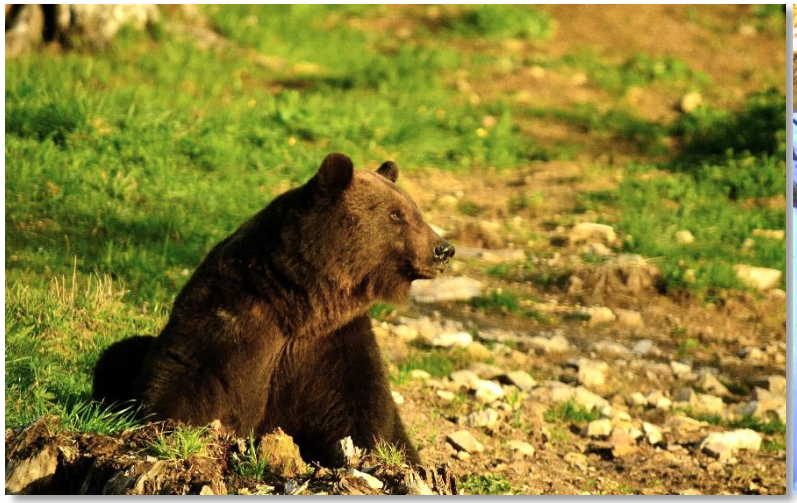


A scientific approach for large carnivore monitoring in the Romanian Carpathians

Ruben Iosif Iasmina Maria Moza Liviu Ungureanu Barbara Promberger Maja Jelenčič Tomaž Skrbinšek

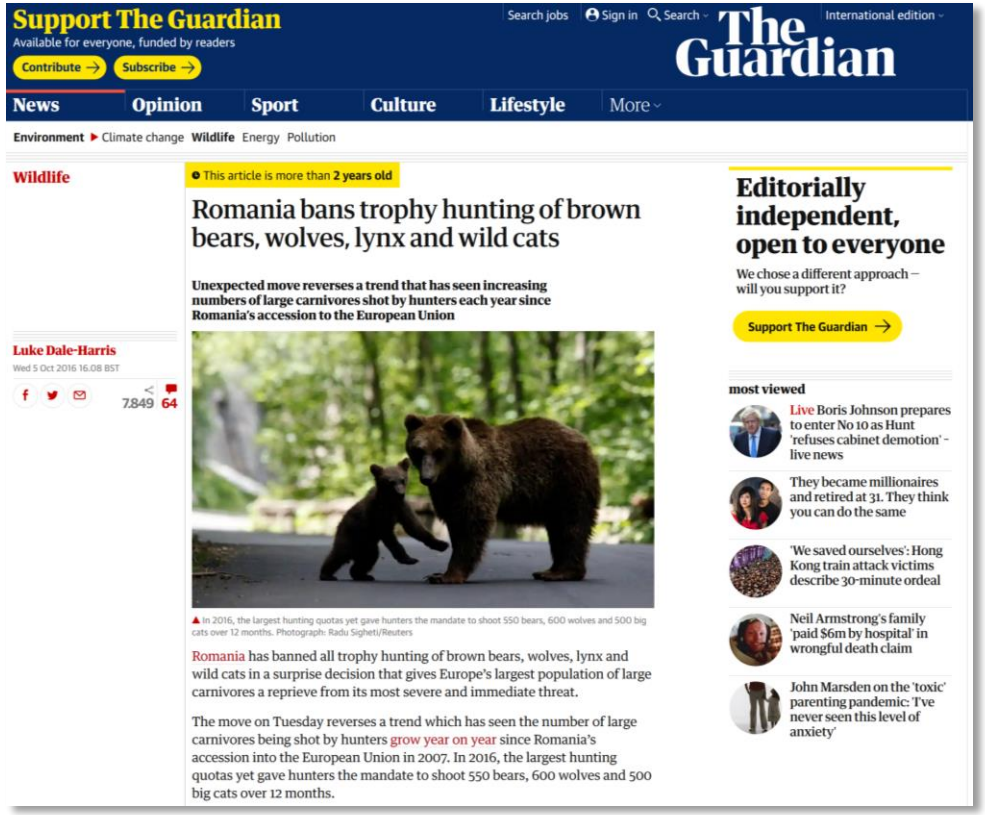
CARPATHIA®
European Wilderness Reserve

University of Ljubljana

Colțești – 25-28 November 2019

Background

October 2016 – Government banned trophy hunting raising the opportunity and the obligation to implement a sustainable management based on scientific data.



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Wildlife

This article is more than 2 years old

Romania bans trophy hunting of brown bears, wolves, lynx and wild cats

Unexpected move reverses a trend that has seen increasing numbers of large carnivores shot by hunters each year since Romania's accession to the European Union

Luke Dale-Harris
Wed 5 Oct 2016 16.08 BST

7,849 64

▲ In 2016, the largest hunting quotas yet gave hunters the mandate to shoot 550 bears, 600 wolves and 500 big cats over 12 months. Photograph: Radu Sigheti/Reuters

Romania has banned all trophy hunting of brown bears, wolves, lynx and wild cats in a surprise decision that gives Europe's largest population of large carnivores a reprieve from its most severe and immediate threat.

The move on Tuesday reverses a trend which has seen the number of large carnivores being shot by hunters grow year on year since Romania's accession into the European Union in 2007. In 2016, the largest hunting quotas yet gave hunters the mandate to shoot 550 bears, 600 wolves and 500 big cats over 12 months.

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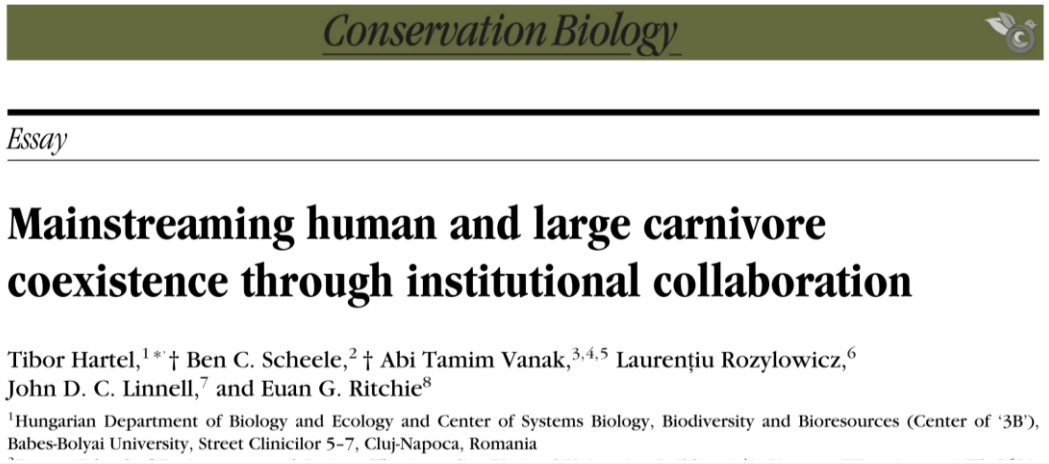
Coexistence through institutional collaboration

- “Embrace the principles and methods of sustainability sciences”
- “Create institutional spaces to implement transdisciplinary curricula”
- “Engage with institutions and stakeholders to create novel institutional structures that can respond to multiple challenges of human–large carnivore coexistence”



Conservation Biology

Essay

Mainstreaming human and large carnivore coexistence through institutional collaboration

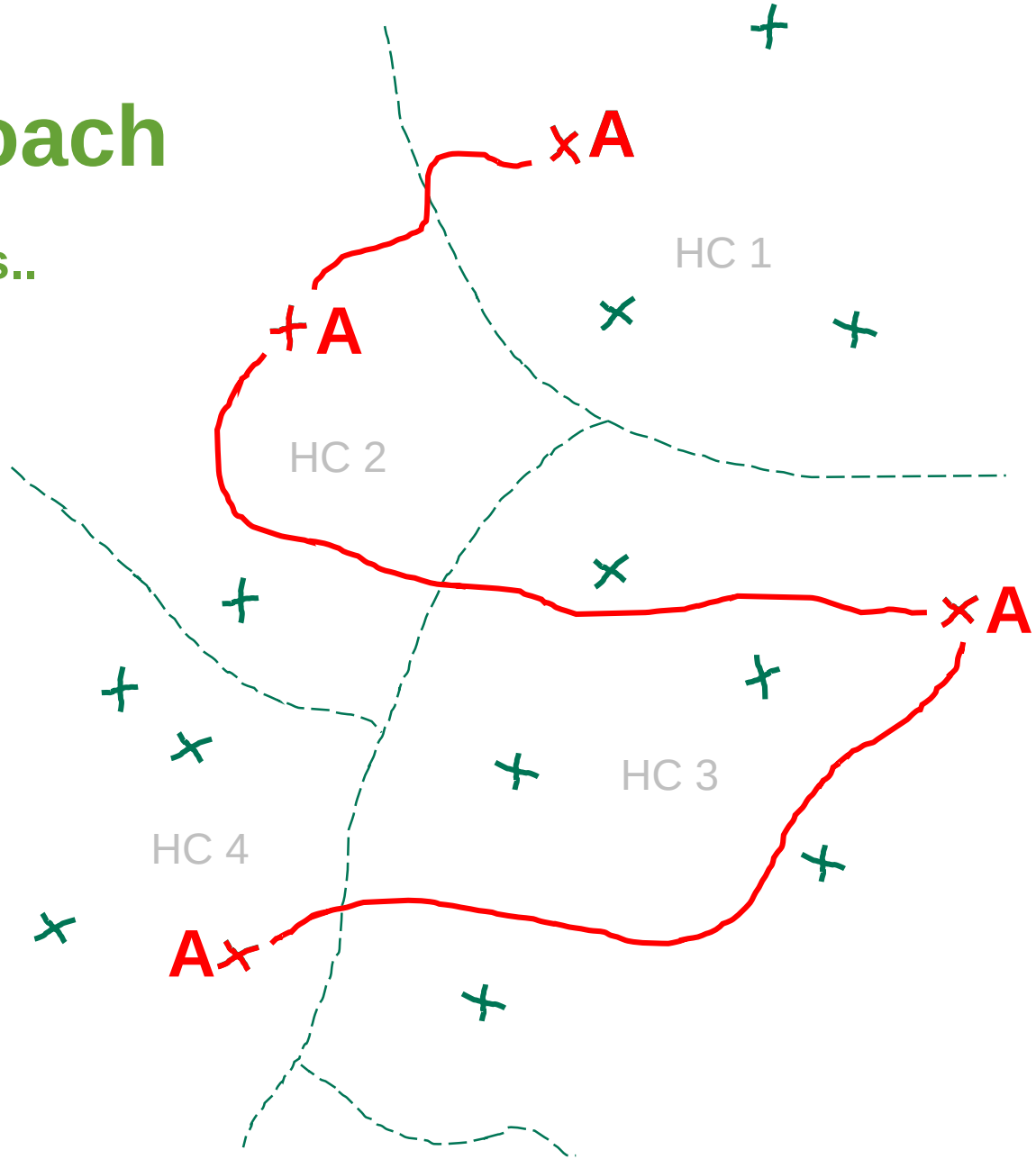
Tibor Hartel,[1]*† Ben C. Scheele,[2]† Abi Tamim Vanak,[3,4,5] Laurenţiu Rozylowicz,[6] John D. C. Linnell,[7] and Euan G. Ritchie[8]

[1]Hungarian Department of Biology and Ecology and Center of Systems Biology, Biodiversity and Bioresources (Center of ‘3B’), Babes-Bolyai University, Street Clinicilor 5–7, Cluj-Napoca, Romania

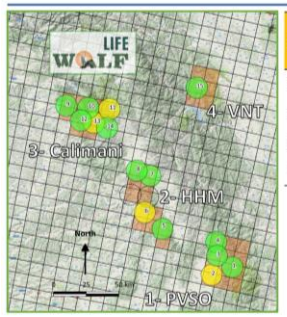
Current monitoring approach

Counting animals per Hunting Concessions..

- Uncertain observations at feeding points
- Uncertain track measurements
- Only a few regional initiatives performing a quantitative assessment (e.g. WolfLIFE)



Packs and Pairs distribution (2014-2017)

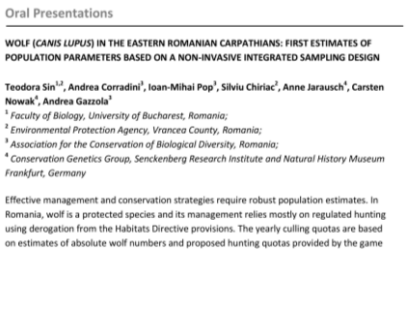


Study area	Wolf density (no./100km²)	Pack density (no./1000km²)
1-PVSO	1.75	2.50
2-HHM	1.91	3.33
3-Calimani	2.80	4.00
4-VNT	1.00	1.66

Pack size: 3-9 wolves/pack

Wolf density: 1.95 wolves/100km²

Pack density: 3.00 packs/1000 km²



Oral Presentations

WOLF (*CANIS LUPUS*) IN THE EASTERN ROMANIAN CARPATHIANS: FIRST ESTIMATES OF POPULATION PARAMETERS BASED ON A NON-INVASIVE INTEGRATED SAMPLING DESIGN

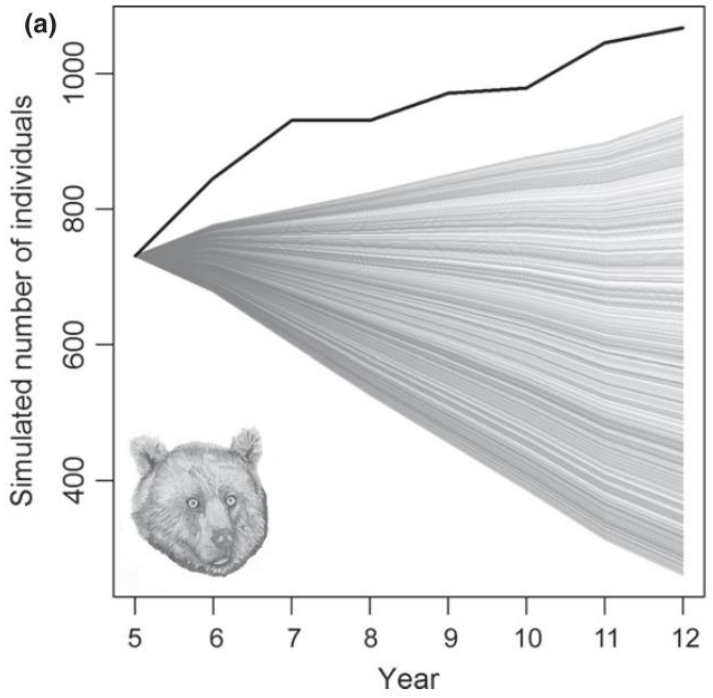
Teodora Sin[1,2], Andrea Corradini[3], Ioan-Mihai Pop[3], Silviu Chiriac[3], Anne Jarausch[4], Carsten Nowak[4], Andrea Gazzola[1]

