

Knee clicks in white-lipped deer (*Cervus albirostris*) as possible indicator of age and social status



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INTRODUCTION:

➤ About white-lipped deer:

White-lipped deer (*Cervus albirostris*) is morphologically unique species of cervid endemic to Eastern Tibetan Plateau. Its range is fragmented and the species is considered vulnerable by the IUCN. It possesses several distinctive traits such as peculiar antler form, hair whorl running down its back and white markings on the lips in addition to clicking sound produced when animal is moving.

➤ Knee-clicks:

Clicking is a highly conspicuous cracking sound produced by limbs of certain species of hoofed animals when they are walking or shifting weight. The „knee-clicks“ is often used term, although mechanism of its origin and exact anatomical structures producing it **are not precisely known**.

From the family Cervidae only White-lipped deer (*Cervus albirostris*), Père David's deer (*Elaphurus davidianus*), Reindeer (*Rangifer tarandus*) and Moose (*Alces alces*) were described in literature as making these peculiar noises.

Suggested function:

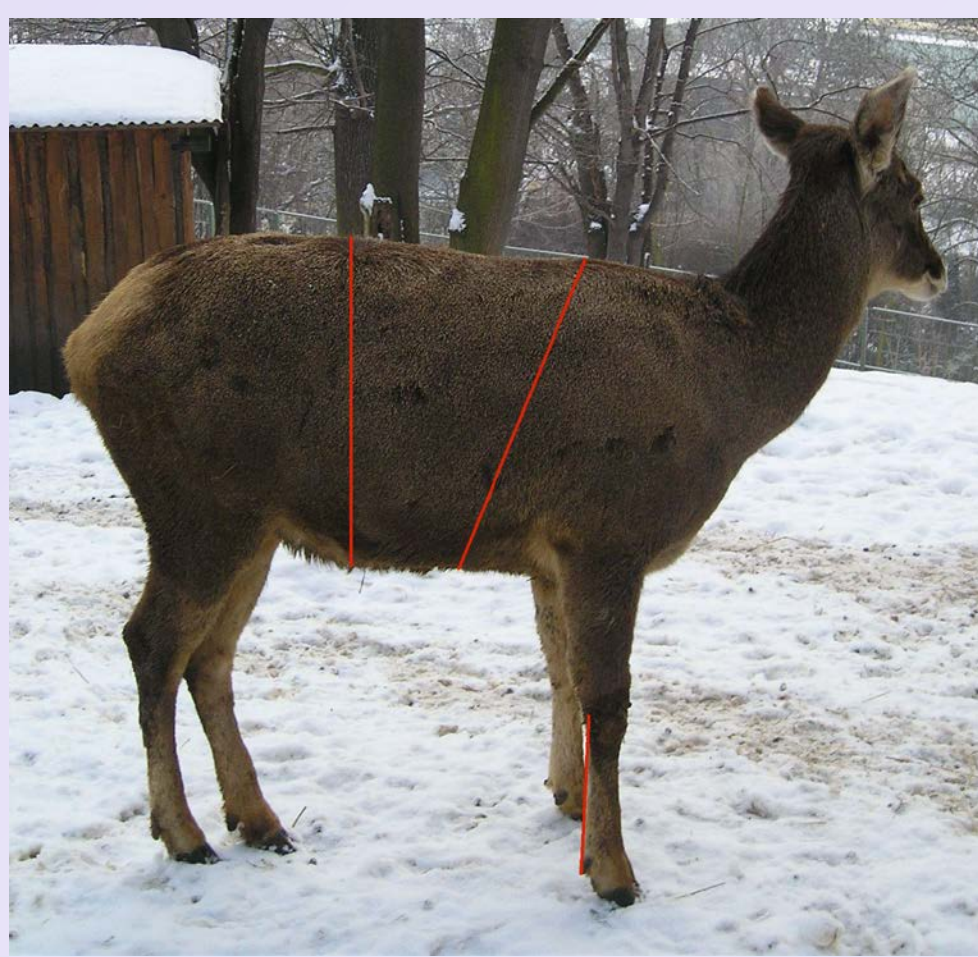
This trait is so distinct, that there were several theories proposed regarding its function and mechanism of origin:

- Mechanical by-product of certain conformation of the pasterns and hoof
- Signal of coherence
- Alarm signal
- Signal of fitness

In cervidae, none of these hypotheses were scientifically tested nor was the sound recorded and its auditory parameters described.



