

# How can epidemiological monitoring and modelling contribute to management decisions?

## Lessons learned from ten years of brucellosis in French wildlife

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# Science – decision nexus



Epidemiological analyses and models are designed to help decision making

How are epidemiological results used ? How to improve knowledge-based decision making ?



Brucellosis in alpine ibex in France : management decisions taken at the same time as knowledge progressing



Determine main phases in knowledge and management (one-year delay)

Identify determinants of change in decision making, role of epidemiological advances

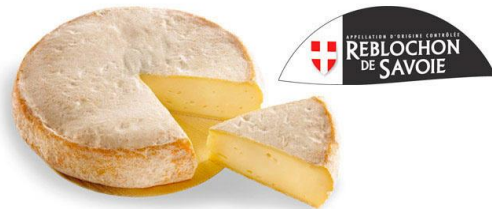
# Context : two success stories



**2005 : France officially free of brucellosis in livestock**

After decades of management

**Farmers, vets, ministry of Agriculture**



**1959 – 1976 : ibex reintroduced in France**

After a century of progressive protection

> 9 000 ibex in France

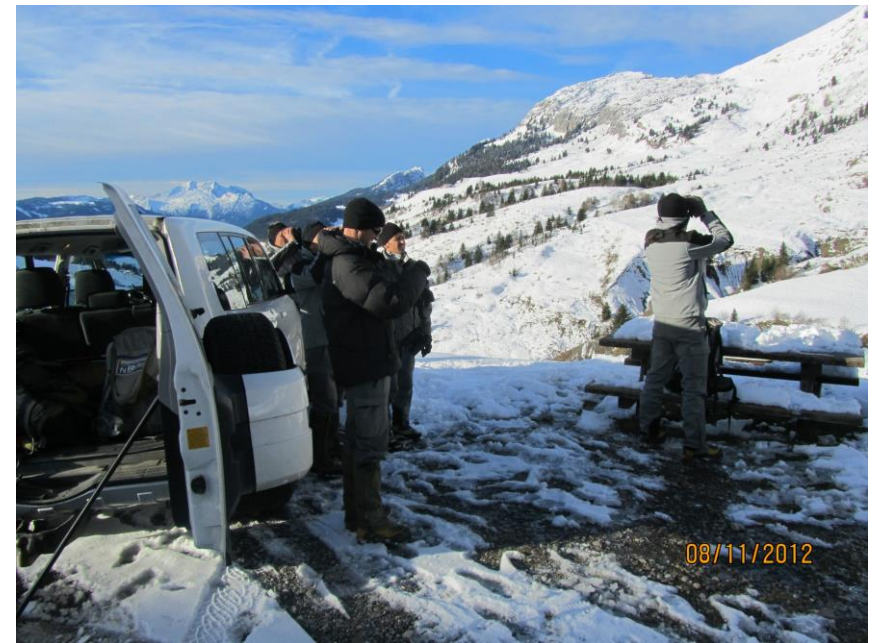
**Associations, National Parks, ministry of Environment**