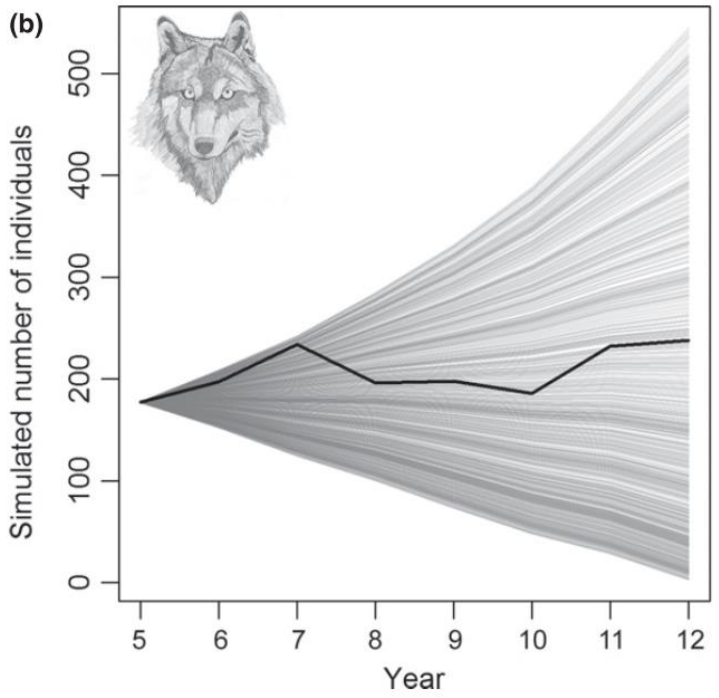
[1] *Faculty of Biology, University of Bucharest, Romania;*
[2] *Environmental Protection Agency, Vrancea County, Romania;*
[3] *Association for the Conservation of Biological Diversity, Romania;*
[4] *Conservation Genetics Group, Senckenberg Research Institute and Natural History Museum Frankfurt, Germany*

Effective management and conservation strategies require robust population estimates. In Romania, wolf is a protected species and its management relies mostly on regulated hunting using derogation from the Habitats Directive provisions. The yearly culling quotas are based on estimates of absolute wolf numbers and proposed hunting quotas provided by the game

Officially reported data unable to assisst management

- Growth rate for Romanian bear population is biologically unrealistic





Journal of Applied Ecology

Journal of Applied Ecology 2016, **53**, 1248–1259 doi: 10.1111/1365-2664.12660

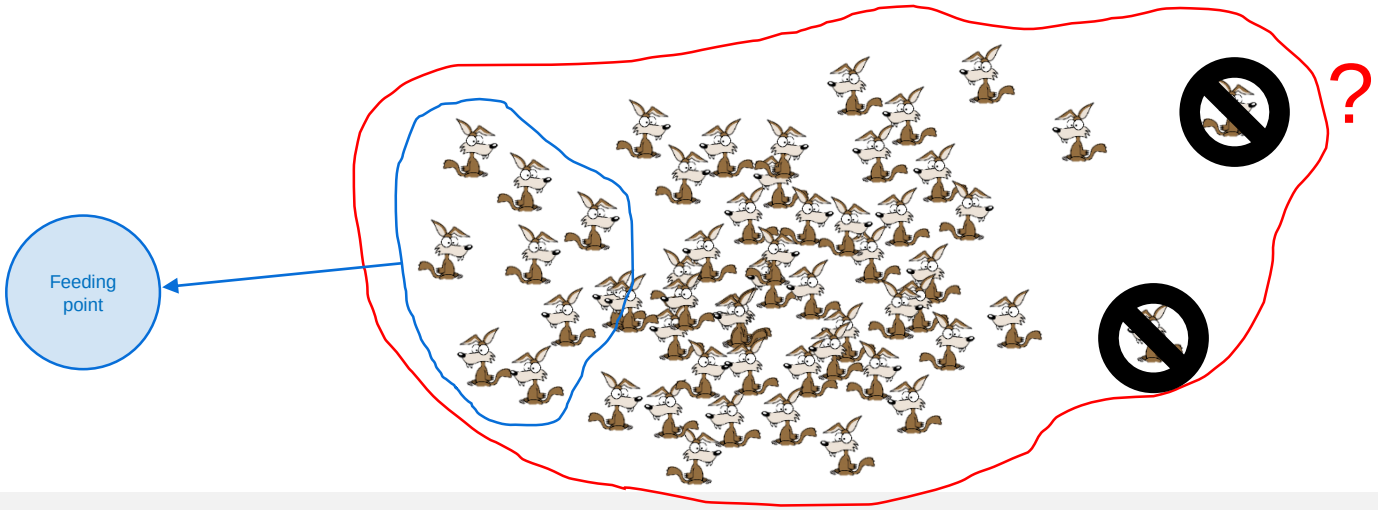
Assessing biological realism of wildlife population estimates in data-poor systems

Viorel D. Popescu[1,2*†], Kyle A. Artelle[3,4†], Mihai I. Pop[1,5], Steluta Manolache[1,5] and Laurentiu Rozylowicz[1]

[1]Centre for Environmental Research (CCMESI), University of Bucharest, Bucharest, Romania; [2]Department of Biological Sciences, Ohio University, Athens, OH, USA; [3]Earth to Ocean Research Group, Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada; [4]Raincoast Conservation Foundation, Sidney, BC, Canada; and [5]Asociatia pentru Conservarea Diversitatii Biologice (ACDB), Focsani, Romania

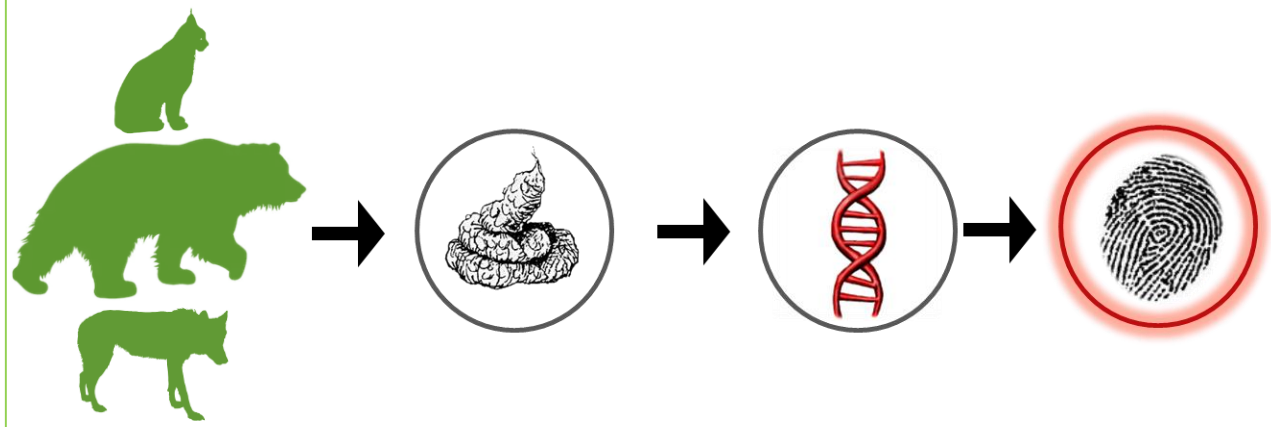
Knowledge gaps towards coexistence and sustainable decision making in Romania

- Robust population estimates
- Assess effects of supplemental feeding in species ecology, behavior, population structure
- Effects of extracting or relocating conflictual individuals



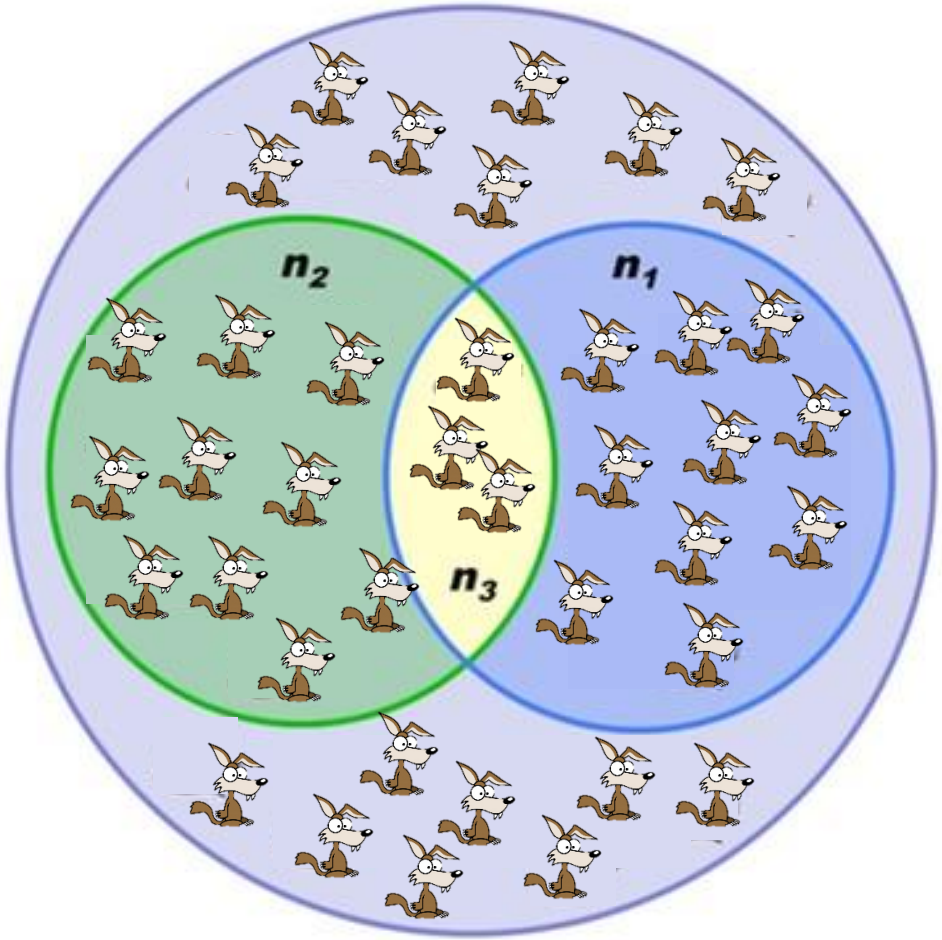
Long term monitoring of populations

- Non-invasive DNA samples



- Systematic camera trapping

Concept of mark-recapture



Total Population

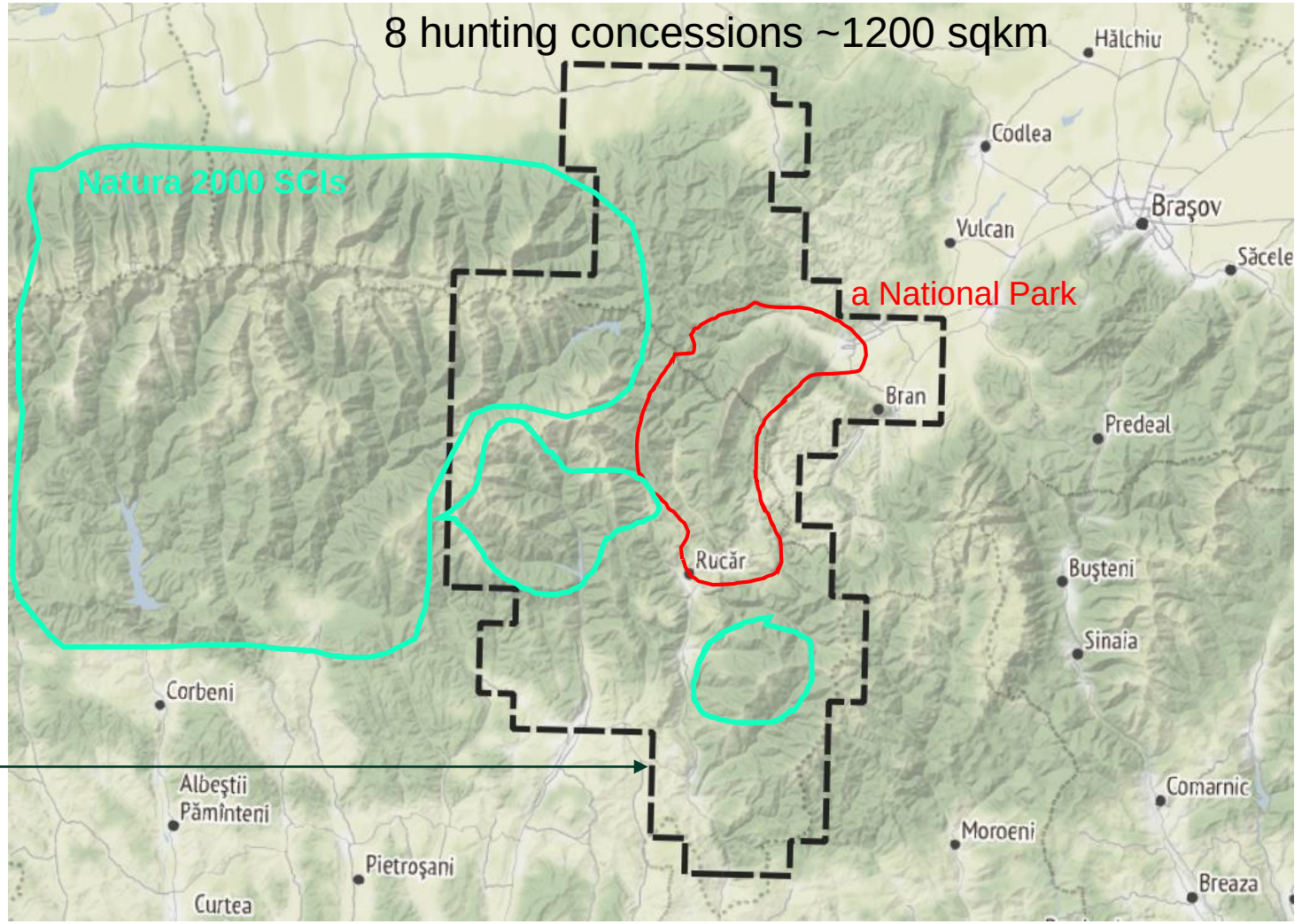
First Capture (n_1)

Second Capture (n_2)

