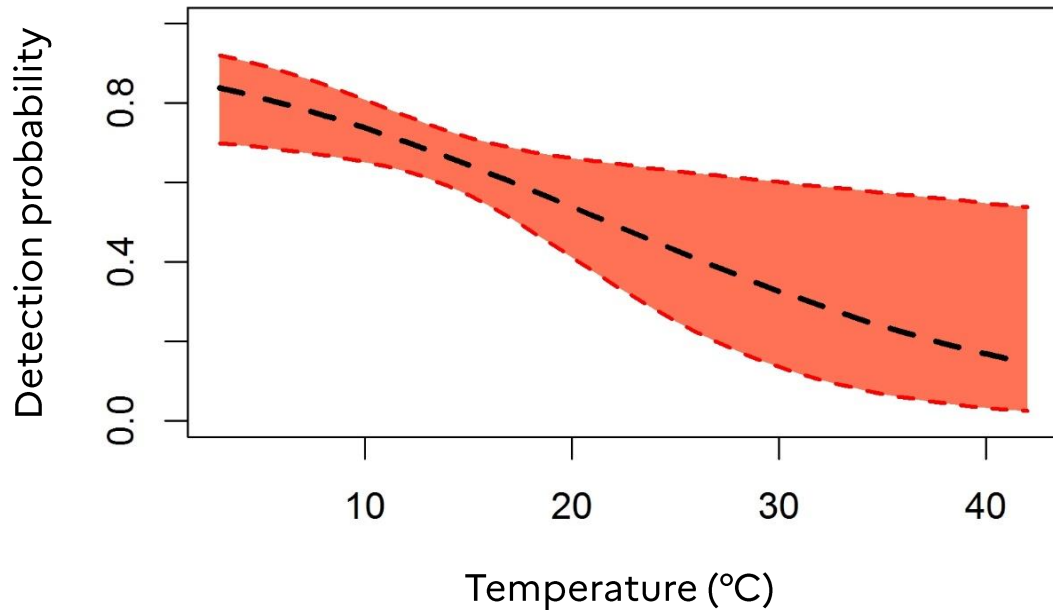
(Sanchis 2018)



V. Habitat selection and use

A) Population scale

- Which environmental variables influence habitat selection and use ?
 - Population scale (occupancy models, MacKenzie et al., 2005):



Negative impact of high temperatures on the detection probability:

- lower activity;
- use of thermal refuges (altitude, vegetation cover).

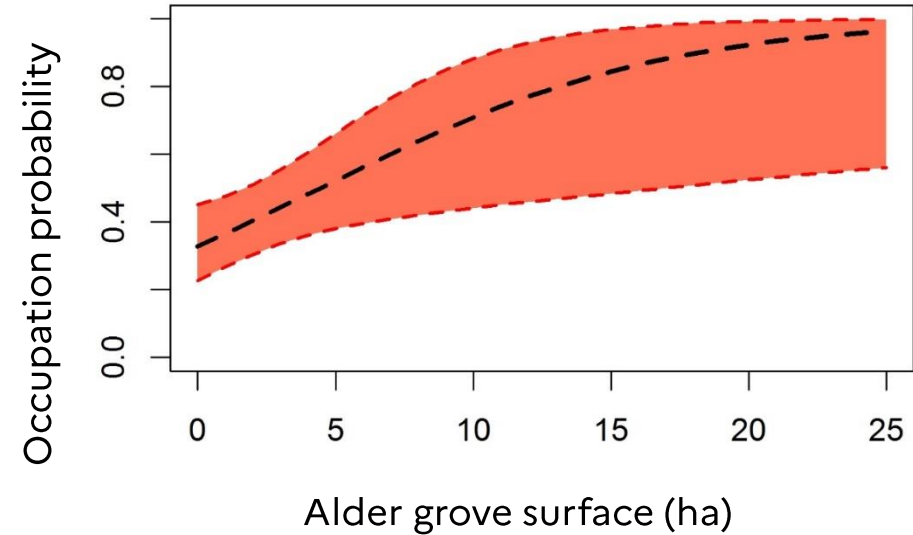
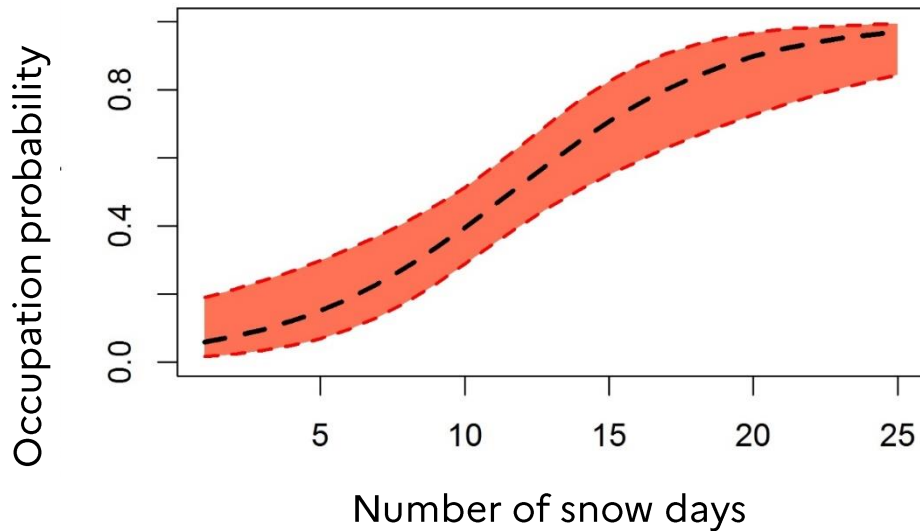