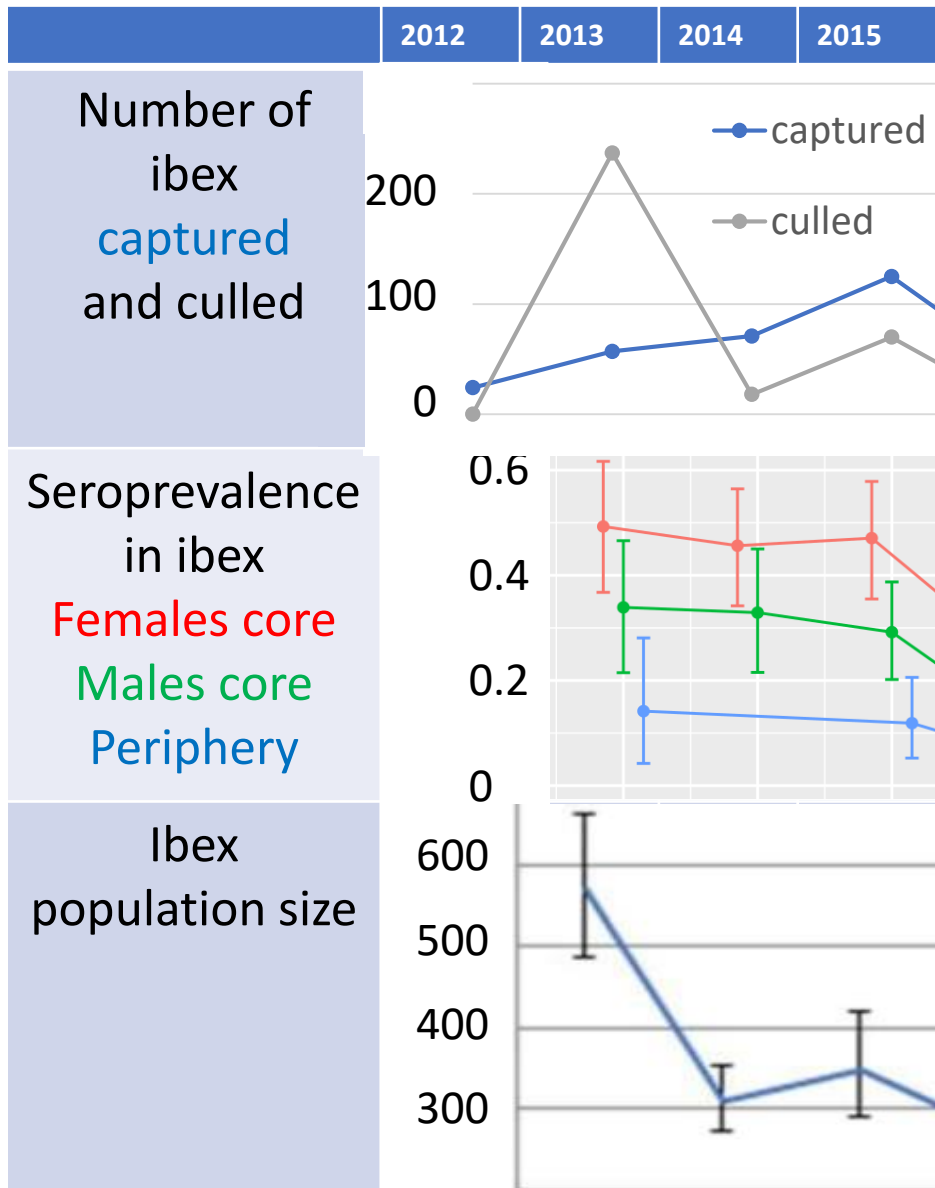
# Phase 1 : 2012-2015

- 2012 : brucellosis in 2 teenager boys
- *Brucella melitensis* in a local cattle herd -> culled
- Source in local wildlife? Captures, monitoring of epidemiology, demography and spatial ecology initiated
