



## Bird biodiversity in heavy metal songs

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Birds have fascinated humankind since forever. Their ability to fly, besides being a constant reminder of our own limitations, was a clear starting point to link birds to deities and the divine realm (Bailleul-LeSuer, 2012). Inevitably, these animals became very pervasive in all human cultures, myths and folklore (Armstrong, 1970). In fact, they are so pervasive that they have found their way to perhaps the most unlikely cultural niche: Heavy Metal.

With some exceptions, such as raptors (Accipitriformes) and ravens/crows<sup>1</sup> (Fig.

1), birds are not typically seen as badass enough to feature on heavy metal album covers and songs, even though sometimes they already have the right makeup for it (Fig. 2).

As we highlighted above, the birds' power of flight is their main feature, but they have another power up their feathery sleeves. And this feat is one that people tend to consider one of the most human endeavors of all: music. Most birds are deemed melodious creatures, like the slate-colored solitaire (*Myadestes unicolor*) from Central



Figure 1. Examples of album covers with birds: Devil's Ground, by Primal Fear (Nuclear Blast, 2004), and the fantastic Winter Wake, by Elvenking (AFM, 2006). Source: Caratulas (2019; [www.caratulas.com](http://www.caratulas.com)).

<sup>1</sup> We'll solve the raven vs crow problem later.

America and the celebrated nightingale (*Luscinia megarhynchos*), although some might seem almost tone-deaf<sup>2</sup> (Fig. 3).



**Figure 2.** Pied falconet, *Microhierax melanoleucos*, a species distributed from China to southeastern Asia; photo by Owen Chiang (2007; [www.i-owen.com](http://www.i-owen.com)), used with permission. Gene Simmons, bassist and co-lead singer of KISS, with his Demon make up; source: Wikimedia Commons (Alberto Cabello, 2010).



**Figure 3.** The Crested Ibis, from Kemono Friends (Mine Yoshizaki, 2015), is made fun of in the series because of her awful singing. The character was based on the Japanese crested ibis, *Nipponia nippon*, a species once widespread through eastern Asia, but now severely endangered (BirdLife International, 2017). Sources: Japari Library (2018); Wikimedia Commons (Olyngo, 2017).

Birds (class Aves) can be largely divided in two groups: the order Passeriformes (with circa 6,000 known species) and “the rest” (several orders, totaling around 5,000 species). Members of the order Passeri-

formes are commonly called “passerines” or “perching birds” and include most of the species that typically comes to mind when we think of birds: sparrows, robins, starlings, blackbirds and crows. Inside Passeriformes, there is a suborder called Passeri<sup>3</sup>, the “songbirds”, a group with roughly 5,000 species of animals. The vocal organ (called syrinx) of songbirds is modified in comparison to that of other birds and can produce complex sounds (Raikow & Bledsoe, 2000). Typically, these sounds result in bird song, but crows have their own way of communicating.

With all these bird species, some are bound to appear in heavy metal songs, right? We mean, besides eagles and ravens, of course. So, we decided to analyze the lyrics of thousands of metal songs in order to find ‘em birds (Fig. 4).



**Figure 4.** Skarmory, one of the few examples of a literal metal bird; more specifically, a Steel/Flying type. Source: Bulbapedia (2019b; The Pokémon Company, 1998–2019).

Here, we show how many songs talk about birds and which specific birds they mention. We also investigate how each bird groups is represented in the genre and in each subgenre. We will also talk a little bit about the biology of some of these animals to make you, our dear headbanging reader, more acquainted with this fantastic slice of Earth’s biodiversity.

<sup>2</sup> If we’re being completely honest, some lead singers out there also seem to be somewhat tone deaf, especially in some of the more peculiar subgenres of heavy metal.

<sup>3</sup> The name Oscines was also used for this group and can still be found in the literature.

## MATERIAL AND METHODS

### Data collection

All lyrics used in this project were collected from Metal Kingdom ([www.metalkingdom.net](http://www.metalkingdom.net)), a web compendium on metal music of diverse genres. To collect this data, we built a custom web crawler that navigated all music pages on the website. This collection yielded us three main datasets:

- Bands: CSV file listing all bands found on the website.
- Genre: CSV file mapping bands to their respective metal genre.
- Lyrics: CSV file which contains the actual lyrics, as well a reference to the artist.

On 07/August/2018, we collected a total of 145,716 songs from 6,359 bands, spanning 368 different metal (sub)genres.

### Data pre-processing

When we started going through the data we obviously ran into some problems. (If you're not finding any problems in your data, you're not looking hard enough!) In this section, we present some of the hurdles we had to overcome when working with this dataset.

### *Language*

A quick look into the data showed us a problem for our study: not all lyrics were in English. For example, below are the verses of "Ohne Dich" by German band Rammstein (2004):

*"Und der Wald er steht so schwarz und leer,  
Weh mir oh weh,  
Und die Vögel singen nicht mehr."*

We may have some additional language skills to identify 'die Vögel', but we certainly won't know every language in the dataset. Because of this, we decided to restrict our study only to songs in English. However, this posed another problem: we have no structured data about the language of each song, and this information would need to be inferred from the lyrics themselves.