V. Habitat selection and use

(Sanchis 2018)

A) Population scale

- Which environmental variables influence habitat selection and use ?



Occupation probability of a site increases with duration of snow cover and surface of alder grove :

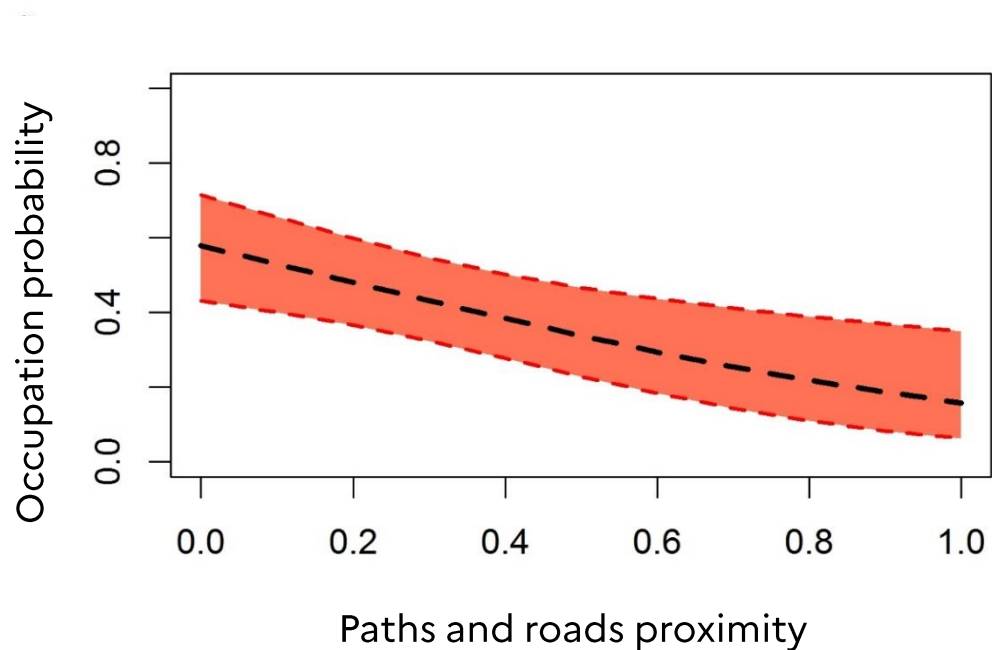
- selection for cool high-altitude areas (thermal cover during summer);
- alder grove = dense shrub layer offering protection against biting insects.



V. Habitat selection and use

A) Population scale

- Which environmental variables influence habitat selection and use ?