- First seroprevalence estimate in ibex : 38%, with adults > 5 years old most often seropositive
- Situation considered an emergency : **decision to kill all ibex > 5 years**

*Garin-Bastuji et al. 2014*



# 2012-2015 : management and outcome

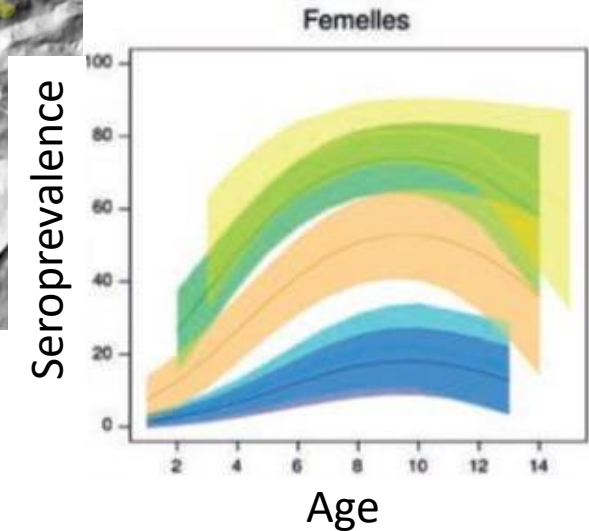
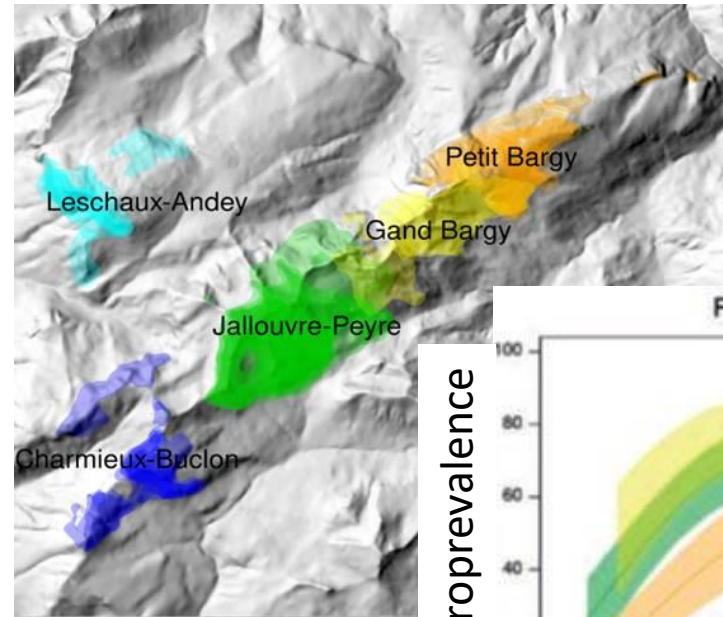


