Co-existing with wildlife

A meta-review of factors influencing citizen's attitudes towards urban wildlife

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Abstract

Urban environments are increasingly becoming potential living environments for a variety of wildlife species. With the growing urbanization all over the world, it is especially relevant to gain knowledge of how co-existing with urban wildlife can be promoted. This meta-review aimed to give an overview of empirical evidence of factors influencing attitudes and behaviour in human-wildlife interactions in urban settings through a social psychological viewpoint. Through a systematic literature research, 24 articles have been identified for analysis. Findings indicate that research is mostly focused on social-demographic variables when explaining attitudes. It is suggested that future research should step away from simply measuring attitudes and the influence of socio-demographic variables on perceptions, by focusing on how these attitudes are formed and which variables are truly of relevance to explaining attitudes and human behaviour. Using social psychological frameworks can give interesting insights into the antecedents of human behaviour and should be applied more often. A framework is provided as a starting point for future research and as a basis for designing effective wildlife management strategies.

Keywords: Urban wildlife, meta review, factors, attitudes, perceptions, urbanizations, human-wildlife interactions

Thanks to all who took the time to read through my thesis to give me pointers for improvement. Special thanks to Hens Runhaar for giving me guidance throughout the process of writing this thesis and helping me in times of need.

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1. Introduction

The ever-increasing human population and consequentially the growing rates of resource use and habitat need in many areas around the world has forced a variety of wildlife species to live in close proximity to humans (Inskip & Zimmermann, 2009). As a result, urban environments are increasingly becoming potential habitats for certain species to find shelter and food in (Soulsbury & White, 2015). Reasons for this phenomenon are the growth of green spaces in cities and the spreading of residential areas to the surrounding countryside (Soulsbury & White, 2015). The interaction of wildlife with the urban landscape can range from living largely outside of the city while sometimes crossing the borders of the urban fringe, to utilizing the whole urban area (Soulsbury & White, 2015). The way in which wildlife makes use of the urban landscape can have a large impact on possible interactions with humans within these areas. The increasing use of urban areas by wildlife signify a higher chance of coming into contact with these wildlife species, and thus an increasing probability of conflict between humans and wildlife.

In the last 20 years, scientific research on human-wildlife conflict has grown almost exponentially (Nyhus, 2016). According to Nyhus (2016), human-wildlife conflict is often defined as: "conflict that occurs between people and wildlife; actions by humans or wildlife that have an adverse effect on the other; threats posed by wildlife to human life, economic security, or recreation; or the perception that wildlife threatens human safety, health, food, and property." Human-wildlife conflict is a complex phenomenon that is affected by a large number of factors, ranging from psychological to economic variables (Nyhus, 2016). Yet research from Dickman (2010) states that a major part of wildlife conflict management strategies is focused on technical solutions while ignoring the relevant social factors that contribute to the experience, perception and response to conflict with wildlife. He hints that attitudinal factors might be of more importance to the occurrence of conflict than actual, sustained damage.

The acknowledgement of the human dimension in human-wildlife conflict has gained a foothold in the scientific community and has been increasingly applied in research on human wildlife management (Kansky, Kidd & Knight, 2014). Especially attitudes have been studied more extensively in conservation research (St John, Edwards-Jones & Jones, 2010). For example, differences have been found between urban and rural residents on their attitude towards wildlife (Bandara & Tisdell, 2003). It seems that urban residents are in general more positive towards wildlife than individuals living in more rural areas. An explanation for this can be that urban residents are less likely to interact with wildlife, as urban habitats are harsh

environments for wildlife species to survive and thrive in (Soulsbury & White, 2015). Indeed, positive attitudes of urban residents towards wildlife decreased when the probability of sustaining damage was high (Kansky et al., 2014). So, whether the positive attitude of urban residents persists towards urban wildlife, which they are more likely to experience conflict with, remains unknown. Despite these findings, Kansky et al. (2014) acknowledge that damage is not per definition the deciding factor predicting attitudes, as their research also suggest that attitudes are formed by other (more salient) predictors. They therefore underline the importance of determining and quantifying other factors than damage that influence attitudes. This conclusion is stressed by a number of other researchers, who have identified numerous factors that could be of importance in explaining attitudes in human-wildlife conflict scenarios other than damage (Dickman, 2010; Soulsbury & White, 2015; Nyhus, 2016; Kanksy, Kidd & Knight, 2016).

It is worth noting that not only attitude is of importance when looking at human-wildlife conflict. In essence, conflict with wildlife is a response to an interaction with wildlife and can be both cognitive as well as behavioural in nature. How an attitude leads to certain (negative) perceptions and behaviour in response to interacting with wildlife gives a stronger insight into how wildlife management strategies should be shaped than just looking at attitudes. As such, Baruch-Mordo et al. (2009) note that it is especially relevant for wildlife management strategies to focus on (changing) human behaviour and the role of attitudes within this focus. Accordingly, various studies on human-wildlife conflict have acknowledged that the expertise of social psychology could be a relevant addition to human-wildlife studies when looking at human behaviour and attitudes (John et al., 2010; Soulsbury & White, 2015; Bennet et al., 2017).

In light of these findings, determining what factors have been identified in empirical research that influence attitudes and behaviour towards urban wildlife can be key to avoiding or mitigating conflict between humans and wildlife in cities. As urban areas are likely to grow even more in the future, it is necessary to explore ways in which the peaceful co-existence between humans and wildlife can be ensured. Despite the urgency of avoiding and resolving conflicts between humans and wildlife in urban areas, it appears that a systematic review of factors influencing attitudes towards urban wildlife specifically does not yet exist. Furthermore, the review done by Soulsbury and White (2015) identified the need for a conceptual framework to help understand human-wildlife interactions in urban settings. Consequently, in this thesis I aim to give an overview of the current scientific knowledge

influencing attitudes of urban wildlife within a social psychological framework. Specifically, this thesis will answer the following research questions:

- What factors are empirically proven to influence attitudes towards urban wildlife?
- Which factors are overrepresented in scientific research based on their significance?
- Which factors need more scientific attention?
- What are the implications for future research?