Fortunately, this was also a problem for Google when deciding in which language you're searching in during your queries, and they were kind enough to open source their implementation<sup>4</sup>. They used a Naïve Bayes approach, which achieved 99.77% accuracy when classifying news articles in over 49 languages (Nakatani, 2010). Using this approach, we managed to label almost all lyrics by language, identifying 43 different ones in the corpus. The distribution of the languages can be seen in Table 1.

**Table 1.** Frequency count of languages for lyrics. Languages are represented by their ISO 639-1 codes.<sup>5</sup>

Language	Count	Language	Count	Language	Count	Language	Count
en	125805	pt	584	uk	75	bn	20
ro	4580	ja	562	sk	70	lt	20
de	2555	hu	415	el	70	cy	18
es	2388	cs	412	tr	57	fa	16
ru	1439	it	317	lv	57	tl	14
fr	1156	sw	255	zh-cn	56	af	14
fi	862	id	246	et	53	ar	7
ko	797	da	172	sl	33	mk	6
no	788	nl	139	so	33	sq	3
sv	713	hr	118	bg	31	ur	1
pl	617	ca	101	vi	29	?	12

<sup>4</sup>You can find it here: <https://github.com/shuyo/language-detection>

<sup>5</sup>Check the Library of Congress for the codes: [https://www.loc.gov/standards/iso639-2/php/English\\_list.php](https://www.loc.gov/standards/iso639-2/php/English_list.php)



This method, however, is not without its own problems. We were curious, for instance, as to why there were so many lyrics in Romanian (ro). A more in-depth investigation revealed that instrumental songs would have only the text “(instrumental)” listed as their lyrics –the algorithm struggles when classifying such short words. However, since this problem affected only songs without lyrics (that is, songs that won’t mention any birds at all) we opted to just remove them from the dataset.

### *Homonyms*

Another problem we identified was homonyms: words that sound and are written the same, but have different meanings depending on the context. Consider, for example, the following excerpts:

**Song:** *White Synthetic Noise*

**Band:** ...And Oceans

*Sorrow sings of everything but survival doesn't seem to ring*

*Isolate, contain your pain to outlast the taste of misery*

*I believe the curse will **swallow** it's<sup>6</sup> teeth*

*Show the stars and I can clear the air and love the end*

**Song:** *Hourglass*

**Band:** A Perfect Circle

*Red flag red, all the sentinels are damned*

*The Tokyo kitty, **swallow**, rose, and canary*

*Tick tick tick, do you recognize the sounds as the grains count down*

*Trickle down right in front of you?*

The word ‘swallow’ has clearly different meanings in these songs. In the former, it is a verb, that is, the act of causing or allowing something to pass down the throat. In the latter, however, we have a reference to a Hirundinidae bird that may or may not be able to carry a coconut.

To address this problem, we must distinguish between the different uses of homonyms. One way of doing this is classifying

each word in a text by its Part of Speech. A part of speech is a category in which a word falls given its syntactic function in a sentence. In the first example above, ‘swallow’ is classified as a verb, while in the second example it is classified as a noun. Since we are interested in identifying mentions of birds in lyrics, knowing that a word function as a noun in the sentence can help us reduce the homonym problem. (Unless, of course, they are nouns for both their meanings. In this case, this approach won’t help much.)

The process of classifying words like this is known as Part-of-Speech tagging, or POS tagging in short. POS tagging can be seen as a supervised learning problem, as we can train a classifier to identify these tags given a pre-labeled dataset of token sequences and tags. For this project, we opted to use a pre-trained model available in NLTK. This default English POS-tagger consists of a Greedy Averaged Perceptron implemented by Honnibal (2013).

Let’s see how this works for our examples. POS tagging on the first one yields the following result:

<b>Word:</b>	I	believe	the	curse	will	swallow	it	's	teeth	.
<b>Tag:</b>	PRP	VBP	DT	NN	MD	VB	PRP	VBZ	NNS	.

The tags are represented by abbreviations from the Penn Treebank Tagset<sup>7</sup>. In this case, we can see that ‘swallow’ was assigned the POS tag ‘VB’ (Verb, Base Form) and as such, should not be counted as a bird. Let’s see how this works out with our second example:

<b>Word:</b>	The	Tokyo	kitty	,	swallow	,	rose	,	and	canary	.
<b>Tag:</b>	DT	NNP	NN	,	NN	,	VBD	,	CC	JJ	.

Here, ‘swallow’ was assigned the POS tag ‘NN’ (Noun, singular or mass) and as such, should be counted as a bird. However, this example also shows that this meth-

<sup>6</sup> This is not a typo on our part. The lyrics are like this in our source.

