

# Comparison of low- and high- density populations of red squirrels (*Sciurus vulgaris* L.) in Warsaw



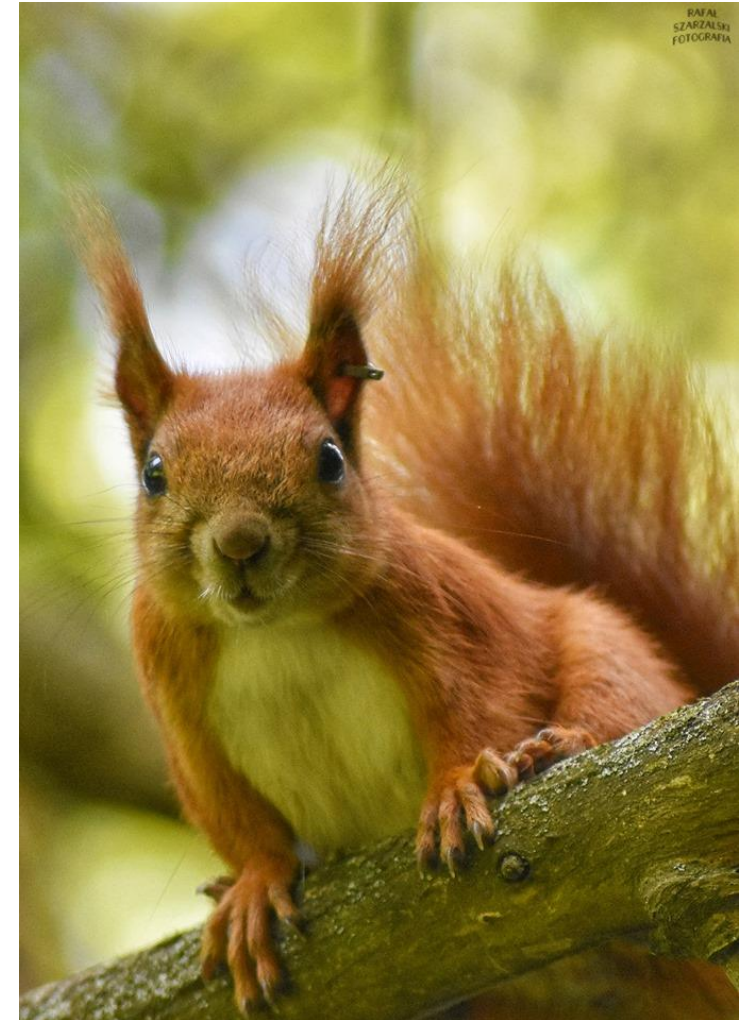
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# Squirrels in cities

Animals are flexible and able to adapt to life in urban areas.

Understanding the influence of urbanization on animal populations is crucial because of possible effects of human relationships with nature and biodiversity.

The red squirrel (*Sciurus vulgaris* L.) is one of the species that has adapted to conditions in cities.