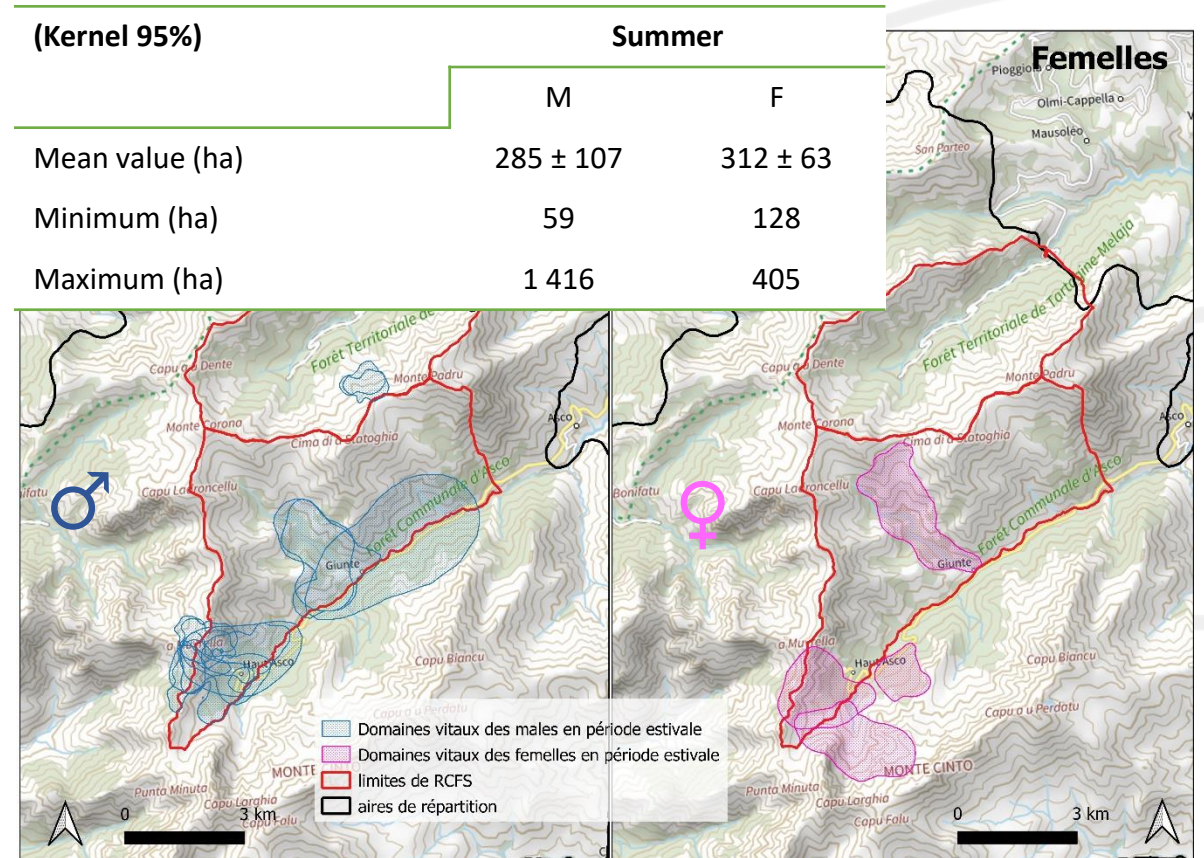
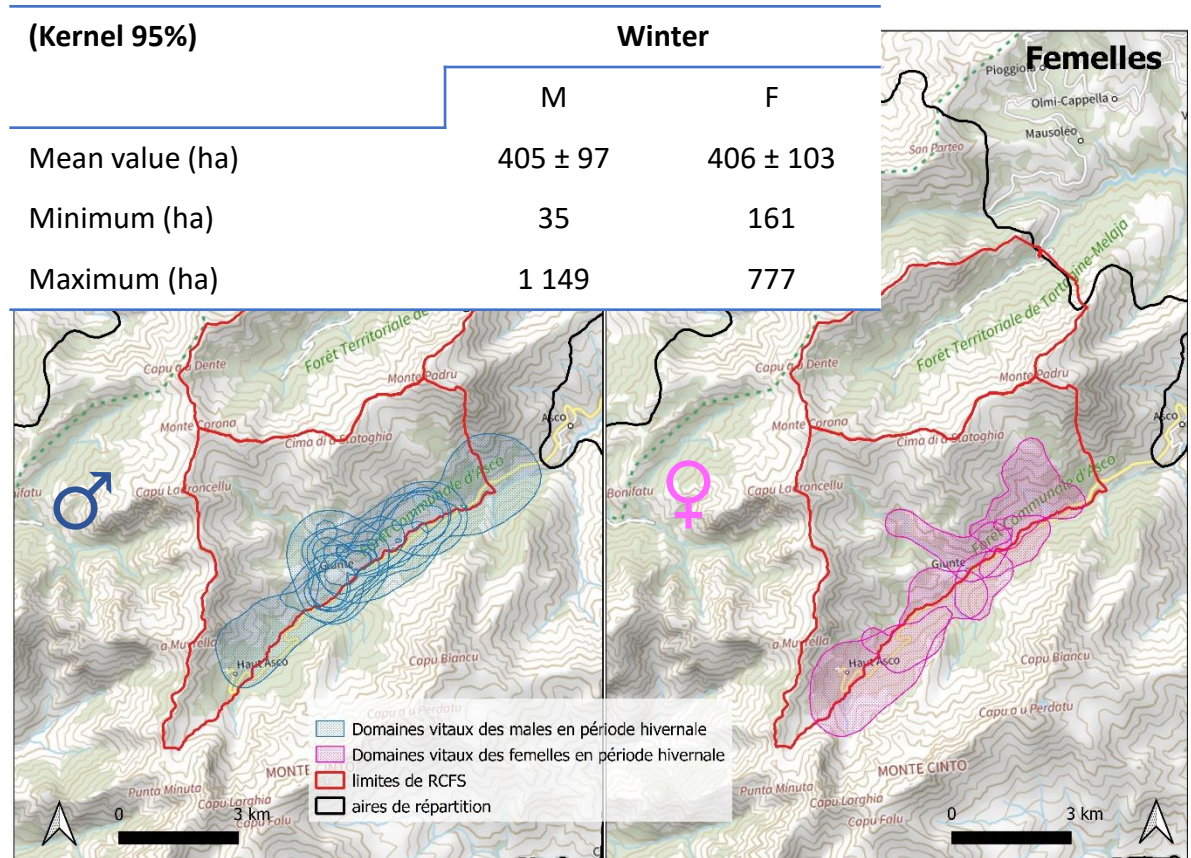
- sites located more than 500m away from hiking trails are four times more likely to be occupied by mouflons in summer;
- less than 20% for the sites located in their immediate vicinity.



