Assessing factors influencing student's perceptions towards animal species conservation

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Background: The way humans perceive and interact with non-human animals is particular to each person, from antipathetic interactions evidenced by fear, aversion or repulsion, to empathy evidenced by feelings of affection, enchantment and interest in the animal. In this sense, herein we investigated the perception of university students about species belonging to different classes of wild vertebrates and the influence of social and educational factors. **Methods**: Data were obtained through online forms answered by 700 university students from 9 Brazilian states, 328 females and 372 males, aged between 18 and 65 years. The form had 8 sentences to be answered in relation to 17 species of wild vertebrates. The agreement level for each of these sentences was to be indicated using a five-point Likert scale. The sentences were designed to assess aesthetic, risk, utilitarian and preservation perceptions attributed to each species by students. **Results**: We found that species that students agree are useful are generally also perceived as beautiful and should be preserved. On the other hand, we found similarity between the species perceived as ugly and should not be preserved; and between the species perceived as harmful and those considered dangerous. We found a high frequency of responses regarding agreement that the animal is useful and that it should be preserved for all species. Lower-income women and students more often agree that animals are harmful. We found that perceptions of danger in relation to animals were predominantly associated with younger respondents; however, this did not lead to less support for conservation among these students, as students of all age groups agree that species should be preserved. Our results show that students' knowledge area was an important predictor associated with empathetic and antipathetic perceptions. Environmental students showed greater empathy in all analyzed categories (beauty, usefulness, harmlessness and preservation) than non-environmental students. On the other hand, students from the

exact sciences area showed greater dislike in all analyzed categories than students from other areas. We found a strong relationship between the areas (Environmental) and (Humanities, Languages and Arts) for the attitudinal factors associated with utility and preservation, suggesting a similar empathetic worldview for students in these areas.

Conclusions: We found that the perception directed towards wild vertebrates varies according to the gender, age and study area of the students, in addition to the taxon considered. Finally, our results indicate that negative perceptions should be taken into account in environmental education efforts, educational policies and in planning fauna conservation plans which should incorporate the most diverse audiences, and not only encompass charismatic species, but extend to animals that arouse great aversion on the part of people.

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24 Abstract

25 **Background**: The way humans perceive and interact with non-human animals is particular to each

26 person, from antipathetic interactions evidenced by fear, aversion or repulsion, to empathy

27 evidenced by feelings of affection, enchantment and interest in the animal. In this sense, herein we

28 investigated the perception of university students about species belonging to different classes of

29 wild vertebrates and the influence of social and educational factors.

30 **Methods**: Data were obtained through online forms answered by 700 university students from 9

31 Brazilian states, 328 females and 372 males, aged between 18 and 65 years. The form had 8

32 sentences to be answered in relation to 17 species of wild vertebrates. The agreement level for

33 each of these sentences was to be indicated using a five-point Likert scale. The sentences were

34 designed to assess aesthetic, risk, utilitarian and preservation perceptions attributed to each species

35 by students.

36 **Results**: We found that species that students agree are useful are generally also perceived as

37 beautiful and should be preserved. On the other hand, we found similarity between the species

38   perceived as ugly and should not be preserved; and between the species perceived as harmful and
39   those considered dangerous. We found a high frequency of responses regarding agreement that the
40   animal is useful and that it should be preserved for all species. Lower-income women and students
41   more often agree that animals are harmful. We found that perceptions of danger in relation to
42   animals were predominantly associated with younger respondents; however, this did not lead to
43   less support for conservation among these students, as students of all age groups agree that species
44   should be preserved. Our results show that students' knowledge area was an important predictor
45   associated with empathetic and antipathetic perceptions. Environmental students showed greater
46   empathy in all analyzed categories (beauty, usefulness, harmlessness and preservation) than non-
47   environmental students. On the other hand, students from the exact sciences area showed greater
48   dislike in all analyzed categories than students from other areas. We found a strong relationship
49   between the areas (Environmental) and (Humanities, Languages and Arts) for the attitudinal
50   factors associated with utility and preservation, suggesting a similar empathetic worldview for
51   students in these areas.

52   **Conclusions**: We found that the perception directed towards wild vertebrates varies according to
53   the gender, age and study area of the students, in addition to the taxon considered. Finally, our
54   results indicate that negative perceptions should be taken into account in environmental education
55   efforts, educational policies and in planning fauna conservation plans which should incorporate
56   the most diverse audiences, and not only encompass charismatic species, but extend to animals
57   that arouse great aversion on the part of people.

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59   **Keywords**: Ethnozoology; Wildlife; Animal conservation; Environmental conservation; Nature
60   conservation

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Introduction

64   The existing relationships between humans and non-human animals have been altered in the course
65   of the social transformations that have taken place throughout human history (Alves et al. 2012b;
66   Alves and Souto 2015). Naturally, these interactions vary according to the animal taxa involved
67   and the cultural context in which human populations are inserted.