# Squirrels in cities

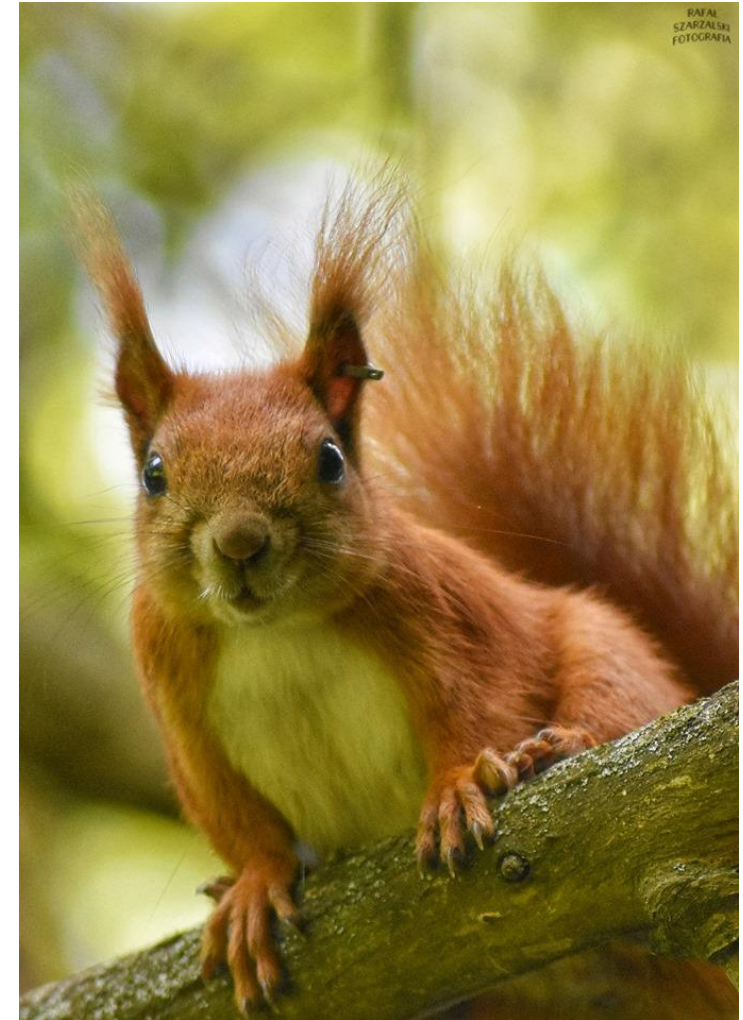
In urban conditions squirrels can use supplementary feeding (from bird feeders or given to them directly).

Artificial food is an important factor that may attract squirrels in urban environments.

Stable food sources in urban habitats are crucial for reproduction in the species, as food abundance strongly affects the body condition of females preparing for birth-giving.

One of the most significant factors that influence red squirrels' density is food availability.

The abundance of red squirrels can be approximately twice as high in urban habitats than in natural forests.



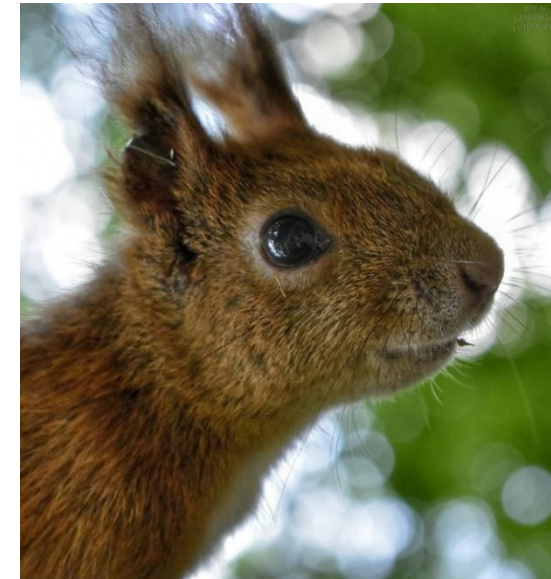
# Aim of a study

to compare two populations with high- and low- population density inhabiting the same city, but utterly different habitats



# We want to answer the following questions:

- Is there a difference in the percentage of males and females being sexually active, time of the breeding period, and a number of breeding attempts per season?
- Do compared populations differ in terms of breeding that may be related to food availability throughout the year?
- Supplementary feeding brings animals together, at elevated densities potentially furthering disease transmission. What is the health and body condition of both populations in light of differences in population density?