<sup>7</sup> You can find it here: <https://www.clips.uantwerpen.be/pages/mbsp-tags>

od is not perfect, as ‘canary’ received a ‘JJ’ tag (Adjective). However, since the alternative would be to manually annotate POS tags for the whole corpus, we decided to proceed with this alternative.

### Plurals

With both language and homonyms out of the way (well, sort of), we can finally tackle our last problem: plurals. Consider the following two examples:

**Song:** *For the birds*

**Band:** 8 Foot Sativa

*To close my eyes*

*Reduce you to black*

*Nothing more than an insignificant shadow among the **vultures***

*I will walk away*

**Song:** *Scavenger*

**Band:** A Static Lullaby

*Scavenger, where does the **vulture** sleep?*

*And when you speak to him*

*Will you bring him to me, bring him to me*

*Scavenger, bring forth the jackals teeth*

We can see that both songs mention the bird ‘vulture’: the first one uses the plural form while the second uses the singular. We wanted to count both references as the same bird, so how could we achieve that?

One solution would be to increment our list of “bird terms” to include all plurals of bird name, as well as a mapping to a root form of the word. This, however, would be a lot of work. This looks like a common problem when doing natural language processing, so we searched for what we could do to address it.

Lemmatization is the process of removing inflectional forms, finding the root word, that is, the lemma, so that they can be analyzed as a single group. It is widely used when running searches for terms in documents as a way to correctly match-related terms. Fortunately, there are various lemmatizers implementations for different languages. For this problem, we will use the WordNet lemmatizer available in the

NLTK library.

Lemmatizer usually requires the POS tag of the word, but fortunately, we got that covered. Running the WordNet Lemmatizer in our first example yields the following: “Nothing more than an insignificant shadow among the vulture.”

You might be thinking: “Wait. That much work just to take out an ‘s’ from the end of the word?”. However, remember that grammatical number can be way more complex than that (e.g., goose and geese), and using a proper lemmatizer takes all that complexity into account.

### Data aggregation

OK. We detected the language of our metal songs and filtered only those in English. We tagged the part-of-speech of all our words, and we even lemmatized them to ensure consistency. What is then left to do?

Well, we need to count our birds! For this project, we decided to use a static list of bird names commonly used in cultural works. The list can be seen in Table 2.

We only counted the term in our dataset if the POS tag of it corresponded to a noun. This reduced the likelihood of homonyms such as ‘swallow’ bird and ‘swallow’ verb, but unfortunately will do nothing for homonyms such as ‘tyrant’ flycatcher (Tyrannidae) and ‘tyrant’ Cersei Lannister. The count was done in two different ways:

- Occurrence counts: This method counts the number of times a word appears, counting multiple repetitions in the same song as distinct occurrences. For example, when counting the word “bird” in the classic song “*Surfin’ Bird*”, by The Trashmen, this counting method would yield 82 occurrences.
- Song counts: This method counts the number of songs in which a word appear, counting multiple repetitions in the same song as a single occurrence.

**Table 2.** Common bird names used in this work, arranged alphabetically.

albatross	crossbill	goose	kite	owl	raven	tanager
auk	crow	grackle	kiwi	parakeet	robin	thrush
bird	cuckoo	grouse	lapwing	parrot	roller	toucan
bird of prey	curlew	gull	lark	passerine	rook	trogon
blackbird	dodo	hawk	macaw	peacock	rooster	turkey
buzzard	dove	heron	magpie	pelican	shrike	tyrant
chickadee	duck	hoopoe	manakin	penguin	snipe	vulture
chicken	eagle	hornbill	mockingbird	petrel	sparrow	warbler
chough	egret	hummingbird	nightingale	petrel	starling	waxwing
cockatoos	emu	ibis	nightjar	pheasant	stonechat	wheatear
cockrel	falcon	jackdaw	nutcracker	pigeon	stork	woodpecker
condor	finch	jay	oriole	puffin	swallow	wren
cormorant	flamingo	kestrel	osprey	quail	swan	wryneck
crane	flycatcher	kingfisher	ostrich	raptor	swift	yellowhammer

Keeping with our previous example, “*Surfin’ Bird*” would only yield 1 as the count of the word “bird”.

To validate our methods, let’s take a look at the top 5 most metal birds:

Word	Occurrence count	Song count
bird	2874	2222
eagle	1738	1036
tyrant	1737	1221
raven	1603	1205
vulture	1230	990

That corresponded with our expectations, even though we probably are suffering from a homonym problem with all those tyrants showing up. The tyrant flycatchers are not actually that metal (Fig. 5).

We also grouped our bird count by each metal genre. In this way, we will be able to run an analysis on how different birds relate to different types of metal. Given that we had 368 different metal subgenres, we had to summarize this if we wanted to run any meaningful statistical analyses. We summarized them using the definitions from Wikipedia into “just” 37 categories, listed in Table 3.