68   The vertebrate group includes taxa that stand out for providing useful products to humans, as well

69   as species that are targets of various conflicts (GORE et al. 2006; Inskip and Zimmermann 2009;

70   Alves 2012). The wide range of perceptions with a greater degree of aversion or greater degree of

71   empathy of people regarding different vertebrate species influences human attitudes towards fauna

72   (Alves et al. 2012a; Alves et al. 2010).

73   It is known, for example, that people generally have a great aversion to snakes and have negative

74   attitudes towards these animals (Alves et al. 2009, Silva et al. 2021). Another example is sharks

75   being stigmatized as devouring humans, a situation partly influenced by negative contributions

76   from the media, particularly television and cinema. These circumstances make the conservation of

77   the group have a very low popular appeal, unlike what happens with other marine animals such as

78   turtles, dolphins and manatees (Lessa R, Santana FM, Rincon G, Gadig OBF 1999). Thus, while

79   some species are annually culled in numbers that put their populations at risk as a way to retaliate

80   against human-wildlife conflicts, others are used as flagship species in conservation programs

81   (Sabino, J., & Prado 2006).

82   Formal education may have an effect on people's attitudes towards animals, indicating that a

83   higher education level is reflected in more positive attitudes adopted by the person (Pinheiro et

84   al.,2016). In this sense, Ceríaco (2012) indicated that people with higher education levels have

85   fewer misconceptions about herpetofauna linked to folkloric aspects that can generate aversion,

86   which could be explained by their greater knowledge when compared to people with low education

87   levels.

88   In this study, we investigated the perception of university students from Northeastern Brazil about

89   species belonging to different classes of wild vertebrates and the influence of social and

90   educational factors on the preservation of these animals. More specifically, we verified whether:

91   (1) students' perceptions vary according to the animal taxon (fish, amphibians, reptiles, birds and

92   mammals); (2) the perception changes according to the social profile of the interviewees (gender,

93   age and socioeconomic profile); and (3) university students from the Environmental area have

94   greater empathy towards wild vertebrates compared to students from Non-Environmental Areas

95   (Exact sciences, Humanities, Arts and Health).

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Materials & Methods

Study area

The data for this study were obtained through sharing online forms among students from higher education institutions in northeastern Brazilian states. This region comprises an area of 1.5 million km² and extends from about 02°54' to 17°21' S and from 35° to 46°30' W, and includes nine states. It has a population of around 57 million inhabitants, representing approximately 27% of Brazil's population (IBGE, 2021).

Participants

The form was answered by students from five knowledge areas: 1) Environmental (N= 285); 2) Linguistics, Languages and Arts (N=31); 3) Exact and Technological Sciences (N= 163); 4) Health (N=107); and 5) Applied Social Sciences and Humanities (N=114). This categorization was based on the classification of the Capes 2017 Table (the most recent version available online: http://www.capes.gov.br/avaliacao/instrumentos-de-apoio/tabela-de-areas-do-conhecimento-avaliacao). The study obtained a favorable opinion from the Research Ethics Committee of the Health Sciences Center of the Federal University of Paraíba - CEP/CCS (Prot. No. 095/16. CAAE: 54452015.5.0000.5188.)

Participants from each knowledge area were randomly selected from web pages of undergraduate courses on the social network Facebook, for example (Biology 2016, Civil Engineering 2016.2, Nursing 2015, Languages 2016). Data were collected after receiving consent from the students, who were previously informed about the research objectives. Responses were obtained from 700 undergraduate students belonging to 61 courses from 49 institutions (18 Federal, 11 state and 20 private institutions) distributed in all of the Northeast Brazilian states (Figure 1). Of the total number of respondents, 328 were women (46.9%) and 372 were men (53.1%), aged between 18 and 65 years. The questionnaires were applied from April 2016 to January 2017.

Data collection

Students' perceptions of wild vertebrates were assessed through the agreement level to a series of sentences that indicate greater or lesser empathy and antipathy towards each species. The sentences were related to 17 animal species, including 4 mammals (dolphin, bat, jaguar and armadillo), 4

131   birds (vulture, owl, parrot and heron), 4 reptiles (snake, lizard, turtle and alligator), 4 fish (shark,

132   ray, tilapia and piranha) and 1 amphibian (frog). The animals were chosen considering their

133   potential to arouse different levels of empathy or aversion in students, in addition to being

134   commonly found in urban and/or rural areas of the study region.