# Two main study areas in Warsaw



**urban park  
central zone**

**urban forest  
peripheral zone**

# Urban forest

– Natolin Forest nature reserve



105 ha

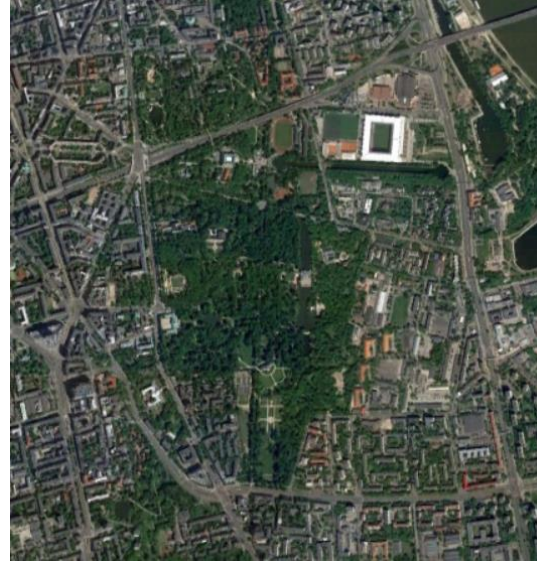
located approximately 10 km from the city centre

fenced and closed to the public, and a pass is required for entrance

**density – 0.29 ind./ha.**

# Urban park

- Royal Łazienki Museum



76 ha

located in the central district of Warsaw

a very popular area for tourists and local inhabitants

**density – more than 2 ind./ha**

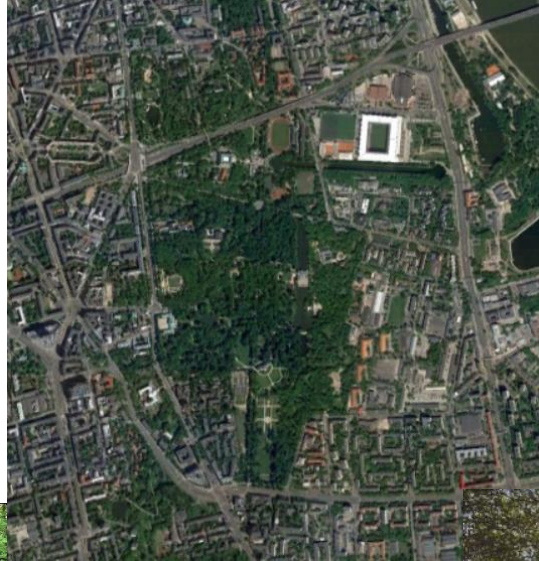
# Urban forest

– Natolin Forest nature reserve



# Urban park

- Royal Łazienki Museum





# Methods – live trapping

live-trapping sessions in two study periods:

2012-2013

+

2018-2020



live traps

40 in urban forest and 25-30 in urban park

trapping sessions (5-7 days) every second month

squirrels were marked with metal ear-tag with unique number

# After catching a squirrel we measured/estimated:

- sex
- body mass
- sexual activity
- \*struggle rate
- \*\*breath rate

this data  
collected only  
during second  
study period

2018-2020



Struggle rate is an index of docility.

Both struggle rate and breath rate are indicators of response to handling and stress level.