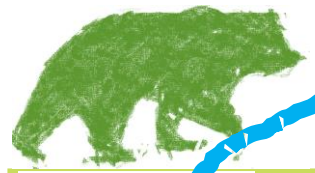
Recaptures (n_3)

$$\frac{n_3}{n_2} = \frac{n_1}{n_{total}}$$

Monitoring area



Data collected so far



analyzed

780 samples

aug – nov 2017

work in progress

720 samples

aug – nov 2018

2021

23 samples
43 trap days

feb – mar 2018

40 samples
105 trap days

dec 2018 – apr 2019

oct-dec
2019

147 samples

oct 2017 – mar 2018

dec 2019-apr
2020

Brown bear

Results for 2017 season

- Number of genotyped individuals
- Sex ratio
- Detection probability
- Recapture rate
- Abundance
- Density

Brown bear

01 780 non-invasive DNA samples:

→ 536 feces

→ 238 hair samples

→ 6 urine & tissue

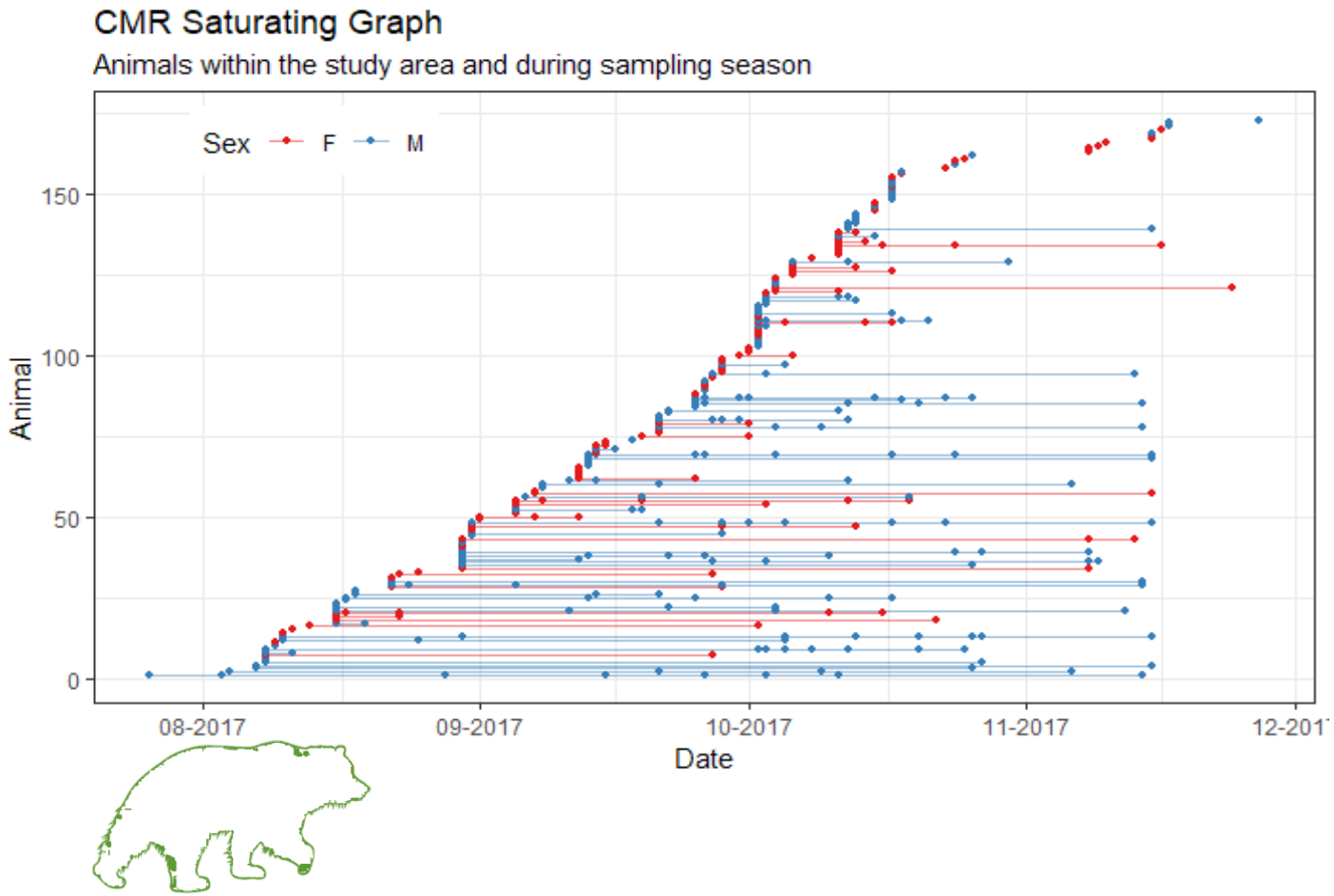
genotyping success = 68.7%

02 The number of successfully genotyped individuals = **173 (83♀, 91♂)**

03 **~ 2.8** recaptures / individual

Brown bear

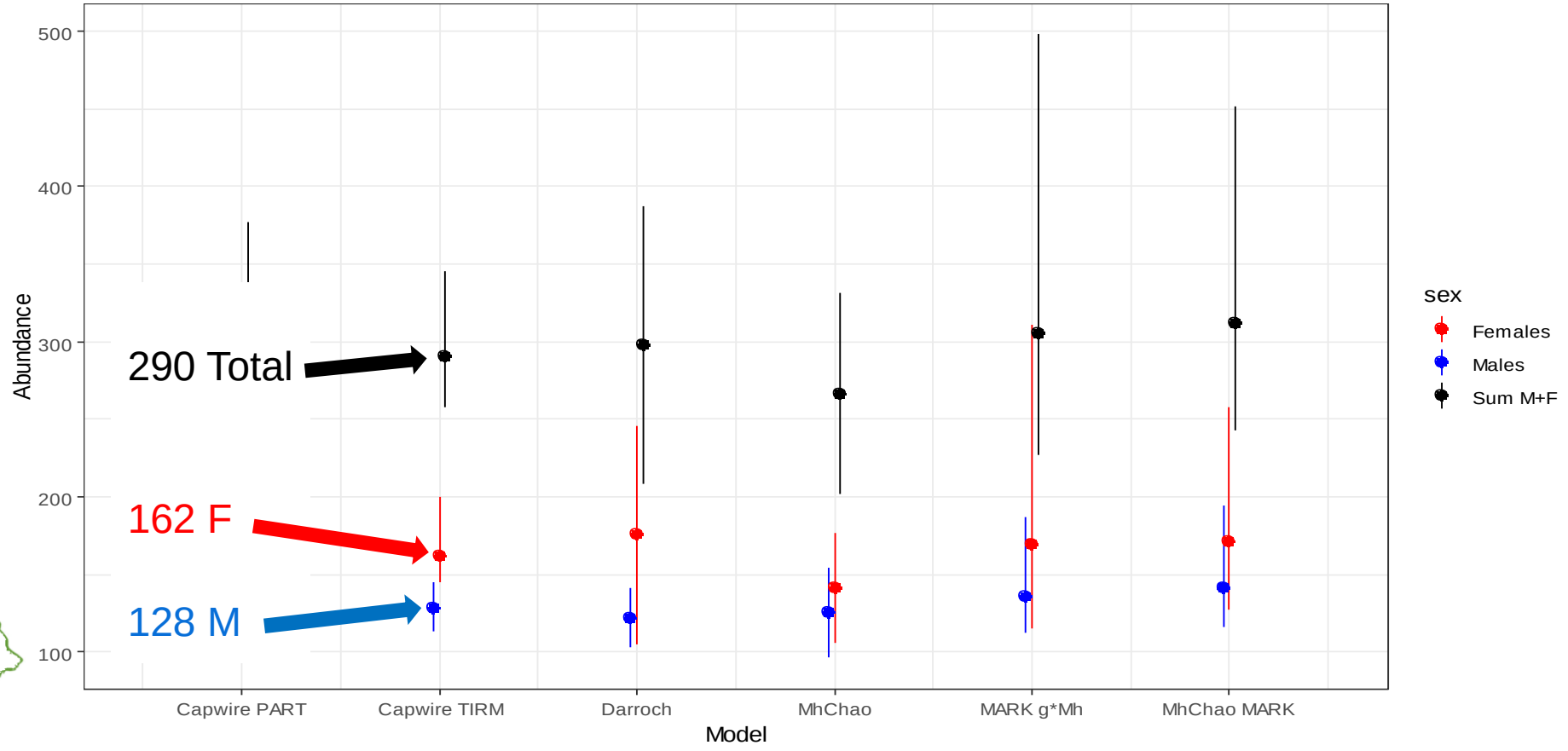
04 Higher detection probability and recapture rates



Bear males have higher detectability at rubbing trees.

Brown bear

05 Estimated number of individuals revealed a sex ratio biased towards females **- a hunted population**

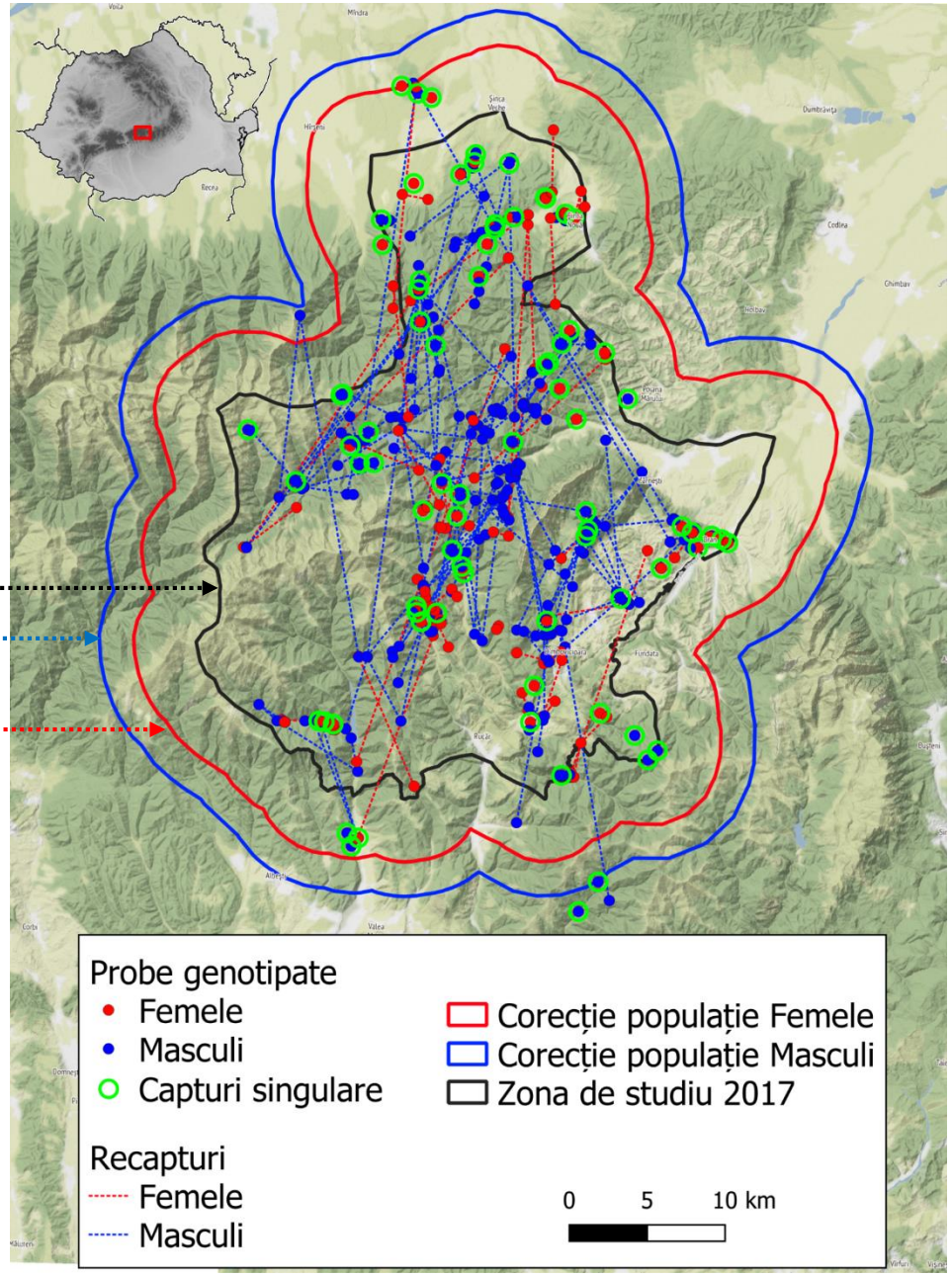


Brown bear

06 Final numbers – density estimates

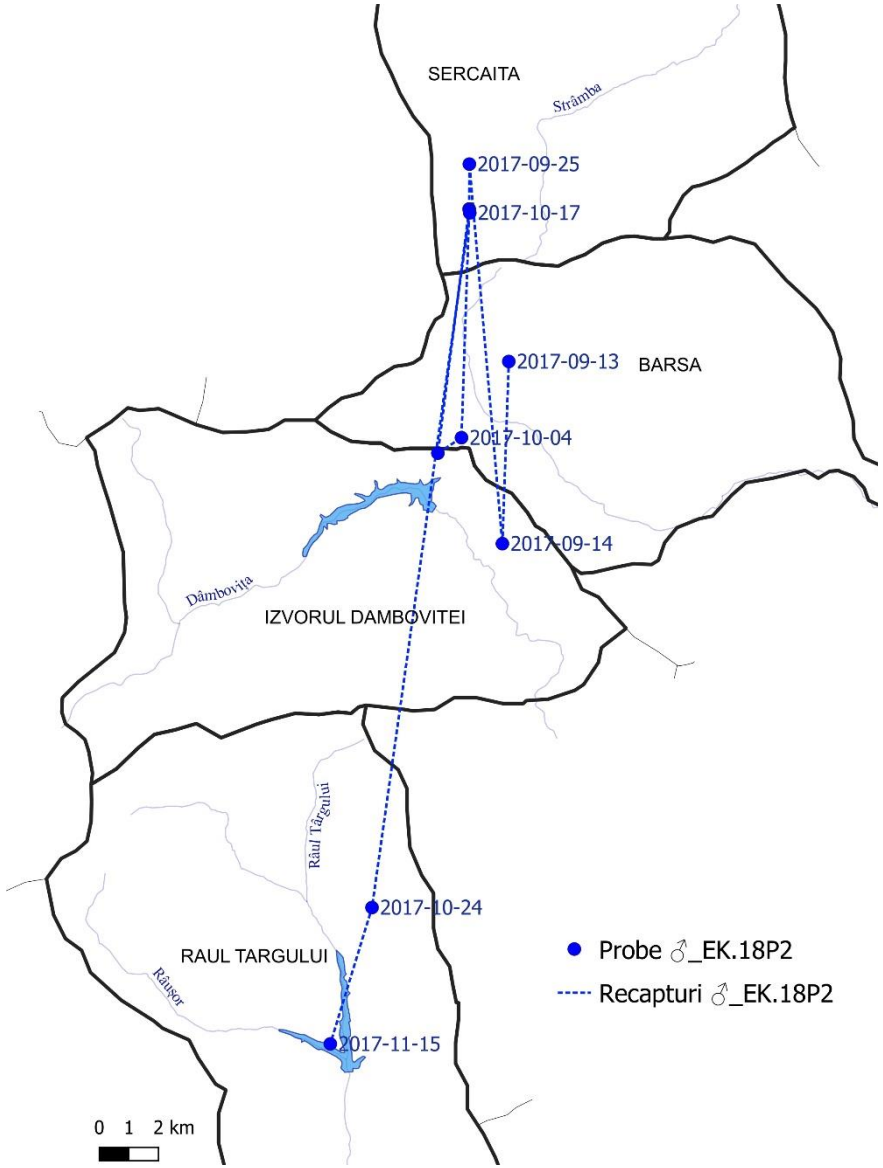
	N	Cid	Ciu
Superpopulation Size	290	258	345
Local Population Size	152	123	202
Population Density [bears/100 km2]			
Total Density	16.9	13.6	22.4
Density Males	6.5	5.4	8.0
Density Females	10.3	8.2	14.4

Officially reported data for 2017 show a total density of **21.9 bears / 100 sqkm** for the 8 GMUs overlapping the monitoring area.