Fig. 1: Picture showing dimensions whose ratios were used for assessing of animal condition.



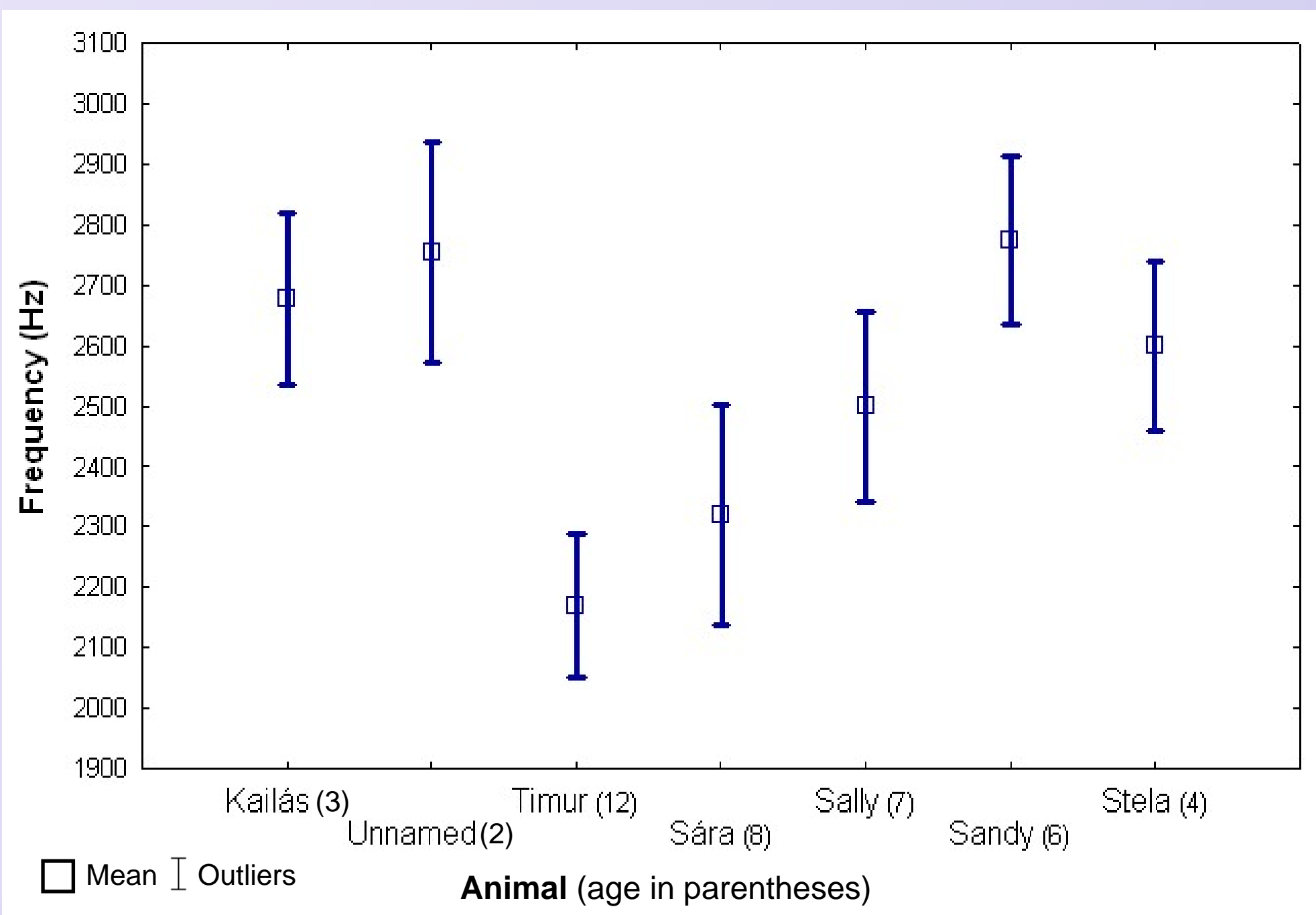
METHODS:

- Clicks of each individual from two herds were recorded every month during the period from October 2010 to August 2011 using solid state recorder Marantz PMD 660 with microphone.
- All clicks were analysed using program **Avisoft Bioacoustics**. Dominant frequency was determined for each click.
- Dominant frequency was correlated with season and age, condition and estimated social status of animal using **one-way ANOVA** statistics.
 - Condition was assessed via body dimensions measured in program **tpsDig**
 - Social status was estimated by observing agonistic behaviour among members of the herd.