In order to answer these questions, I will conduct a systematic meta-review on attitudes towards urban wildlife. This way I hope to summarize what factors have been empirically proven to contribute to the occurrence of human-wildlife conflict in urban areas and thus the direction conflict management strategies should take when tackling human-wildlife conflict in cities.

In the following sections I will first of all give an overview of current theoretical knowledge of attitudinal factors influencing human-wildlife conflict. By framing these factors within a social psychological viewpoint, I have created a conceptual model for analyzing empirical studies on human-wildlife conflict in urban areas. Thereafter, I will give an overview of the methods I used in selecting and analyzing the empirical studies. The results section will contain what factors I have identified to be empirically proven within my data-selection and their importance in explaining attitudes relative to the amount of times they were studied and found to be significant. I will conclude with a discussion on my findings, with the implications for future research and the limitations of my study.

2. Theoretical background

As attitudes will be the main focus of this review as a predictor of the response to human-wildlife interaction, it is important to understand just how attitudes lead to behaviour. John et al. (2010) note that several conservation studies have repeatedly focused on attitudes but are of limited use in developing effective wildlife management strategies. An explanation for this can be found in research on attitudes from social psychology.

2.1 Attitudes as a predictor of behaviour

Social psychologists have repeatedly found that attitudes are a poor predictor of behaviour, as much so that some psychologists even suggested to drop the concept of attitudes as a predictor of behaviour all together (Wicker, 1969). One of the reasons for this mismatch is that behaviour is subject to a high number of factors, and attitudes are just one of the many factors influencing behaviour. Another reason is given by Ajzen and Fishbein (1970), who proclaimed that when the measured attitude is a general one, yet the behaviour is very specific, the correspondence between the measured attitude and the specific behaviour will be very small. For example, when measuring general attitudes of wildlife conservation, it will not be a good predictor of hunting behaviour. Indeed, Waylen et al. (2009) concluded that positive attitudes towards conservation did not mean that the respondents stopped hunting wildlife. St. John et al. (2010) suggest that this mismatch is due to the fact that Waylen et al. (2009) measured general attitudes towards conservation, instead of attitudes relevant to the specific behaviour (e.g. hunting). As such, wildlife management strategies need to focus on specific attitudes of behaviour in order to design effective strategies.

In light of such findings, Ajzen and Fishbein (1970) introduced the concept of behavioural intention as the main determinant of behaviour in their Theory of Reasoned Action (TRA). Behavioural intention can be understood as: “a person’s readiness to carry out a certain behaviour” (Kim & Nan, 2012). To predict behavioural intention, it is important to understand two other variables, that is, subjective norms and attitudes towards the behaviour. Subjective norms are defined as a person’s perception of the normative expectations of important or significant others and the need to comply with these expectations (Fishbein & Ajzen, 1985). Attitude on the other hand is defined as “a favorable or unfavorable evaluative reaction towards somethings or someone, rooted in one’s beliefs and exhibited in one’s feelings and inclinations to act” (Myers et al., 2010). However, the TRA was limited to behaviour that individuals had

volitional control over. As such, the TRA was revisited to include the concept of perceived behavioural control and renamed to the Theory of Planned Behaviour (TPB). Perceived behavioural control refers to the perceived ability a person believes to have in actually performing that behaviour (Azjen, 2006). It can be divided in control beliefs and power beliefs. Control beliefs refer to the presence or absence of facilitative resources to perform a certain behaviour. Power beliefs refer to the ability to perform the actual behaviour with the given resources (St. John et al., 2010).

A few comments should be made regarding the use of TPB. First of all, research criticized the TPB model by stating that more variables are of relevance to behavioural intention than the factors identified by Ajzen. Ajzen (1991) stressed however that the model can be changed by adding various variables, which makes it a good model to use in human-wildlife interactions as a lot of variables have been identified to influence interactions. Secondly, some scholars found unclear causal relationships between behavioural intention and behaviour, suggesting that behavioural intention is just added for convenience sake and does not lead to behaviour that often. However, true consensus about the effectiveness of the TPB model has not been reached, as the TPB model has a high correlation value in comparison to other typical constructs used in social psychology (Kim & Nan, 2012).

Despite its criticism, the TRA/TPB has received much empirical support and is recognized as one of the most effective theories for predicting behaviour in various contexts (Kim & Nan, 2012). As such, in order for wildlife management to effectively use attitudes as a basis for conflict strategies, it is important to include measures on social norms, perception of behavioural control and behavioural intention. Otherwise, the measured attitudes will be of little help in predicting the response to conflict situations and thus to management strategies. Hence, the TRA/TPB will serve as a framework by which factors influencing human-wildlife conflict will be sorted, and thereby gives an idea to what extent social psychology has been used in conservation studies on attitudes.

2.2 Identified factors influencing attitudes and behaviour

Through a literature research on current knowledge of human-wildlife conflict, a number of factors have been found to determine the pattern of human-wildlife conflict. The three meta-reviews of Kansky and Knight (2014), Soulsbury and White (2015) and Nyhus (2016) on human-wildlife conflict are the main basis for the proposed factors contributing to attitudes towards urban wildlife. As these meta-reviews are theoretical in nature, it is unclear which of

the discussed variables influencing human-wildlife conflict are also found in empirical studies. Notably, Kanksy and Knight (2014) tested their theoretical model in an empirical meta-analysis in a follow-up study. Their focus lay on more visible and bigger species, such as ungulates, primates and carnivores. Urban wildlife on the other hand mostly (but not always) consists of smaller species. Whether or not the factors proposed by Kanksy and Knight (2014) and Nyhus (2016), who also maintains a focus on more popular wildlife species, can be generalized towards more common species which are ordinarily found in urban areas, remains to be seen. Therefore, it is valuable to test whether the variables proposed by the three meta-studies are relevant in urban wildlife settings, and whether these variables are supported by empirical research. The identified factors are explained in further detail in the following sections.