- 251 adult ibex culled in autumn 2013 / spring 2014 : age, sex and health status not measured
- seroprevalence (estimated a posteriori) did not decrease, while population size decreased, while
- Population size in 2013 (estimated a posteriori) : 500-600 individuals, without newborn
- **Culls much criticized, better acceptance for captures followed by test-and-cull**

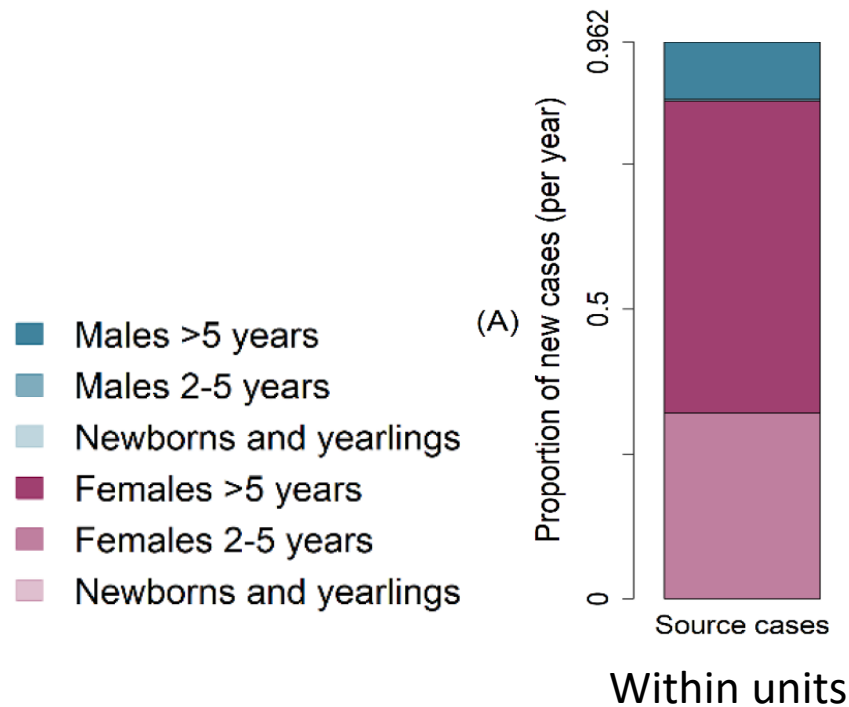


# Phase 2 : 2016-2021

**Spatial structure of the population**, variable seroprevalence among population units : core area vs periphery



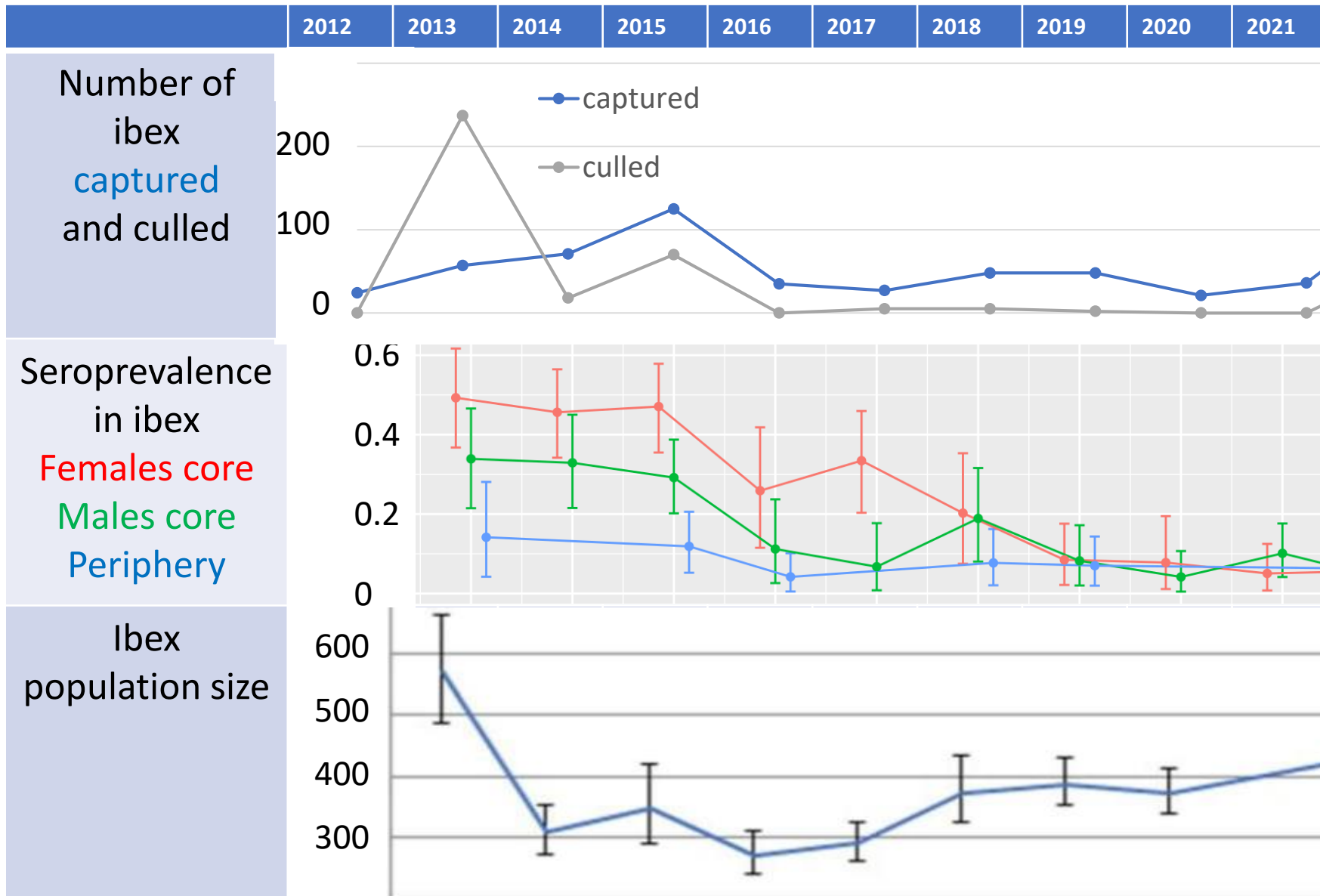
*Marchand et al. 2017 Sci Rep*



**Modelling** : transmission occurs mainly within units (96%), through exposure to infectious births and abortions  
 Females are the source of 90% of infections, males may disseminate infection between units