	Name	Sex	Born	Age (as of 2011)	Clicks	Hierarchy order
Herd 1	Timur	male	1.7. 1999	12	264	- (1)
	Sára	female	1.8. 2003	8	124	2
	Sally	female	7.7. 2004	7	148	3
	Sandy	female	26.6. 2005	6	194	4
	Stela	female	14.6. 2007	4	187	5
Herd 2	Kailás	male	18.8. 2008	3	185	1
	Unnamed	male	19.6. 2009	2	120	2

Table 1 - List of animals used in the study. All belong to Zoo Ústí nad Labem, which is the only breeder of white-lipped deer in Czech Republic.

Fig. 2: Dominant frequency of clicks differs among animals. Mean dominant frequency for each individual is distinctive and also corresponds to age and possibly dominance status of the deer.



Df.	F	p
6	10,671	0,00000000

Fig. 2: Change in average dominant frequency during the year for all adult animals. Change was statistically significant only for both males and one female „Sally“.

	Df.	F	p
Kailás	3	5,0234	0,002297
Timur	3	5,407	0,00126
Sára	3	1,422	0,240429
Sally	3	3,398	0,019574
Sandy	3	1,410	0,241199
Stela	3	2,486	0,062067

OBJECTIVES:

- record, analyze and describe the main auditory parameter of the clicks – **dominant frequency**
- capture moving animals on video to analyse how the sound is produced
- find out possible individual variability in dominant frequency of clicks
- perform statistic correlation of dominant frequency of knee-clicks and age, condition and social status of animal
- reveal possible change in dominant frequency of knee-clicks during the year

