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1 **Zoo visitor effect on mammal behaviour: does noise matter?**

2

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22

23 ABSTRACT

24 The zoo visitor effect is the change in animal behaviour and physiology in response to
25 the presence of a viewing public. It is thought to result from, amongst other things,
26 visitor generated sound (i.e., noise), but this hypothesis has never been explicitly tested.
27 We tested this hypothesis through observations on the behaviour and enclosure use of
28 12 mammal species held in 12 separate enclosures at the Belo Horizonte Zoo when
29 exposed to different sound pressure levels (i.e., noise) from the visiting public. The
30 results show that increasing sound pressure levels without the public being present
31 significantly reduced resting behaviour. Whereas increasing sound levels with the public
32 present significantly reduced resting, other behaviour and significantly increased
33 vigilance and social negative behaviours. In terms of enclosure use in the presence of
34 visitors, the majority of species spent significantly more time in the 50% of their
35 enclosure furthest away from the public (when public were present). These results show
36 that zoo visitors have a negative welfare impact on zoo-housed mammals, especially
37 groups of noisy visitors where levels were recorded outside of the recommended limits
38 for human well-being (>70 dB(A)). Thus, zoos need to address this issue, probably,
39 through a combination of visitor education campaigns and acoustic modification to
40 enclosures.

41 *Keywords:* animal behaviour; animal welfare; mammals; noise; zoo visitor effect.

42

43 **1 Introduction**

44

45 The zoo visitor effect is the change in behaviour and/or physiological responses
46 of animals in the presence of zoo visitors (Davey, 2006). Such changes are often
47 indicators of poor animal welfare, but, for certain species, human audiences are an
48 enriching interaction (Hosey, 2000; Davey 2006). Scientific investigations into the zoo
49 visitor effect have been ongoing since the 1980s and have generally considered how the
50 viewing public's behaviour affects the well-being of the animals they are watching
51 (Davey, 2006, 2007). In many of these studies, it is assumed that more people means
52 greater levels of noise (i.e., Noise pollution) at animal enclosures.

53 A positive correlation of noise levels and the audience is a common assumption,
54 but it was not empirically tested. In fact, the link between the visitor effect and sound
55 pollution remains untested.

56 Modern zoos, first and foremost need to ensure the well-being of the animals in
57 their care. It is from this core activity that the stated goals of the modern zoo in
58 conservation, research, education and entertainment can be achieved (Young, 2003).
59 Besides the common effort to improve the animal welfare, zoos can negatively impact
60 the well-being of the animals they house due to inherent aspects as unvarying
61 husbandry routines (Lyons et al., 1997) and exposing the animals to the public (Young,
62 2003; Davey, 2006, 2007).

63 The zoo-going public is a potential source of both positive and aversive stimuli
64 for the animals. Previous studies into the zoo visitor effect have largely reported a
65 negative impact on animal behaviour (Mallapur et al., 2005; Sellinger and Ha, 2005) and

66 animal physiology (Hosey, 2000; Davis et al., 2005; Davey, 2006, 2007). For example,
67 some species show less affiliative behaviour (Glatson et al., 1984; Hosey, 2008) in the
68 presence of the public and in some species stress hormone levels are higher during
69 visitor presence (Davis et al., 2005). Typically, such studies have measured the zoo
70 visitor effect in a poorly quantified manner or using qualitative measurements such as
71 the presence or absence of visitors (Mitchell et al., 1991, 1992), while other studies
72 subjectively categorised visitor behaviour as 'agitated' or not (Wells, 2005) for primate
73 species. These studies provide some insights into the zoo visitor effect; however, a
74 better quantification of zoo visitor impacts would provide greater insights. Sound
75 pressure level meters are now relatively low cost and the principles of measuring and
76 assessing noise pollution have been well established by acoustic engineers (Ross, 2007)
77 and are now used by biologists (e.g., Duarte et al., 2011).

78 Zoo visitors are the source of three potential types of stimuli to animals: visual,
79 olfactory and auditory (Young, 2003). Visual and olfactory stimuli are difficult to
80 quantify and measure, not least because there are the emitted stimuli (e.g., colours,
81 movement, smell) and there are the perceived stimuli (i.e., what the animal was
82 observing or smelling). Auditory stimuli are easier to quantify, as they are perceived if
83 the animal is paying attention or not, and their effects, at least on human well-being,
84 are understood (WHO, 1999). Furthermore, there are some studies of noise pollution of
85 the viewing public in zoos, which show negative effects on animal welfare (Owen et al.,
86 2004; Powell et al., 2006). Despite this, we found no zoo studies on sound pollution,
87 which have quantitatively measured noise as a direct consequence of the public's
88 behaviour. Therefore, the aim of this study was to directly measure how sound pollution

89 from the zoo-going public affected behaviour and enclosure use by zoo housed
90 mammals.