*Thébault et al. 2015, Lambert et al. 2020 Ecol Model*

# 2016-2021 : management and outcome



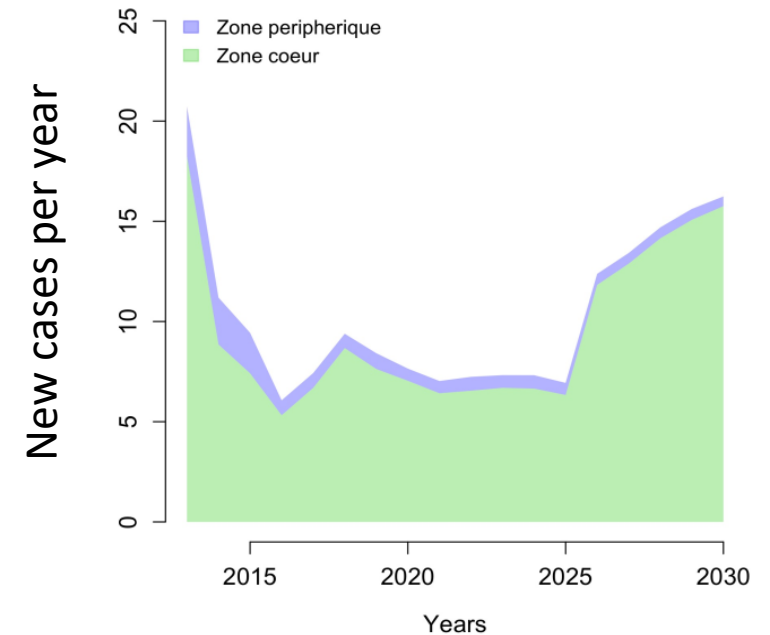
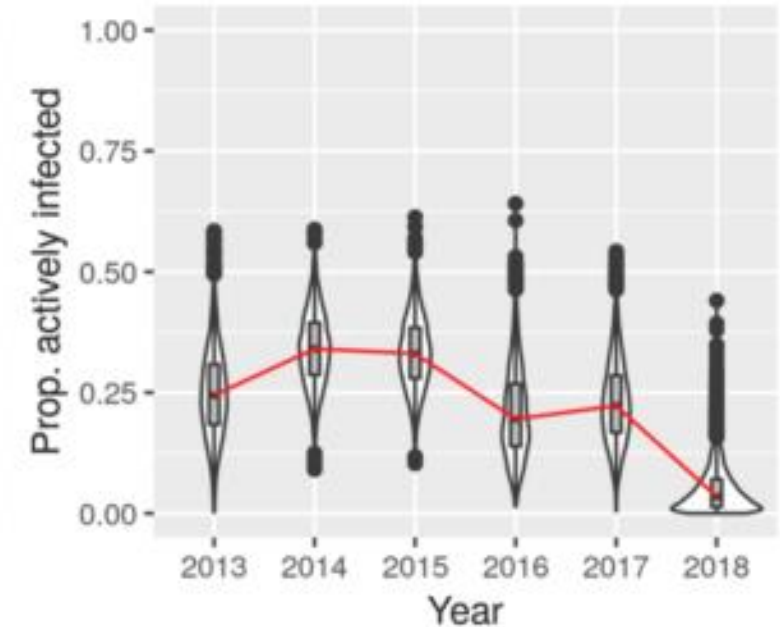
- Decisions included captures and culls and differentiated core area / periphery
- Strong opposition against culling : actual management = captures (18-48 / year), few cullings (0-5 / year)
- **Decrease in seroprevalence, population stable or increasing**

# Phase 3 : 2022

- Vaccination discarded *Ponsart et al. 2019 Vet Res*
- Adjusted estimates of seroprevalence and force of infection *Calenge et al. 2021 Prev Vet Med*
- Management scenarios compared *Lambert et al. 2021 Vet Res*