\*struggle rate – how long squirrel struggles in handling bag, in 30 seconds

\*\*breath rate – measured after caching, in 10 seconds

2012-2013

+

2018-2020

# Results

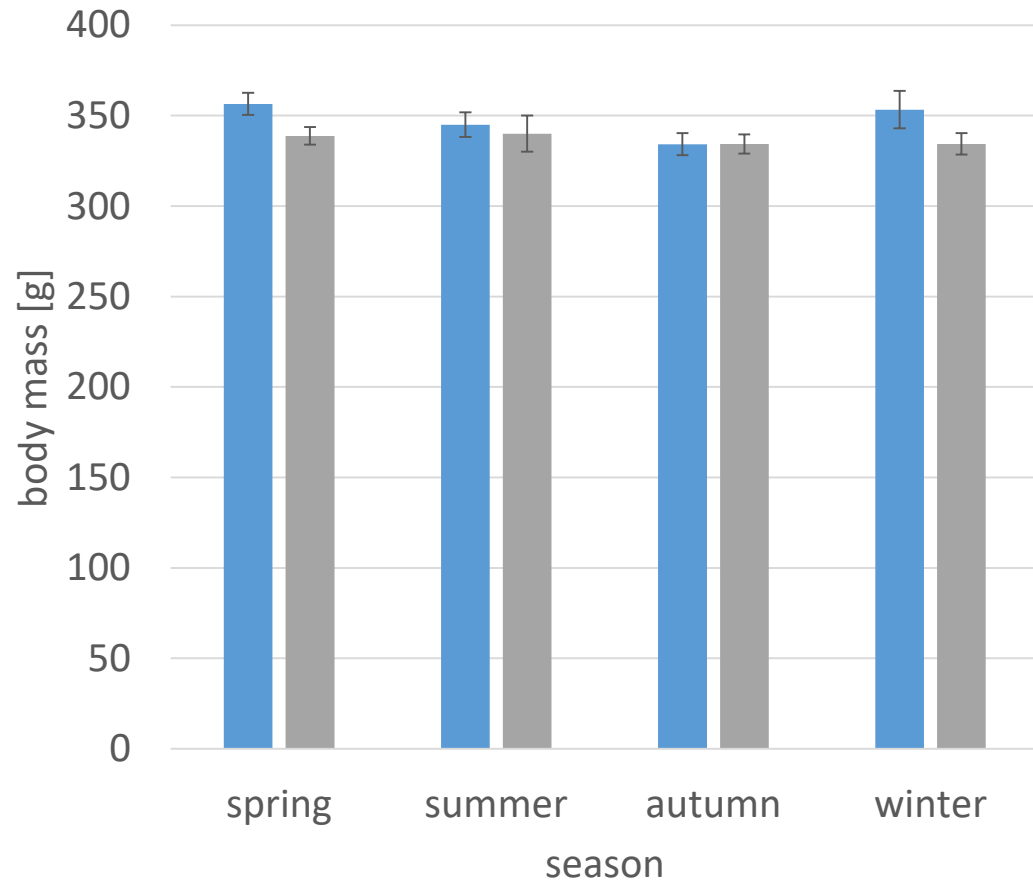
Study site	2012-2013	2018-2020	Total
Number of catches			
Urban forest	79	129	208
Urban park	169	266	435
Number of trapped and tagged squirrels			
Urban forest	18	36	54
Urban park	45	107	111

Squirrels could be trapped more than once during trapping sessions.