91

92 **2 Methods**

93

94 *2.1 Study area and experimental subjects*

95 This study was conducted at the Belo Horizonte Zoo, Minas Gerais, Brazil (S 19°
96 51', W 44° 01') from June 2009 to March 2010. Subjects were 12 different mammal
97 species housed in 12 different enclosures (see Table 1). We chose species known to be
98 popular with visitors such as Chimpanzee (*Pan troglodytes*), and matched with less
99 popular species such as deer (*Cervus elaphus*) (Ward et al., 1998; Whitworth, 2012).
100 Matching was done across all families and its function was to ensure that we had
101 species, which received large and small zoo visitor numbers.

102 *2.2 General data collection*

103 The Belo Horizonte Zoo is closed to the public every Monday (i.e., this creates
104 the experimental condition: background noise but no public) and receives intense
105 visitation on Tuesdays (free entrance day) and the weekend (i.e., this creates the
106 experimental condition: noise and public). Unfortunately, it was not possible for us to
107 create a condition of background sound level and public (i.e., visitor present but control
108 sound pressure level to be equal to background levels). Therefore, control data; that is,
109 no public influence on sound pressure levels were collected on Mondays, and days with
110 visitor influence on Tuesdays and weekends. On Mondays, background levels of noise

111 observed were due to normal routine zoo maintenance activities (e.g., feeding of
112 animals and cleaning of enclosures). To control for time of day effects, we observed,
113 animals in different enclosures using a Latin square experimental design from 0900 h to
114 1700 h. Each group of animals in the 12 different enclosures was observed for 10 hours
115 without (i.e., background sound condition) and 10 hours with the zoo visitors being
116 present (i.e., sound and public condition). We used each enclosure as statistical units for
117 noise pollution sampling (N=12).

118 *2.3 Behavioural sampling visitor avoidance*

119 We observed animals using scan sampling and behaviour was recorded once
120 every two minutes during a 20-minute observation period (see Table 2). Animals in
121 different enclosures were observed at least once or twice per day with the minimum
122 interval of 4 hours between observation sessions (to increase statistical independence)
123 (N=15).

124 The animal's positions within enclosures were recorded simultaneously with the
125 behavioural sampling. All enclosures had an indoor area not in view of the public. When
126 the animal was inside the shelter or hidden by any element inside the enclosure we
127 recorded the behaviour Not visible. The frequency of Not visible was used to measure
128 the visitor avoidance by comparing the expression of this behaviour while high levels of
129 public's noise.

130 *2.4 Sound pressure level measurements*

131 All sound pressure level measurements were made simultaneously with
132 behavioural and enclosure use measurements, thus permitting the direct comparison of

133 data. Sound pressure levels were measured using a sound level meter (model 1325C
134 Minipa, São Paulo, Brazil), mounted on a tripod 2 m above the ground and 2 m from the
135 public (to avoid interference) outside the enclosure pointing towards the animals. All
136 enclosures were open-air with no solid barrier between the animal and the public. The
137 sound level meter had frequency weighting, a fast response, and could measure
138 between 30 and 130 dB on the “A” curve (Rossing, 2007). Immediately before and after
139 each measurement, the sound level meter was calibrated (MSL Calibrator, Minipa model
140 1326, São Paulo, Brazil). We used ‘equivalent continuous sound level’ (L_{eq}) as our
141 measurement of noise, which is the energy mean of the noise level averaged over the
142 measurement period. L_{eq} is the most widely used measurement of sound pollution (see
143 Rossing, 2007; Duarte et al., 2011). We also calculated the percentage sound pressure
144 level L_{50} , which represents an average sound pressure level during the sampling.

145 The non-constant source of sound in this study was from zoo visitors. The
146 number of visitors varied throughout our sampling points during each 20 minutes
147 observation session. As a L_{eq} value represents the energy levels as a constant noise
148 during sampled period, we used categories ranging from one visitor (researcher
149 excluded) to 49, because above this number we were not able to count the number of
150 visitors precisely. . Each category of visitors is represented by a median of L_{eq} from all
151 samples with the same number of visitors.

