Species can base their impression of themselves on the number of sensory neurons they have and their IUCN level

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April 16, 2024

Abstract

Humans have the most sensory neurons of any terrestrial species, 18.83B, with more than twice as many as the runner up western gorilla. There are three aquatic species with more than humans and seven more with more than the western gorilla. The killer whale with more than twice as many as humans, long-finned and short-finned pilot whale with a little less than twice humans. With that many sensory neurons it would be assumed that those would be the species with the most emotional disturbance from anthropogenic influence. There is no data on killer whale endangerment, and both long and short finned pilot whales are LC, ranking them 23rd and 24th most disturbed species. It is important for us to consider what the species means to them in evaluating what species we should care about, it would be beneficial to base that on what species care about themselves the most.

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Open Research

An excel table was put together to form this data. RStudio was used to get ranks for the different categories of data for pertinence to the article's intended conveyance and interpretation for explanations of validity of using this basis as an effective way of resource management on endangered species.

Introduction

Humans have the most sensory neurons of any terrestrial species, 18.83B, with more than twice as many as the runner up western gorilla. There are three aquatic species with more than humans and seven more with more than the western gorilla. The killer whale with more than twice as many as humans, long-finned and short-finned pilot whale with a little less than twice humans. With that many sensory neurons it would be assumed that those would be the species with the most emotional disturbance from anthropogenic influence. There is no data on killer whale endangerment, and both long and short finned pilot whales are LC, ranking them 23rd and 24th most disturbed species.

Methods

Species sensory associated neuron and total neuron quantities from wiki were columnized on an excel. There are 146 species that have their sensory neuron quantities documented on wiki and 110 of those have their total quantities on wiki. A percentage of sensory neurons was then calculated for each of the 110 species that have both. The 146 species were checked on the IUCN for their level. 26 species are without IUCN document so 120 species have both sensory neuron quantities and an IUCN level. For an IUCN level .01 was used for LC, .25 for NT, .5 for VU, .75 for EN and .99 for CR. That percentage multiplied by the quantity of sensory neurons totals a level of IUCN sense for each of the 120 species. Each of the 120 species levels of IUCN sensory use was percentagized comparatively to the species with the most combined sensory neurons and IUCN level. A weighted level of IUCN sense was also calculated for the 110 species that have both sensory and total neuron quantities, only 92 of those with an IUCN level, multiplying the IUCN level and the percentage of sensory neurons to total.

These variables were then put into R as a MLR using $y_i = \beta_0 + \beta_1 + \beta_2 + \beta_3 + \epsilon_{1\text{-}3} \sim$ Normal $(0, \sigma^2)$ to determine the role of each of the columns as variables with the response being the total level of IUCN sense.

y= total.level.of.iucn.sense (sensory associated neurons x iucn level)

sens= sensory.associated.neurons (data on wiki 'List of animals by number of neurons')

tot= total.neurons (data on wiki 'List of animals by number of neurons')

perc= percentage.sens (sens/tot)

iucn= iucn.level (.01 for LC, .25 for NT, .5 for VU, .75 for EN, .99 for CR)

name= name

weightediucn= weighted.level.of.iucn.sense (perc x iucn)

AIC scores were compared for $y_1 \sim \beta sens + \beta perc + \beta iucn$, $y_2 \sim \beta perc + \beta iucn + \beta weightediucn$, $y_3 \sim 1$ (null), $y_4 \sim \beta iucn + \beta sens + \beta weightediucn$, $y_5 \sim \beta weightediucn + \beta tot + \beta iucn$, and $y_6 \sim \beta sens + \beta iucn$.

Results

The three species with more sensory neurons than humans have not had their total neurons quantified, so humans have the most total neurons of all neural measured species with, 86B total, while the western gorilla has 33.4B and the orangutan 32.6B. Five of the 146 species that have sensory neuron totals are CR with the IUCN an eight are EN. Of the 14 species with the most disturbed ranked, having the most neurons combined with IUCN level, 5 are VU, 6 EN and 3 CR. The species with the most disturbed rank is an EN, the blue whale. After the ninth ranked species the percent of IUCN sense goes less than half of the top ranked species.

