Acoustic individuality in the hissing calls of the male black grouse (*Lyrurus tetrix*)

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Acoustic individuality may well play a big role during the mating season of many birds. Black grouse (*Lyrurus tetrix*) produces two different long-distance calls during mating on leks: rookooing and hissing calls. The first one represents low frequency series of bubbling sounds and the second one represents hissing sound. This hissing represents a signal not produced by the syrinx. We analyzed 426 hissing calls from 24 individuals in Finland and Scotland. We conducted cross-validated discrimination analyses (DFA). The discrimination model classified each call with almost 78 % accuracy (conventional result) and the validated DFA revealed 71 % output, that is much higher than classification by chance (4 %). The most important variables were Frequency 95 %, 1st Quartile Frequency, Aggregate Entropy and Duration 90 %. We confirmed that hissing call of black grouse is individually distinct. In comparison to the signals produced by the syrinx, non-vocal sounds have been studied rarely and according to our knowledge, this is the second evidence of vocal individuality in avian hissing sounds which are not produced by syrinx. Individuality in the vocalization of the male black grouse may aid females in mating partner selection, and for males it may enable competitor recognition and assessment. Individually distinct hissing calls could be of possible use to monitor individuals on leks. Such a method could overcome problems during traditional monitoring methods of this species, when one individual can be counted multiple times, because catching and traditional marking is problematic in this species.

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2 **(*Lyrurus tetrix*)**

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26 **ABSTRACT**

27 Acoustic individuality may well play a big role during the mating season of many birds.

28 Black grouse (*Lyrurus tetrix*) produces two different long-distance calls during mating on leks:

29 rookooing and hissing calls. The first one represents low frequency series of bubbling sounds

30 and the second one represents hissing sound. This hissing represents a signal not produced by the

31 syrinx. We analyzed 426 hissing calls from 24 individuals in Finland and Scotland. We

32 conducted cross-validated discrimination analyses (DFA). The discrimination model classified

33 each call with almost 78 % accuracy (conventional result) and the validated DFA revealed 71 %

34 output, that is much higher than classification by chance (4 %). The most important variables

35 were Frequency 95 %, 1st Quartile Frequency, Aggregate Entropy and Duration 90 %. We

36 confirmed that hissing call of black grouse is individually distinct.

37   In comparison to the signals produced by the syrinx, non-vocal sounds have been studied

38 rarely and according to our knowledge, this is the second evidence of vocal individuality in avian

39 hissing sounds which are not produced by syrinx. Individuality in the vocalization of the male

40 black grouse may aid females in mating partner selection, and for males it may enable competitor

41 recognition and assessment. Individually distinct hissing calls could be of possible use to monitor

42 individuals on leks. Such a method could overcome problems during traditional monitoring

43 methods of this species, when one individual can be counted multiple times, because catching

44 and traditional marking is problematic in this species.

45

46 **INTRODUCTION**

47   At the time of a decline in the black grouse (*Lyrurus tetrix*) population across its distribution

48   range (Ciach 2015; Jankovska et al. 2012; Kasprzykowski 2002), determining actual number of

49   individuals is becoming increasingly important. The causes for this decline vary: change of the

50   environment and climate (Kurhinen et al. 2009; Kvasnes et al. 2010; Viterbi et al. 2015; White et

51   al. 2013), parasite infestation (Jankovska et al. 2012), predation (Charnov et al. 1976; Korpimaki

52   et al. 1996; Pekkola et al. 2014; Policht et al. 2019; Summers et al. 2004; Tornberg et al. 2013;

53   Widen et al. 1987), reducing genetic diversity (Segelbacher et al. 2003; Segelbacher et al. 2014)

54   and human activities (Formenti et al. 2012; Hess & Beck 2012; Ingold 2005; Nichter et al. 2017;

55   Storch 2013). Methods and options for protection and conservation of grouse are manifold and

56   are realized at the local, regional, and national levels (Storch 2013).

57   An integral part of any conservation measures in general, and thus also in the case of

58   black grouse populations in particular, is monitoring. Methods of monitoring are diverse.

59   Franceschi et al. (2014) simulated two monitoring approaches: plot sampling and distance

60   sampling. According to their study, distance sampling is a better way to monitor grouse in terms

61   of accuracy. On the other hand, this approach is also costly, as it requires 4–5 sampling points

62   per km² for reliable outcomes (Franceschi et al. 2014). The most common counting method for

63   black grouse is to register males displaying in the spring (Hancock et al. 1999). Depending on

64   the size of the area to be monitored, it is possible to perform a full-area survey or to select

65   sample areas at random (Hancock et al. 1999). Monitoring based on acoustic features of bird

66   vocalization could be a more efficient method. Laiolo et al. (2007) recommended combining

67   counting based on vocalization with physical marking.