135   Four categories of perception were considered, each one consisting of two antagonistic sentences:

136   1) Aesthetic perception, measured by the sentences "*the animal is beautiful*" and "*the animal is*

137   *ugly*"; 2) Risk perception, measured by the sentences "*the animal is dangerous*" and "*the animal*

138   *is harmless*"; 3) Utilitarian perception, measured by the sentences "*the animal is useful*" and "*the*

139   *animal is harmful*"; and 4) Ecological perception measured by the sentences "*the animal must be*

140   *preserved*" and "*the animal must not be preserved*". The empathy and aversion levels were

141   measured according to the agreement level with each sentence, with an agreement degree ranging

142   from 1 to 5 on the Likert scale (Strongly Disagree, Slightly Disagree, Neither Agree nor Disagree,

143   Slightly Agree and Strongly Agree). We attributed the perception of empathy to agreement with

144   the empathetic sentences and disagreement with the antipathetic sentences. We attributed the

145   perception of aversion to agreement with antipathetic sentences and disagreement with empathetic

146   sentences.

147

148   **Data analysis**

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150   Reliability analyzes of the scales used were performed considering Cronbach's alpha as an

151   indicator of internal consistency (Byrne 2001). The reliability test was applied to the 4 scale factors

152   and to all factors together.

153   Next, we performed multiple factor analysis (MFA) (Husson et al. 2018) to check for similarity

154   between the most frequent species in each perception category. MFA takes into account the fact

155   that the data is structured into groups (herein, different species) to balance the importance of each

156   group in the analysis. Some perception categories are then associated when the same agreement

157   level with certain attitudes is answered for the same set of species.

158   The Mann-Whitney U test was used to test the variation in the perception of students of different

159   genders in relation to each taxonomic group evaluated. To examine the effects of student gender,

160   age, income and knowledge area on the level of agreement with each sentence we performed a set

161   of cumulative link mixed model (CLMM). We used CLMM because the data of the level of

162 agreement are ordinal, ranging from 1 (completely desagree) to 5 (completely agree). We
163 performed five different models associated with each perception category. We considered i) the
164 perception category as a response variable; ii) student gender, age, income and knowledge area as
165 fixed effects predictor variables; and iii) student ID as a random factor. There was no collinearity
166 ($p > 0.05$) among predictor variables. We used residual checks to verify whether our models were,
167 in principle, suitable or not. We used the Akaike information criterion to select models of interest
168 if ΔAIC values >6 (ΔAIC obtained from the difference between a null and complete model AIC
169 values; Harrison et al., 2018; Richards, 2008). All analyses were performed in R ver. 3.5.3 (R
170 Development Core Team, 2019) CLMM were based on the ordinal package (Christensen, 2019)
171 and MFAs were based on the *FactoMineR* (Husson et al 2018).

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175 **Results**
176 **Similarities between species in different Perception categories**

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178 We found that species that students agree are useful are generally also perceived as beautiful and
179 should be preserved. On the other hand, we found similarity between the species perceived as ugly
180 and that should not be preserved; as well as between species perceived as harmful, and those
181 considered dangerous (Fig 2, supplementary material Table 1). The first dimension (Dim_1) of the
182 MFA accounted for 35.8% of the variability in attitude categories across different species (Fig.
183 3a). The items beautiful, ugly and harmful contributed to 21%, 20% and 18% of the variance
184 explained by Dim_1, respectively (Fig. 2b). The second MFA dimension (Dim_2) explained 18.5%
185 of the variance with harmless and dangerous explaining most of the variance (34% and 31%,
186 respectively) (Fig. 2c). We found a high frequency of responses regarding the agreement that the
187 animal is useful and that it should be preserved for all species (Figs 3A and G). In addition, most
188 students disagreed that the species should not be preserved (Fig 3H). Larger animals, such as
189 jaguars, dolphins, macaws, turtles and sharks comprise the animals most frequently perceived as
190 beautiful (Fig 3C); while piranhas, vultures, bats and frogs are generally perceived as ugly (Fig
191 3D). Species perceived as harmless are dispersed in all categories (Fig 3E), and therefore the axis
192 related to the harmless category did not appear close to the axes associated with other categories

193 in the MFA analysis (Fig 2). Snake, piranha and alligator make up the species most perceived as
194 both dangerous and harmful (Fig 3B and F).