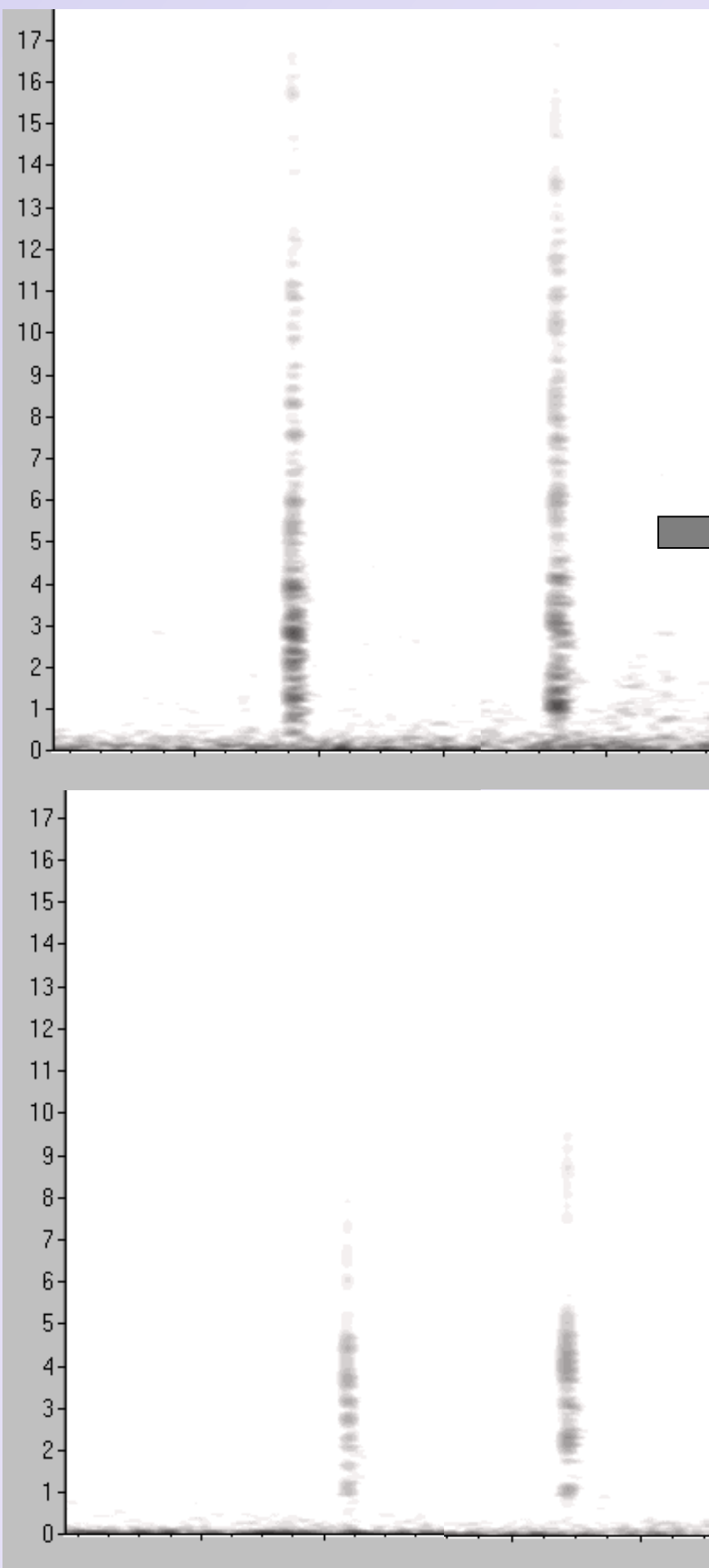


Fig. 2: Spectrogram showing visual comparison of typical form of knee-click of male Timur (upper picture) and young female Sandy (lower picture). Frequency is represented on Y-axis.