68   Black grouse males produce the following kinds of sounds: resonant rookooing call and

69   hissing calls. The latter is further subdivided into tones of aggression and alarm calls (Cramp

70   1983). This study is focused on a particular type of hissing call – crowing-hiss, described by

71   Cramp (1983) as harsh and angry sound, which is produced during the display of male black

72   grouse. This hissing sound is not produced by syrinx. Such non-vocal sounds are produced by

73   some constriction located on the way from the lungs to the bill (Fitch & Hauser 2003). Potential

74   information encoded in non-vocal sounds of birds remains almost unstudied (Budka et al. 2018).

75   Recent research of hissing sounds produced by geese confirmed encoding of individual identity

76   during antipredator behavior (Policht et al. 2020). In comparison to non-vocal acoustic signals of

77   birds, majority of bioacoustic studies focused on research of sounds produced by syrinx. A

78   hissing sound also appears in black grouse chicks above the age of three weeks, but we do not

79   suppose it is the same sound category that is the focus of our study (Meinert & Bergmann 1983).

80   This type of vocalization, along with the rookooing call, is the most prominent sound made by

81   black grouse, which can be heard over long distances and even in closed habitats such as forests

82   with dense undergrowth. Such calls are frequently used for population monitoring to find

83   actually used leks and counting present males. Therefore, this type of call may play an important

84   role in noninvasive monitoring of black grouse. The rookooing call can be characterized as a

85   low-frequency, repetitive sound within a range of about 200 Hz to 1000 Hz. This is why this type

86   of call often overlaps with background noise frequencies. Compared with this, the hissing call is

87   found in the frequency range of 350 Hz to 4500 Hz and is therefore easier to filter out from

88   background noise and to mark this type of call for measurement using acoustic software. Thanks

89   to these characteristics, the hissing call may be more suitable for acoustic monitoring of black

90   grouse.

91   In an effort to ensure quiet conditions for game wildlife, non-invasive monitoring, such as

92   that based on vocalization, is the method of choice. This method relies on distinguishing

93   individuals without physical marking. In our study, we analyzed the vocalization of male black

94   grouse to examine variation between individuals, and to find out whether vocalization

95   characteristics could serve as a unique identifying trait.

96

97   **METHODS**

98   **Study Areas and Recording**

99   We recorded the hissing calls of male black grouse during their mating season. Recording took

100   place in Finland in 2012 and 2013, and in Cairngorms National Park, Scotland in 2019. Field

101   experiments were approved by the Department of Natural Resources, Ministry of Agriculture

102   and Forestry, Finland and by the Game & Wildlife Conservation Trust, Scotland. According to

103   Finnish legislation in general and to the hunting legislation, this type of scientific project does

104   not require any special permits or licenses. All appropriate permissions were in place for the

105   fieldwork in Scotland. The research was conducted in accordance with the guidelines of the

106   Animal Behavior Society for the ethical use of animals in research. The study was carried out in

107   accordance with the recommendations in the Guide for Care and Use of Animals of the Czech

108   University of Life Sciences, Prague. The Animal Care and Use Committee of the Czech Ministry

109   of the Environment approved the protocol (Permit number: 15106/ENV/14-825/630/14).

110   Vocalization of male black grouse was recorded with the audio recorder Olympus LP-100 in

111   combination with a Sennheiser ME 66 directional microphone (frequency response 20 Hz–20

112   kHz ± 2.5 dB) complemented by a K6 powering module. Recordings were saved in .wav format

113   (48 kHz sampling rate, 16-bit sample size). We recorded all individuals in the wild during

114   courtship at leks. Lek is an area where two or more males perform courtship displays to gain an

115   advantage for mating with females. All leks were approached before the arrival of males, about

116   two hours before sunrise. Each recording session took on average one hour and was performed

117   from a portable hide so that the males could be observed without being disturbed. The distance

118   of the hide from display sites was 10 m on average. To avoid repeated recordings of the same

119   individual, only one recording from each location was included in the analysis. During the pilot

120   study, we only tested the variability between multiple individuals on one lek, and it turned out

121   that the individual variability is much larger. To avoid the risk of multiple counting of the same

122   individual, we chose the option of selecting only one, maximum of two individuals on each lek.

123   The distance between visited display sites was at least one kilometer and, according to Borecha

124   et al. (2017), black grouse males show strong fidelity to their lek; therefore, the risk of recording

125   the same individual at the two display sites was low.

126

127   **Acoustic Analyses**

128   Recordings were analyzed using Raven Pro 1.5 software with a 512 sample size and a Hann

129   window. We selected good quality calls with high signal to noise ratio, non-overlapping with

130   other hissing calls or background noise and wind. Each selected hissing call was manually

131   bounded by the selection frame that is defined by the beginning and end of the signal and the

132   lower and highest frequency of the signal. Temporal and frequency variables were then measured

133   automatically. These measurements were entered into the statistical analysis.