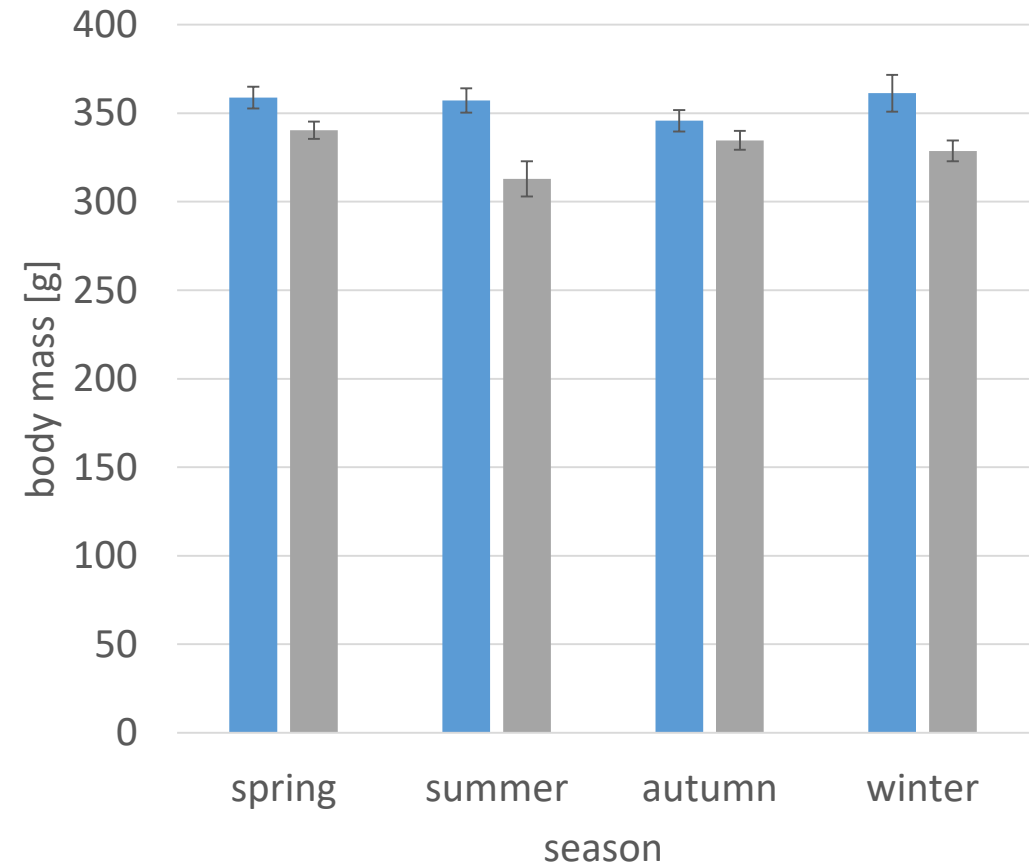
# Body mass of individual squirrels

2012-2013



■ forest (N=52) ■ park (N=108)