Brown bear

07 Long distance moves



Wolf

Results for winter 2017-2018

- Number of genotyped individuals
- Sex ratio
- Size and pack structure (pedigree reconstruction)
- Abundance

Wolf

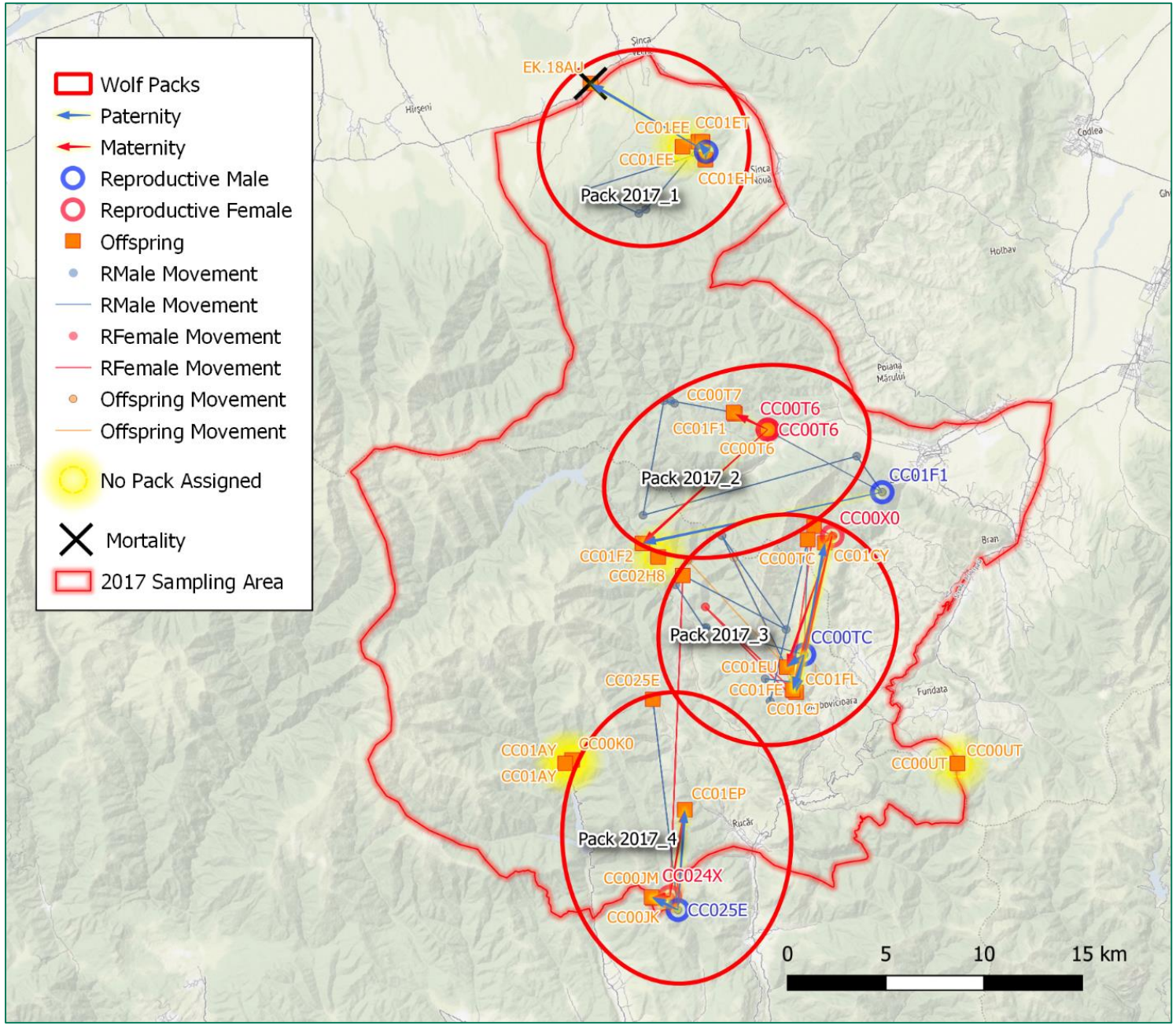
01 147 non-invasive DNA samples:
→ 53.7% wolf samples
→ 6.8% dog or fox samples
→ 8.2% mixt samples (urine)
→ 31.3% degraded DNA samples (scat and hair)

02 The number of successfully genotyped individuals = **26**

03 **Sex ratio: 11♂ and 15♀**

04 **21 individuals belong to 4 packs (pack size = ~5 individuals)**

Wolf

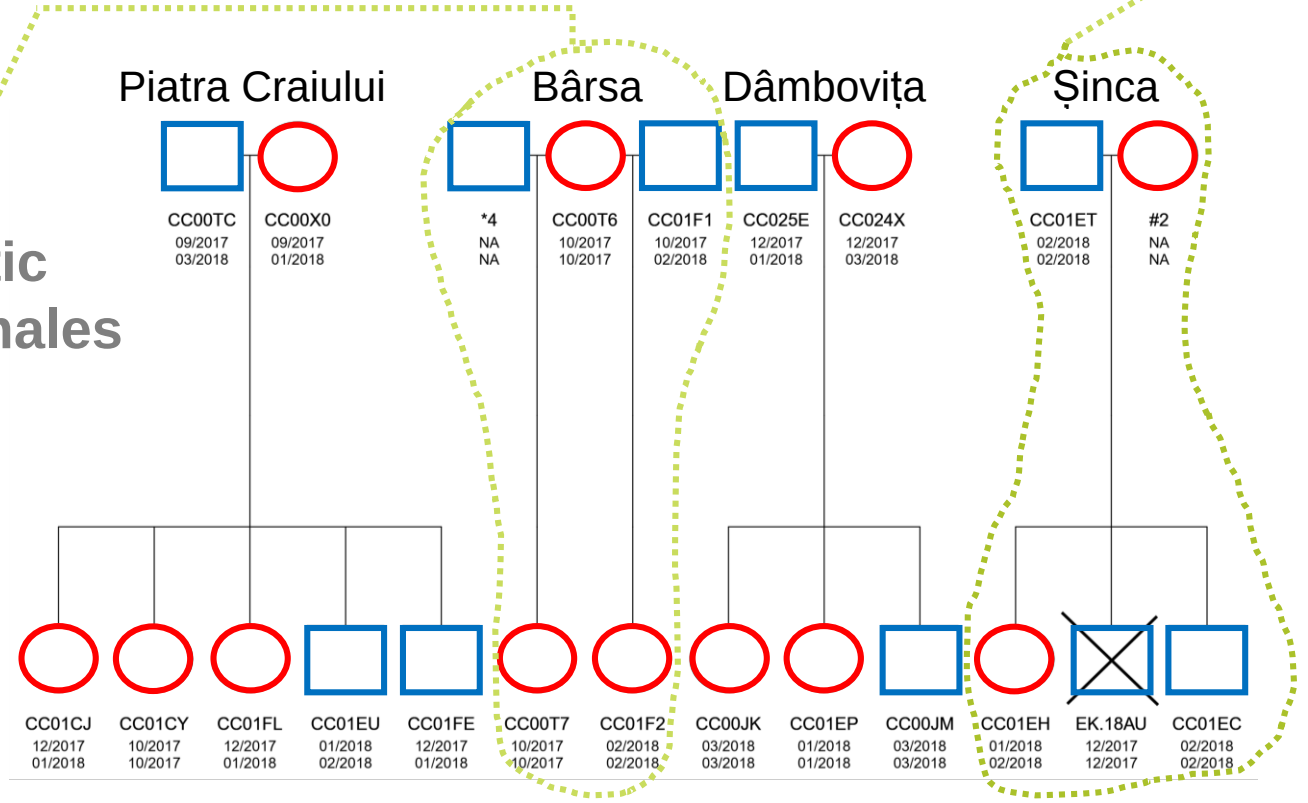

Wolf Packs
Paternity
Maternity
Reproductive Male
Reproductive Female
Offspring
RMale Movement
RMale Movement
RFemale Movement
RFemale Movement
Offspring Movement
Offspring Movement
No Pack Assigned
Mortality
2017 Sampling Area
EK.18AU
CC01EE
CC01ET
CC01EE
CC01EH
Pack 2017_1
CC00T7
CC00T6
CC01F1
CC00T6
CC00T6
Pack 2017_2
CC01F1
CC00X0
CC01F2
CC02H8
CC00TC
CC01CY
Pack 2017_3
CC00TC
CC01EU
CC01FL
CC025E
CC01FE
CC01
CC01AY
CC00K0
CC01AY
CC00UT
CC00UT
CC01EP
Pack 2017_4
CC00JM
CC024X
CC00JK
CC025E
0
5
10
15 km

Wolf

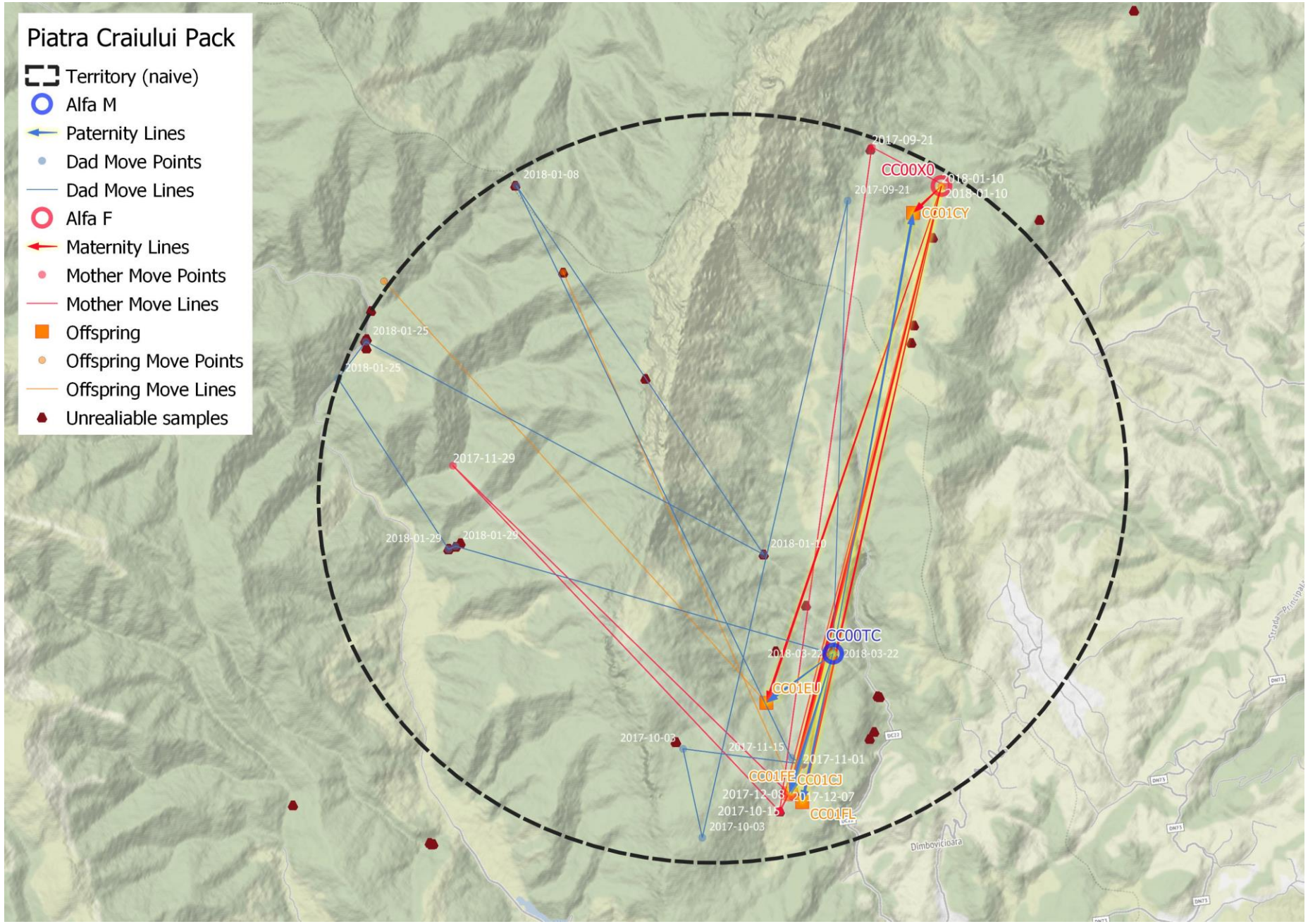
05 Pedigree reconstruction → identified parental relations between individuals and assigned individuals to four different packs.