EXPERIENCE

Experience with wildlife species is an important factor contributing to the perception of human-wildlife interaction (Kanksy et al., 2014). Experience can be divided into two categories: indirect and direct experience. Direct experience can range from actually interacting with wildlife to simply seeing wildlife. People tend to learn from direct experiences and shape their perceptions and cognitions according to their experiences (Chance, 2013). Therefore, having either negative or a positive direct past experiences with urban wildlife can greatly influence the attitude towards such species (Heberlein, 2012).

On the other hand, indirect experiences can also influence perceptions of urban wildlife. Indirect experience is more psychological in nature and is closely linked to the perception of risk. The risk of sustaining some sort of adverse effects due to wildlife, greatly influences how certain wildlife species are perceived. Notably, Slovic (1987) states that the social environment influences how individuals perceive risk. For example, when one person sustains damage from wildlife, the fear of also sustaining damage is elevated in other people of the same community, even when they never had experience with wildlife before (Dickman, 2010). Thus, there is often a disproportion between the perception of risk, the actual risk and the subsequent response to risk (Nyhus, 2016). For attitudes towards urban wildlife specifically this means that species who are perceived as riskier, are often seen in a more negative light than less risky species.

CHARACTERISTICS OF SPECIES

Attitudes towards wildlife are dependent on the specific species in question and the characteristics of these species (Bjerke, Østdahl & Kleiven, 2003). As such, research states that the physical size of animals, dietary requirements, rarity, attractiveness and other characteristics of species determine the attitudes of the species in question (Nyhus, 2016; Kanksy et al., 2014). For instance, species who are perceived to be more beautiful are liked better than species perceived as less attractive.

SOCIO-DEMOGRAPHIC FACTORS

Socio-demographic characteristics, such as gender, wealth, residential area, religion and education influence how one perceives interactions and how one handles conflict (Dickman, 2010). First of all, the place of residency can determine the frequency of coming in contact with wildlife. Urban residents living near green spaces, such as large parks, have a higher chance of coming into contact with wildlife (Soulsbury & White, 2015).

Secondly, education or knowledge can change how one perceives certain wildlife species. Knowledge about animal species and their behaviour can lessen negative attitudes towards wildlife (Dickman, 2010). For example, knowledge can help with changing misconceptions about certain species and has been used in a number of conflict management strategies (White, Eberstein & Scott, 2018).

Another factor that influences human-wildlife conflict is the economic situation of individuals. Less wealthy individuals suffer more from human-wildlife conflict when damage is sustained (Hill, 2004).

Lastly, religion can determine in what way communities and individuals respond to conflict with wild animals. For example, Christian beliefs have been linked to hostility towards wildlife (Hazzah, 2006), while Buddhist religion is traditionally far more accepting of conflict with wildlife (Dickman, 2010).

DAMAGE AND BENEFITS

Damage by wildlife as a predictor of attitude has been extensively studied in the scientific community (Dickman, 2010). Kansky and Knight (2014) proposed two types of damage that are of relevance when analysing attitudes: tangible and intangible damage. Tangible damage is direct costs which you can translate in monetary values. Think of damage to property or attacks. On the other hand, intangible damage entails psychological costs, such as feelings of fear, anxiety and stress. Interestingly, Kansky and Knight (2014) propose that tangible damage is

far less important in human-wildlife conflict focused on changing attitudes and tolerance of wildlife than intangible damage. However, most conflict management strategies have been focused on solving or mitigating effects from tangible damage, without looking at the intangible costs (Dickman, 2010). This might be a reason for why conflict management strategies have not been as effective as expected in reducing conflict.

Much in the same way as damage, benefits can also be divided in tangible and intangible benefits. Tangible benefits are about the instrumental value of wildlife to humans. For example, some wildlife species can become tourist attractions by which people can earn money. Intangible benefits on the other hand are about the beneficial effects of wildlife, such as enjoying seeing wildlife. Benefits from interacting with wildlife have been of little interest in science, due to the focus on damage and conflict in most wildlife studies (Soulsbury & White, 2015).

VALUES

The values individuals possess towards wildlife in general, shapes the response to interaction with wildlife species in specific contexts. For example, an already existing interest in animals or general environmental concern influences the reaction to coming in contact with wildlife species, or to what extent individuals are willing to live alongside wildlife (Kanksy & Knight, 2014).

SOCIAL AND CULTURAL FACTORS

As shown in the TPB model, social factors influence behaviour. As explained earlier, social norms can influence how a person will behave in a certain situation. The way in which wildlife is framed in the media can be a good indicator of how people and communities think about human-wildlife interactions (Runhaar, Runhaar & Vink, 2015). However, how media represents wildlife can also influence how certain species are perceived by the public (Nyhus, 2016). According to Dewulf et al. (2009), framing theory is especially relevant for conflict studies, as framing can influence both the perception and response to conflict situations.

Cultural factors influence attitudes and perceptions of wildlife and impacts the way in which individuals and communities will react to conflicts with wildlife species (Nyhus, 2016; Dickman, 2010; Hazzah, 2006; Linnell et al., 2003). For instance, animals have traditionally played important roles in folklore and myths, and attitudes towards species can be largely influenced by such perceptions (Dickman, 2010).

Conflict between humans and wildlife can sometimes be caused by intergroup-hostility between humans. For example, rural communities often feel more aggrieved by damage caused by wildlife, because they feel like conflict with wildlife is imposed on them by the 'urban elite' (Skogen et al., 2008). As such, underlying inter-group tensions can negatively influence human-wildlife conflict.

2.3 Conceptual framework

Based on the above literature, the following conceptual framework can be distinguished. This model maps the various factors that determine how individuals and communities respond to human-wildlife conflict, sorted according to the TPB model. In appendix 1, the coding list of these variables can be seen.