**Figure 5.** Too cute for metal? Left: a tyrant flycatcher, known as western kingbird (*Tyrannus verticalis*), lives in North and Central America; source: Wikimedia Commons (M&F, 2010). Right: the grey-hooded Attila (*Attila rufus*), from southern Brazil, is actually named after a tyrant; source: Wikimedia Commons (D. Sanches, 2010).

**Table 3.** List of metal genres used in our analyses. Note that: (1) occasionally, a rock genre popped up in the database; (2) the category ‘Various’ include weird singletons we just could not classify elsewhere, such as “A Capella”.

Alternative Metal	Experimental Rock	Industrial Metal	Sludge Metal
Alternative Rock	Folk Metal/Rock	Industrial Rock	Southern Rock
Black Metal	Glam	Melodic Metal	Speed Metal
Christian Metal/Rock	Gothic Metal	Metalcore	Stoner Metal
Crust Punk	Gothic Rock	Pagan Metal	Stoner Rock
Dark Metal	Grindcore	Power Metal	Trash Metal
Death Metal	Grunge	Progressive Metal	Various
Doom Metal	Hard Rock	Progressive Rock	
Electronic	Hardcore	Punk Rock	
Experimental Metal	Heavy Metal	Rock n’ Roll	

## RESULTS AND DISCUSSION

The word ‘bird’ appears in 2,222 songs, as we’ve seen above. It seems quite a lot, but on a closer look, it’s not quite: that number represents only about 1.5% of all the songs in the database. We honestly didn’t know what to expect when we started this project, so it is hard to decide if that’s a lot of birds or too few of them. We are more inclined to the latter, given that birds are such prominent symbols in most worldwide cultures.

But more specific mentions of popular bird names also appear in several songs. Some likely refer to a single species, like ‘nightingale’ (*Luscinia megarhynchos*) and ‘blackbird’ (*Turdus merula*). Most common names, however, refer to a whole group of species, like ‘eagle’ and ‘penguin’, and not to a particular species in each group. Finally, some common names, like ‘dove’ and ‘swan’, while being representatives of larger groups, in this context probably refer to the most common European forms, the rock dove (*Columba livia*) and the mute swan (*Cygnus olor*).

We present below the number of times each type of bird is mentioned in a metal song and we do this in two ways. Table 4 shows the total count (the “occurrence count” from the example above), which includes all the times a particular word pops up in the lyrics. As explained above, this includes repetitions within the same song, such as in chorus sections. For instance, ‘eagle’ appears several times in Helloween’s “*Eagle Fly Free*” (1988). Table 5 shows the counts ignoring all the repetitions (the “song count” from the example above). This way, ‘eagle’ is counted only once in Helloween’s song.

We think the second type of counting (Table 5) is a better representation of bird abundance in metal songs, so we will only refer to this one in our discussion below<sup>8</sup>. However, it should be noted that eagles are the most used bird according to Table 4, but they come in second in Table 5, having switched places with ravens. Even though we knew from simple life experience that these two were the most metal birds, we expected eagles to get the crown in both types of count.

<sup>8</sup>We excluded ‘tyrants’ from the analysis due to the homonym problem presented above. Likewise, we excluded ‘roller’, which is typically used in the term ‘rock n’ roller’ rather than referring to the members of family Coraciidae.



**Table 4.** Total count of common bird names in heavy metal songs.

Bird	Count (total)	Bird	Count (total)	Bird	Count (total)
bird	2874	nightingale	59	thrush	9
eagle	1738	blackbird	55	starling	7
tyrant	1737	condor	50	woodpecker	7
raven	1603	gull	50	shrike	6
vulture	1230	peacock	48	snipe	6
crow	977	goose	37	finch	5
dove	511	lark	34	puffin	5
swan	430	rooster	34	stork	5
roller	324	heron	33	cormorant	4
owl	315	rook	30	nightjar	4
swift	256	magpie	27	chickadee	3
hawk	241	parrot	27	grouse	3
falcon	225	cuckoo	21	ostrich	3
swallow	220	hummingbird	18	penguin	3
chicken	129	mockingbird	18	kestrel	2
duck	119	turkey	18	macaw	2
sparrow	94	buzzard	17	petrel	2
crane	78	quail	17	toucan	2
raptor	78	robin	12	parakeet	1
kite	77	jay	11	wheatear	1
pigeon	75	cockerel	9		
albatross	64	ibis	9		



**Figure 6.** While we were writing this article, the Gen VIII Steel/Flying Pokémon Corviknight was aptly announced. Gen VIII's Galar region is based in England, birthplace of heavy metal (Allsop, 2011). So thank you, Game Freak Inc.! Source: Bulbapedia (2019a; The Pokémon Company, 1998–2019).

### Popular birds

So now we can say with certainty that the most metal bird is the raven (Fig. 6). The word can refer to several species worldwide, but it is logical to assume that people usually think of the common raven (*Corvus corax*; Fig. 9) when using the word. This species is distributed throughout the Northern Hemisphere and is one of the largest passerines alive. Ravens are omnivorous animals, extremely opportunistic and versatile, and their intelligence is well-known to biologists.