195

196 **Influence of socioeconomic factors on aesthetic perceptions of wild vertebrates**

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198 We found a trend that women agree more often than men that animals are "beautiful" and less
199 often that they are ugly, but this difference between genders was not significant (Table 1). When
200 dividing the species into taxonomic groups, we only observed differences in perceptions between
201 genus for mammals. In this case, we found that women more often agreed that the mammal species
202 presented are beautiful, which denotes empathy (W=21579; p=0.01). On the other hand, men more
203 often agreed that these species are ugly, indicating dislike (W= 16158; p= 0.01). There was no
204 statistically significant variation in relation to the aesthetic category for the other taxa. The
205 variation in the age group and income of the interviewees did not interfere in the aesthetic
206 preference of the animals (p> 0.05). Students from all areas when compared to students from
207 environmental areas significantly perceive that the analyzed animals are uglier (Table 1).
208

209 **Effect of socioeconomic factors on risk perceptions**

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211 Age showed an effect on students' aversion, with younger students showing a greater tendency to

212 fear, confirmed by the item "Dangerous" when compared to older students who attributed the

213 perception that animals are more "harmless" with greater frequency. We found no significant

214 difference between income and gender regarding risk factors (Table 2). However, analysis by

215 taxonomic group showed that male respondents were less likely to have aversions to reptiles than

216 females. In turn, females more frequently attributed "Dangerous" to animals in this group

217 (W=15614; p=0.01), to the detriment of animals from the other taxonomic groups analyzed.

218 Therefore, we did not obtain significant variation in relation to the other taxa. Regarding the

219 knowledge area, students from all other areas perceive animals as more dangerous and less

220 harmless when compared to students from the environmental area.

221

222 **Effect of socioeconomic factors on utilitarianism perceptions attributed to taxa**

223

224 There was an influence of gender and student income on the harmful category, with women and

225 lower-income students more often agreeing that animals are harmful. Regarding the knowledge

226 area, the agreement was significantly higher when considering the usefulness of vertebrates and

227   lower when considering their harmfulness between students of courses in the environmental area

228   in relation to those in the areas of "Exact and Technological Sciences", "Applied Social Sciences"

229   and "Human Sciences". On the other hand, we did not find a significant difference between

230   students in the "Languages, Linguistics and Arts" area and in the "Environmental" area (Table 3).

231

232   **Influence of socioeconomic factors on preservation perceptions**

233

234   Our results showed that it was generally possible to perceive that the university students

235   interviewed support the preservation of the evaluated organisms (median = 4.90; interquartile

236   range = 4.70 to 5.0). We found that the agreement regarding the preservation of wild vertebrates

237   is significantly higher among students of courses in the Environmental area in relation to those in

238   the Exact and Technological Sciences area, followed by students of the Applied Social Sciences

239   and Humanities area; and finally, by Health. On the other hand, we found no significant difference

240   between students in the Languages, Linguistics and Arts area and in the Environmental area

241   regarding the preservation of wild vertebrates.

242   We also observed that agreement of the "do not preserve" category was significantly lower among

243   students from courses in the Environmental area in relation to those in the areas of Exact and

244   Technological Sciences, Applied Social Sciences and Humanities. Older and lower-income

245   students more often agree that species should not be preserved (Table 4).

246

247   **Cronbach's Alpha for Scale Factors**

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249   The factor analysis results indicated that the eight items used in our scale were used to measure

250   four factors: Aesthetics, Utility, Risk and Preservation. Cronbach's alpha coefficient for the

251   **Aesthetic Factor** was (α = 0.94); we obtained (α = 0.79) for the **Risk factor,** (α = 0.81) for the

252   **Preservation factor**, while we found a much lower value (α= 0.17) for the **Utility factor**.

253   Cronbach's alpha coefficient for the entire instrument was (α = 0.73). This indicates that the

254   questionnaire showed a good degree of reliability (Nunnaly 1978; Prokop, Tolarovičová *et al.*

255   2010; Prokop *et al.* 2009).

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257

258   **Discussion**

259   We found that factors such as aesthetics, utilitarian potential and the risk associated with animals

260   are strong influencers of perceptions and attitudes towards the preservation of wild vertebrates.

261   These results reinforce previous studies carried out with students of different education levels

262   (Kidd & Kidd 1990; Prokop et al. 2009a; Prokop et al. 2009; Campos et al. 2012), from

263   kindergarten (Alves et al. 2014; Borgi and Cirulli 2015; Kubiatko 2012) to University.

264   It is known that the perception directed to animals varies according to taxa. Our results reinforce

265   this trend, with a great variation in the perception of the students interviewed in relation to the

266   different animals analyzed. Among the animals considered the most beautiful are large,

267   charismatic and iconic mammals such as the jaguar and dolphin, and one of the most popular wild

268   birds as pets in Brazil and in the world: the parrot (Alves et al. 2013; Fernandes-Ferreira et al.

269   2012b; Roldán-Clarà et al. 2014). Charismatic wild vertebrates that are often the target of

270   conservation campaigns (Barney et al. 2005; Schlegel and Rupf 2010) are also favored in relation

271   to society's perception of fauna, and this situation was also observed in our study.