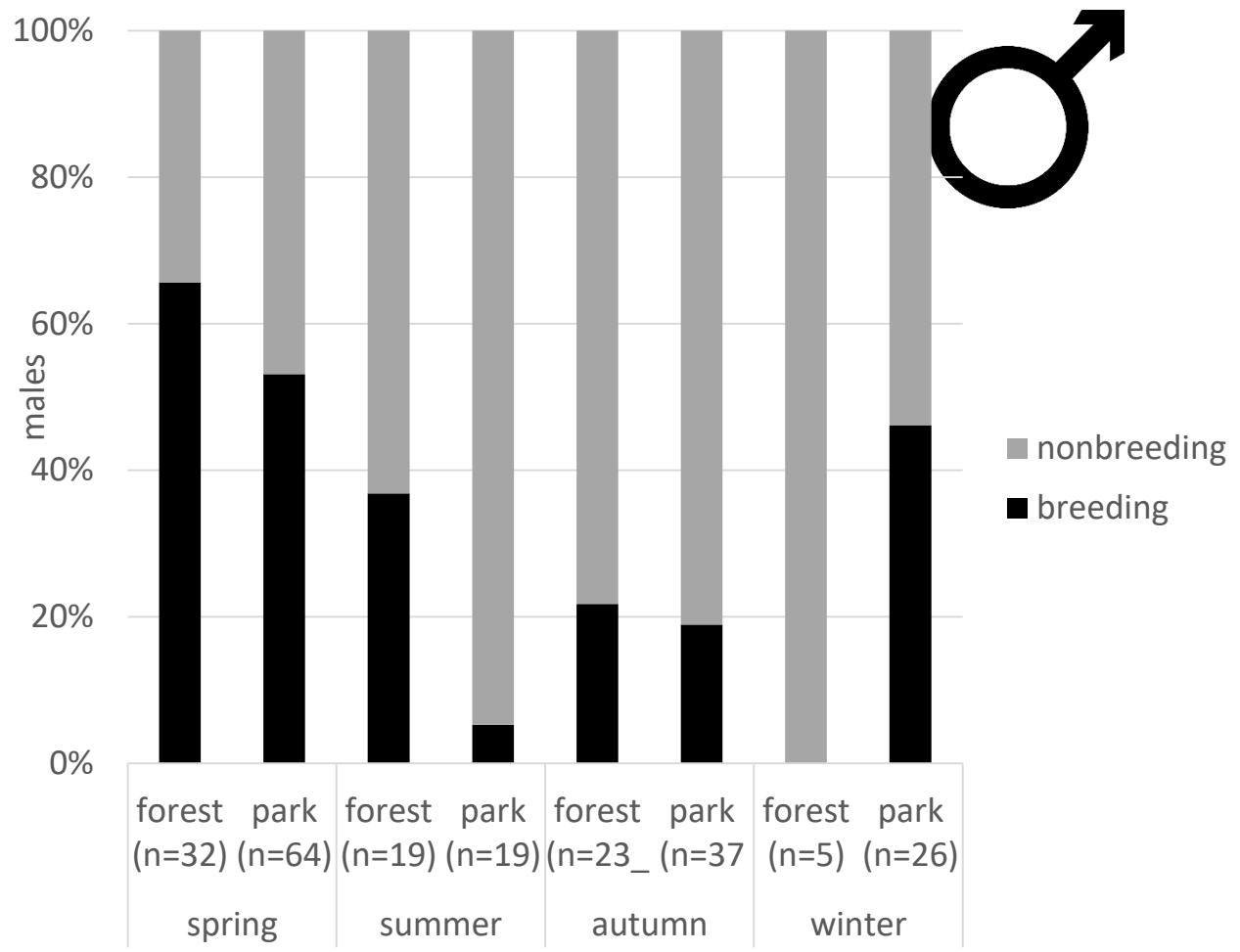