134

135   **Statistical Analyses**

136   We analyzed 426 good-quality calls from 31 individuals (at least 10 separate hissing calls per

137   individual). We measured 29 variables (*Table 1*). We excluded variables with low or no

138   variation. The remaining variables were standardized using Z-score transformation (subtracting

139 the mean and dividing by standard deviation). In order to test individual variation, we used

140 stepwise Discrimination Function Analysis (DFA) using IBM SPSS Statistics 24.0 software

141 (IBM Corp., Armonk, USA). We applied a leave-one-out cross-validation procedure (IBM SPSS

142 Statistics 20) to validate the results of DFA.

143 To test the potential for individual variation (Potential of Individual Coding - PIC) for each

144 parameter, we compared the coefficient of variation (CV) within and between individuals. The

145 PIC ratio was computed for each acoustic parameter by dividing the CVbetween by the mean of

146 the CVintra values related to each individual (Robisson 1992). For these tested parameters, a PIC

147 value greater than 1 means that an inter-individual variability is higher than intraindividual

148 variability. We tested a significance using Kruskal–Wallis test.

149

150 **RESULTS**

151 **Hissing Call Description**

152 The hissing calls of black grouse represent wideband acoustic signals, in which energy is spread

153 across a wide frequency range. The duration of such calls ranged from 0.1 to 1.21 s (0.76 ± 0.16,

154 mean ± SD). This type of call can consist of 1 or 2 notes; however, the occurrence of a two-

155 syllable form was rare (~n < 1 %) – so we did not analyze these calls.

156   The Low frequency ranged from 352.9 to 1310.3 Hz (830.2 ± 195.6 Hz, mean ± SD) and

157 the High frequency from 1702.4 to 4482.8 Hz (2687.5 ± 536.4 Hz, mean ± SD) for all

158 individuals. The frequency ranged from 729.6 to 3241.4 Hz (1857.3 ± 478.6 Hz, mean ± SD).

159 The spectrograms of black grouse recorded in Finland and Scotland are shown in the figures

160 below (Fig. 1,2). The spectrograms were generated in Avisoft-SASLab Pro with FFT length,

161 1024 sample size, a Hamming window and 87.5 % overlap. For a representative recording of a

162   hissing call of one individual form Scotland and one individual from Finland see *Audio S1* and

163   *Audio S2*.

164

165   **Individual Variation**

166   From selected parameters the resulting model (see *Supp. Table S1*) included 13 significant

167   acoustic variables (p < 0.001; r ≤ 0.87): 1st Quartile Frequency, Relative 1st Quartile Frequency,

168   Aggregate Entropy, Average Entropy, Relative Center Time, Call Duration, Duration 90 %,

169   Frequency 5 %, Relative 3rd Quartile Frequency, Frequency 95 %, Inter-Quartile Range

170   Bandwidth, Inter-Quartile Range Duration and Time 5 % (*Table 1*). The first 4 discriminant

171   functions had Eigenvalues > 1 and explained 79.7 % of the variation. With the first

172   discrimination function mostly correlated F95 % (Frequency 95 %) (r = 0.767) and Q1F

173   (Quartile 1 Frequency) (r = 0.707) and the second discriminant function correlated best with

174   AggEnt (Aggregate Entropy) (r = 0.390) and Dur 90% (Duration 90 %) (r = 0.387) (Fig. 3). The

175   Discriminant Function Analysis excluded seven out of 31 individuals due to their missing or

176   extreme values of the measured parameters. The cause could be a poorer degree of sound quality

177   that did not pass the analysis. This selection has been made by model procedure automatically.

178   The resulting DFA model correctly classified 77.9 % (71.1 %, cross-validated result) hissing

179   calls. Six individuals showed the highest classification accuracy (80–100 %), and most

180   individuals (N = 15) were classified with 60–79 % success. Only three males were classified

181   with a lower than 59 % success. These results were much higher than classification by chance (4

182   %). The output of classification results is shown in *Supp. Table S2*. We tested whether observed

183   classifications differed from the expected classifications (by chance) and we found a significant

184   difference: Chi-Square = 307.1, df= 23, p < 0.001. We also tested whether between individual

185 variation is higher than within individual variation using PIC and we found that all acoustic

186 parameters had PIC > 1 (*Table 2*).