272   In another perspective, some authors suggest that humans empathize with phylogenetically closer

273   animals, for example those exhibiting, physical, behavioral or cognitive similarities with humans

274   (Herzog & Burghardt 1988; Miralles et al. 2019), therefore mammals would also benefit in this

275   aspect due to the potential to awaken anthropomorphic projections (human emotions or intentions

276   to non-human entities) (Miralles et al. 2019). On the other hand, among the taxa with the lowest

277   scores in relation to aesthetics are animals such as piranha, vultures, frogs and bats, which are

278   associated with risks to humans or negative beliefs. For example, bats are the target of legends and

279   tales that encourage people to dislike these animals in Brazil (Rego et al. 2015), being considered

280   uncharismatic for the general population and the potential ecological benefits of these animals are

281   rarely disclosed.

282   Aesthetically attractive species also received greater support for preservation and were more

283   perceived as useful by respondents. Other studies (Pinho et al. 2014; Gunnthorsdottir 2001) have

284   also reported greater public support for species deemed most attractive. Our data also revealed that

285   students of both genders valued the aesthetics of organisms, but with women considering mammals

286   more beautiful and reptiles more dangerous than other taxa. For Kaltenborn et al. (2006), gender

287   exerts a significant influence on affinity levels towards animals. In this sense, some works such as

288   those by (Kellert 1989; Williams et al. 2002; Zinn and Pierce 2002) suggest that women have

289   higher levels of support for species protection than men. However, it is noteworthy that this affinity
290   may vary according to the taxon considered, as found herein.
291   The results obtained by Czech et al. (1998) reinforce this situation, suggesting that mammals, birds
292   and fish are part of a distinctly more positive social construction, and thus were identified as more
293   "advantaged" than reptiles (excluding turtles). However, in the case of reptiles, despite the
294   aversion that people generally have towards some animals of this group such as snakes (Alves et
295   al. 2012a; Alves et al. 2014; Alves et al. 2012c), there are extremely charismatic species, such as
296   turtles; they are characterized by docility and are often the target of conservation campaigns, which
297   reflects people's positive view of these chelonians, as our results indicate, which point to the
298   "turtle" with greater preservation appeal than other reptiles.
299   Like aesthetics, the usefulness of animals tends to be a factor which positively influences their
300   perception by people. Species of practical utility in human life, whether for providing products
301   used by people for nutrition or as part of their leisure activities tend to be more valued. In fact, the
302   animal that obtained the highest score in the "useful" item was a fish (tilapia), widely consumed
303   as food in Brazil. However, animals such as jaguars, vultures and frogs also achieved high scores,
304   suggesting that students recognize the value of these animals in the environment. This may indicate
305   that higher education students recognize the ecological role of animals in general, regardless of
306   whether the animals in question are a source of products used directly by humans or not. Similar
307   results were found by other authors, such as Kellert and Berry (1980), Bjerke and Ostdahl (2004)
308   and Schlegel and Rupf (2010), who found coherence between higher education levels and positive
309   perceptions of fauna.
310   If useful animals generate greater empathy in people, animals that pose risks and are targets of
311   conflict with humans, in turn, tend to arouse more aversion. This is the case of snakes in Brazil,
312   which, as some works point out, are the target of aversion and fear on the part of people generally
313   due to the risk they pose to human lives and their domestic animals (Alves et al. 2012a; Alves et
314   al. 2012c; Fernandes-Ferreira et al. 2013; Mendonça et al. 2014). Additionally, snakes inspire
315   many myths, proverbs and stories that are transmitted orally and that place these animals as beings
316   associated with evil and that influence the way local people relate to these animals, generally
317   provoking negative attitudes on the part of people (Fernandes-Ferreira et al. 2013; Mendonça et
318   al. 2011; Mendonça et al. 2014). Thus, snakes were the animals which generally had the highest
319   scores on the harmful item among the students interviewed. In addition to snakes, animals such as

320   piranhas, alligators and sharks, which can be seen as a potential risk to humans, were recognized

321   as more harmful (Fig.3).

322   Our data revealed that lower-income students more often agree that animals are harmful. This

323   result can be associated with the fact that the economic impact generated by the attack of wild

324   animals on crops and livestock is more significant for low-income people than for those with

325   higher incomes. In particular, among the animals that were shown to arouse higher perceptions of

326   danger in the students interviewed, some of them such as sharks, jaguars, alligators and snakes are

327   known to evoke fear because they are predominantly large, with physical characteristics that

328   arouse threat or because they are venomous (Staňková et al 2021; Silva et al 2021). A greater

329   perception of fear and harm by smaller vertebrates was associated with piranha, which may

330   indicate a direct threat link to humans given that their attack can generate extensive tissue loss and

331   bleeding (Haddad and Sazima 2003). Piranhas are quite small compared to sharks (for example),

332   but both fish stand out in our study as the species with the highest fear perception scores. Both

333   species are carnivorous, with sharp teeth and often referred to as dangerous animals by the media,

334   thereby constituting characteristics which reinforce the perception of fear in humans. It should be

335   noted that other animals such as bats and snakes, for example, are also associated with negative

336   aspects by the media, enhancing society's negative perception of them.