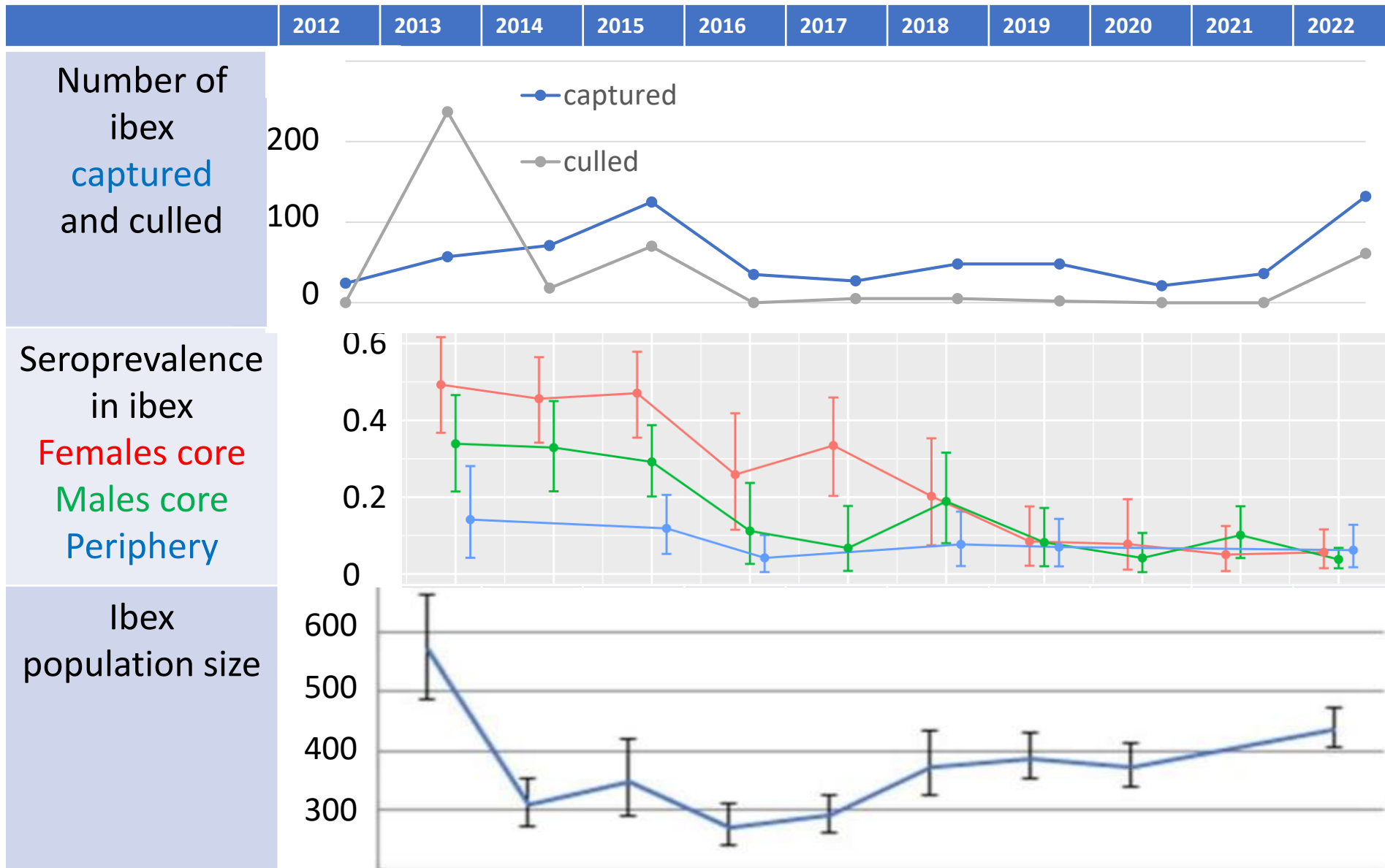
**End of 2021 : a large cattle herd infected by *B. melitensis* : culled January 2022**

**June 2022 : a female ibex infected in an adjacent area, many livestock herds exposed**





# 2022 : management and outcome



- Management combined captures (135) and culls (61)

- Seroprevalence estimated at 2 to 6% according to the place and sex

- Population increasing : at risk situation

# Conclusion : phases and determinants

## Decision to change was driven by crisis situations...

- social reactions to culls in 2015
- farmers' reaction to the discovery of a new infected herd in 2021

## ... but changes incorporated some new knowledge...

- massive culls in 2013-2014 not followed by decrease in seroprevalence, absence of herd infected from 2013 to 2021
- model outputs asked for in 2021

## ... with some limits

- the scenario privileged by the 2021 expertise group was not chosen, no model outputs available in 2022
- decisions were not always implemented in the field (field constraints, opponents), which in turn influenced next decisions



# Factors promoting the science-management interaction

**All structures and occasions promoting communication :**

Among scientific groups (expertise groups)

Between scientists and decision makers (project funding)

Between scientists and stakeholders (field activities)



# Limits to the science-management interaction

Opposed views on the aim of the management, feasibility, efficacy and interest of tools



Absence of place/time for discussion among decision makers and among stakeholders



Different time frames between research and decision, turnover of people in charge

Memory of previous situation or interpretation  
*« The culling in 2013 resulted in an increase in prevalence » : invalidated in Marchand et al. 2017*

View of the crisis as an emergency and belief in rapid crisis resolution... up to 2022

Divergent and untold ethical values... including by scientists and decision-makers

# Perspectives



Place of discussion between scientists, decision-makers and stakeholders

Long-term approach, including social science, using explicit values

More flexible models, considering scenarios discussed by all



Discussions between ministries of agriculture and environment

2023-2027 : co-financed modelling project

Alert of managers in other protected areas : surveillance improved



Thanks to...



  
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Thank you for your attention