187

188 **DISCUSSION**

189   Our results reveal that the wideband hissing call of male black grouse is individual

190 specific. The discrimination model classified each call with almost 78 % accuracy, and the first 4

191 discriminant functions explained nearly 80 % of variation. The PIC ratio was higher than 1 for

192 all parameters tested, demonstrating that the variability between individuals was higher than the

193 variability within individuals. Therefore, the hissing call is a type of vocalization that carries

194 information about individuality. Considering this type of call is a wideband, non-vocal sound,

195 such a result is quite unique. There are not many studies focused on non-vocal animal sounds

196 and even fewer of them have provided results confirming individuality in this type of

197 vocalization, but there are a few. Individual variation was found in the male Houbara Bustard

198 (*Chlamydotis undulata undulata*), which produces sounds called booms during courtship

199 (Cornec et al. 2014). Acoustic variation between individuals was also investigated in the Greater

200 Prairie-chicken (*Tympanuchus cupido*) and the boom vocalization of this species was found to

201 have individual characteristics (Hale et al. 2014). Thanks to temporal patterns, along with the

202 number of drumming strokes, it is possible to discriminate individuals of the Great Spotted

203 Woodpecker (*Dendrocopos major*) (Budka et al. 2018). According to acoustic analysis in the

204 male Greater Sage-grouse (*Centrocercus urophasianus*), the "rustling" of wings differs between

205 individuals (Koch et al. 2015). Therefore, mechanical sounds can also carry acoustic information

206 about individuality.

207   Vocal individuality in some non-passerine groups has been intensively studied, such as

208   colonial birds or nocturnal birds. On the other hand, gallinaceous species has not been studied

209   frequently. Acoustic displays of the Japanese quail (*Coturnix coturnix japonica*) are

210   characterized by a potential for vocal individuality in terms of temporal parameters. Spectral

211   characteristics of the voice are then associated with the possibility of greater stability during the

212   development of the individual, which is important in the question of long-term recognition of

213   individuals (Sezer & Tekelioglu 2010). Call analyses of European and Japanese quail (*Coturnix*

214   *c. japonica, C. c. coturnix*) confirm a difference between these two subspecies based on the time

215   structure of vocalization (Collins & Goldsmith 1998). The hazel grouse (*Bonasa bonasia*),

216   studied in Switzerland, exhibits 6 to 11 elements of singing during flight. These elements

217   (individual tones or syllables) are characterized by their individual specificity (Mulhauser &

218   Zimmermann 2003). Specific parameters responsible for acoustic individuality were also found

219   in males and females of the common quail (*Coturnix coturnix*); the results of this study also

220   indicated that the male's inter-individuality is dependent on sexual maturation and age

221   (Guyomarc'h et al. 1998). Our study demonstrates a vocal individuality in gallinaceous species

222   with lek mating system.

223   What role acoustic individuality plays in the black grouse's voice is still a question for

224   future research. Calls of individual birds may carry information about male quality (e. g.,

225   physiological state, age) for females (Guyomarc'h et al. 1998), and, at the same time, it might be

226   a signal for other males providing information about the strength of a rival. Finally, individuality

227   can serve to easily identify individuals among each other within a group. Its potential for

228   scientists lies in the possibility of use for noninvasive monitoring. Taking an observation, census

229   may be inaccurate; due to overflights of individuals within the lekking site, repeated census of

230   the same individuals may occur and therefore the results of counting may be overestimated.

231   Monitoring based on acoustic recognition could provide the required accuracy and assistance in

232   areas where observation is limited by environmental conditions (e. g., the situation when males

233   of black grouse lek individually hidden in the undergrowth).

234

235   **Conclusion**

236   The black grouse population is affected by many factors that contribute to its decline, and as part

237   of its conservation, efforts are being made to develop better methods of protection, including

238   monitoring. Vocalization recording and analysis could be a non-invasive monitoring tool,

239   especially if there is individuality in the voice of individuals. This method could significantly

240   reduce the risk of multiple counting of the same individual. Surprisingly, we found this

241   individuality in the black grouse in the non-vocal type of display. The discrimination model

242   classified each call with high accuracy and important variables turned out to be Frequency 95 %

243   and Quartile 1 Frequency. In comparison to the signals produced by the syrinx, non-vocal sounds

244   have been studied rarely and according to our knowledge, this is the second evidence of vocal

245   individuality in avian hissing sounds which are not produced by syrinx. Finding specific

246   identifiers in vocalization could lead to a more accurate determination of the number of

247   individuals.

248

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257

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369

Figure 1

Spectrogram: Representative hissing calls of two of the black grouse from Scotland (a,b) and Finland (c,d).

Each lettered panel refers to one individual bird.