337   Negative perceptions directed towards animals imply less support for their preservation, and, as

338   we have pointed out in our study, may result from social factors such as gender, income, age,

339   superstitions and myths, formal education and education area. Reinforcing previous research, our

340   results suggest that human beliefs which negatively impact animals are randomly pervasive in the

341   population, regardless of age, culture, gender (Mintzes & Wandersee 1998), or specialized study

342   area (Prokop & Kubiatko 2009). The increase in knowledge about the ecological role of less

343   attractive animals in human vision could make it possible to improve their respective images,

344   reinforcing the need to create environmental policies that include less aesthetically attractive

345   organisms, as well as flagship species.

346   Corroborating our results, previous studies have found that younger people with higher education

347   are often more associated with positive perceptions of wildlife (Dressel et al. 2015; Kellert 1980;

348   Smith et al. 2014; Vaske et al. 2011). However, this has not led to less support for conservation

349   among older students, as students of all age groups agree with high frequency that species should

350   be preserved.

351 Antipathetic perceptions towards animals are also widespread in the population, with greater
352 aversion to animals that pose a risk to humans and are the target of conflicts with them. Our results
353 also showed that the knowledge field of university students has an influence on targeted
354 perceptions of vertebrate preservation. Thus, it can be seen that there is a tendency towards more
355 favorable perceptions of preservation among students of courses with content associated with
356 nature and with greater contact with educational-environmental activities. Several studies point
357 out that having contact with nature and developing an emotional bond with natural elements are
358 determining factors for a preservationist perception (Collado et al. 2013, Collado & Corraliza
359 2015, Duerden & Witt 2010), and attitudes that support biodiversity will be consolidated through
360 concrete experiences with nature (Turpie, 2003). In this context, since our results showed
361 similarity in the preservation perception between students of "Languages, Linguistics and Arts"
362 and the "Environmental" area, it is assumed that a greater appreciation for biodiversity may also
363 result from intrinsic motivations of the student's own subject, as they seek to study something for
364 which they are already close to. On the other hand, direct contact with the urbanized environment
365 and the appropriation of technologies, whether in the home or work environment, may imply less
366 contact between people and nature, both from an affective and preservation point of view (Zhang
367 et al. 2014). This situation may explain the greater antipathy towards the conservation of fauna
368 observed among university students of the courses in the Exact and Technological Sciences area,
369 therefore configuring a different connection link with the fauna than that established among the
370 students of the Environmental area.

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374 **Conclusions**
375 Our results indicate that the perception directed towards wild vertebrates varies according to the
376 students' gender, age and study area, in addition to the taxon considered, implying more or less
377 favorable perceptions of animal preservation. Animals with utilitarian value and components of
378 the so-called charismatic megafauna tend to have more preservation appeal, to the detriment of
379 animals which cause aversion and are the target of constant conflicts with humans, such as snakes
380 and bats, which confirms our hypothesis that there is variation of perception directed to vertebrates
381 according to the analyzed taxon. It is therefore evident that this whole scenario, which influences
382 negative perceptions, must be taken into account in elaborating environmental education and fauna

383 conservation projects, which must incorporate the most diverse audiences, and not only encompass

384 charismatic species, but also extend to animals that arouse great aversion on the part of people.

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386

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Ordinal models designed to verify the effect of age, gender, area of study and income of respondents in relation to Aesthetics.

Abbreviations: E- Environmental; CET- Exact and Technological Sciences; CSAH- Applied Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

1 **Table 1**. Ordinal models designed to verify the effect of age, gender, area of study and income of
2 respondents in relation to Aesthetics.

Response variable	Predictor variables	Estimate	Std. Error	z value	Pr(>|z|)		AIC	AIC Null model	ΔAIC
Beautiful	Age	0.002861	0.007376	0.388	0.69812		30630.47	30744	113.53
	Male: Female	-0.00453	0.08315	-0.054	0.95659				
	A: CET	-1.06814	0.106636	-10.017	<2,00E-16	***			
	CSAH: A	-0.78108	0.117514	-6.647	3.00E-11	***			
	LLA: A	-0.53802	0.200009	-2.69	0.00715	**			
	S: A	-0.94677	0.120177	-7.878	3.32E-15	***			
	Family income	0.020939	0.0264	0.793	0.4277				
Ugly	Age	-0.00057	0.007224	-0.079	0.93676		30467.14	30586.18	119.04
	Male: Female	0.041412	0.081418	0.509	0.61101				
	CET: A	1.009141	0.104326	9.673	<2,00E-16	***			
	CSAH: A	0.865941	0.115195	7.517	5.60E-14	***			
	LLA: A	0.547248	0.19635	2.787	0.00532	**			
	S: A	0.993913	0.117561	8.454	<2,00E-16	***			
	Family income	-0.0359	0.025898	-1.386	0.16572				

4 Abbreviations: E- Environmental; CET- Exact and Technological Sciences; CSAH- Applied
5 Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

Ordinal models designed to verify the effect of age, gender, area of study and income of respondents in relation to Risk.