Ravens are undoubtedly one of the most common birds in folklore and pop culture but are generally regarded as birds of ill-omen and related to “evil stuff”. Thus, they are well-represented in Black and Death Metal, with respectively, 328 and 152 occurrences. However, they are sometimes asso-



**Table 5.** Count of common bird names in heavy metal songs, avoiding repetitions within the same song (e.g., chorus sections).

Bird	Count (per song)	Bird	Count (per song)	Bird	Count (per song)
bird	2222	raptor	43	cockerel	6
tyrant	1221	gull	37	snipe	6
raven	1205	goose	35	finch	5
eagle	1036	blackbird	34	ibis	5
vulture	990	lark	29	puffin	5
crow	742	peacock	29	starling	5
dove	428	rooster	29	stork	5
swan	313	rook	28	cormorant	4
owl	249	condor	26	shrike	4
swift	229	heron	23	chickadee	3
swallow	183	magpie	20	ostrich	3
hawk	159	parrot	20	penguin	3
roller	148	turkey	18	grouse	2
falcon	137	buzzard	17	kestrel	2
chicken	97	quail	15	macaw	2
duck	81	robin	12	nightjar	2
sparrow	79	jay	11	petrel	2
pigeon	59	hummingbird	10	toucan	2
kite	58	cuckoo	9	parakeet	1
nightingale	53	mockingbird	9	wheatear	1
crane	49	thrush	9		
albatross	44	woodpecker	7		

ciated with nicer things, like the ravens from the Tower of London (Kennedy, 2004) and Nordic mythology. The relationship with the latter is very clear given the 114 times this bird appears in Pagan Metal songs.

In second place, we have the eagle, a staple of Power Metal and original Heavy Metal (Fig. 1), with 197 and 193 counts, respectively. Eagles are very likely the most prominent bird symbol of all in Western culture (Armstrong, 1970): Zeus, the Roman Empire, European heraldry (especially Germany and Austria), and of course, 'Murica. As the "king of birds", the eagle is almost always a symbol of power or leadership. The 'eagle', however, will not be the same bird species for every headbanger: American bands and fans will always think of their national symbol, the bald eagle (*Haliaeetus leucocephalus*), while others will possibly think of the golden eagle (*Aquila chrysa-*

*tos*) or other more regional species. Eagles are part of the Accipitridae family, together with hawks, kites and Old world vultures (see below); however, the name 'eagle' is given to several large species that are not actually too closely related to each other (e.g., booted eagles, snake eagles, sea eagles, harpy eagles; Lerner & Mindell, 2005).

The third most used bird is the vulture. This term does not refer to any specific vulture species, but most likely to a sort of over-generalized stereotypical representation of a vulture in popular imagination. Vultures suffer from a bad press, being often mindlessly associated with corpses, death and decay due to their scavenging diet. Unsurprisingly, it is a prevalent bird in Death and Black Metal songs, with 228 and 143 counts respectively. Trash Metal also has a good number of counts (117), but given this genre's more political lyrics, 'vul-

ture' is here often related to bad people or practices.



**Figure 7.** Examples of Old World vultures. Top: Egyptian vulture (*Neophron percnopterus*). Bottom: griffon vulture (*Gyps fulvus*). Source: Wikimedia Commons (D. Ash, 2013 and S. Krause, 2011, respectively).



**Figure 8.** Examples of New World vultures. Left: turkey vulture (*Cathartes aura*) and Andean condor (*Vultur gryphus*). Source: Wikimedia Commons (respectively S. Blanc, 2007, and E. del Prado, 2007).

The popular name vulture actually refers to 23 species worldwide, distributed in two distinct yet closely related biological groups (Buechley & Sekercioglu, 2016): the Old World vultures (Fig. 7) and the New World vultures (Fig. 8). Old World vultures belong to the family Accipitridae, the same as eagles and hawks, while the New World ones (which include condors) comprise the

family Cathartidae. The scavenging habits of vultures evolved independently in these two lineages and in both cases has led to some common adaptations to this way of life: large bodies and wings, powerful beaks and featherless heads (Buechley & Sekercioglu, 2016).

The fourth bird on our list are the crows. Again, 'crow' can refer to any out of 30-something species. The typical European black crow is called carrion crow (*Corvus corone*; Fig. 10); the hooded crow (*Corvus cornix*) is also very common in the continent, but it is not entirely black and so possibly unsuitable for metal songs. North American headbangers will be typically more familiar with the American crow (*Corvus brachyrhynchos*).

Note that all these species belong to the genus *Corvus* and, in fact, so does the raven (see above). People get confused about these birds all the time and often use the words 'raven' and 'crow' interchangeably. While neither word has any true biological meaning (that's what scientific names are for, after all!), we will give you some pointers as how to differentiate the common raven from those crows. Also, after reading this, try checking all those raven and crow illustrations on heavy metal albums – you'll be surprised how many of them are just plain wrong.