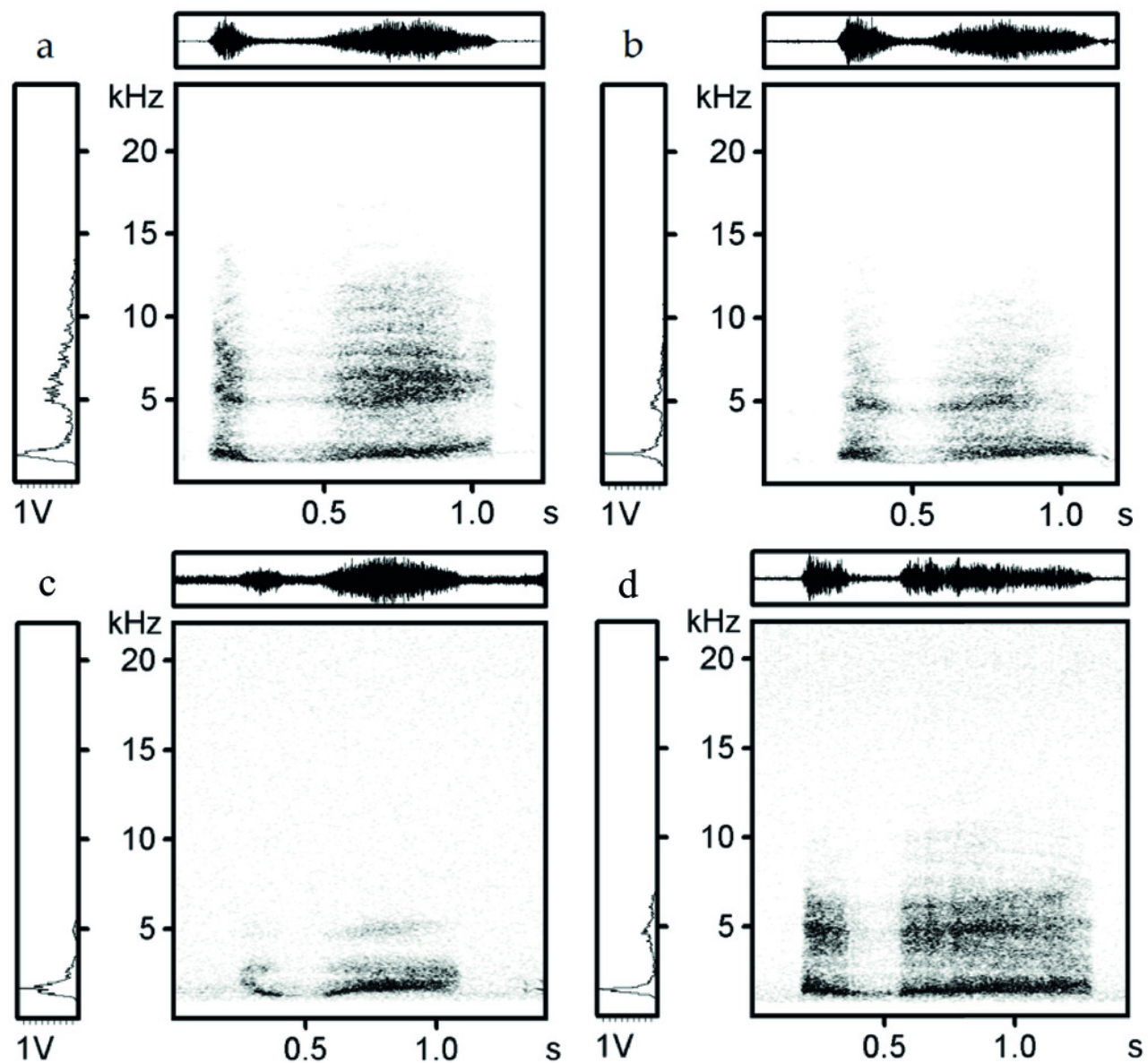



Figure 2

Spectrograms of 3 hissing calls of black grouse from one individual from Scotland (a,b,c) and one individual from Finland (d,e,f).

Each lettered panel refers to one hissing call.