152 *2.5 Statistical analysis*

153 We tested whether the data met the requirements for parametric statistics by
154 an Anderson-Darling Normality test. Noise levels follow a parametric distribution

155 (P>0.05), but the behavioural data did not (P<0.05), even after attempting data
156 transformations; therefore, parametric tests were used for noise levels analysis and
157 non-parametric statistical tests were used for behavioural analysis.

158 For noise levels analysis, we performed a linear regression to verify the relation
159 of visitors (independent) and L_{eq} (dependent). We also compared L_{eq} values between
160 intense visitation days and Mondays (day closed for visitation) for each enclosure by a
161 Paired T test. Noise levels for all enclosures were assessed by Kruskal-Wallis test and a
162 cluster analysis (Nearest neighbour cluster method) was performed to identify groups
163 where the noise levels are similar. Noise levels, L_{eq} for enclosures (Cage, Paddock, and
164 Pit/Island) were also evaluated by Kruskal-Wallis tests. The correlation between rank of
165 noise levels and rank popularity was also examined by Spearman rank correlation test.
166 Ranks of species popularity were based on Whitworth (2012).

167 Behavioural data were converted into percentages for each session per species
168 group (N=15). Behavioural and shelter use data were compared for days with and
169 without the presence of visitors using Wilcoxon matched pair tests. This was performed
170 for each species group as well as for enclosure type. As noise levels can be similar for
171 days with and without visitors, we established a noise threshold for L_{eq} . When the
172 equivalent noise levels were higher than the mean, we considered the noise higher than
173 usual and expected a behavioural change. In other words, when the L_{eq} was higher than
174 L_{50} , we predict a behavioural response. We compared the behaviours shown by each
175 species group with higher L_{eq} and lower L_{eq} employing the Wilcoxon matched pair tests.
176 The same procedure was used for comparing expressed behaviours in louder and
177 quieter samples at each enclosure type. All statistical tests used a statistical significance

178 level of $P < 0.05$ and were carried out in the software Minitab version 16 and IBM SPSS
179 20.

180 3 Results

181 3.1 Noise levels

182

183 On days without public, the mean sound pressure level for all enclosures L_{eq} was
184 46.75 dB(A) ± 1.18 , which was significantly lower than the 60.42 dB(A) ± 2.46 on days with
185 the public (Paired T test = -20.00, $N_1 = N_2 = 12$, $P < 0.001$).

186 Noise levels are significantly predicted by visitor numbers by the following
187 regression equation: $L_{eq} = 55.5 + 0.18 \times \text{visitor number}$. Results from the linear regression
188 shown a significant positive relationship between L_{eq} and visitors ($r^2 = 0.55$, $F(1) = 55.31$,
189 $P < 0.05$). The equivalent noise levels slightly increase with the number of visitors.

190 Overall, enclosures showed significantly different noise levels ($H(11) = 92.51$,
191 $P < 0.001$). The cluster analysis revealed three main groups. Howler monkeys (*Alouatta*
192 *guariba*) enclosure only was the quietest with a median L_{eq} of 56 dB(A) and an
193 interquartile range of 5.25. The second grouping was deer (*Cervus elaphus*) (58 \pm 4.5
194 dBA), bushdog (*Speothos venaticus*) (58 \pm 5.5 dBA), and ocelot (*Leopardus pardalis*) in the
195 pit enclosure (58.5 \pm 6.5 dBA). The third grouping contains all remaining animals,
196 including: ocelot (*L. pardalis*) in the cage enclosure (59.5 \pm 6 dBA), giraffe (*Giraffa*
197 *camelopardalis*) and kob (*Kobus ellipsiprymnus*) at the same paddock (60.5 \pm 6 dBA),
198 golden lion tamarin (*Leontopithecus chrysomelas*) (61 \pm 5.25 dBA), jaguar (*Panthera onca*)
199 (61 \pm 6.25 dBA), elephant (*Loxodonta africana*) (62.5 \pm 5 dBA), gorilla (*Gorilla gorilla*) (63 \pm 5

200 dBA), capuchin (*Cebus xantosternos*) (63.5 ± 4.25), and chimpanzee (*Pan troglodytes*)
201 (63.5 ± 6.25).