There are several differences to keep an eye out for when trying to identify crows and ravens (BTO, 2013). First off, ravens are huge, with a wingspan similar to a buzzard's and an even larger body. If you're uncertain about the identity of the bird you're seeing, it's probably a crow. When you finally encounter a raven, you'll immediately know it. But there are other features that might help you out if the animals are seen far off, flying or just through photos.

Crows have a rounded head, with the plumage arranged neatly on the body; their beak is deeply curved and stout (Fig. 10). Ravens have very long and heavy beaks, ruffled throat feathers, a barrel-like chest and a long neck, which together gives them a heavy-headed impression (Fig. 9). In



flight, crows beat their wings more heavily and their fan-shaped tail is clearly seen (Fig. 10). Ravens, however, tend to soar more; the feathers on their wing tips look more like a raptor's when flying and they have a long and wedge-shaped tail (Fig. 9). Finally, crows have a far-carrying "caw" vocalization, while the ravens' calls are a deep and hoarse croak.



**Figure 9.** Common raven. Source: top: Wikimedia Commons (F. Veronesi, 2016); bottom: iNaturalist (A. Viduetsky, 2019).

### Unexpected birds

There are some unexpected results. For starters, we imagined hawks and falcons would rank higher on the list, as well the nightingale, which is typically associated with song and poetry. We also have lots of mentions to ducks, geese and chicken, but a good portion of them refer to expressions (e.g., sitting ducks) or, metaphorically, to people.



**Figure 10.** Carrion crow. Source: top: Wikimedia Commons ('Loz' L.B. Tettenborn, 2007); bottom: iNaturalist (E. Bosquet, 2019).

However, there were some actual surprises. From the list of bird "species" we initially came up with (Table 2), we had included some oddballs just to be thorough and have all avian orders represented. To our surprise, however, our search came up with some occurrences for them, like penguins, ostriches, macaws and toucans.

The song Ostrich, by American band Gloomy Grim (2000), focuses on the fallacious idea that ostriches (*Struthio camelus*) bury their head in the sand to hide. They do not. What they are doing is inspecting and caring for their eggs; they dig shallow nests and from a distance, it might look like an ostrich has its head buried in the sand (American Ostrich Association, 2019). In fact, ostriches have no need to hide; besides being the largest living dinosaur and having a mean kick, they are the fastest animals on two legs (Donegan, 2002; Stewart, 2006).

All mentions of penguins come from a single Swedish Black metal band called Satan's Penguins. Several of their songs stick to the theme, such as "Antarctic Winterstorm", "Behind Mountains of Ice", and "Night of the Penguins". Despite being thought of

as birds from the icy wastes of our planet, most penguin species live in sub-Antarctic or temperate areas (Davis & Renner, 2003). Actually, the Galapagos penguin (*Spheniscus mendiculus*) is endemic to the Galapagos Islands, very close to the equator.

### Battle of the genres

One curious thing to see was how each genre has its own favorite bird (Table 6). However, when we looked more closely at these results, they are entirely expected. Eagles are the stars in genres such as Heavy, melodic, Power and Speed Metal, while ravens dominate the Gothic, Folk and Pagan genres. The preference of owls in Electronic, however, is a mystery to us.

We could also check which genre is the most biodiverse, that is, which genre cites the largest number of bird “species” in its

songs (Table 7). The undisputed crown goes to Death metal, with 46 species; after it, we have Power, Black and Heavy Metal all clustered together with 41, 40 and 39 species, respectively. However, this might just be an artifact of the sheer number of Death Metal songs: this genre has twice more songs in the database (a total of circa 46,000 songs) than the second genre (Black Metal, with circa 23,000). So the change of a bird popping up in a Death Metal song is just higher because of this. (Also, several species are mentioned just once and birds are not mentioned that much in their songs; see also Table 8.) The other three genres we mentioned are better balanced: Black Metal has 23,000 songs total, as shown above, while Power Metal has circa 17,000 and Heavy Metal 22,000.

The least ornithological genre is Grunge, but one could rightfully argue that “grunge’s not metal” or “who cares about grunge

**Table 6.** List of metal genres and the most cited bird “species” in their songs.

Genre	Fave birb	Genre	Fave birb
Alternative Metal	vulture	Heavy Metal	eagle
Alternative Rock	crow & vulture	Industrial Metal	vulture
Black Metal	raven	Industrial Rock	dove
Christian Metal/Rock	dove	Melodic Metal	eagle
Crust Punk	vulture	Metalcore	vulture
Dark Metal	swan	Pagan Metal	raven
Death Metal	vulture	Power Metal	eagle
Doom Metal	raven	Progressive Metal	vulture
Electronic	owl	Progressive Rock	crow
Experimental Metal	raven	Punk Rock	swan
Experimental Rock	vulture	Rock n’ Roll	eagle
Folk Metal/Rock	raven	Sludge Metal	vulture
Glam	eagle	Southern Rock	eagle & turkey
Gothic Metal	raven	Speed Metal	eagle
Gothic Rock	swan	Stoner Metal	vulture
Grindcore	vulture	Stoner Rock	eagle & vulture
Grunge	vulture	Trash Metal	vulture
Hard Rock	eagle	Various	eagle
Hardcore	vulture		



anyway?” So the least ornithological true genres are Dark Metal and Christian Metal (Table 7).