Abbreviations: A- Environmental; CET- Exact and Technological Sciences; CSAH- Applied

Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

1 **Table 2**. Ordinal models designed to verify the effect of age, gender, area of study and income of
2 respondents in relation to Risk.

Response variable	Predictor variables	Estimate	Std. Error	z value	Pr(>|z|)		AIC	AIC Null model	ΔAIC
	Age	-0.0128	0.005499	-2.328	0.0199	*	32627.02	32687.06	6
	Male: Female	-0.07712	0.061621	-1.251	0.2108				
	CET: A	0.550612	0.07922	6.95	3.64E-12	***			
Dangerous	CSAH: A	0.415412	0.08732	4.757	1.96E-06	***			
	LLA: A	0.380898	0.148025	2.573	0.0101	*			
	S: A	0.49943	0.08918	5.6	2.14E-08	***			
	Family income	0.024774	0.019653	1.261	0.2075				
	Age	0.017547	0.006197	2.832	0.00463	**	32810.42	32828.69	1
	Male: Female	0.043145	0.069681	0.619	0.5358				
	CET: A	-0.38918	0.089677	-4.34	1.43E-05	***			
Harmless	CSAH: A	-0.18455	0.098673	-1.87	0.06144	.			
	LLA: A	-0.35428	0.166569	-2.127	0.03343	*			
	S: A	-0.32648	0.100956	-3.234	0.00122	**			
	Family income	-0.01403	0.022218	-0.631	0.52771				

5 **Abbreviations**: A- Environmental; CET- Exact and Technological Sciences; CSAH- Applied
6 Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

Ordinal models designed to verify the effect of age, gender, area of study and income of respondents in relation to Utilitarianism.

Abbreviations: A- Environmental; CET- Exact and Technological Sciences; CSAH- Applied

Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

1 **Table 3**. Ordinal models designed to verify the effect of age, gender, area of study and income of
2 respondents in relation to Utilitarianism.

Response variable	Predictor variables	Estimate	Std. Error	z value	Pr(>|z|)		AIC	AIC Null model	ΔAIC
Useful	Age	0.007104	0.017166	0.414	0.679		19188.76	19246.8	58.04
	Male: Female	0.186096	0.195761	0.951	0.3418				
	CET: A	-1.9796	0.249857	-7.923	2.32E-15	***			
	CSAH: A	-1.19782	0.274287	-4.367	1.26E-05	***			
	LLA: A	-0.78058	0.464509	-1.68	0.0929	.			
	S: A	-1.50345	0.282192	-5.328	9.94E-08	***			
	Family income	0.050179	0.061637	0.814	0.4156				
Harmful	Age	-0.00161	0.001336	-1.206	0.227728		22645.07	22679.13	34.06
	Male: Female	-0.32636	0.001875	-174.035	<2,00E-16	***			
	CET: A	1.00767	0.001875	537.439	<2,00E-16	***			
	CSAH: A	0.618616	0.181239	3.413	0.000642	***			
	LLA: A	0.577028	0.337199	1.711	0.087038	.			
	S: A	1.038877	0.183769	5.653	1.58E-08	***			
	Family income	-0.19047	0.003324	-57.301	<2,00E-16	***			

4 **Abbreviations**: A- Environmental; CET- Exact and Technological Sciences; CSAH- Applied
5 Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

Ordinal models designed to verify the effect of age, gender, area of study and income of respondents in relation to Preservation. Abbreviations: A- Environmental; CET- Exact and Technological Sciences; CSAH- Applied Social Sciences and Humanities; LLA- Le

Table 4. Ordinal models designed to verify the effect of age, gender, area of study and income of respondents in relation to Preservation.