202 Noise levels across enclosures also demonstrated significant differences while
203 comparing enclosures with different shapes and public's proximity ($H(2) = 25.77$,
204 $P < 0.001$). Circular enclosures, such as islands and pits, had greater public access from
205 almost the whole perimeter, and showed higher L_{eq} values of 62.00 ± 6.0 dB(A) ($Z = 4.93$),
206 followed by the rectangular paddock with L_{eq} of 60.00 ± 6 dB(A) ($Z = -2.02$) and the square
207 cage with a L_{eq} of 59 ± 5.25 dB(A) ($Z = -3.41$).

208 Visitors' preferences and attitudes, regarding noise levels, were evaluated
209 correlating the rank of noise levels and the rank of popularity based on Whitworth
210 (2012). We considered apes, monkeys, elephants, giraffe, big cats, canids and relatives,
211 and deer species, as a descending order of popularity. Noise levels and popularity were
212 positively correlated ($r_s(10) = 0.668$, $P < 0.05$).

213

214 3.2 Behaviour

215

216 The mean of each behaviour expressed for every species group ($N=9$) between
217 days with intense visitation and in days closed to visitation were not statistically
218 different for all species observed ($P > 0.05$). The use of shelter or any other structure at
219 the enclosure to avoid the public was also not significant ($P > 0.05$). The same occurred
220 comparing behaviours per enclosure ($N=3$). Behaviours expressed on Pits and Islands,
221 Cages, or Paddocks are not significantly different when comparing days with and

222 without visitors ($P>0.05$). Besides the fact of different noise levels due to visitation, we
223 were not able to find behavioural differences between days with or without zoo visitors.

224 As we observed enclosures with different noise levels and different attitudes
225 towards animals, due to popularity, we set a threshold for L_{eq} at the midpoint of noise
226 level during sampling, L_{50} . Each enclosure has a different L_{eq} and, consequently, a
227 different L_{50} values. The bushdog's paddock (L_{50} = Median 61.5, Interquartile range ± 5
228 dBA), capuchin's island (L_{50} = 67 ± 4.25 dBA), chimpanzee's pit (L_{50} = 66.5 ± 4.75 dBA),
229 deer's paddock (L_{50} = 61.5 ± 4 dBA), elephants' paddock (L_{50} = 65 ± 4.25 dBA), giraffe's and
230 kob's paddock (L_{50} = 63 ± 5.5 dBA), golden lion tamarin's cage (L_{50} = 65 ± 6.25 dBA), gorilla's
231 pit (L_{50} = 67 ± 5 dBA), howler's cage (L_{50} = 61.5 ± 5 dBA), jaguar's pit (L_{50} = 64 ± 6 dBA),
232 ocelot's cages (L_{50} = 62.5 ± 5.25 dBA), and ocelot's pit (L_{50} = 61 ± 7.5 dBA) presented these
233 respective values for L_{50} . For these values, we used for behavioural analysis, only records
234 where the L_{eq} were greater than or equal to the L_{50} limit.

235 We did not observed any behavioural change between higher and lower noise
236 levels ($P>0.05$). No differences in shelter use or public avoidance were observed either
237 ($P>0.05$). As before, no behavioural differences for animals in Pit or island, Paddock or
238 Cage was verified ($P>0,05$).

239

240 **4 Discussion**

241

242 In this study, we did not assume that a higher visitor numbers implies greater noise
243 levels. We approached the effects of visitor presence and the noise that they produce
244 from their effects on the behaviour of the mammals.

245 As expected, noise levels were greater during visitation days. Despite the difference
246 found, this does not necessarily imply non-visitor days were better for animal welfare.
247 Belo Horizonte Zoo is located in an urban area, approximately 5.6 kilometres from an
248 airport and 3.5 kilometres from football stadium. Thus, the zoo is not free from traffic
249 noise from roads and air even on non-visitor days.

250 Visitors' presence slightly increased noise levels, although, individual enclosures
251 presented different noise levels. We found three groupings based on L_{eq} values, the
252 enclosure's location and animal activity level appear to explain these groupings. In the
253 case of the group represented by Howler monkeys. Trees surround this cage and visitors
254 have a naturalistic experience observing these animals. Naturalistic enclosures are more
255 aesthetically pleasing and provide visitors with an immersive experience changing their
256 perception of animals, their conservation and their welfare (Hancocks 2012, McPhee
257 and Calstead 2012). Bushdog, ocelot in pit enclosure, and deer, composed the second
258 group. These animals express low activity levels and responses towards the public. Big
259 and charismatic animals form the last group. Indeed, we found that popularity was a
260 good predictor for noise levels. This reinforces the result that an increase in visitor
261 numbers does not always result in greater noise levels. The behaviour of animals and
262 the visitor's preference strongly influenced the noise levels.