However, if you take into account the proportion of songs that mention birds (Table 8), Pagan Metal is the true bird-loving

(or should we say raven-loving?) genre. Around 13.5% of Pagan Metal songs mention some sort of bird. The second place goes to Folk Metal/Rock, with 11.2% of songs mentioning birds. The least bird-friendly genres are Alternative Metal (1.7%) and Glam (1.9%).

**Table 7.** List of metal genres and the total number of bird “species” featured in their songs.

Genre	Nr of birds	Genre	Nr of birds
Alternative Metal	19	Heavy Metal	39
Alternative Rock	16	Industrial Metal	13
Black Metal	40	Industrial Rock	9
Christian Metal/Rock	6	Melodic Metal	30
Crust Punk	8	Metalcore	24
Dark Metal	5	Pagan Metal	18
Death Metal	46	Power Metal	41
Doom Metal	33	Progressive Metal	33
Electronic	18	Progressive Rock	23
Experimental Metal	24	Punk Rock	6
Experimental Rock	18	Rock n’ Roll	18
Folk Metal/Rock	25	Sludge Metal	26
Glam	12	Southern Rock	8
Gothic Metal	25	Speed Metal	15
Gothic Rock	6	Stoner Metal	18
Grindcore	25	Stoner Rock	12
Grunge	2	Trash Metal	33
Hard Rock	35	Various	20
Hardcore	16		

### Biodiversity

And what about the songs that have the most birds? Well, we have two worth mentioning, one from a big name in metal and the other from, well, a rather obscure band. First is “*The Crow, the Owl and the Dove*” by Finnish symphonic metal band Nightwish, from the album *Imaginaerum* (Nuclear Blast, 2011), later also released as a single

(Fig. 11). As expected from the title, there is a good avian diversity in this song: besides the three titular birds, there is also mention of the swan. The second song is “*Proverbs of Hell Plates 7-10*” by Norwegian black metal and avant-garde metal band Ulver<sup>9</sup>, from the album *Themes from William Blake’s the Marriage of Heaven and Hell* (Jester Records, 1998). This song mentions the peacock, eagle, crow and owl.

<sup>9</sup> We confess none of us had the slightest idea Ulver even existed.

Table 8. List of metal genres and the total number of bird “species” featured in their songs.

Genre	% of songs with birds	Genre	% of songs with birds
Alternative Metal	1.7%	Heavy Metal	3.9%
Alternative Rock	3.2%	Industrial Metal	2.0%
Black Metal	5.6%	Industrial Rock	3.2%
Christian Metal/Rock	2.1%	Melodic Metal	5.7%
Crust Punk	5.1%	Metalcore	2.2%
Dark Metal	5.6%	Pagan Metal	13.5%
Death Metal	2.9%	Power Metal	4.4%
Doom Metal	5.3%	Progressive Metal	3.8%
Electronic	4.5%	Progressive Rock	5.1%
Experimental Metal	5.2%	Punk Rock	2.6%
Experimental Rock	3.2%	Rock n’ Roll	3.4%
Folk Metal/Rock	11.2%	Sludge Metal	4.5%
Glam	1.9%	Southern Rock	4.2%
Gothic Metal	5.7%	Speed Metal	3.6%
Gothic Rock	3.5%	Stoner Metal	5.6%
Grindcore	2.1%	Stoner Rock	6.4%
Grunge	4.5%	Trash Metal	2.6%
Hard Rock	3.1%	Various	3.5%
Hardcore	2.1%		



Figure 11. Album cover of The Crow, the Owl and the Dove by Nightwish (Nuclear Blast, 2012). Source: Wikimedia Commons.

## CONCLUSIONS

We have certainly been surprised by some of our findings: from ravens overtaking eagles to the odd penguin and ostrich popping up in some lyrics. As we’ve argued, birds are very diverse group of ani-

mals, and several species are deep-seated symbols in cultures worldwide. So maybe it’s about time heavy metal left the tropes of ravens, eagles and vultures on the bench for a while and let other avian stars shine (Fig. 12).



Figure 12. Washimi, the secretarybird from Aggretsuko (2018) seems to enjoy some good old death metal in the karaoke scenes in Netflix’s animated series. Yes, secretarybird is an actual thing; the species is called *Sagittarius serpentarius* and it is a terrestrial bird of prey (Accipitriformes) that inhabits the savannah and open grasslands of sub-Saharan Africa.