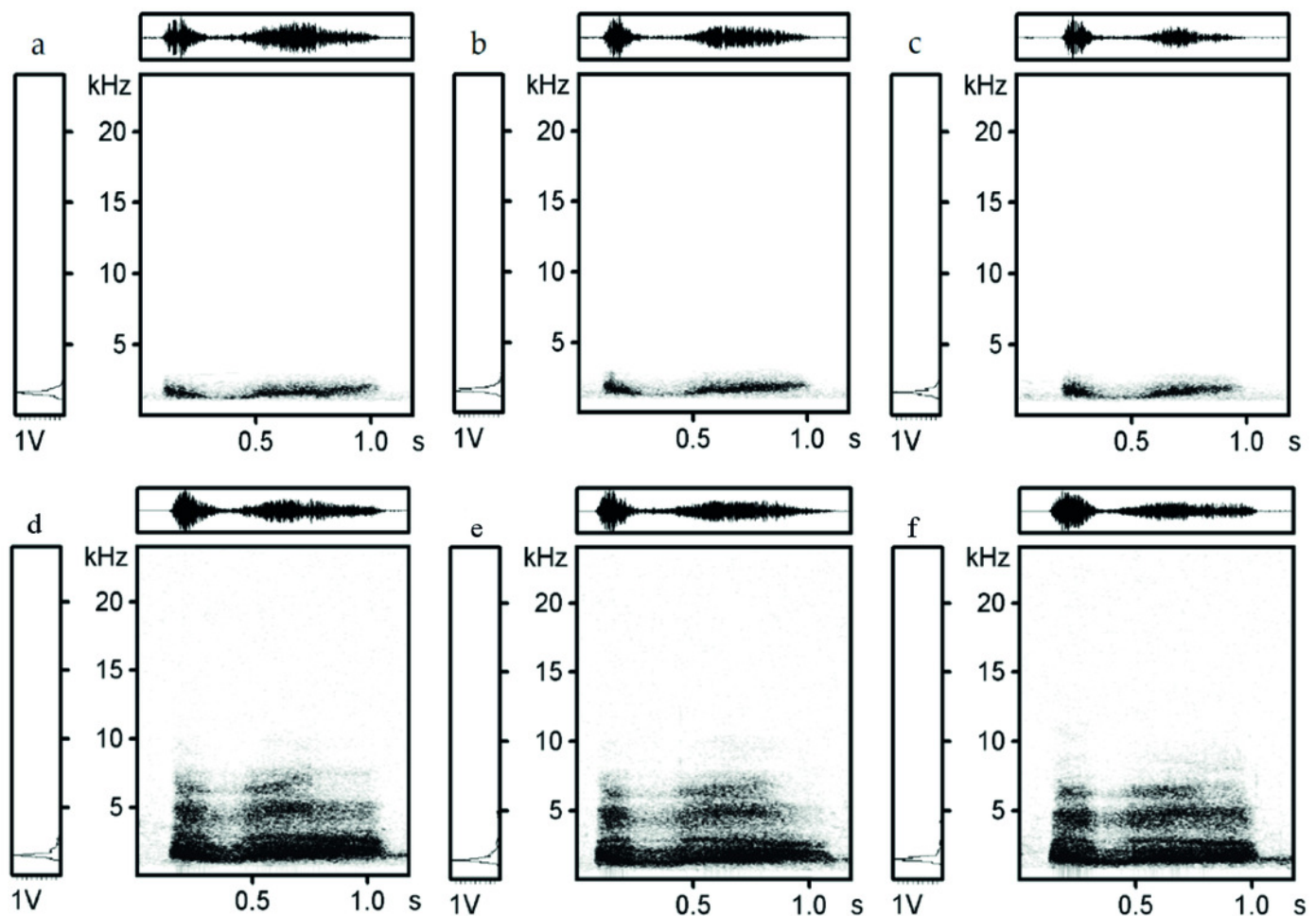
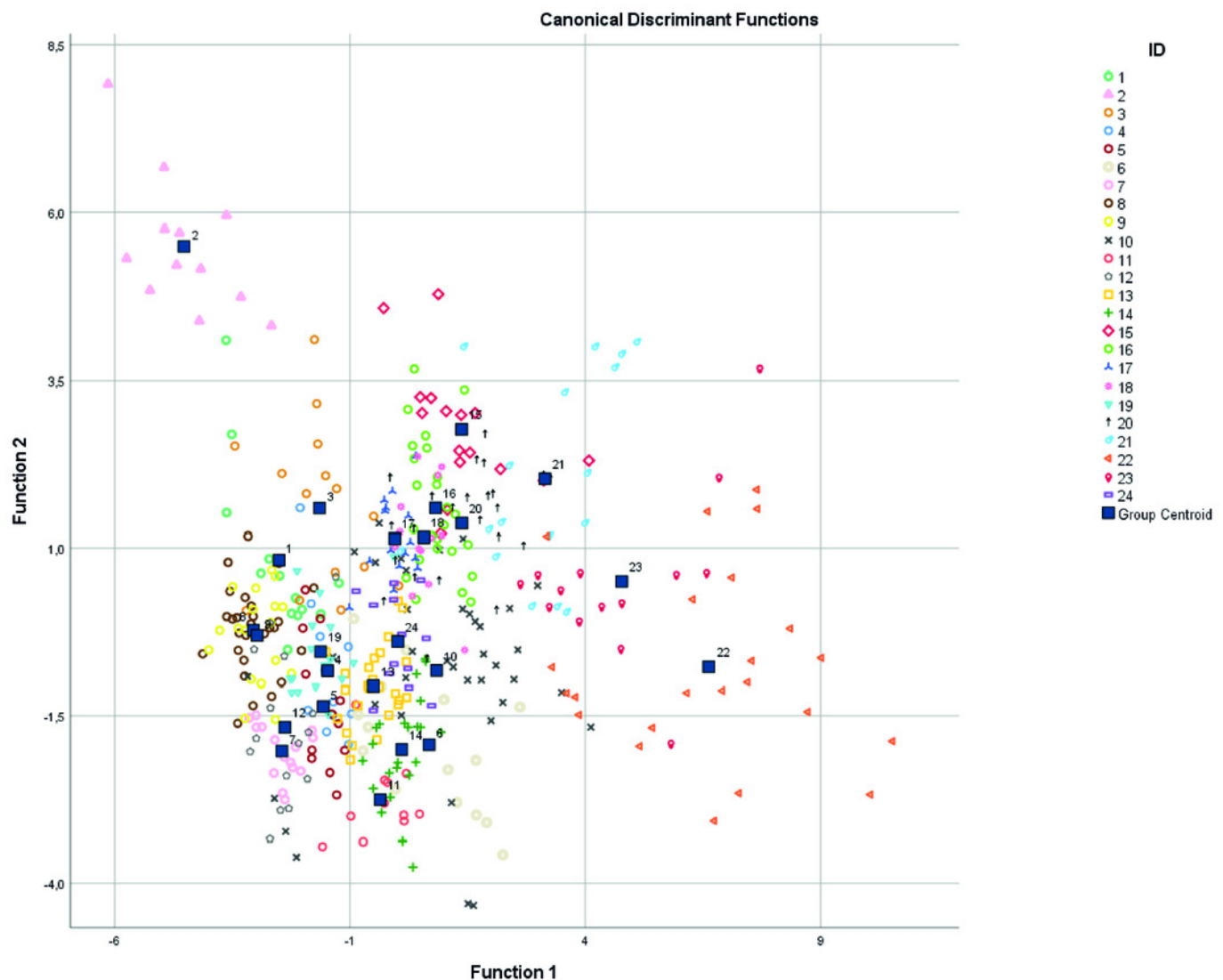