263 The enclosure type also influenced the noise from visitors. Circular enclosures, such
264 as islands and pits, allow the public to follow the animal using the perimeter, increasing
265 the interaction and the noise produced. At these enclosures, we observed the highest
266 L_{eq} values. In the same manner, the rectangular shape of paddocks, allowed the public
267 to move only along the front. Cages, besides being the smallest enclosures, permitted
268 the animals to move in three-dimensional space escaping from the public view,
269 consequently decreasing the interaction and noise levels.

270 The lack of significant behavioural changes in this study does not mean that visitors
271 or noise pollution does not have impacts on the welfare of captive animals. Previous
272 studies have reported increases in vigilance and social negative behaviours in response
273 to visitor numbers (Glatson et al., 1984; Mallapur et al., 2005; Wells, 2005; Davey, 2006,
274 2007), but had not confirmed the link with sound levels. Increased vigilance behaviour
275 is associated with animals perceiving that their environment may contain some kind of
276 serious threat (e.g. a stressful situation such as predator presence; Chamove et al.,
277 1988). Whereas, clearly, public induced aggressions towards each other is not good for
278 animal welfare. Some studies of animal stress reported that increasing stress levels
279 often leads to increased levels of aggressive interactions (Hosey and Druck, 1987).
280 However, absence of behavioural changes may also reflect a deprived individual state.
281 Behavioural responses in birds are strongly influenced by the environment and
282 individual state and can be independent from the strength of the disturbance event
283 (Beale and Monaghan, 2004). It might be the case that animals have habituated
284 behaviourally to the noise from the public, but this does not mean they are not being
285 stressed. Studies of humans have found that they can habituate to noisy environments,

286 even learning to sleep in them, but physiological studies show stress levels are
287 maintained high (Ross, 2007).

288 It is also important to take into account the management plan adopted to increase
289 the animals' welfare and avoid displays of acute and agonistic behaviours.
290 Environmental enrichment, conditioning, enclosure design and other variables are
291 relevant when discussing animal welfare and may have an important influence on our
292 results. A number of studies have reported an increase in locomotor behaviour in the
293 presence of zoo visitors. For example, in a study of several primate species the most
294 common response was an increase in locomotion with increasing public numbers
295 (Mitchell et al., 1992). It is interesting to note that zoo visitors prefer more active animals
296 and the results of this study suggest that many zoo animals may respond to increases in
297 noise with an increase in activity. Thus, it would appear that this interaction between
298 animals and visitors is a positive feedback cycle. This phenomenon has been reported
299 in sports stadiums where crowds shout to try and influence the referee and players
300 (Unkelbach and Memmert, 2010; Barnard et al., 2011). In other words the more noise
301 a crowd makes the more an animal becomes active and the more a crowd shouts in
302 response. Clearly, this problem is something zoos could try to resolve using public
303 education programmes.

304 Some studies show that animals may perceive human disturbance similarly to
305 predation risk and, consequently, divert their time and energy into anti-predator
306 responses (Frid and Dill, 2002). Visitor noise could change species' activity cycles making
307 them more active after the zoo closes. This was not investigated in the present study.

308 We observed no increase of shelter use or Not Visible as predicted for public and
309 noise avoidance. Acoustic stimuli are more difficult to avoid than visual stimuli (Wright
310 et al. 2007). Escape from noise is almost impossible in enclosures where the animals
311 have a limited space and shelters are not usually soundproof. Visual stimuli are generally
312 reflective and indirect in which animals could mainly turn way to avoid.

313 Untangling precisely what is aversive about zoo visitors would be complicated as it
314 would involve a reductionist approach to the great number of components that make-
315 up the visual (e.g., crowd size, behaviour, clothes) and auditory (e.g., amplitude,
316 frequencies) stimuli emitted by zoo visitors. In addition, to other possibly harder to
317 quantify stimuli such as olfactory (Farrand, 2007).