V. Habitat selection and use

B) Individual scale

- Home range : GPS data collected during 1 year on 18 animals (13 males/5 females), 48 814 locations (1loc/2h)



V. Habitat selection and use

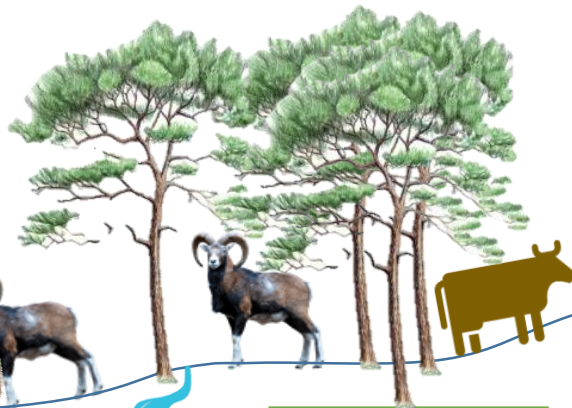
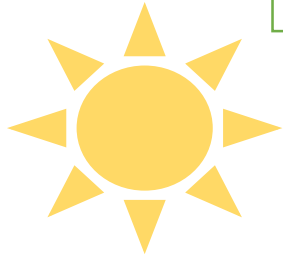


B) Individual scale

- Summer habitat selection (K-select analysis)

Resident strategy (40%)

high temperature



Pine forests

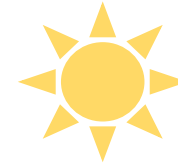
Heather



streams



Migration strategy (60%)