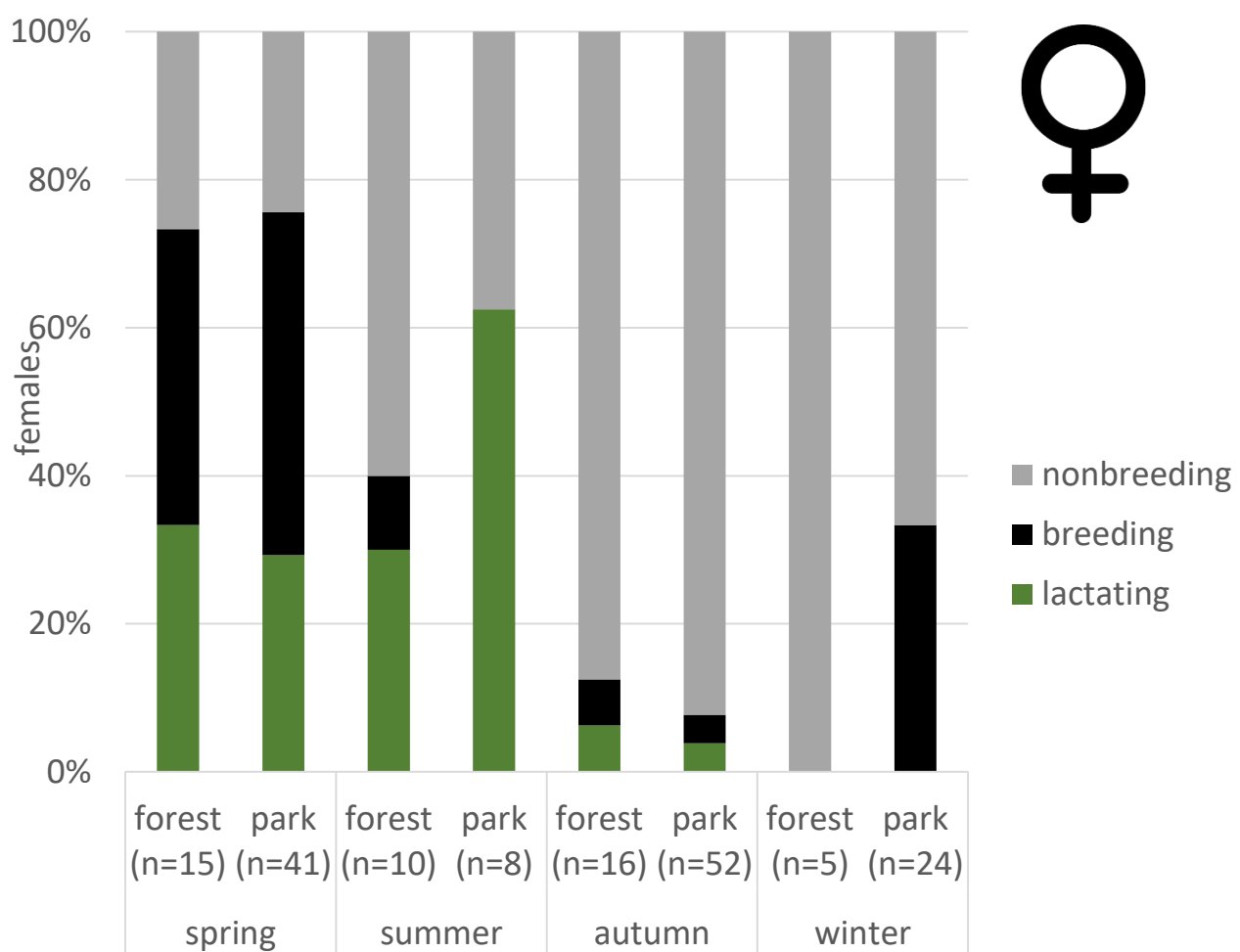
2018-2020