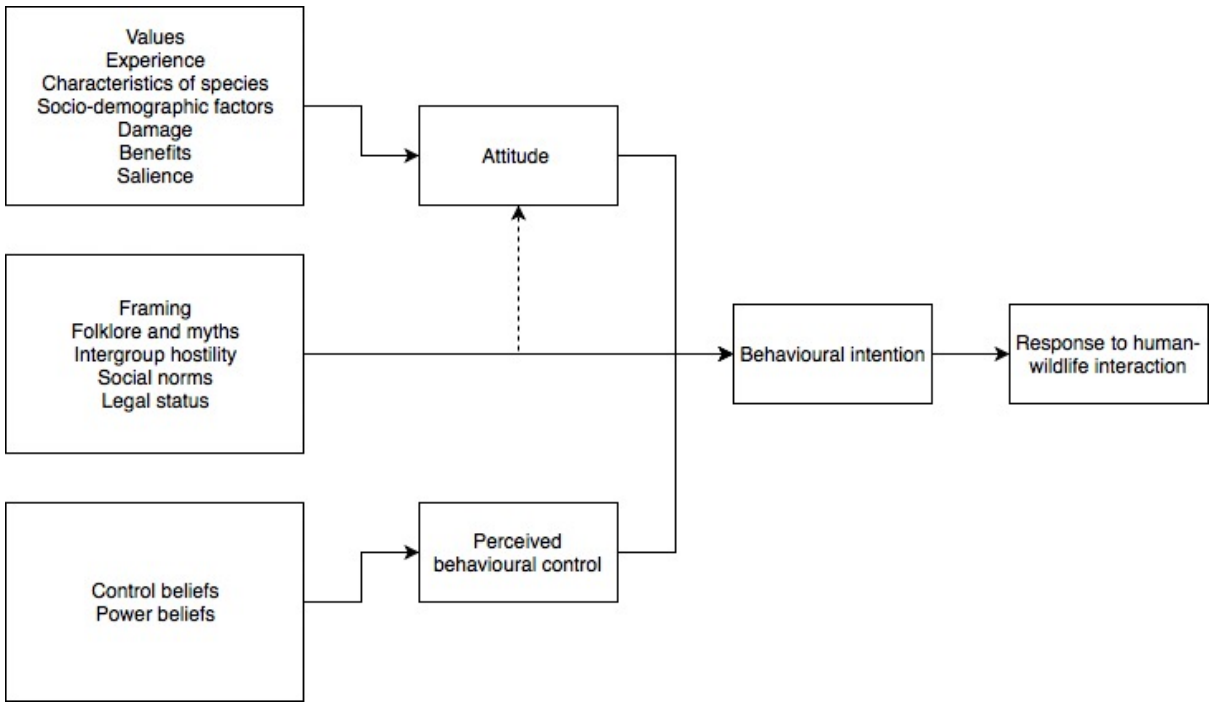

Figure 1: Conceptual framework of response to human-wildlife interaction

3. Method

The type of literature review conducted in this study will be a systematic literature review of empirical evidence of variables influencing attitudes and human behaviour regarding human-wildlife interactions in urban settings. The aim of this study is to give an overview of which factors have been studied empirically and to what extent these factors are truly important in influencing attitudes and behaviour. Furthermore, this review will give insightful information for future research on human-wildlife conflict in urban environments. In the following sections will be explained how I narrowed down my search to a select amount of literature and how I analysed the chosen articles. For simplicity and transparency reasons, only the database of Scopus will be used.

3.1 Systematic selection of articles

STEP 1

The first step of this method is an initial assessment of the literature on attitudes and human-wildlife interaction, in order to identify the relevant keywords and develop the search string. The following keywords have been used: 'urban wildlife', 'urban', 'wildlife', 'attitude', 'conflict', 'human wildlife conflict', 'tolerance', 'wildlife management', 'perception', 'damage', 'acceptance', 'urban fauna', 'human wildlife interaction', 'human wildlife benefits'.

Search strings used:

TITLE-ABS-KEY (urban AND wildlife AND attitude OR tolerance)

TITLE-ABS KEY (human AND wildlife AND conflict AND urban) AND attitude

TITLE-ABS KEY (urban AND wildlife AND (attitude OR perception OR tolerance OR acceptance))

TITLE-ABS-KEY ("urban wildlife" AND (attitude OR perception OR tolerance OR acceptance))

TITLE-ABS-KEY (wildlife AND management AND urban AND (attitude OR perception OR tolerance OR acceptance))

STEP 2

In the next step, a more qualitative assessment of the articles will be undertaken. In this step, articles are included or excluded based on their abstract. Only articles that focus on attitudes or perceptions and analyse attitudes quantitively are included.

STEP 3

In the last step, articles are assessed thoroughly to decide whether they will be included or excluded. Based on this full-text search, more inclusion and exclusion criteria have been established. Articles which were not specified to urban wildlife have been excluded, as well as articles that were not written in English. Furthermore, a number of studies only measured attitudes on certain species and did not analyse what factors might have contributed to these attitudes. These articles were excluded as well. Lastly, some articles (n=3) were not accessible and were thus not considered (see Supplementary Information for an overview of these articles). In total, 24 articles have been deemed as relevant for this study and were analysed according to the factors distinguished in the conceptual model (see figure 1). Variables were coded with the categorizations of table 1 found in Appendix 1.

3.2 Data analysis

In line with the method used in Kansky & Knight (2014), three indexes are established to analyse the articles and describe factor trends in attitudinal research on urban wildlife interactions. The first index will give insight into how many times a variable was studied. On the other hand, the second index will give a better understanding of how many times each variable actually had a significant influence on perceptions and/or on behaviour. The last index will put the first two indexes together in order to show which variables are of real importance to the scientific community in explaining attitudes and behaviour in human-wildlife interactions in cities and what focus future research should take in this field.

3.2.1 The Application Index (APP) is a measure of the frequency a variable is examined in articles relative to the total amount of articles studied. In this way, it gives an idea of how many times a variable was studied in percentages. The formula associated with this index is:

$$APP = n \div N \times 100$$

where n the number of times each variable was studied in total and N is the total amount of articles studied in this meta-review.