	name	sensory associated neurons	total neurons	percentage sens	iucn level	weighted level of iucn sens	total level of iucn sense	percent of sense
2	Blue whale	15,000,000,000			0.75		11250000000	1
3	Western gorilla	9,100,000,000	33400000000	0.27245509	0.99	0.269730539	9009000000	0.8008
4	Orangutan	8,300,000,000	32600000000	0.254601227	0.99	0.252055215	8217000000	0.7304
5	Fin whale	15,000,000,000			0.5		7500000000	0.666666667
6	Chimpanzee	7,400,000,000	28000000000	0.264285714	0.75	0.198214286	5550000000	0.493333333
7	African elephant	5,600,000,000			0.99		5544000000	0.4928
8	Pygmy chimpanzee or bonobo	7,250,000,000			0.75		5437500000	0.483333333
9	Asian elephant	6,775,000,000	2.57E+11	0.026361868	0.75	0.019771401	5081250000	0.451666667
10	Walrus	3,929,000,000			0.5		1964500000	0.174622222
11	Guenon	2,500,000,000			0.75		1875000000	0.166666667
12	Mandrill	3,102,000,000			0.5		1551000000	0.137866667
13	Hyacinth macaw	2,944,000,000			0.5		1472000000	0.130844444
14	Pigtail Macaque	2,531,000,000			0.5		1265500000	0.112488889
15	Kea	1,281,000,000	2149000000	0.596091205	0.75	0.447068404	960750000	0.0854
16	Horse	1,200,000,000			0.75		900000000	0.08
17	Giraffe	1,731,000,000	10750000000	0.161023256	0.5	0.080511628	865500000	0.076933333
18	Tufted capuchin	1,140,000,000	3691000000	0.308859388	0.75	0.231644541	855000000	0.076
19	Bonnet macaque	1,660,000,000	3780000000	0.439153439	0.5	0.21957672	830000000	0.073777778
20	Grey parrot	850,000,000	1566000000	0.542784163	0.75	0.407088123	637500000	0.056666667
21	Raccoon	453,000,000	2148000000	0.210893855	0.99	0.208784916	448470000	0.039864
22	Crab-eating macaque	800,960,000	3440000000	0.232837209	0.5	0.116418605	400480000	0.035598222
23	Long-finned pilot whale	37,200,000,000			0.01		372000000	0.033066667
24	Short-finned pilot whale	35,000,000,000			0.01		350000000	0.031111111
25	Tarsius	310,000,000			0.99		306900000	0.02728
26	Lion	545,240,000	4667000000	0.116828798	0.5	0.058414399	272620000	0.024232889
27	Risso's dolphin	18,750,000,000			0.01		187500000	0.016666667
28	Goeldi's marmoset	357,130,000	636,000,000	0.561525157	0.5	0.280762579	178565000	0.015872444

Table 1: Top 28 most disturbed species IUCN sense = sensory associated neurons x IUCN level

The results from the AIC scores y_1-y_6 have y_4 (iucn+ sens + weightediucn) with the best covariates, with y_1 (sens + perc + iucn) only 45.11795 away. The others are more than 5,000 away. This suggests that combining the iucn and the sens variables are most effective in the 3 variable equations. y_6 was added just to test that having the three variables does get a better AIC score than two, even if the two contain the two most pertinent variables, sens + iucn. sens is shown to be the best categorical data contributing to the rankings that measure IUCN and sensory neuron quantities because y_2 and y_5 are without sens but with iucn and have AIC scores similar to the null, y_3, and the two-variable equation, y_6. Avoiding combining sens and tot is imperative, because those are already directly used to form the other categories. Implications that y_4 has the best AIC score compared to y_1 suggests that sens is most pertinent, iucn second, weightediucn third, and perc a close fourth variable category in putting the rankings together of most imperative species to protect, given sensory neurons have been quantified.

$y_i = \beta_0 + \beta_1 + \beta_2 + \beta_3 + \epsilon_{1\text{-}3} \sim$ Normal $(0, \sigma^2)$

$y_4 \sim 11{,}180{,}000 + 17{,}000{,}000_{iucn} + \beta_{sens\ 1\text{-}79} + .000104_{weightediucn} + 6.94x10^{-13}$ $(\sigma^2 = .0000008334^2 = \epsilon y_4)$

95 % Confidence intervals

y intercept = 11,180,000 + 2(.000001664) = 11,180,000.000003328 = upper bound

11,180,000 - 2(.000001664) = 11,179,000.999996672 = lower bound

iucn = 17,000,000 + 2(.00007943) = 17,000,000.00015886 = upper bound

17,000,000 - 2(.00007943) = 16,999,999.99984114 = lower bound

sens = 1-79 estimates + 2(1-79 std. error)

1-79 estimates - 2(1-79 std. error)

weightediucn = .000104 + 2(.0004177) = .0009394 = upper bound

. 000104 - 2(.0004177) = - .0007314 = lower bound

weightediucn is only sort of sure that the slope is going in the right direction. It is only useful to get the confidence interval of that variable, as third ranked, to compare it to fourth ranked perc, because y_1 AIC is only 45.11795 away from y_4.

Discussion

It is important for us to consider what the species means to them in evaluating what species we should care about, it would be beneficial to base that on what species care about themselves the most. Using resources to protect species just because they are CR on the IUCN doesn't necessarily make the most sense because a species with less sensory neurons is not necessarily understanding as much as one with more neurons.

Data Accessibility

Dryad dataset
https://datadryad.org/stash/share/cqlVNCyXwwEsU1bhQYryYXUWBQ3Got2FnQoJVvUR0Kc

198

199

200 Reference

201 https://en.wikipedia.org/wiki/List_of_animals_by_number_of_neurons. 10/18/21.