Missing alpha female

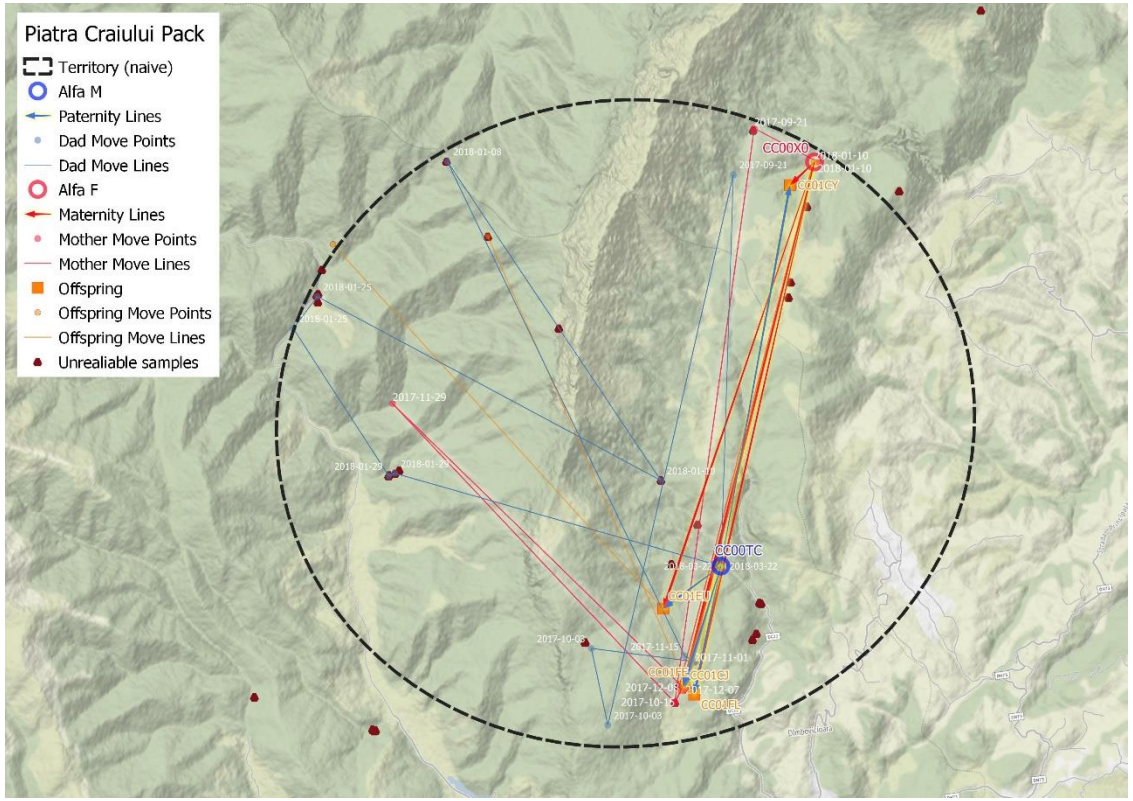
Offspring have genetic traces of two alpha males

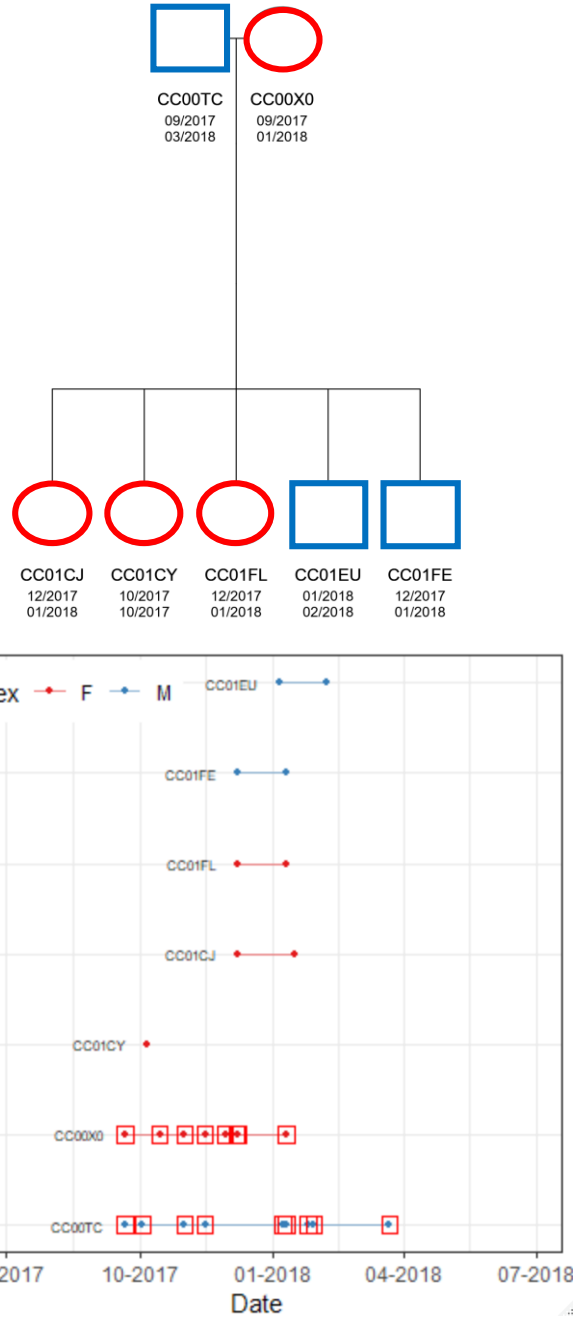


Wolf


Piatra Craiului Pack
Territory (naive)
Alfa M
Paternity Lines
Dad Move Points
Dad Move Lines
Alfa F
Maternity Lines
Mother Move Points
Mother Move Lines
Offspring
Offspring Move Points
Offspring Move Lines
Unrealiable samples
2017-09-21
CC00X0
2018-01-10
2018-01-10
2017-09-21
CC01CY
2018-01-08
2018-01-25
2018-01-25
2017-11-29
2018-01-29
2018-01-29
2018-01-10
CC00TC
2018-03-22
2018-03-22
CC01EU
2017-10-03
2017-11-15
2017-11-01
CC01FE
CC01CJ
2017-12-08
2017-12-07
2017-10-15
CC01FL
2017-10-03
Dimbovicioara

Wolf

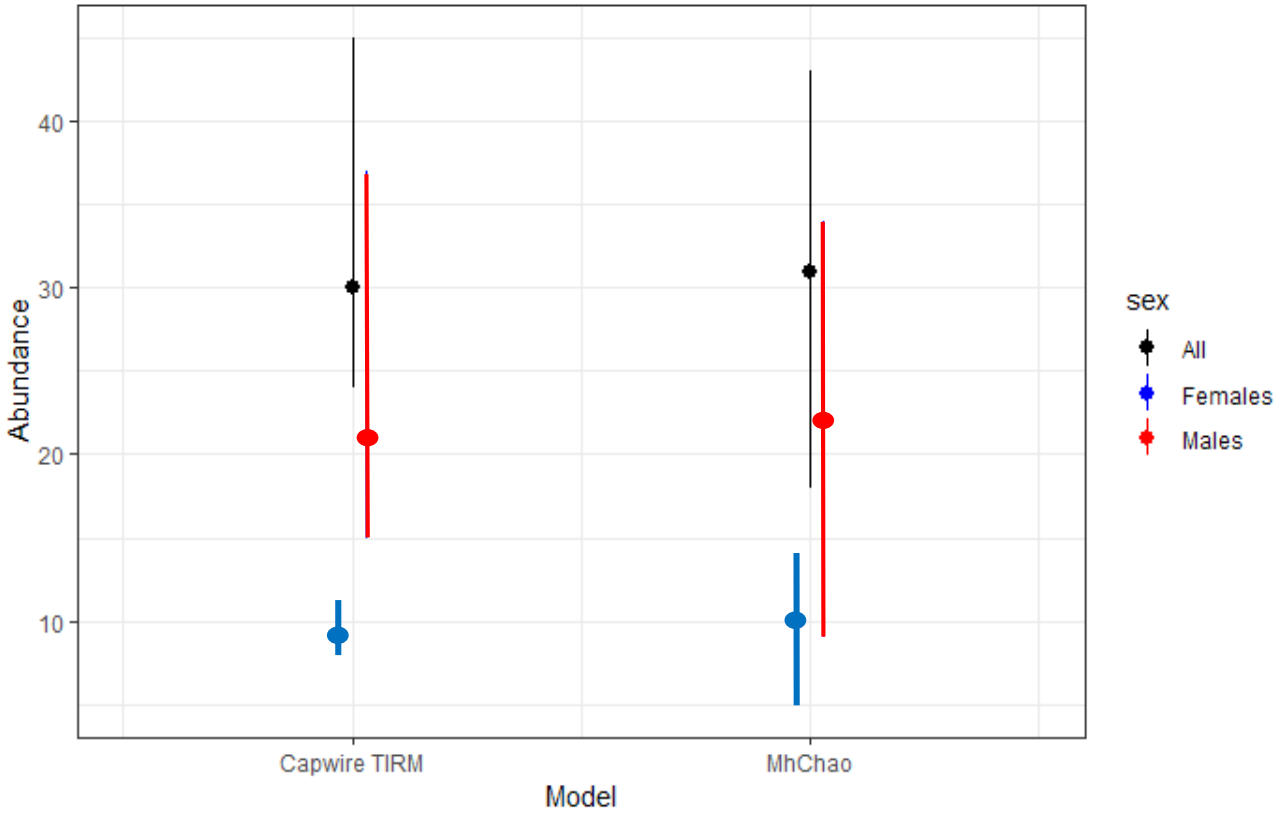

Piatra Craiului Pack
Territory (naive)
Alfa M
Paternity Lines
Dad Move Points
Dad Move Lines
Alfa F
Maternity Lines
Mother Move Points
Mother Move Lines
Offspring
Offspring Move Points
Offspring Move Lines
Unrealiable samples
CC00X0
CC01CY
CC00TC
CC01EU
CC01FE
CC01CJ
CC01FL


CC00TC
09/2017
03/2018
CC00X0
09/2017
01/2018
CC01CJ
12/2017
01/2018
CC01CY
10/2017
10/2017
CC01FL
12/2017
01/2018
CC01EU
01/2018
02/2018
CC01FE
12/2017
01/2018
Sex
F
M
Animal
6
4
2
07-2017
10-2017
01-2018
04-2018
07-2018
Date

Wolf

06 Abundance estimates

Model	Sex	N	95% CI
Capwire TIRM	**All**	**31**	**25 - 46**
Capwire TIRM	**Males**	**10**	**9 - 12**
Capwire TIRM	**Females**	**21**	**15 - 37**
MhChao	All	32	19 - 44
MhChao	Males	11	6 - 15
MhChao	Females	22	9 - 34



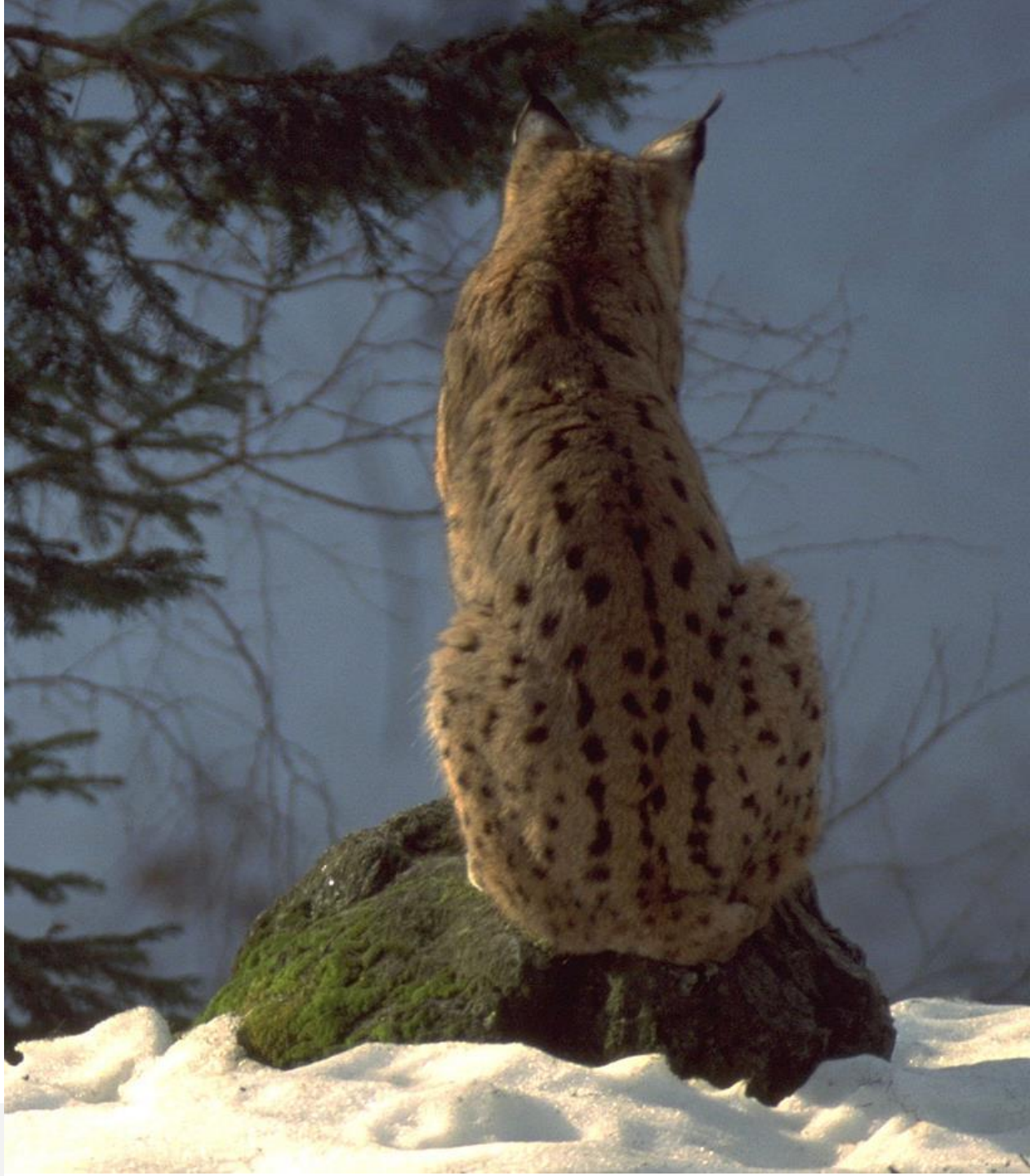
Lynx

III Non-invasive DNA sampling

- Lynx samples (especially hair) are degraded

IV Camera trapping

- Two sessions
  - winter 2017-2018
  - winter 2018-2019
- Number of “captured” individuals
- Number of females with cubs
- Detection probability
- Recapture rate
- Density