3.2.2. The Significance Index (SIG) is a measure of the frequency a variable was found to be statistically significant in explaining attitudes and behaviour, relative to the frequency the same variable was found to be insignificant. It is therefore an indication of the importance of the variable in explaining the cognitive and behavioural response to urban wildlife. The formula associated with this index is:

$$SIG = (f(S) - f(NS)) \div n_s \times 100$$

where *f (NS)* is the number of times a variable was found to be insignificant in explaining attitudes, and *f (S)* the amount of times the same variable was found to be significant in explaining attitudes. n_s is the sum of both significant and insignificant values. In this way, it is possible to see how many times a variable was found to be significant relative to how many times it was found insignificant. Large, negative values indicate that the variable was more often found to be insignificant than significant. On the other hand, large, positive values indicate that a variable was more often found to be significant in explaining attitudes. Thus, this index gives an idea of the importance of a variable in explaining attitudes.

3.2.3 The Accuracy Index (ACC) is a measure of the amount of times a variable was studied (the APP index) and the importance of the variable in influencing attitudes (the SIG index). As such, it explains how accurately publications used variables to explain attitudes. The formula associated with this index is:

$$ACC = \text{rank}(SIG) - \text{rank}(APP)$$

The value derived from the APP index and the SIG index allows for ranking the different variables according to their importance in explaining urban wildlife attitudes. In case of the SIG index, a low value indicates a higher importance in explaining attitudes. For the APP index, a high value indicates the most importance, as it explains the frequency a variable was studied in publications. By subtracting these two ranks with each other, the number derived from the ACC index will give insight into how accurate a variable has been used in the different articles relative to their true importance in explaining attitudes and behaviour of humans in urban wildlife interactions.

Thus, when the value derived from the ACC index is close to zero, it means that a variable was applied in studies at a frequency in line with its significance in explaining attitudes. In contrast, if the value derived from the ACC is an extreme negative value, the variable is highly underapplied in publications while relatively important in explaining attitudes. On the other

hand, if the value derived from the ACC index is an extreme positive value, the variable is overapplied in studies, suggesting that the variable is overrepresented in publications even though it is relatively unimportant in explaining attitudes (Kansky & Knight, 2014).

4. Results

4.1 Descriptive results

I identified 24 suitable sources for my analysis. Seven publications were focused on cities in Europe, seven in the United States, five in Australia, one in Canada, two in South-America, one in Asia and two in South-Africa. The wildlife species studied ranged from small mammalians such as foxes and possums, to small aviary species and larger carnivores such as coyotes and bears. The amount of significant and insignificant results lay closely together, with slightly more insignificant results (n=293) than significant results (n=243). This is in contrast with the other meta-analysis by Kansky and Knight (2014), which found almost double the amount of insignificant results than significant results.

From the variables identified beforehand through the literature review, 32 have been studied statistically. The other variables, while deemed to be important by theoretical research, have not been empirically analysed at all in urban wildlife settings. Most of the variables left unstudied were social factors, such as social norms, general values, folklore and framing.

4.2 Results from the APP index

Results from the APP index indicate that some factors received significantly more attention in empirical research than other factors. In general, almost 70% of all variables were studied in less than 20% of the publications. Only 2 variables were studied in more than 50% of all studies, namely gender and direct experience with urban wildlife. In contrast, intergroup hostility, perceived behavioural control, tangible benefits, legal status of species and some social-demographic data were the least studied factors, applied in just 5% of the cases (see figure 2).