Response variable	Predictor variables	Estimate	Std. Error	z value	Pr(>|z|)		AIC	AIC Null model	ΔAIC
Preserved	Age	-0.03492	0.018733	-1.865	0.0622	.	9492.07	9502.07	10
	Male: Female	0.05516	0.21735	0.254	0.7996				
	CET: A	-1.32584	0.27351	-4.847	1.25E-06	***			
	CSAH: A	-0.68263	0.30408	-2.245	0.0248	*			
	LLA: A	0.68779	0.5541	1.241	0.2145				
	S: A	-0.768	0.31445	-2.442	0.0146	*			
	Family income	0.06078	0.06865	0.885	0.376				
Not Preserved	Age	0.06046	0.01732	3.49	0.000482	***	9469.7	9486.48	16.78
	Male: Female	-0.08506	0.20434	-0.416	0.677204				
	CET: A	0.75854	0.26026	2.915	0.003562	**			
	CSAH: A	0.74505	0.28557	2.609	0.009082	**			
	LLA: A	-0.68934	0.51888	-1.329	0.184009				
	S: A	0.83797	0.29274	2.863	0.004203	**			
	Family income	-0.1332	0.06521	-2.043	0.041073	*			

Abbreviations: A- Environmental; CET- Exact and Technological Sciences; CSAH- Applied Social Sciences and Humanities; LLA- Letters, Linguistics and Arts; S- Health

Figure 1

States of location of respondents, Number of institutions included in the research by state (N=49). Number of students interviewed by state (N=700)

Figure 2

Compositional similarity of sentences of perceptions of empathy and antipathy obtained from (a) of the MFA.

Contributions of each perception to (b) the first (Dim1) and (c) the second dimension (Dim2). The red dotted line indicates the percentage that would be obtained if all factors contributed equally to the overall variance.
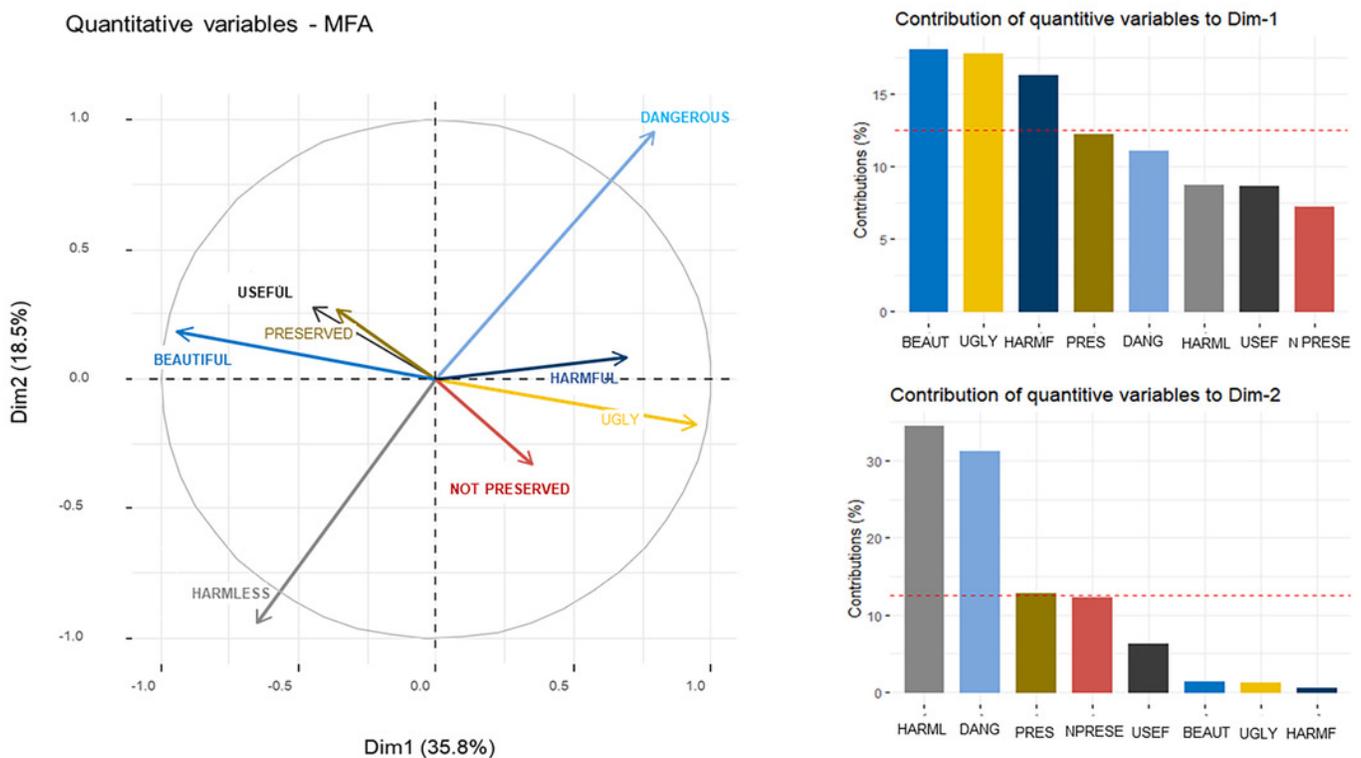
Figure 3

Number of responses for each level of agreement associated with the perception categories Aesthetics (A and B), Utilitarian (C and D), Risk (E and F) and Preservation (G and H) among wild vertebrates.