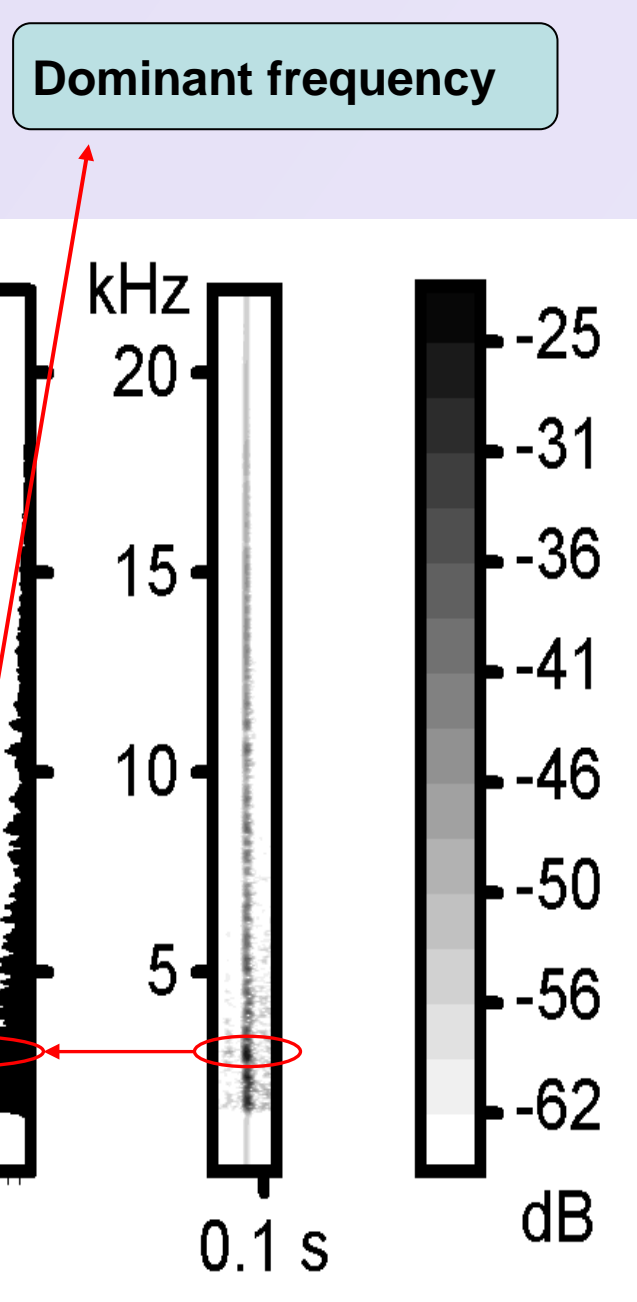
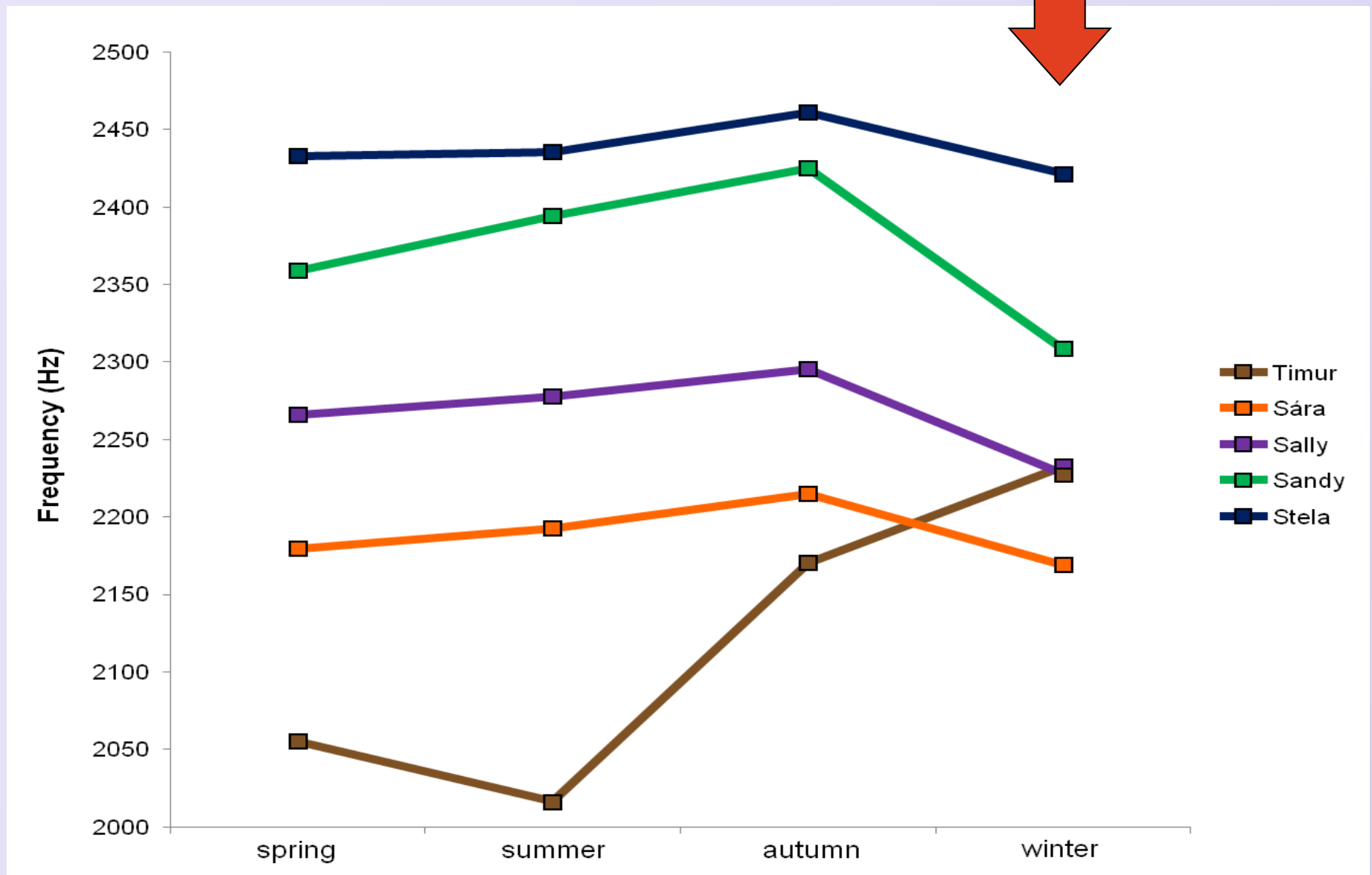
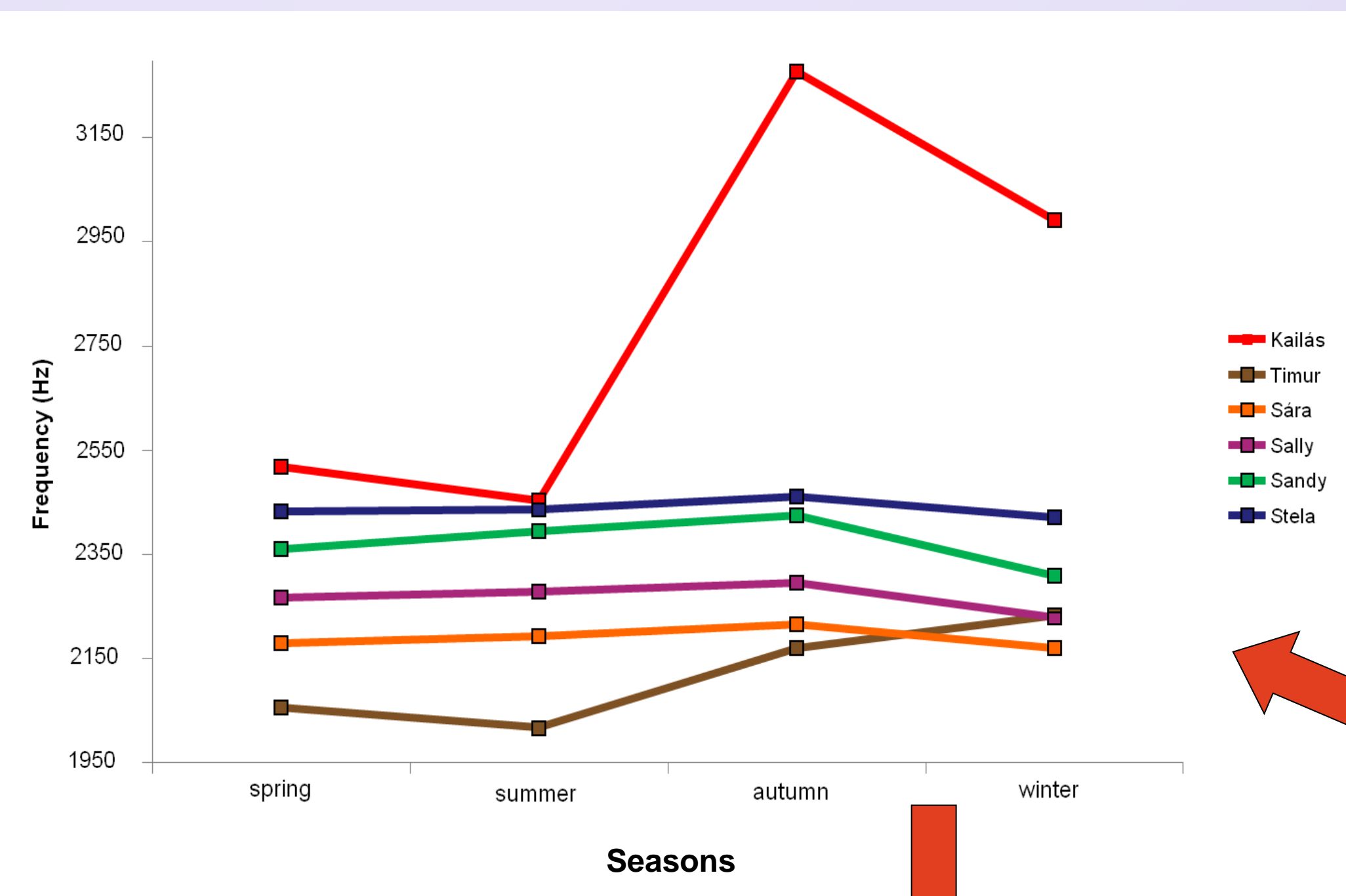