Figure 3

Scatter plot of hissing calls.

Numbers refer to individuals, pentagons represent group centroids. Discrimination function 1 represents Frequency 95% and function 2 represents 1st Quartile Frequency .

Descriptions of acoustic parameters measured in Raven Pro 1.5 that entered statistical analysis. 13 parameters (*) were included in resulting DFA model.

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Acoustic parameter name	Abbreviations/Units	Description
*1st Quartile Frequency	Q1 Freq (Hz)	The frequency that divides the selection into two frequency intervals containing 25% and 75% of the energy in the signal.
*Relative 1st Quartile Frequency	Q1 Freq Rel,	The frequency that divides the selection into two frequency intervals containing 25% and 75% of the energy in the signal relative to the frequency range of the signal.
*3rd Quartile Frequency	Q3 Freq (Hz)	The frequency that divides the selection into two frequency intervals containing 75% and 25% of the energy in the signal.
Relative 3rd Quartile Frequency	Q3 Freq Rel,	The frequency that divides the selection into two frequency intervals containing 75% and 25% of the energy in the signal relative to the frequency range of the signal.
1st Quartile Time	Q1 Time (s)	The time that divides the selection into two time intervals containing 25% and 75% of the energy in the selection.
Relative 1st Quartile Time	Q1 Time Rel,	The time that divides the selection into two time intervals containing 25% and 75% of the energy in the selection relative to signal duration.
Relative 3rd Quartile Time	Q3 Time Rel,	The time that divides the selection into two time intervals containing 75% and 25% of the energy in the selection relative to signal duration.
*Aggregate Entropy	Agg Entropy (bits)	The aggregate entropy measures the disorder in a sound by analysing the energy distribution. Higher entropy values correspond to greater disorder in the sound whereas a pure tone with energy only one frequency bin would have zero entropy. It corresponds to the overall disorder in the sound.
*Average Entropy	Avg Entropy (bits)	This entropy is calculated by finding the entropy for each frame in the signal and then taking the average of these values.
Bandwidth 90%	BW 90% (Hz)	The difference between the 5% and 95% frequencies.