■ forest (N=90) ■ park (N=205)

# Sexual activity

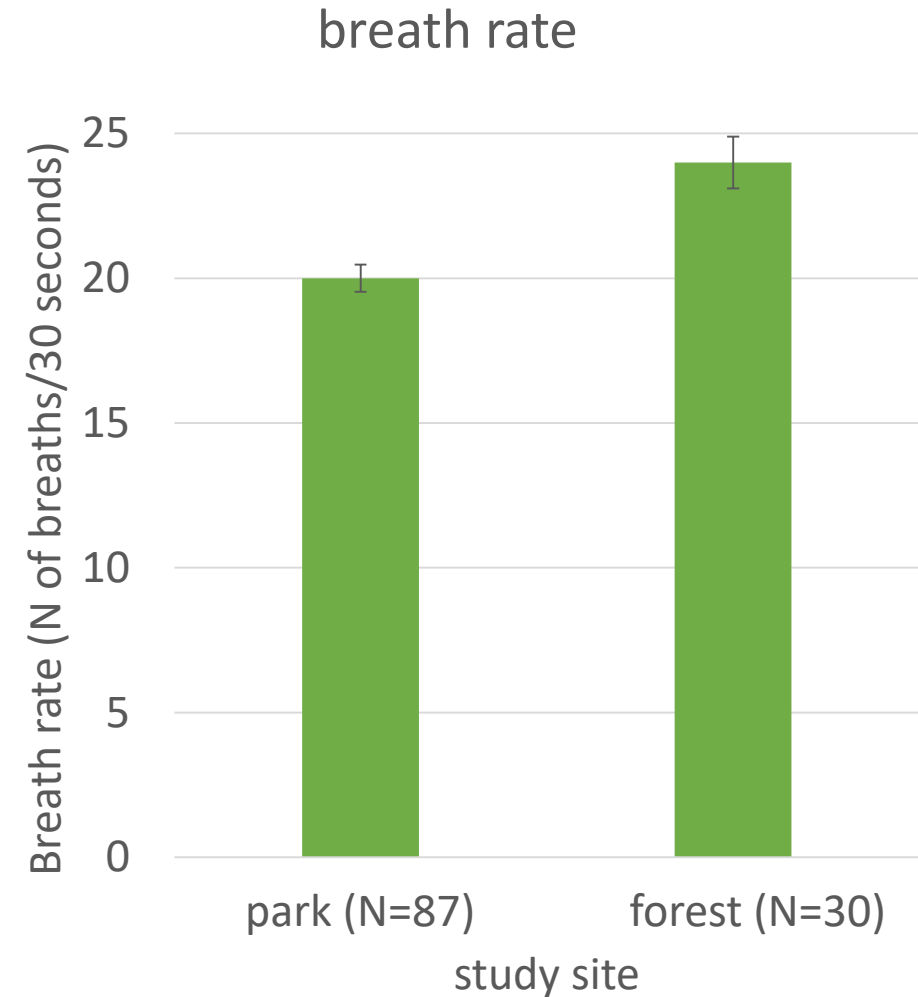
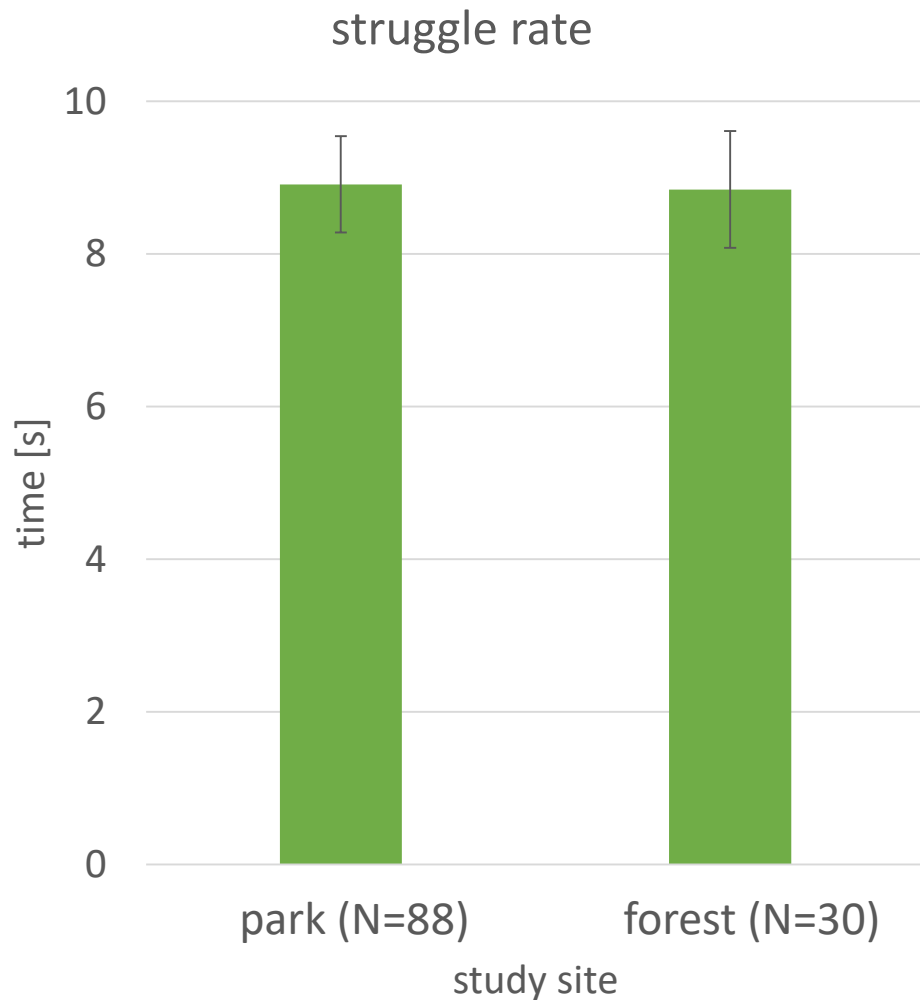
2012-2013 + 2018-2020



# Breath rate and struggle rate

(only squirrels trapped for the first time were taken into analysis)

2018-2020



Both struggle rate and breath rate are indicators of response to handling and stress level.

# Conclusions - very first results

squirrels in the forest had on average higher body mass

better body condition? squirrels has to have optimal body mass to be sexually active

difference in the body mass was most clear during winter and spring

when natural food sources are highly limited

squirrels inhabiting urban park, started their reproductive period earlier

year-round access to supplementary feeding provided by people

stress indicator (number of breath rate) of trapped squirrels was significantly higher

contact with human was more stressful for squirrels from the forest

This study may be a proof that two populations inhabiting the same city may differ significantly in terms of population condition.

# Thank you for your attention

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