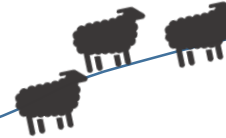


Juniper

Alder grove

high altitude

steep slopes

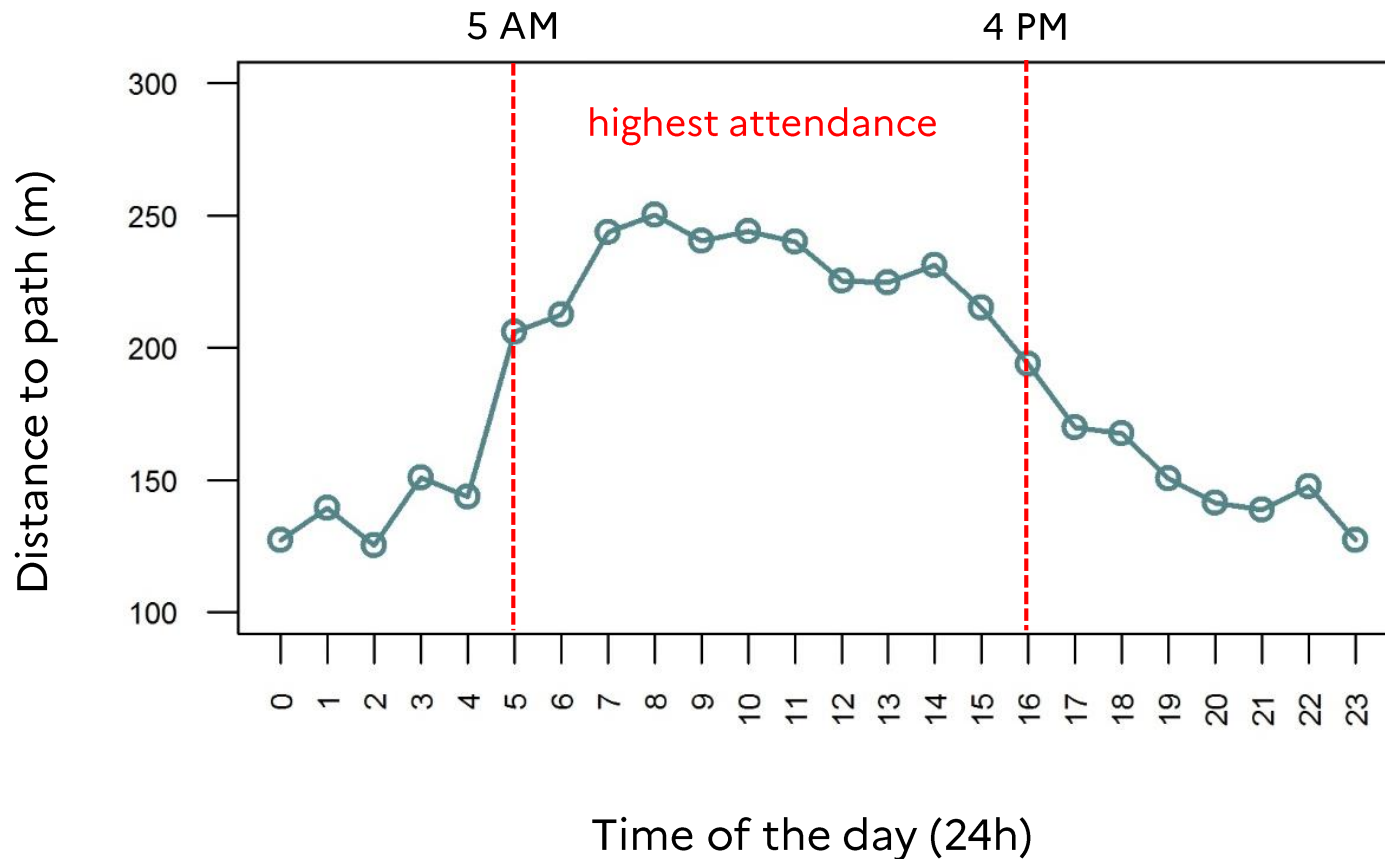




V. Habitat selection and use

B) Individual scale

▪ Habitat selection vs human disturbance



→ avoidance strategy : during the busiest hours, animals are more than 200 m from the path;

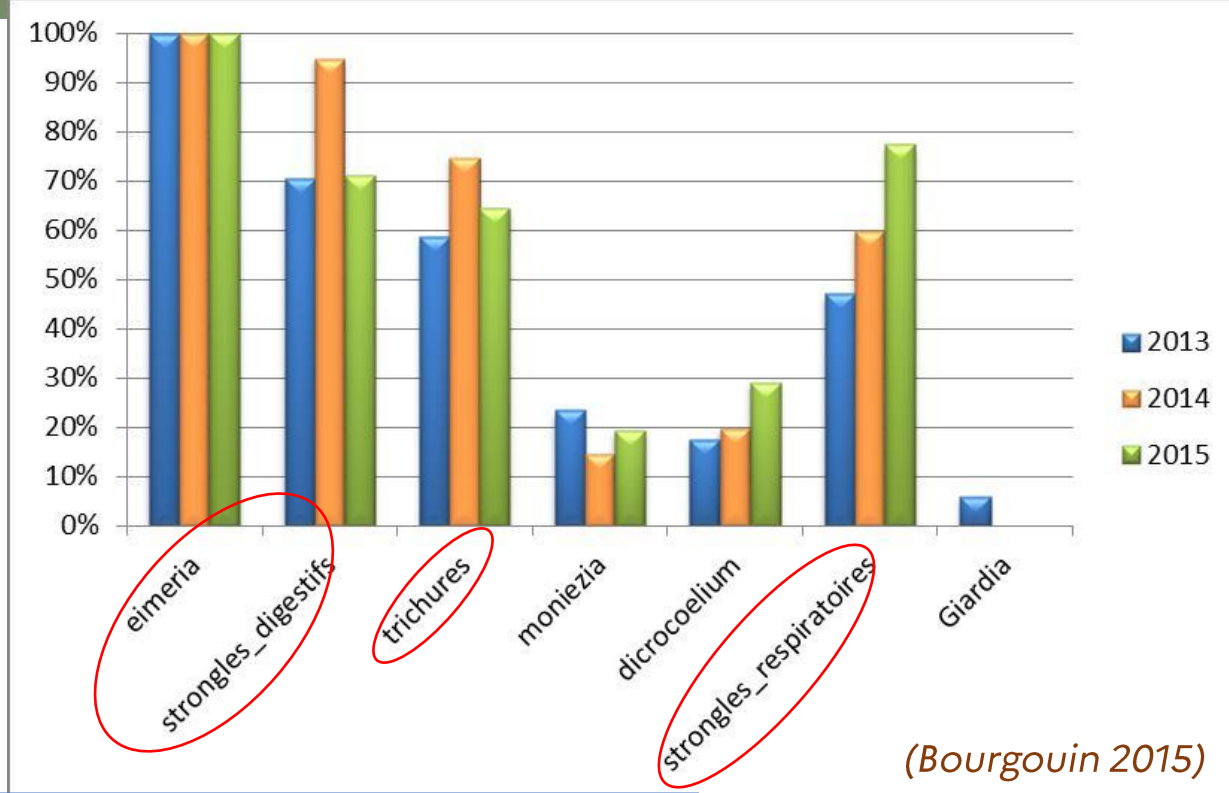
→ metabolic cost that can have an impact on the physiology of the species (reproduction, growth, survival).