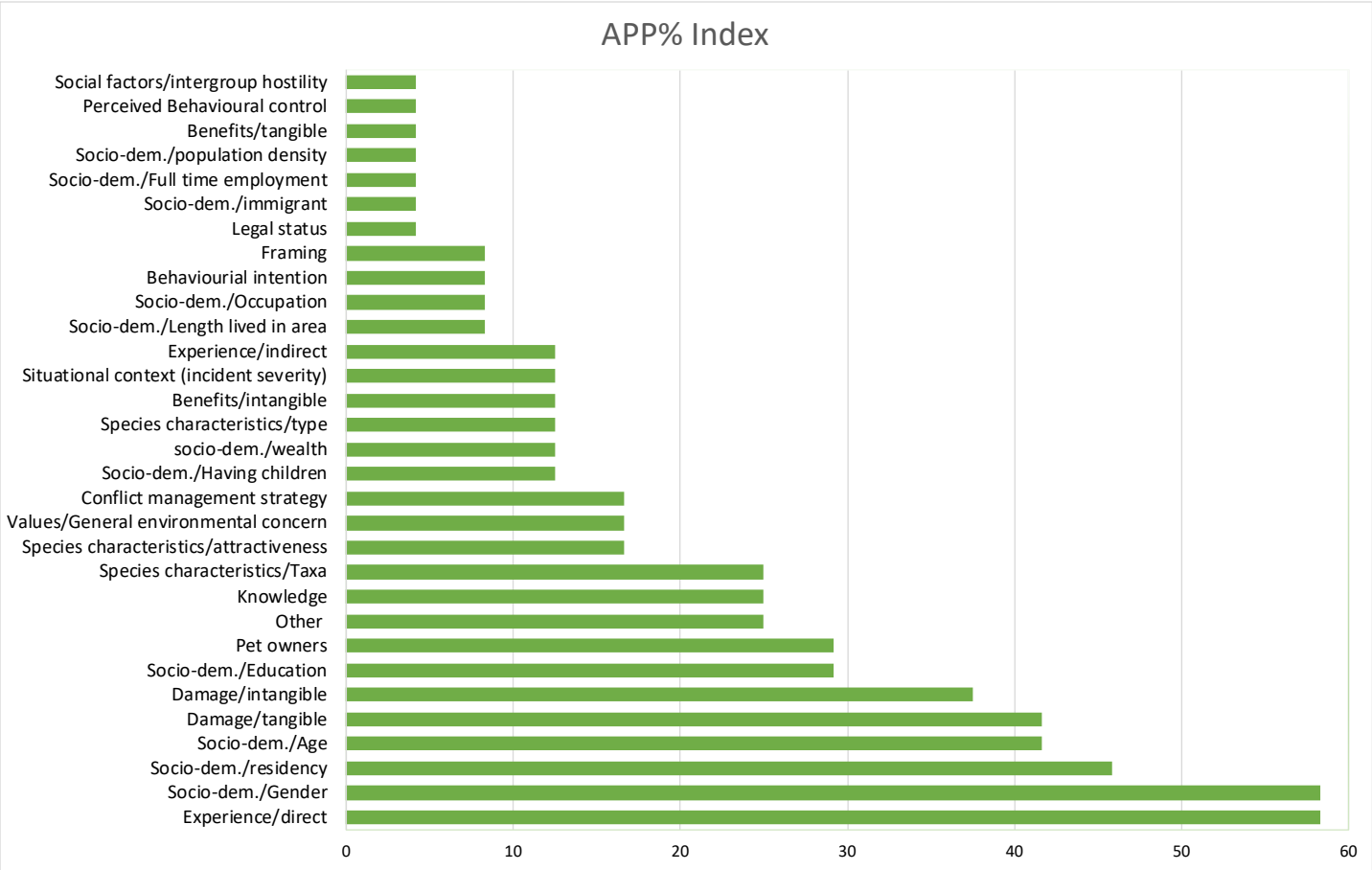

Figure 2: APP index for variables influencing attitudes, ordered according to their increasing importance. Highest values are applied the most in research, while small values are applied the least.

4.3 Results from the SIG index

Results from the SIG index indicate the relative importance of variables influencing attitudes and behaviour relative to their significance. Most research findings are mixed, with results of both significant and insignificant results for the same variable (see figure 3). Notably, gender and direct experience are more often found to be insignificant in explaining attitudes and behaviour than significant (see figure 3), even though they were studied the most in urban wildlife settings (see figure 2). In the same light, of the variables that have been studied more than 20% of the time, 6 out of 11 variables are generally not significant in influencing attitudes and behaviour. Some variables are significant and insignificant 100% of the times, however, it must be mentioned that these percentages can give a slightly biased view. As some variables have been researched only once, but were found to be significant this one time, they get a score of 100% in explaining attitudes. Obviously, more research is needed in order to establish

whether these variables are found to be statistically significant in more instances. That is why the ACC index is relevant in further analysing these results.

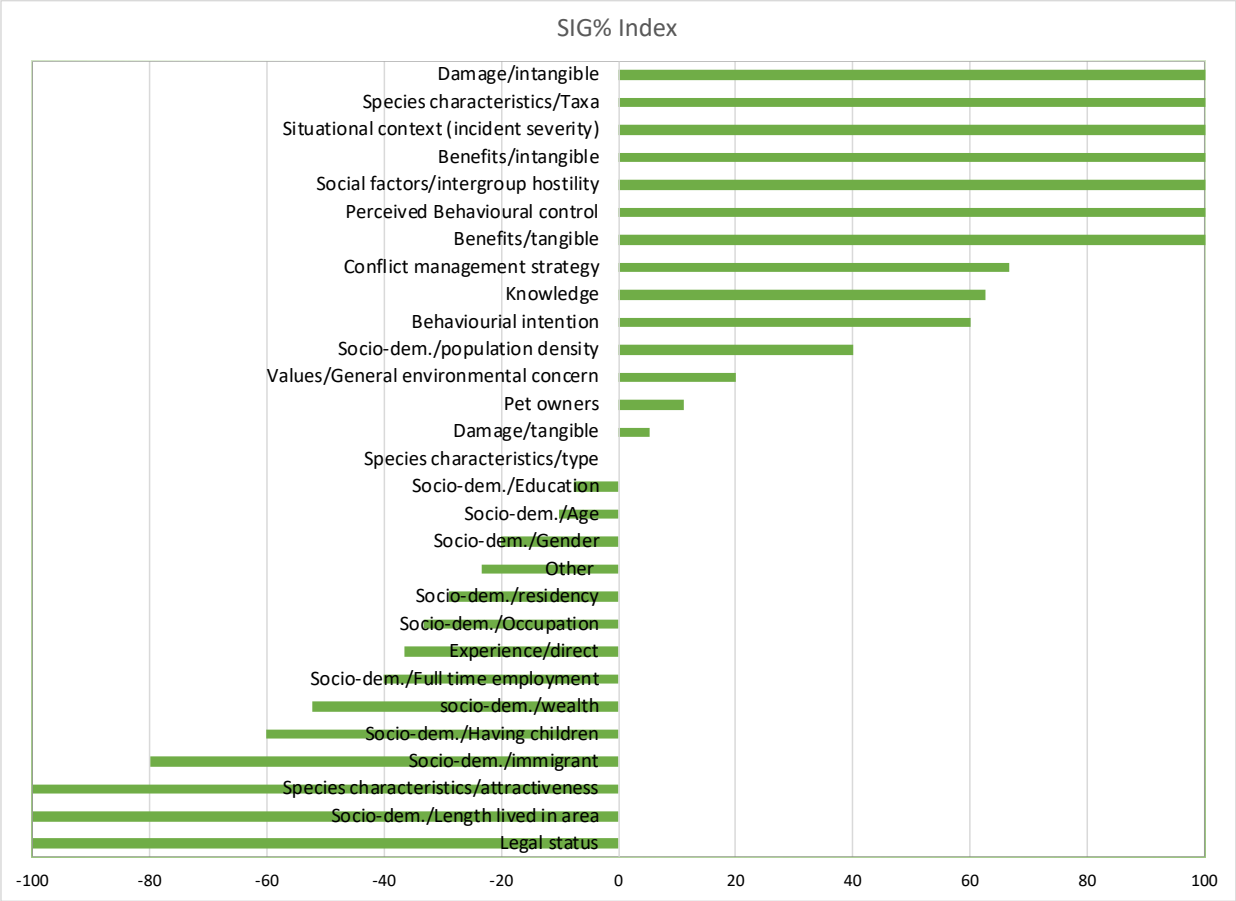

Figure 3: SIG index. High positive values mean that a variable was found to be significant more often than it was insignificant. Negative values indicate that a variable was found insignificant more often than it was significant.