Lyn

01


we probably collected “dead” hair left behind with degraded DNA

Lynx – camera trapping

01 Session 1: 47 traps → 40 trap days

02 Lynx detected at 20 traps
42%

03 37 detections
not all good enough to identify individuals

Lynx – camera trapping

04 12 unique individuals

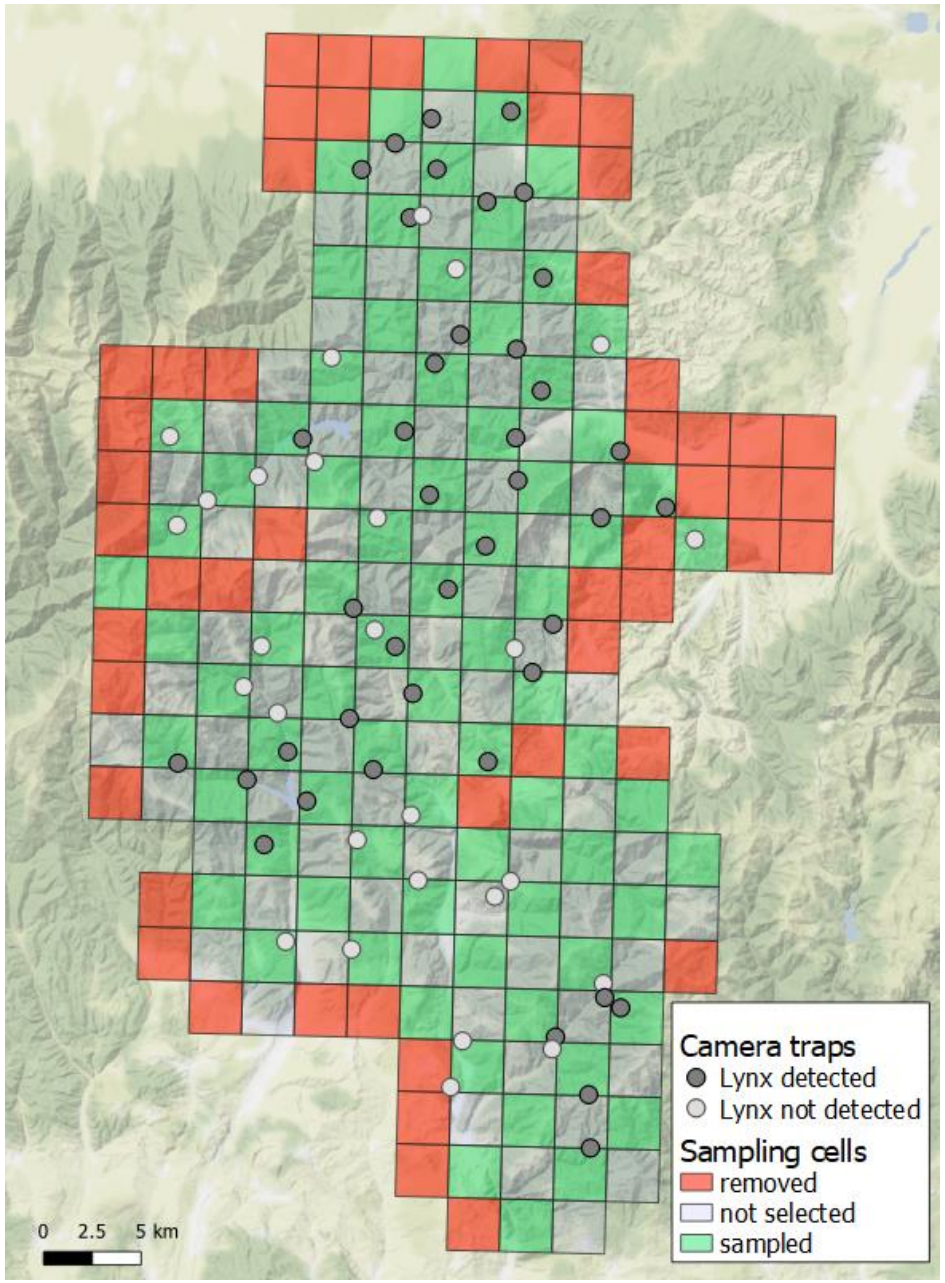
05 Recapture rate = 1.4 → not enough for population estimates

Lynx – camera trapping

01 Session 2: 64 traps → 105 trap days

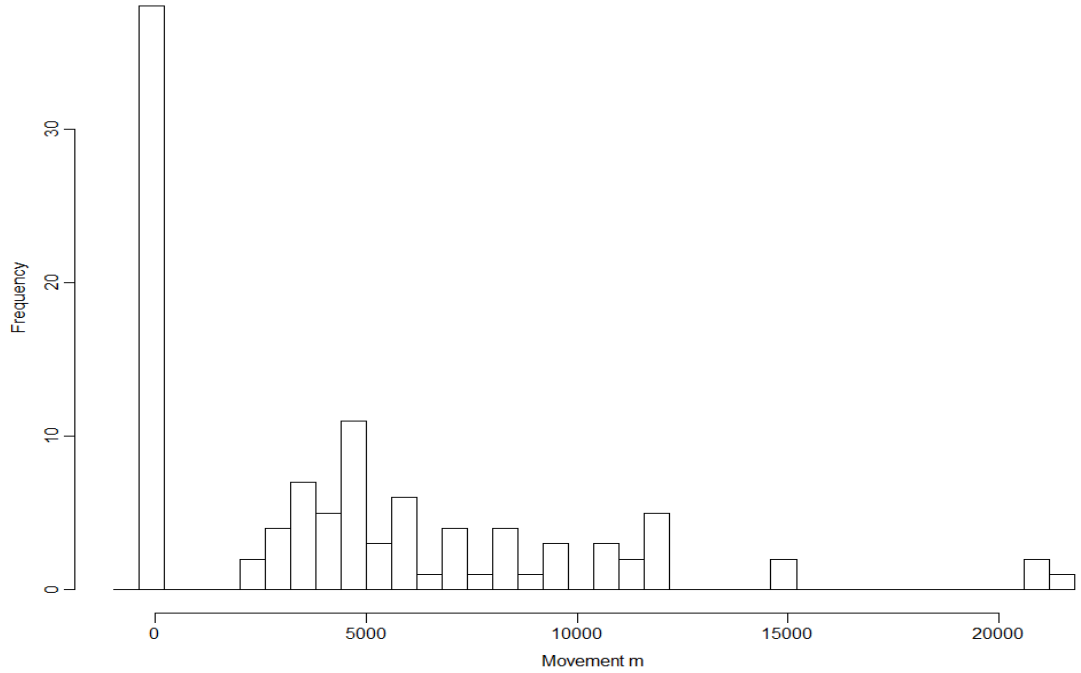
02 Lynx detected at 40 traps

63.5%

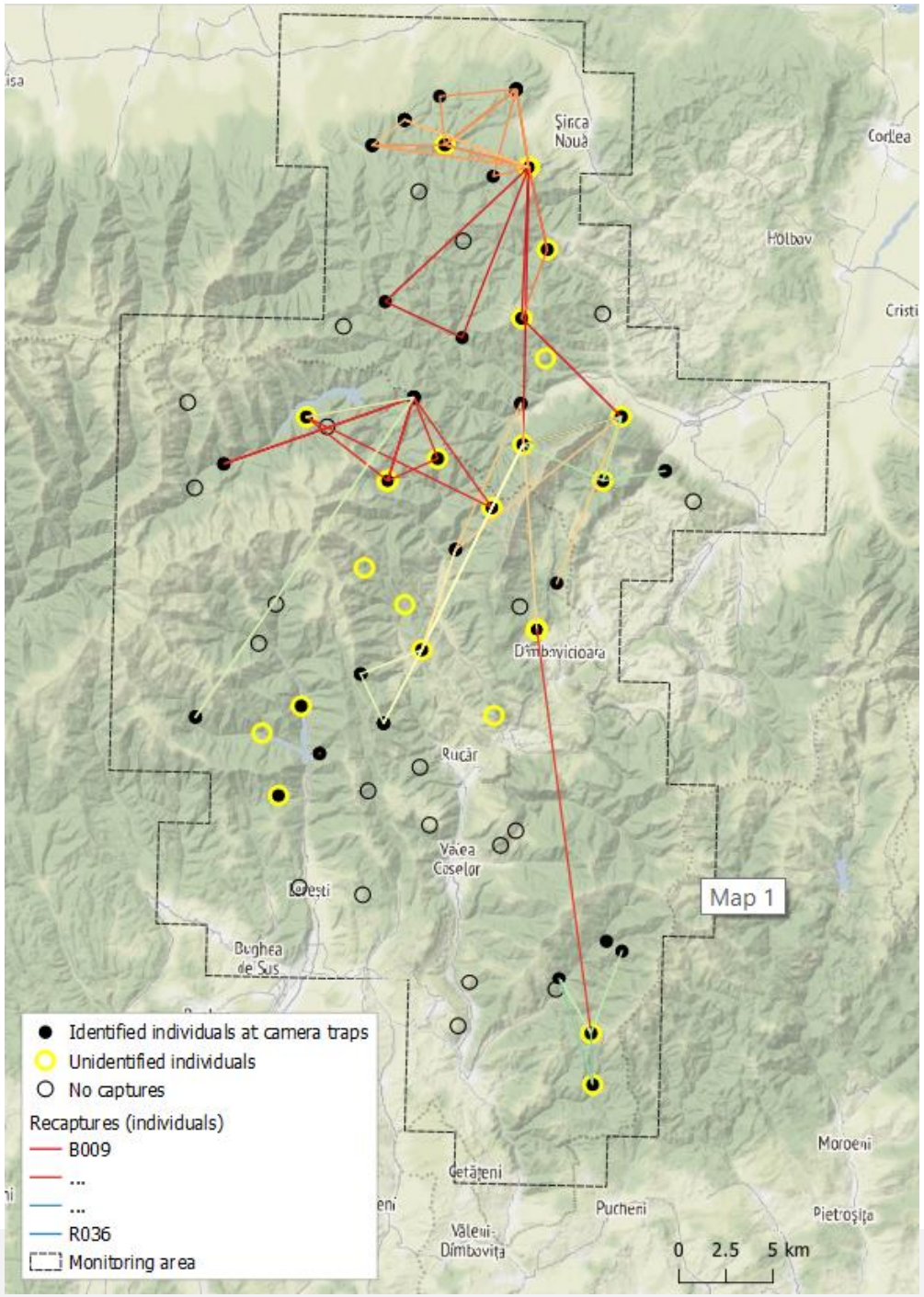


Lynx – camera trapping

03 A catalog of 31 unique individuals
4 females with cubs

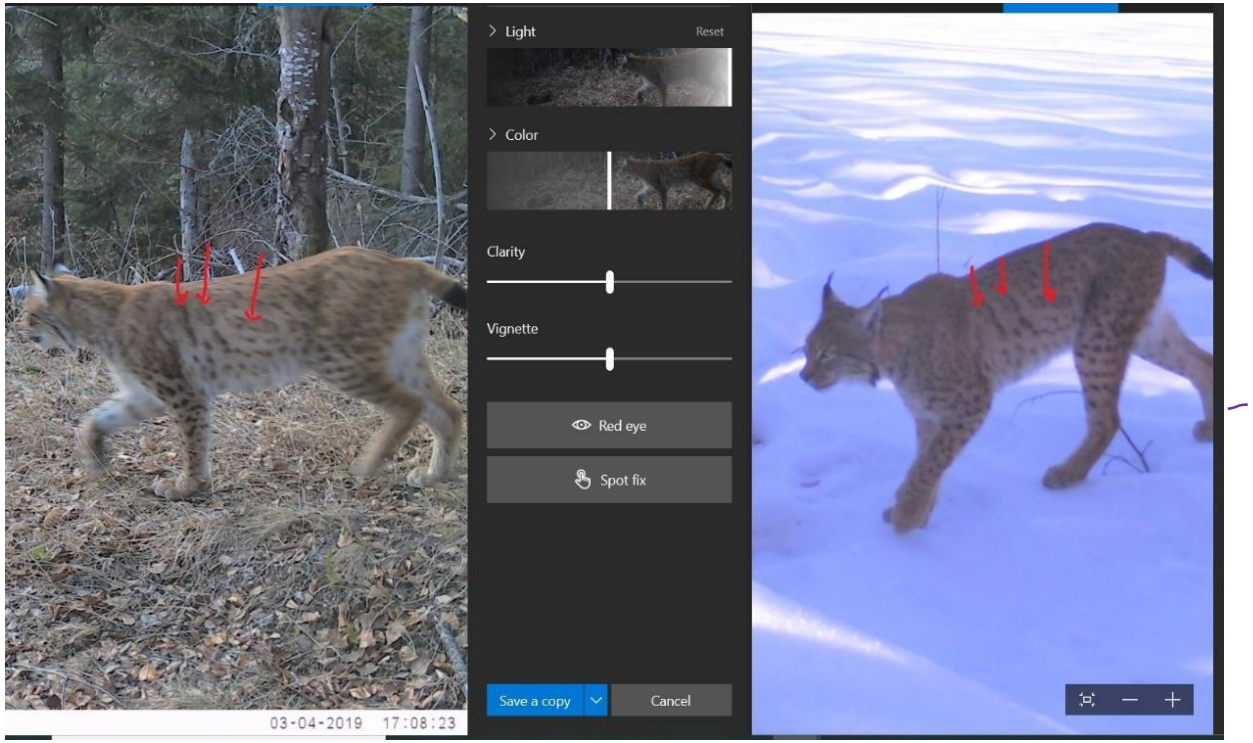


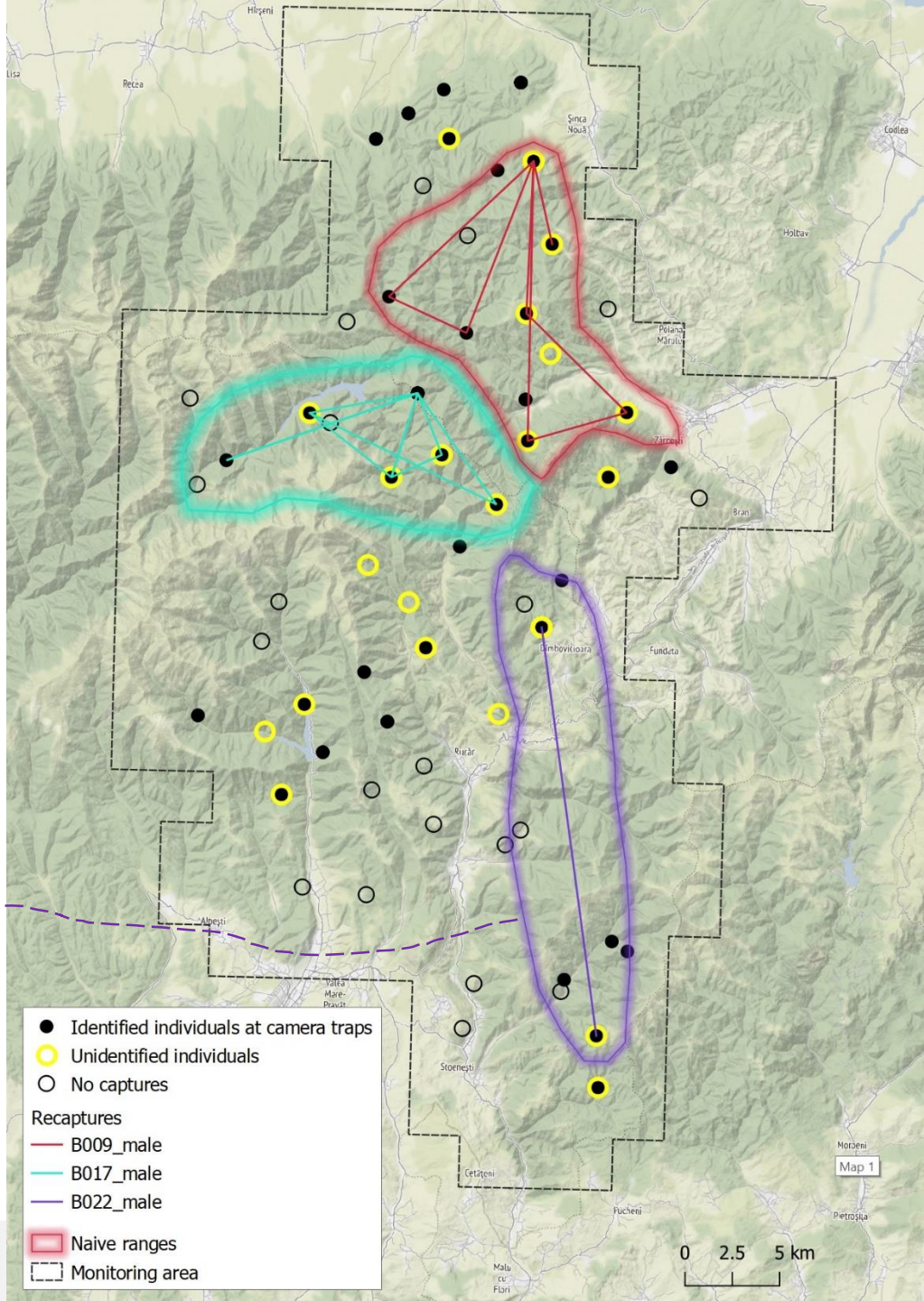
04 Average recapture rate per individual = **3.64**