VI. Sanitary aspects

A) Internal parasitism and diseases

- Coproscopy : prevalence of internal parasites measured between 2013 and 2015 (n=68, Cinto)
- Blood analysis : low seroprevalence (n=97, Cinto, list of 22 diseases)



Infectious agent	Disease	Suspicion	Positive
<i>Chlamydiophila abortus</i>	Chlamyophilosis	1	3
<i>Anaplasma phagocytophilum</i>	Granulocyte Ehrlichiosis		1
<i>Bartonellosis</i>	Bartonellosis		1
<i>Babesiosis</i>	Babesiosis		1
<i>Toxoplasma gondii</i>	Toxoplasmosis	2	
<i>Paramyxovirus/Pneumovirus</i>	Respiratory syncytial virus		1



VI. Sanitary aspects

B) Tick parasitism

- Tick-borne pathogens: 2011-2015, n=86, Cinto, total ticks number 495

Tick species	larvae	nymph	male	female
<i>Rhipicephalus bursa</i>	8	145	194	128
<i>Haemaphysalis punctata</i>	0	0	3	1
<i>Haemaphysalis sulcata</i>	0	0	13	3

(Habib et al., 2024)

Table 2. Results of PCR assays for the different tested pathogens (number of positive samples/number of tested samples, with the corresponding percentages in brackets), for each tick species from the four study areas in France.

Sites	Tick species	<i>Babesia/</i> <i>Theileria</i> spp	<i>B. burgdorferi</i> s.l.	Anaplasmataceae	<i>A. phagocytophilum</i>	<i>A. marginale</i>	<i>A. ovis</i>	<i>Rickettsia</i> spp.	SFG <i>Rickettsia</i>
Bauges	<i>Ixodes ricinus</i>	0/155 (0)	1/155 (0.6)	102/155 (65.8)	18/155 (11.6)	0/155 (0)	0/155 (0)	68/155 (43.9)	10/155 (6.5)
Bazès	<i>Ixodes ricinus</i>	1/202 (0.5)	0/202 (0)	62/202 (30.7)	2/202 (1.0)	0/202 (0)	0/202 (0)	12/202 (5.9)	2/202 (1.0)
Caroux-Espinouse	<i>Ixodes ricinus</i>	1/93 (1.1)	8/93 (8.6)	70/93 (75.3)	14/93 (15.1)	0/93 (0)	1/88* (1.1)	3/93 (3.2)	1/93 (1.1)
	<i>Rhipicephalus sanguineus</i> s.l.	0/55 (0)	–	7/55 (12.7)	0/55 (0)	0/55 (0)	5/54* (9.3)	3/55 (5.5)	3/55 (5.5)
Cinto	<i>Haemaphysalis punctata</i>	0/66 (0)	–	8/66 (12.1)	0/66 (0)	0/66 (0)	0/65* (0)	0/66 (0)	–
	<i>Rhipicephalus bursa</i>	5/206 (2.4)	–	37/206 (17.9)	0/206 (0)	0/206 (0)	0/206 (0)	11/206 (5.3)	2/206 (1.0)
	<i>Haemaphysalis sulcata</i>	0/14 (0)	–	2/14 (14.3)	0/14 (0)	0/14 (0)	0/14 (0)	11/14 (78.5)	0/14 (0)

* Not enough DNA for a few samples to test for *A. ovis*.



VI. Sanitary aspects

C) Conclusions

- health monitoring mainly carried out on the **Cinto population** (2011 to 2019) through captures (2011-2015). Population in **good health** in terms of viruses and bacteria (vs the local domestic fauna) ;
- endo and ecto parasitism commonly described in mouflon sheep, with **some specificities** (presence of *Giardia*, low prevalence of *Dicrocoelium*, absence of *Ixodes ricinus* ticks and a major presence of *Rhipicephalus bursa*) ;
- **large number of parasitized animals** and poor general physiological condition (undernourishment) but probable bias due to the small sample and the method used (capture cage with bait, winter period).
→ **need to maintain a permanent epidemiological monitoring !**



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VII. Conservation

A) National Action Plan (PNA)

→ Strategic and operational tool designed to ensure the conservation or restoration to a favourable conservation status of a wild species (fauna and flora) that are threatened or of particular interest.

- 10 years duration (2024-2033)
- 11 actions involving all partners in Corsica and beyond



MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET DE LA COHÉSION DES TERRITOIRES

PNA MOUFLON
Plan National d'Actions
en faveur du Mouflon de Corse
(*Ovis gmelini musimon var. corsicana*)

2024
2033

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PREFET DE CORSE
Direction régionale de l'environnement de l'aménagement et du logement de Corse