## REFERENCES

- Allsop, L.** (2011) Birmingham, England... the unlikely birthplace of heavy metal. CNN. Available from: <http://edition.cnn.com/2011/WORLD/europe/07/01/birmingham.home.of.metal/index.html> (Date of access: 25/Jun/2019).
- American Ostrich Association.** (2019) American Ostrich Association. Available from: <https://www.ostriches.org/> (Date of access: 28/Jun/2019).
- Armstrong, E.A.** (1970) *The Folklore of Birds*. Second Edition. Dover, New York.
- Bailleul-LeSuer, R.** (2012) Introduction. In: Bailleul-LeSuer, R. (Ed.) *Between Heaven and Earth: Birds in Ancient Egypt*. The Oriental Institute, Chicago. Pp. 15–18.
- BirdLife International.** (2017) *Nipponia nippon*. The IUCN Red List of Threatened Species 2017. Available from: <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22697548A117871728.en> (Date of access: 13/Aug/2018).
- BTO, British Trust for Ornithology.** (2013) Crow, Rook or Raven? Available from: <https://www.bto.org/community/news/2013-06/crow-rook-or-raven> (Date of access: 03/Jun/2019).
- Buechley, E.R. & Sekercioglu, C.H.** (2016) Vultures. *Current Biology* 26(13): R560–R561.
- Bulbapedia.** (2019a) Corviknight (Pokémon). Available from: [https://bulbapedia.bulbagarden.net/wiki/Corviknight\\_\(Pokémon\)](https://bulbapedia.bulbagarden.net/wiki/Corviknight_(Pokémon)) (Date of access: 28/Jun/2019).
- Bulbapedia.** (2019b) Skarmory (Pokémon). Available from: [https://bulbapedia.bulbagarden.net/wiki/Skarmory\\_\(Pokémon\)](https://bulbapedia.bulbagarden.net/wiki/Skarmory_(Pokémon)) (Date of access: 03/Jun/2019).
- Davis, L. & Renner, M.** (2003) *Penguins*. Yale University Press, New Haven.
- Donegan, K.** (2002) *Struthio camelus*. Animal Diversity Web. Available from: [https://animaldiversity.org/accounts/Struthio\\_camelus/](https://animaldiversity.org/accounts/Struthio_camelus/) (Date of access: 27/Jun/2019).
- Honnibal, M.** (2013) A good Part-of-Speech Tagger in about 200 lines of Python. Available from: <https://explosion.ai/blog/part-of-speech-pos-tagger-in-python> (Date of access: 27/May/2019).
- Japari Library.** (2018) Japari Library, the Kemono Friends Wiki. Available from: <https://japari-library.com> (Date of access: 14/Aug/2018).
- Kennedy, M.** (2004) Tower's raven mythology may be a Victorian flight of fantasy. *The Guardian*. Available from: <https://www.theguardian.com/uk/2004/nov/15/britishidentity.artsandhumanities> (Date of access: 03/Jun/2019).
- Lerner, H.R. & Mindell, D.P.** (2005) Phylogeny of eagles, Old World vultures, and other Accipitridae based on nuclear and mitochondrial DNA. *Molecular Phylogenetics and Evolution* 37(2): 327–346.
- Nakatani, S.** (2010) Language detection library for Java. Available from: <https://www.slideshare.net/shuyo/language-detection-library-for-java> (Date of access: 27/May/2019).
- Raikow, R.J. & Bledsoe, A.H.** (2000) Phylogeny and evolution of the passerine birds: independent methods of phylogenetic analysis have produced a well-supported hypothesis of passerine phylogeny, one that has proved particularly useful in ecological and evolutionary studies. *BioScience* 50(6): 487–499.
- Stewart, D.** (2006) A bird like no other. *National Wildlife*. Available from: <https://www.nwf.org/Magazines/National-Wildlife/2006/A-Bird-Like-No-Other> (Date of access: 28/Jun/2019).

ABOUT THE AUTHORS

**Henrique Soares** is an engineer and machine learning enthusiast, not particularly knowledgeable in either birds or metal. When he is not working on unconventional applications of machine learning, Henrique spends his time wondering how could there be people that don't know about the bird, because everyone knows that the bird is a word! A-well-a-bird, bird, b-bird's a word, a-well-a...

**João Tomotani** is a mechanical engineer currently working with Supply Chain. Though he is more of a power/melodic metal enthusiast, he agreed to focus on birds instead of dragons in this research.

Dr. **Barbara Tomotani** is a biologist and the only one in this group whose work actually focuses on birds. She is not a big heavy metal fan and does not work with heavy metal birds, preferring the tiny flycatchers. But she has certainly liked the new metal bird Corviknight.

Dr. **Rodrigo Salvador** is a zoologist who lately has found himself working with a lot of bird-related stuff. One of the first songs he remembers ever hearing as a child was *Walk of Life*, by Dire Straits - his sister's "fault" and an influence that eventually led him down the road to metal. He'll quickly tell you his favorite bands are Queen and Avantasia, but he's hard pressed to decide his favorite bird.