Lynx – camera trapping

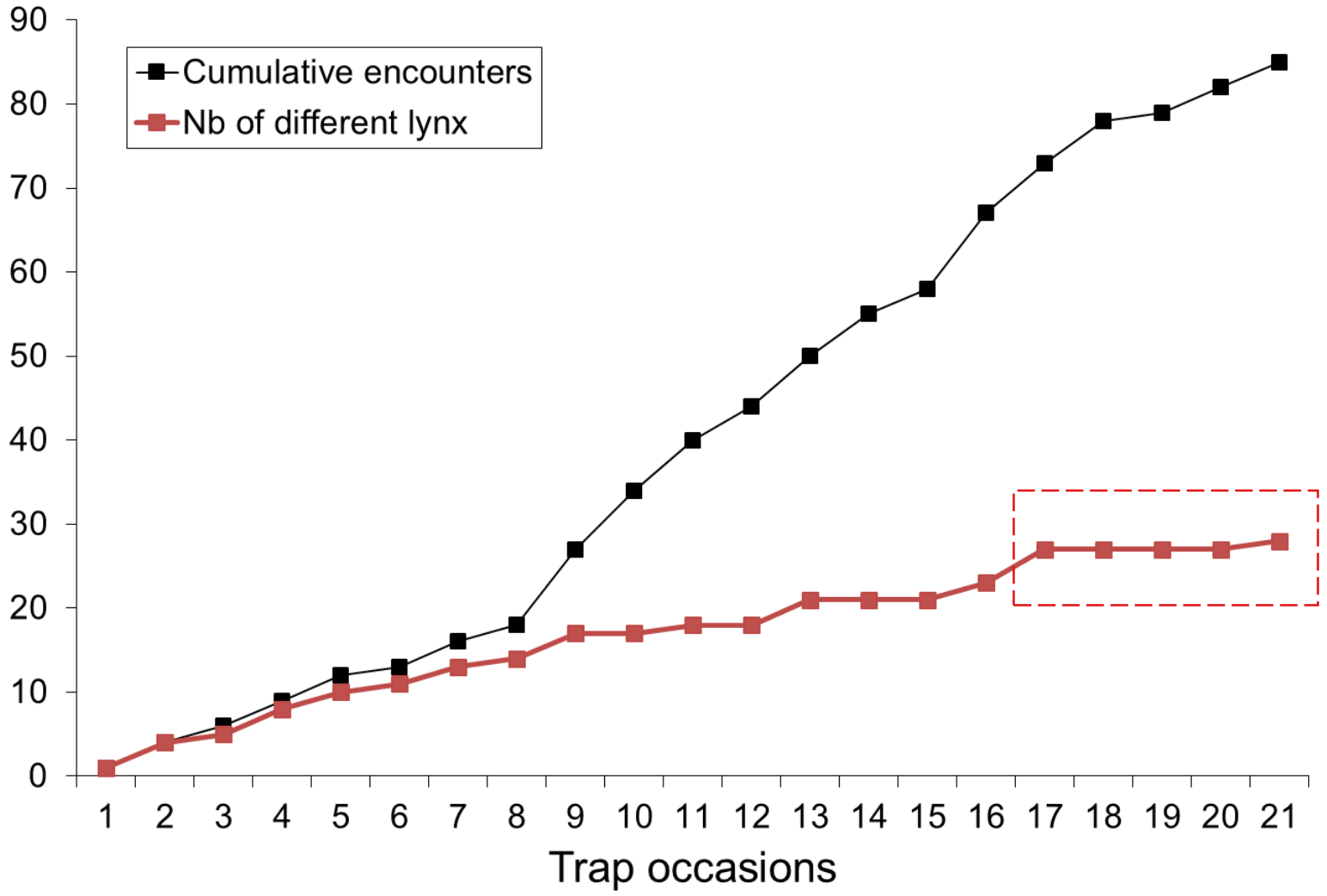
05 Examples





Lynx – camera trapping

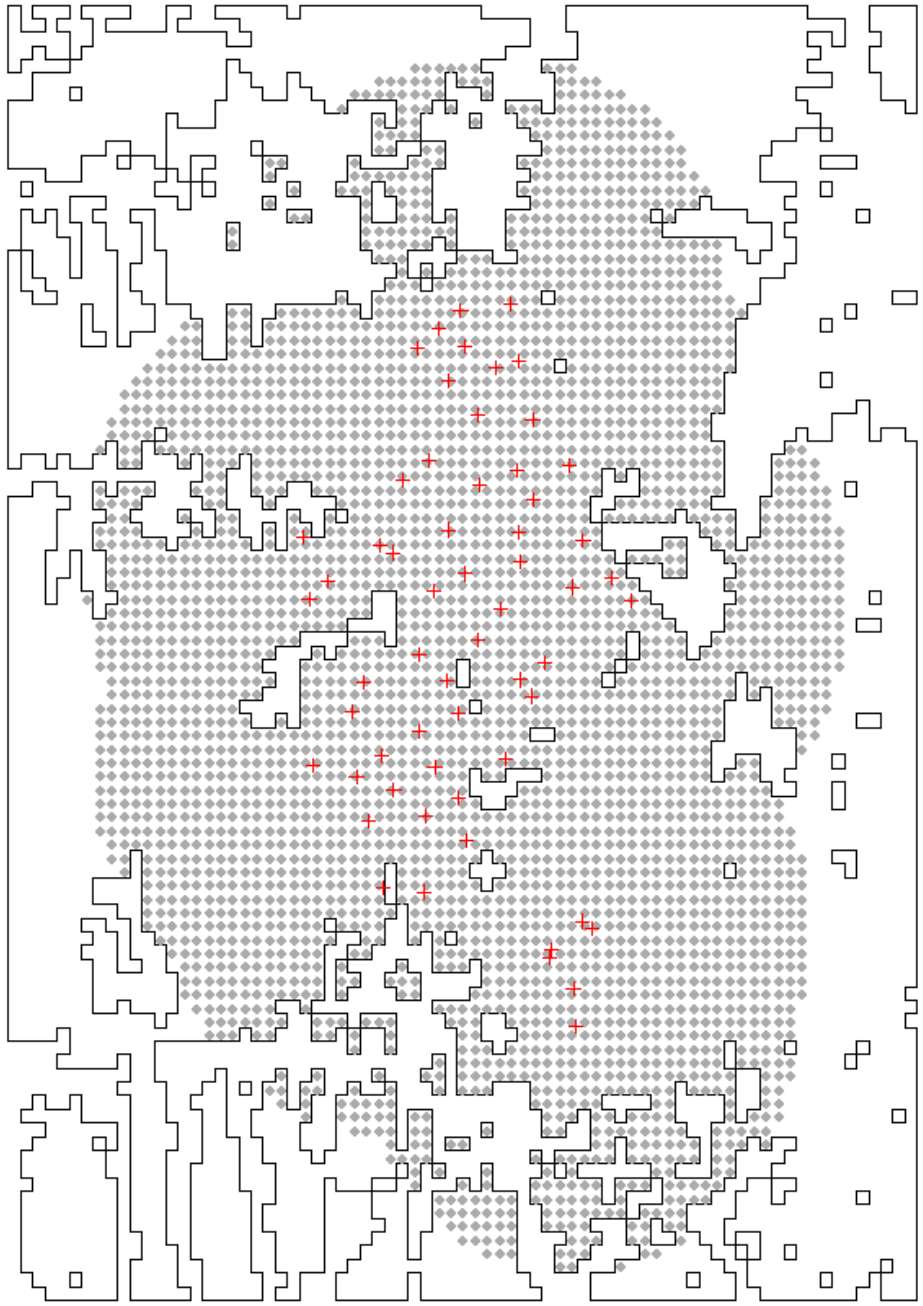
05 Encounter history



Lynx – camera trapping

05 Density estimates

Local population density (lynx / 100 sqkm)	N	Cid	Ciu
secr.usage	2.02	1.36	2.98
secr.null	1.91	1.31	2.77
secr.t	1.91	1.31	2.77



Take home message

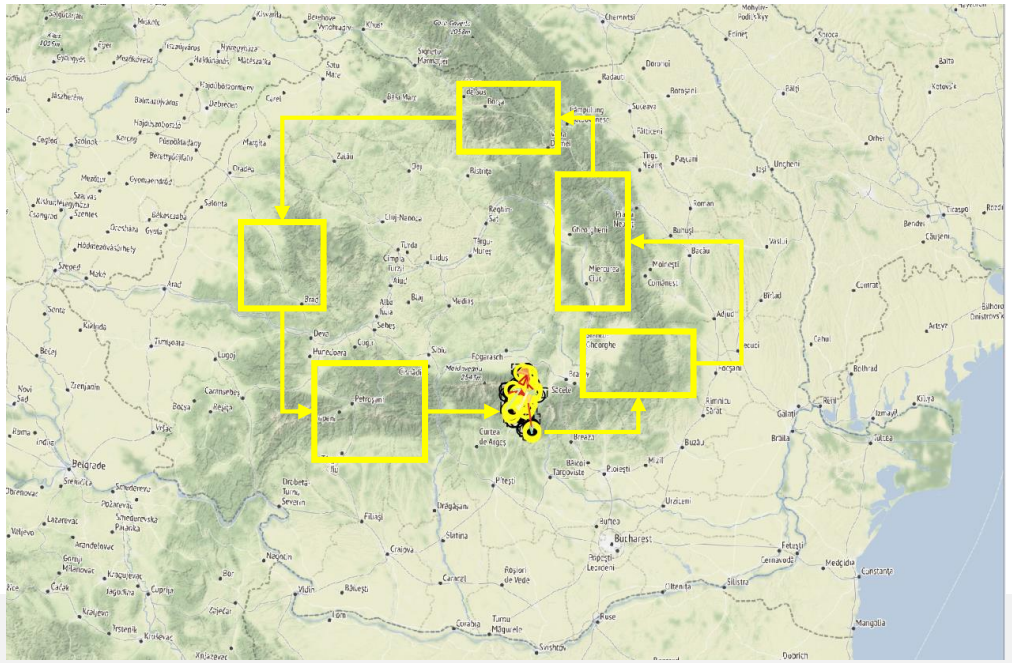
Lynx

- Genetics is not working
- Camera trapping works fine – detailed results for decision making
- Byproducts - data on other species (ungulates abundance, predator-prey overlap, human disturbances, etc.)

Take home message

The possibility of using these model studies nationwide

- We need competent lab and scientists (transparency)
- Collaboration between hunters, game wardens and researchers



Thank you!

