

Intra- and interspecific competition is common around the world. Animals of various species constantly to a lesser or greater degree compete for food availability, nesting places, habitats, etc. It's commonly known that the biggest competitors for wild animals in the



access to habitat are humans who continue to purposefully or accidentally decrease the quality of habitat for wild animals causing many species to become extinct. In this report we would like to analyse the results of scientific research discussing the effects of competition between red squirrels (*Sciurus vulgaris*) and grey squirrels (*Sciurus carolinensis*).

Is there significant competition for habitat or food?

Results of scientific research clearly show that interspecific competition between adult grey and red squirrels does not have any significant effect on the population of red squirrels inhabiting a common area with grey squirrels (Gurnell 1996, Wauters et al. 2001a). The hypothesis assuming significant effect on the population of red squirrels from interspecific competition for food with grey squirrels (Kenward & Holm 1993) was not supported in further research and eventually was disproved (Gurnell 1996, Wauters et al. 2001a).

Is there interference competition between the two species?

None of the studies observed any significant mutual aggression between red and grey squirrels. Interspecific interactions were usually indifferent, with no signs of interference competition (Wauters & Gurnell 1999, Wauters et al. 2000). This result is not surprising because neither of the species show strong territorial traits.

Fitness of red squirrels in areas of co-existence with grey squirrels

In the studies in the area of co-existence of grey and red squirrels, body mass of red squirrels was marginally lower than in the area with only red squirrels. **Co-habitation* of red and grey squirrels in the same forest did not have any significant effect on the condition and survival of red squirrels** (Wauters et al. 2001a). Minimally lower body mass of red squirrels co-existing with grey squirrels scientists were inclined to attribute rather to – much lower – quality of the habitat (see "Difference in the quality of habitats ...*") where

mixed populations were studied than to the influence of grey squirrels (Wauters et al. 2001a).

Reproduction results of red squirrels

The scientists collected quite a lot of data from years 1992-1994 and 1996-1998 about the

reproductive success of red squirrels living alone. Results of red squirrels reproduction – in the areas with only red squirrels – showed a lot of variability and could differ even by a few times between years (Wauters et al. 2000, Gurnell et al. 2004).

Unfortunately there is little data about reproduction in mixed populations (of red and grey squirrels) – only from years 1996-1997. Based on the scarce data a hypothesis can be put forward that **reproduction results of red squirrels co-existing with grey squirrels can undergo the same fluctuations as those observed in the areas with only red squirrels** (data from Gurnell et al. 2004).

Any attempt to suggest any other scientifically valuable hypothesis on the basis of data collected is extremely difficult not only due to the scarcity of data collected from the areas inhabited by mixed populations (red and grey squirrels) but also considering the significant differences in the size and quality of habitats (see "Difference in the quality of habitats ...*") where both populations were studied (Gurnell et al. 2004).

Note: *Difference in the quality of habitats where data was collected for the research by Wauters et al. 2000, Wauters et al. 2001a and Gurnell et al. 2004)

Scientific research confirmed long time ago that the quality and size of habitat is of primary importance for the stability of the population and the reproduction success of red squirrels (Verboom & van Apeldoorn 1990, Gurnell & Pepper 1991, Harris et al. 1995, Lurz et al. 1998, Verbeylen et al. 2003).

Habitats selected for studies with only red squirrels occupancy were of significantly better quality and bigger than the habitats where mixed populations (red and grey squirrels) were studied.

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Analysis of scientific research about interspecific competition between red squirrel (*Sciurus vulgaris*) and grey squirrel (*Sciurus carolinensis*)

The first of the study areas with mixed populations was not only 3 times smaller – from the area where only red squirrels lived – but it was extremely unfavourable when it comes to its quality. Most of the red squirrel population lived in fact in the forest stand of Sitka spruce (Wauters et al. 2000) which is commonly considered as the worst type of habitat for red squirrels (Verboom & Apeldoorn 1990, Gurnell & Pepper 1991, Harris 1995, Huxley 2003, Verbeylen et al. 2003, Harris et al. 2006).

The second site where mixed populations were studied was not only much smaller (over 100 times) – from studied habitat with only red squirrels – but also the number of red squirrels per hectare in that habitat was 3 times higher than in red squirrels only habitat.

Summary

The scientific research shows minimal competition for food and habitat between European red squirrel (*Sciurus vulgaris*) and grey squirrel (*Sciurus carolinensis*). The same research shows that significant variability of reproduction – observed in different years – which occurs naturally within red squirrel populations living in areas with no grey squirrels (Wauters & Lens 1995, Wauters et al. 2000, Gurnell et al. 2004) can also occur among red squirrels inhabiting the same area with grey squirrels (data

from Wauters & Lens 1995, Wauters et al. 2000, Gurnell et al. 2004). It is also well known that small and fragmented habitats are very unfavourable for sustaining a red squirrel population (Verboom & van Apeldoorn 1990, Gurnell & Pepper 1991, Rodriguez & Andren 1999, Flaherty et al. 2012).

It is also not a new discovery that red squirrel populations living in – big and of suitable tree species composition – coniferous forests are much less vulnerable to seasonal/annual variations in seeds availability (Wauters & Lens 1995). Also for many years it's been known which tree species – like Sitka spruce – have very negative effect on the state of red squirrel population living in such habitat (Verboom & van Apeldoorn 1990, Gurnell & Pepper 1991, Lurz et al. 1998) which has been confirmed by more recent studies and reports (Bryce et al. 2002, 2005, Huxley 2003, Harris et al. 2006, Bryant 2011, Haigh et al. 2015).

Final notes

Considering the scarcity of data available from the areas where competition between co-existing red and grey squirrels were studied it is necessary to conduct further research – in "comparable" with regard to the size and quality habitats similar to the areas where red squirrels living as a separate population were studied.

References and more about squirrels: www.i-csrs.com/competition

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