4.4 Results from the ACC index

In order to give a better overview of the accuracy index, I divided the ACC index up in three categories: low, medium and high accuracy. Lighter shades indicate less accuracy than darker shades. High accuracy means that the amount of times a variable was applied in research, was similar to the amount of times that same variable was found to be statistically significant in explaining attitudes and behaviour. Approximately, 35% of variables occurred in the high accuracy category, while the other 35% in the medium accuracy category. The other 30% were deemed to be low in accuracy (see figure 4). In other words, many variables have been overapplied in research, while they are of little importance in explaining attitudes and behaviour.

First and foremost, socio-demographic data has been studied a lot in this area of research. The ACC index indicates however that most of these socio-demographic variables are overapplied in publications when looking at their significance in actually explaining attitudes and behaviour. Most socio-demographic variables are either in the low or medium category of accuracy, except for population density and education.

In contrast, in line with the findings of Soulsbury and White (2015), benefits are studied very little relative to their importance in explaining attitudes and behaviour. The focus on conflict with wildlife has overshadowed the potential benefits wildlife could bring. This is especially relevant in urban areas where people do not get into contact with nature as often as those living in more rural areas.

Furthermore, most of the variables that were proposed by the TPB model were either left unstudied or understudied. For example, the ACC index indicated that perceived behavioural control and social factors are underapplied, while highly interesting for future research. Notably however, behavioural intention is placed in the high accuracy category, indicating a slow shift in scientific research of wildlife studies towards more behavioural variables.

Last but not least, it is noteworthy to mention that even though direct experience gets a lot of attention in research, it is not really important in explaining attitudes. In contrast, the situational context calls for more scientific attention. This finding suggests that it not really that important that interactions take place, but rather what type of interaction took place. However, in many studies direct experience was measured as 'seeing specie X', or 'being aware of their presence'. Instead of focusing on counting quantitative frequencies of interactions or focusing on unimportant interactions, it is much more relevant to study what types of interactions took place and how these interactions were perceived to influence attitudes and behaviour.

In light of these findings, the conceptual framework has been changed according to the results (see figure 5). Think black lines mean that these variables have been empirically proven to be significant in explaining attitudes and human behaviour. On the other hand, a light shade of grey mean that these variables are in need of more research attention in order to establish the relation between attitude. A dotted line means that these variables were not studied at all but deemed to be important by theoretical research. Insignificant variables have been removed. This framework can thus be used as a starting point for future research for explaining and analysing the antecedents of attitudes and human behaviour.

Benefits/tangible	-9
Perceived Behavioral control	-9
Social factors/intergroup hostility	-9
Benefits/intangible	-7
Situational context (incident severity)	-7
Behavioral intention	-5
Conflict management strategy	-5
Socio-dem./population density	-5
Species characteristics/Taxa	-5
Damage/intangible	-3
Knowledge	-3
Values/General environmental concern	-1
Species characteristics/type	1
Pet owners	2
Damage/tangible	5
Socio-dem./Education	5
Socio-dem./Occupation	6
Other	7
Socio-dem./Full time employment	7
Socio-dem./Age	8
Socio-dem./immigrant	10
socio-dem./wealth	10
Legal status	11
Socio-dem./Gender	11
Socio-dem./Having children	11
Socio-dem./Length lived in area	12
Socio-dem./residency	12
Species characteristics/attractiveness	14
Experience/direct	15

Figure 4: ACC index. High positive values mean that variables have been overapplied in research relative to their significance, while high negative values indicate that these variables have been studied relatively little compared to their significance in explaining attitudes. Thus, darker shades represent higher accuracy, medium shades represent medium accuracy and light shades represent low accuracy in publications measuring attitudes.