318 Despite, physiological responses to noise being difficult to measure, noise pollution
319 has well verified relationship with human health and well-being (Clark et al 2006,
320 Dallman and Bhatnagar 2001). Although different from traumatic experiences (e.g.
321 capture and containment), noise can be equally traumatic (Wright et al. 2007). The
322 constant exposure to noise pollution can lead to negative health consequences, even
323 for sub-threshold levels (Wright et al. 2007).

324 We also should bear in mind that different species have different sensitivities to
325 noise based on their acoustic perception thresholds (Heffner and Heffner, 2007), thus
326 the extrapolation of human standards for noise pollution to animals should be avoided
327 and specific studies regarding healthy noise limits should be reinforced.

328 The sound pressure produced by visitors is characterised by loud peaks and not
329 continuous in nature. Behavioural responding might be occurring only during such

330 peaks. The L_{eq} itself is a measure used for the noise analysis represented by all noise
331 events as a constant noise for the sampled period. Fright responses are related to peak
332 values and are commonly reported events (Ross 2007). However, this study aimed to
333 understand how the noise pollution influences the behaviour of captive mammals and
334 its implications for animal welfare.

335

336 **5 Conclusions**

337 This study showed that the presence of the public increased the sound pressure
338 levels in the areas of visitation at the enclosures of several species of mammals to levels
339 above those recommended for human well-being (>70 dB(A); WHO, 1999); therefore,
340 almost certainly having a negative impact on the welfare of these species. A species
341 inherent activity level and the visitor's species preferences strongly influenced noise
342 levels. The results of this study demonstrate the need for auditory barriers and
343 opportunities for animals to escape from visitor-generated noise. Future research
344 should consider the variation in the amplitude of the pressure levels, the noise
345 frequency spectrum produced by visitors and other noise sources (e.g., vehicles).
346 Furthermore, the sound propagation characteristics of enclosures should be
347 investigated [Ross, 2007].

348

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- 437

438 **Table 1**

439 Mammal species studied and their enclosures at the Belo Horizonte Zoo, Minas Gerais,
 440 Brazil.

Enclosure Style	Species	Enclosure size (m ²)	Distance animal (m)	Visitation area (m)	Sex
Cage	<i>Alouatta guariba</i>	40	1	14	1♂, 3♀
Cage	<i>Leontopithecus chrysomelas</i>	29	1	7	4♀
Pit	<i>Pan troglodytes</i>	1256	15	100*	2♂, 2♀
Pit	<i>Gorilla gorilla</i>	2040	3	110*	1♂
Island	<i>Cebus xanthosternos</i>	2123	1	50*	1♂, 3♀
Pit	<i>Panthera onça</i>	1256	15	100*	2♂
Pit	<i>Leopardus pardalis</i>	1256	15	100*	3♂
Cage	<i>Leopardus pardalis</i>	70	1	7	1♂, 1♀
Paddock	<i>Speothos venaticus</i>	263	1	13	4♂
Paddock	<i>Loxodonta africana</i>	7407	1	74*	1♂, 3♀
Paddock	<i>Giraffa camelopardalis</i>	2100	1	105*	2♀
	<i>Kobus ellipsiprymnus</i>				1♂, 2♀
Paddock	<i>Cervus elaphus</i>	1027	1	26	2♂, 1♀

441 *Area of visitation: it is possible to have more than 200 people in front of the enclosure;

442 Distance animal = minimum possible distance between animal and sound pressure
 443 meter (m).

444

445 **Table 2**

446 Ethogram of behaviours recorded in the present study on zoo visitor effects at the Belo
 447 Horizonte Zoo, Minas Gerais, Brazil.

Behaviour	Description of behaviour
Movement	Animal in any type of movement around its enclosure
Feeding	Animal eating or drinking
Resting	Animal in any posture with its eyes closed or not paying attention to its environment
Foraging	Animal exploring its enclosure and clearly searching for a resource
Vigilance	Animal stationary in any posture paying attention to its environment or actively scanning/checking its environment
Vocalisation	Any sound deliberately made by the animals
Affiliative behaviours	Animals from the same group interacting positively, including: contacts, copulas, grooming, social play, sniffing
Aggressive behaviours	Animals from the same group interacting negatively, including: fights, threats, and agonistic behaviours.
Abnormal behaviour	Behaviour that is qualitatively (e.g., stereotypic) abnormal
Other behaviours	All other behaviours expressed, which are not described above
Not visible	When the animal cannot be observed and/or inside the shelter.