Fig. 3: Section of fig. 2 showing changes of mean dominant frequency during the year for adult animals only. Though changes for most females were statistically insignificant, the trend is visible.



RESULTS:

- Knee-clicks were produced mostly by front limbs of animals older than one year.
- There was no marked change in condition of animals during the year and thus no statistical correlation with knee-clicks.
- The older and more dominant animals have lower dominant frequency of clicks.
- The average dominant frequency of every individual changed noticeably between seasons of the year. However only for males and one doe were changes statistically significant.

CONCLUSION:

This is the first study regarding clicking in cervids. Our preliminary results suggest a possible negative correlation between age and social status of deer from this herd and dominant frequency of its clicks, i.e. the older and possibly more dominant the animal is, the lower is the frequency of its clicks. Adult male Timur was animal with lowest dominant frequency of the clicks which can be also attributed to his bigger body mass. However the weight of females and both young males was roughly the same and frequency of their clicks varied dramatically. Results obtained for males with different body frame were in accordance with conclusion made by Bro-Jørgensen & Dabelsteen (2008) in similar study of eland antelopes. In this study, the click's frequency was lower in bigger males and was thus an honest signal of their fighting ability. In both male and females the height of frequency oscillated during the seasons of the year, but only in males the change was noticeable enough to be statistically significant. There was also no correlation between condition and clicking. Because the weight of the animals in captivity remained fairly constant during the year, our result suggests, at least for males, that changes in frequency can be influenced by another factor, perhaps hormonal activity. Further study into the subject is certainly needed.