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12 Cristianului St., Brasov – Romania
info@carpathia.org

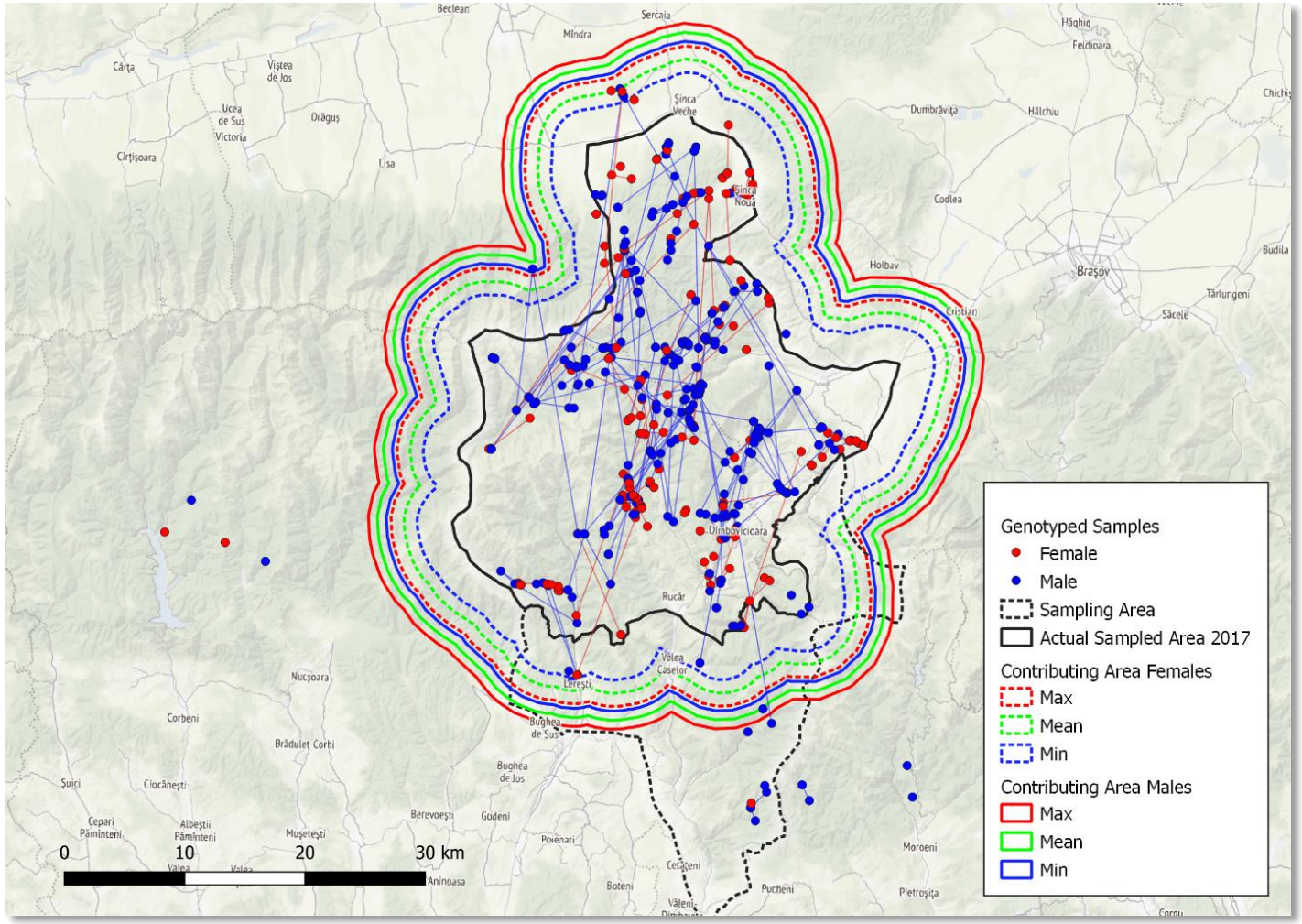
Acknowledgements
Our monitoring team: Daniel Bârloiu, Liviu Bulgaru, Viorel Ganci, Radu Geantă, Nelu Moșu, Răzvan Rohan, Bogdan Sulică, Călin Șerban, Laviniu Terciu, Claudiu Țoanță

Agreements: Asoc. de Vânătoare Bârsa Brașov, RPL de Adm. a Pădurilor Zărnești, Adm. Parcului Național Piatra Craiului, AVPS Jderul Argeș, AVPS GTS Muntenia Argeș, AV Piatra Craiului Făgăraș Conservation, OS Carpathia

Backup Slide 1

Edge effect – brown bear individuals from outside the monitoring area, those of which home range only partially overlap with our monitoring area

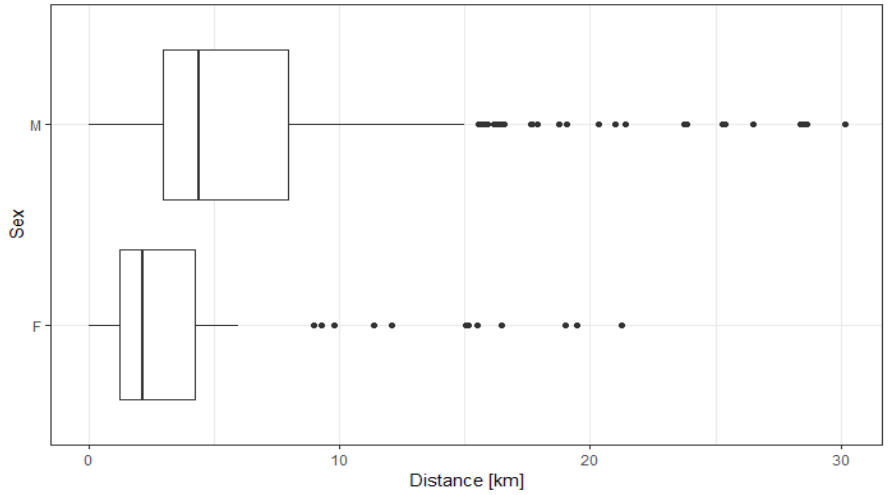
- To calculate local density we applied a spatial correction around our monitoring area.
- This buffer (correction factor) is calculated per sexes based on the distance between recaptures of the same individuals.

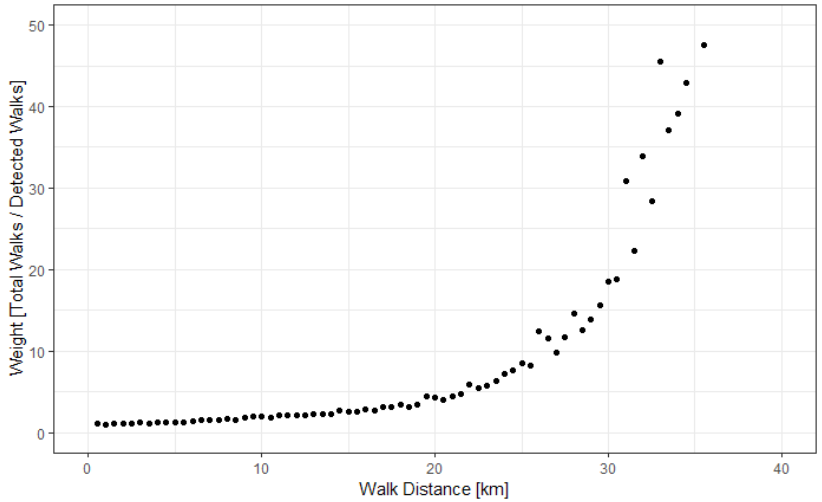


Backup Slide 2

Edge effect – brown bear individuals from outside the monitoring area, those of which home range only partially overlap with our monitoring area

- The buffer is bootstraped around a mean, minimum and a maximum distance moved. The parameter used to calculate this buffer is called **M**ean **M**aximum **D**istance **M**oved

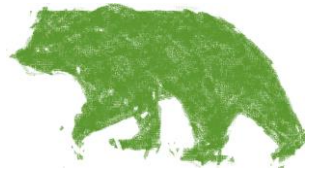




	area [km2]	min	max	MMDM [m]	min	max
Sampling Area	899	899	899			
Males Buffer	1956	1822	2093	12511	11013	14009
Females Buffer	1566	1382	1755	8059	5872	10246
CF Males	0.459	0.493	0.430			
CF Females	0.574	0.650	0.512			

Backup Slide 3

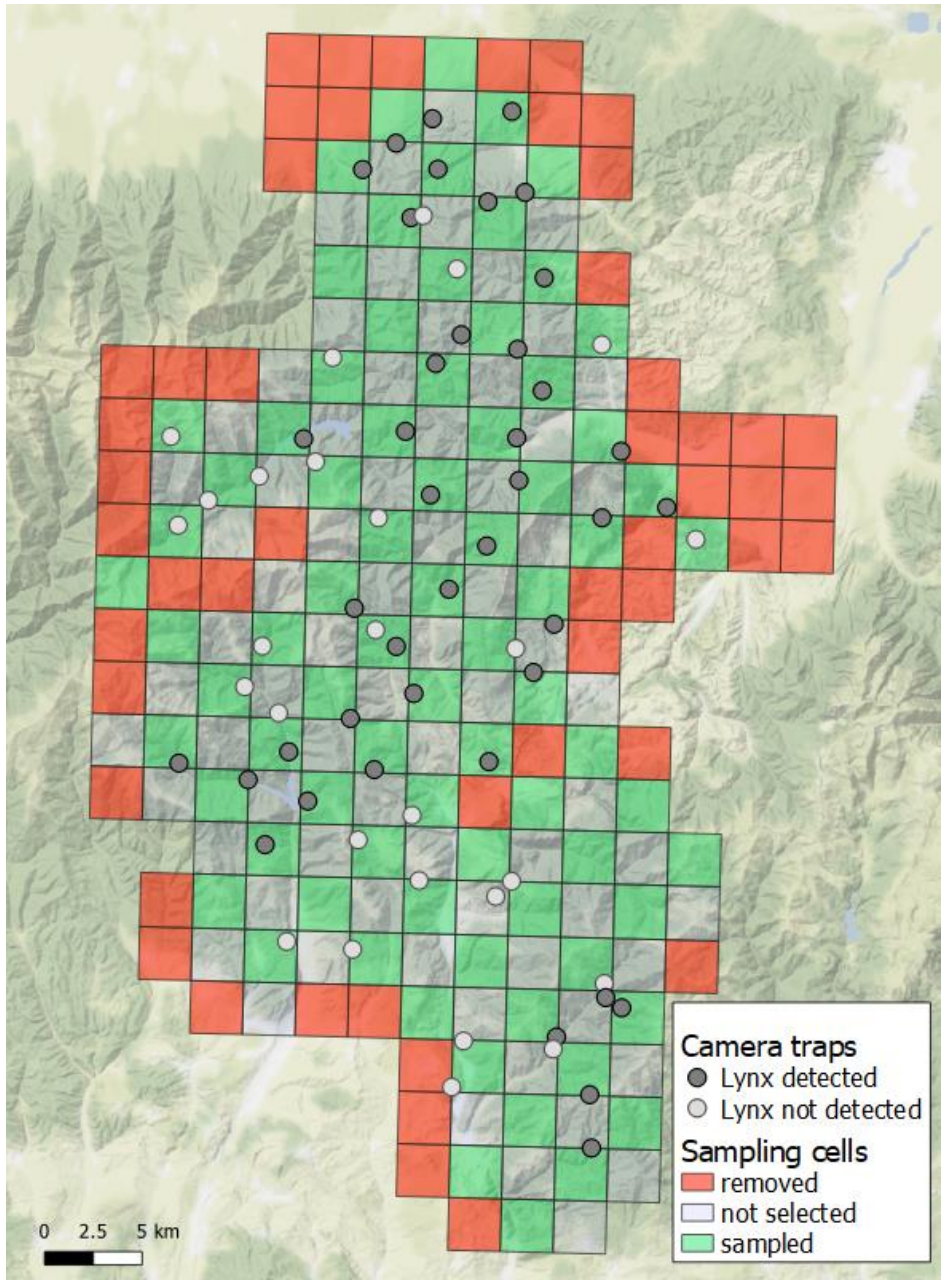
Estimated expenses for genetic monitoring of brown bear
A three month season
At the scale of a hunting concession (10000 ha)



	Expenses	Ammount (lei)	Description
Fixed costs	Statistical analyses and scientific report	**23500**	Costs do not vary significantly with the surface
	Develop mobile app for consistent data collection	**46000**	On long term, apply only once independent on the surface
Costs that will vary / surface	Field personnel	**36000**	Sallaries and field equipment
	Fuel	**1100**	Fuel consumption for a car for 30 days in the field
	Genetic analyses	**33000**	Approx. 100 kits, consumables, transport, lab procedures

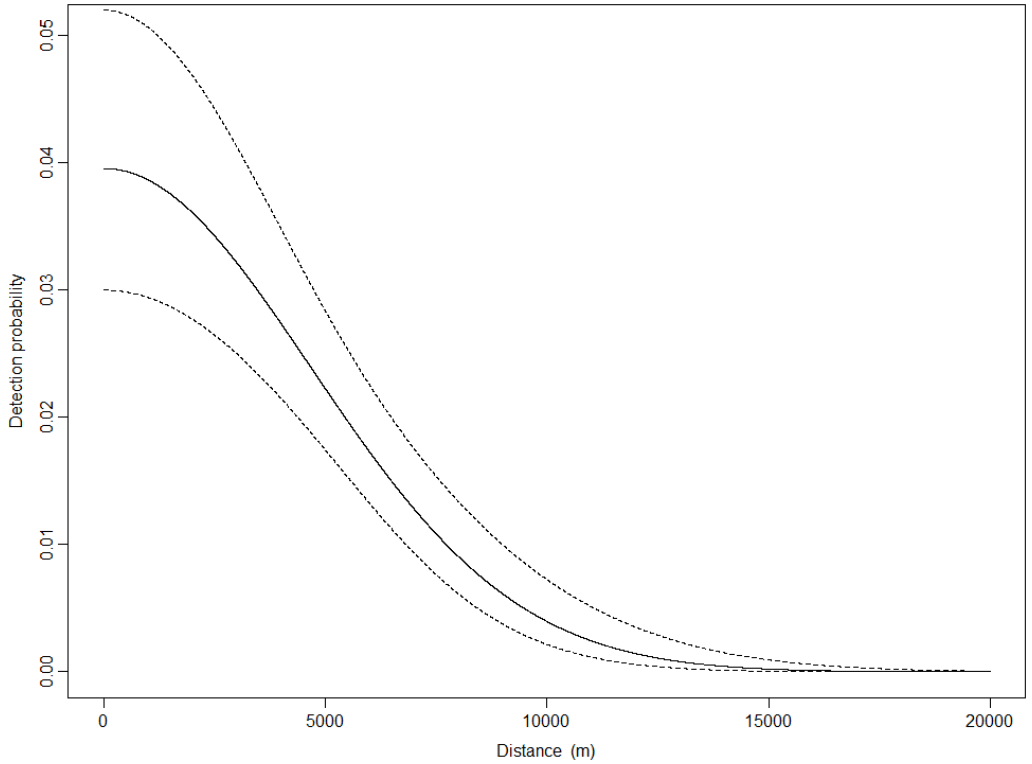
Backup Slide 4

- Average home range size of lynx in similar study areas in Europe (Alps, Jura, Dinaric, and Carpathians) was around 252.1 km2 for males and 146.6 km2 for females.
- Our trap array can include the entire home ranges of ~6 individuals, with an average 13.6 trap stations per individual home range.
- However, edge effect is expected to be high

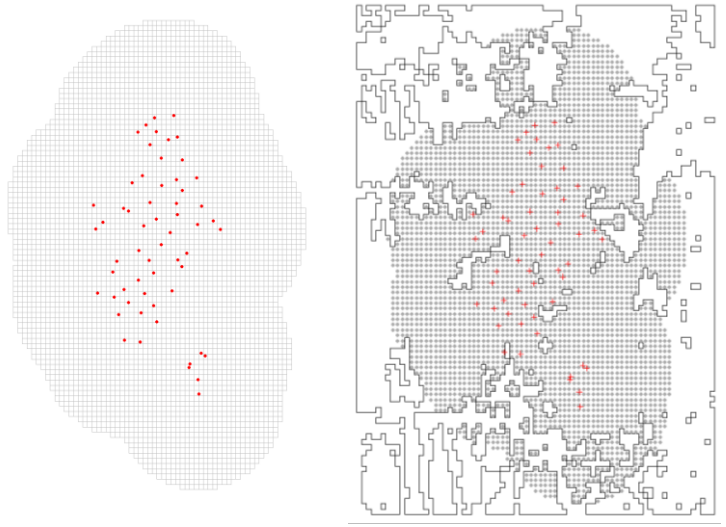


Backup Slide 5

- Dealing with edge effect in SECR



- Effective monitoring area affects density estimates



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