Center Frequency	Center Freq (Hz)	The frequency that divides the selection into two frequency intervals of equal energy.
Center Time	Center Time (s)	The point in time at which the selection is divided into two time intervals of equal energy.
*Relative Center Time	Center Time Rel,	The point in time at which the selection is divided into two time intervals of equal energy relative to the signal duration.
*Call duration	Duration (s)	The difference between Begin Time and End Time for the selection.
*Duration 90%	Dur 90% (s)	The difference between the 5% and 95% times.
*Frequency 5%	Freq 5% (Hz)	The frequency that divides the selection into two frequency intervals containing 5% and 95%.
Relative Frequency 5%	Freq 5% Rel,	The frequency that divides the selection into two frequency intervals containing 5% and 95% relative to frequency range.
*Frequency 95%	Freq 95% (Hz)	The frequency that divides the selection into two frequency intervals containing 95% and 5%.
Relative Frequency 95%	Freq 95% Rel,	The frequency that divides the selection into two frequency intervals containing 95% and 5% relative to frequency range.
*Inter-Quartile Range Bandwidth	IQR BW (Hz)	The difference between the 1st and 3rd Quartile frequencies.
*IQR (Inter-quartile Range) Duration	IQR Dur (s)	The difference between the 1st and 3rd Quartile Times.
Max Entropy	Max Entropy (bits)	Maximum entropy calculated from each frame.
Max Frequency	Max Freq (Hz)	The frequency at which Max Power occurs within the selection.
Max Time	Max Time (s)	The first time in the selection at which a spectrogram point with power equal to Max Power/ Peak Power occurs.
Min Entropy	Min Entropy (bits)	The minimum entropy calculated for a spectrogram slice within the selection bounds.

Peak Time	Peak Time (s)	The first time in the selection at which a sample with amplitude equal to Peak Amplitude occurs.
*Time 5%	Time 5% (s)	The time that divides the signal into two time intervals containing 5% and 95%.
Relative Time 5%	Time 5% Rel,	The time that divides the signal into two time intervals containing 5% and 95% relative to signal duration.
Relative Time 95%	Time 95% Rel,	The time that divides the signal into two time intervals containing 95% and 5% relative to signal duration.

Descriptive statistics and Potential for individual coding.

(DFA) 13 variables included in final DFA model (X). (SE) standard error of the mean. (Krusk-Wallis) Kruskal-Wallis test after Bonferroni correction, (*) p < 0.001. (Mean CVw) within individual comparison. (CVa) between individual comparison. (PIC) Potential for Individual Coding.

Variable	DFA	Mean	Min	Max	SE	Krusk–Wallis	Mean CVw	CVa	PIC
1st Quartile Frequency	X	1444,3	0,9	3000,0	271,8	*	38503,6	73887	1,919
Relative 1st Quartile Frequency	X	3,3	0,0	1500,0	62,4	*	219,9	3896	17,714
3rd Quartile Frequency	X	197,8	0,1	3027,8	436,6	*	70423,4	190607	2,707
Relative 3rd Quartile Frequency		0,3	0,0	1,0	0,2	*	0,0	0	1,960
1st Quartile Time		1747,2	0,5	3562,5	367,6	*	60556,2	135130	2,231
Relative 1st Quartile Time		2,4	0,1	1687,5	56,2	*	229,5	3159	13,761
Relative 3rd Quartile Time		246,2	0,2	43525,0	1508,0	*	216894,9	2274186	10,485
Aggregate Entropy	X	3,2	0,7	4,8	0,5	*	0,2	0	1,846
Average Entropy	X	2,8	1,7	4,0	0,4	*	0,1	0	1,869
Bandwidth 90%		839,2	187,5	2437,5	355,2	*	69079,2	126142	1,826
Center Frequency		1589,0	468,8	3375,0	303,2	*	45489,3	91910	2,020
Center Time		198,1	0,1	3028,1	436,6	*	70428,0	190611	2,706
Relative Center Time	X	0,5	0,1	1,0	0,2	*	0,0	0	2,470
Call Duration	X	1,0	0,2	1,9	0,2	*	0,0	0	1,460
Duration 90%	X	0,7	0,1	1,6	0,2	*	0,0	0	1,657
Frequency 5%	X	1209,8	375,0	2250,0	249,9	*	42818,7	62427	1,458
Relative Frequency 5%		0,2	0,0	0,5	0,1	*	0,0	0	1,303
Frequency 95%		2049,0	1125,0	4125,0	432,2	*	84005,1	186777	2,223
Relative Frequency 95%		0,7	0,3	1,0	0,1	*	0,0	0	1,823
Inter-Quartile Range	X	301,8	86,1	1218,8	188,9	*	17712,6	35694	2,015
IQR (Inter-quartile Range) Duration	X	0,4	0,0	1,2	0,1	*	0,0	0	2,301

Max Entropy		3,9	2,9	4,9	0,3	*	0,0	0	2,044
Max Frequency		1572,4	468,8	3468,8	336,3	*	58737,8	113076	1,925
Max Time		197,9	0,1	3027,5	436,6	*	70409,4	190584	2,707
Min Entropy		1,6	0,1	2,9	0,4	*	0,1	0	1,685
Peak Time		197,9	0,1	3027,5	436,6	*	70409,3	190583	2,707
Time 5%	X	197,9	0,0	3027,5	436,5	*	70738,2	190565	2,694
Relative Time 5%		0,1	0,0	0,4	0,0	*	0,0	0	2,247
Relative Time 95%		0,8	0,6	1,0	0,1	*	0,0	0	2,143