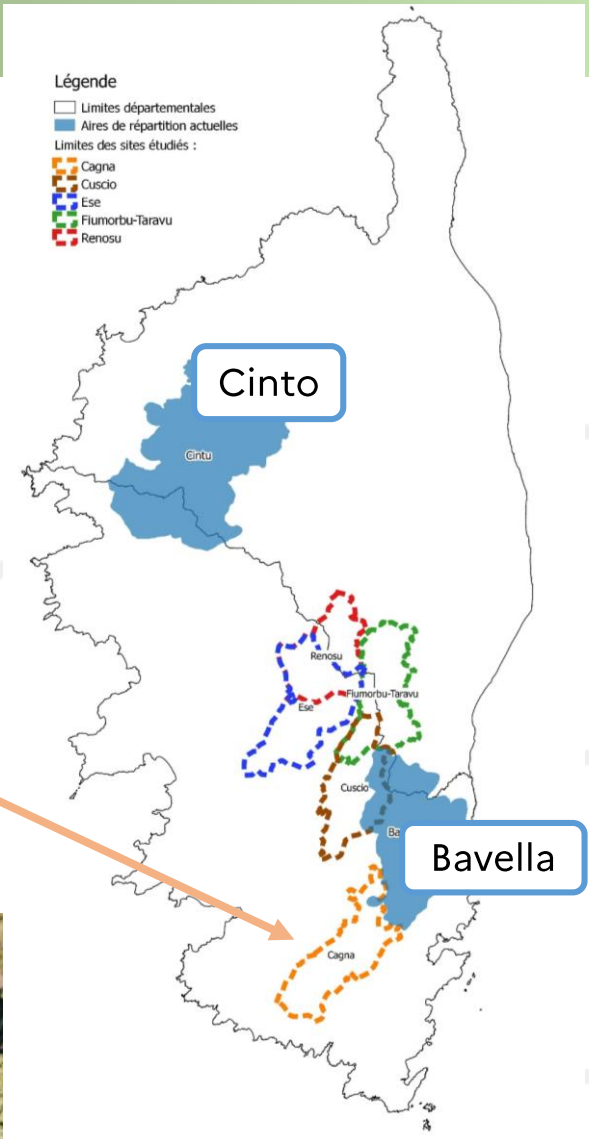
RÉPUBLIQUE FRANÇAISE
OFB



VII. Conservation

B) Operation to reinforce the population

- 2004 : Breeding enclosure initiated by LIFE program with the aim of creating a new population nucleus close to the southern range of Bavella (management by the Corsican natural park PNRC)
- 2017-2018 : study of a release site (OFB) : selection of Cagna
- October 2020 : First release operation



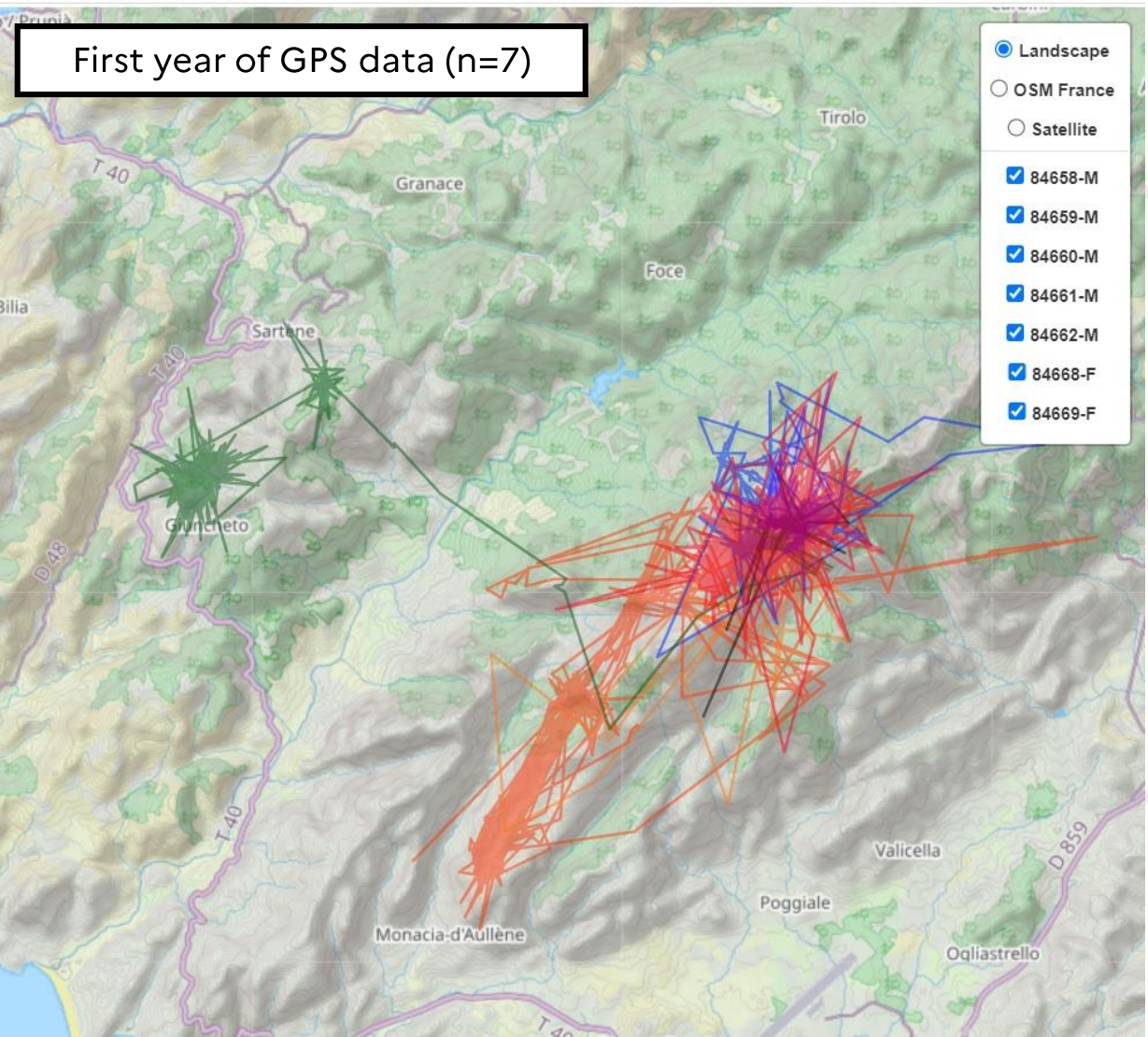


VII. Conservation

B) Operation to reinforce the population

Date of release	Males	Females	Number of GPS collars
October 2020	13	2	7
October 2021	7	16	9
October 2022	3	11	10
Total number	23	29	26

- First results :
 - no mortality due to release ;
 - low dispersion of marked animals ;
 - very good general condition of the animals on site (camera trap monitoring).





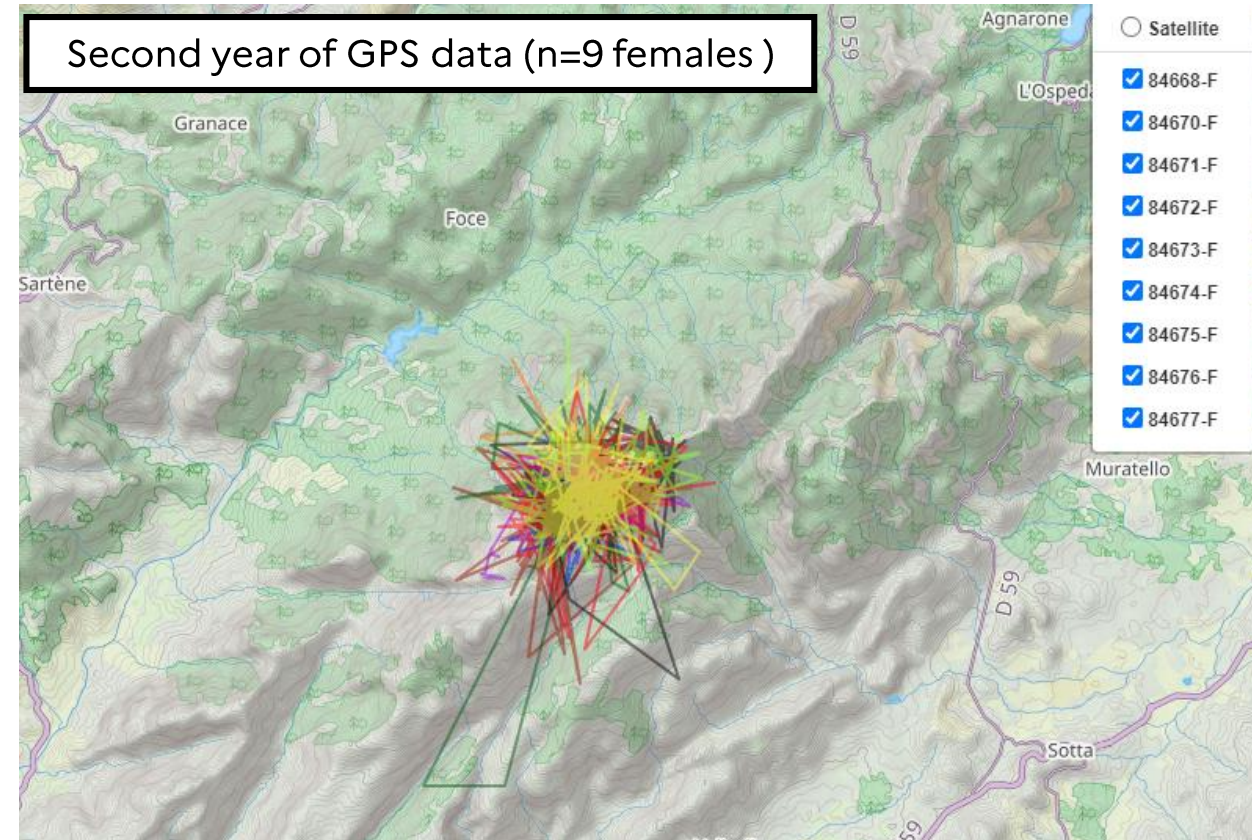
VII. Conservation

B) Operation to reinforce the population

- Results after 3 releases:
 - since 2020, 4 adult females have died on site, 11 young animals have never been seen again;
 - Questioning regarding lamb survival: 2 lambs born in spring 2022, 6 in spring 2023, none survived beyond 2 months of age.



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Thanks fo your attention

Allègre, C, Benedetti, P, Sanchis, F, Portanier, E, Comiti, G, Bourgoïn, G. and Garel, M.
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