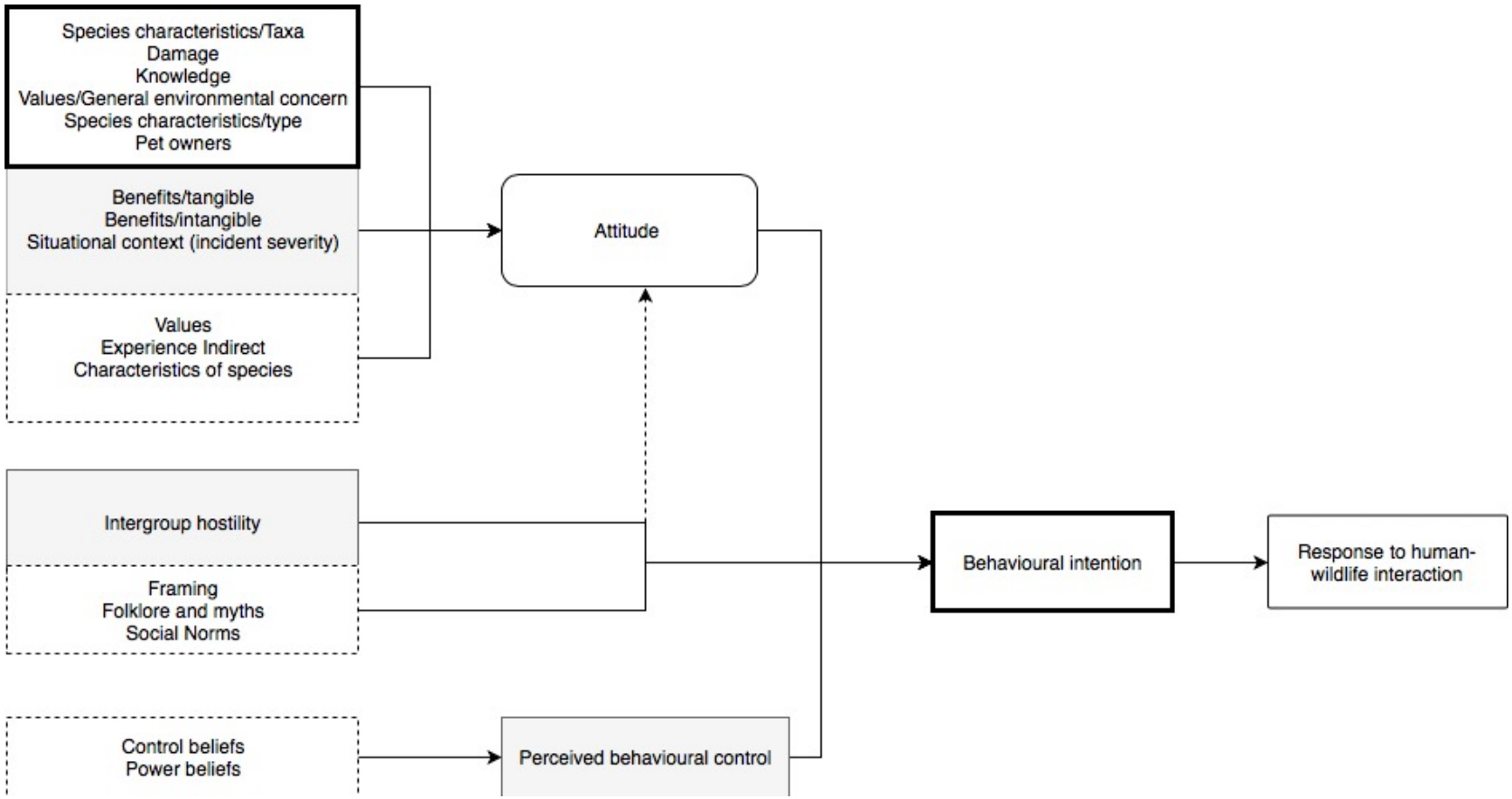

Figure 5: Framework of the relationship between variables and attitudes and human behaviour. Boxes with thick black lines indicate a proven relationship between the variables and the outcome variable. Light grey boxes indicate some evidence but are in need of more research. Dotted lines on the other hand are variables not yet studied in empirical research.

5. Discussion

The aim of this meta-review was to give an overview of empirical evidence of factors influencing attitudes and behaviour in human-wildlife interactions in urban settings through a social psychological viewpoint. The findings indicated that much research has focused on socio-demographic variables, but these factors were in general not significant in explaining attitudes and behaviour. The reason for this overapplication in scientific research is perhaps because socio-demographic variables are relatively easy to measure and analyse.

On the other hand, there remains a significant number of other variables that are left unstudied or understudied, even though these variables are deemed to be of relevance in influencing attitudes in human-wildlife interactions by theoretical research, including the most recent meta-review by Nyhus (2016). Results show that the variables social norms, power and control beliefs and values are not studied at all. Furthermore, behavioural intention and perceived behavioural control have been studied very little. These are all variables that were identified to be very important in explaining the response and attitude towards wildlife by social psychology. Many researchers of conservation studies have acknowledged the profound influence of the human dimension in human-wildlife interactions and stated the importance of learning from other disciplines, such as psychology, in order to efficiently move forward (John et al., 2010; Soulsbury & White, 2015; Bennet et al., 2017). The results of this meta-review show however that there is still a lot left to learn from the field of psychology when it comes to predicting human behaviour and attitudes in human-wildlife studies.

Another interesting finding is the apparent bias on certain animals within the empirical studies that were analysed. In urban settings, more visible animals, such as coyotes, monkeys, possums and birds got the most research attention. Invertebrates and rodents on the other hand were almost never studied. This is pretty interesting, because those less studied animals are probably seen the most in urban settings. This focus is confirmed by other research, who noted that smaller animals and less popular species are underrepresented in wildlife studies (Nyhus, 2016). In the same sense, most studies were done in Europe, the USA or Australia. As cities in developing countries are growing more rapidly than in developed countries, there could likewise be a higher strain on human-wildlife relations. The apparent lack of research in those countries is worrisome, as some of the more uncommon species reside in these areas. Additionally, findings indicate that the acceptance of lethal methods when dealing with wildlife is increasingly declining, meaning that innovative management strategies need to be designed.

Limitations of study

Some limitations of this study should be noted. As mentioned before, some contrasting findings with other meta-analytical research has been found. Even though this study also found more insignificant than significant results, Kansky and Knight (2014) had almost double the amount of insignificant results compared to their significant results. Reasons for this disparity in findings could be due to some bias in the data-collection. First of all, no unpublished data or grey literature was used and access to some sources was denied. Furthermore, this meta-review had a relatively small sample size of 24 articles, while other meta-research had at least 40 articles, in which the gap between significant and insignificant results could have been broadened. The reason for the small sample size of this research could be because potential studies for analysis might have neglected to add the keyword 'urban wildlife' and instead only mentioned the specific animals they studied. If this is the case, with the used search queries in this meta-review, these studies would not have shown up in the Scopus database. For future research, this limitation can be avoided by adding keywords of specific animals which are commonly found in urban wildlife settings.

Additionally, some articles did not link attitude to factors empirically. However, the variable was statistically measured and discussed in combination with attitude. Whether other meta-analytical research choose to code these variables as insignificant, significant or not at all, could be another explanation for the differences in results. Notably though, simply measuring attitude will not give any insights into how attitudes are formed. Thus, to gain more knowledge about the empirical relationship between factors and attitudes, it is important for research of human-wildlife interactions to start analysing attitudinal studies differently.

The former point is also an important discussion point within the data-analysis of this research. Different studies defined each variable differently. As such, some qualitative assessment is needed to judge how a variable is coded. For example, sometimes individual scale items are linked to attitudes, but the whole scale is measured as well. This assessment is especially hard when interaction effects are found, as they are only of relevance in combination with another variable. Thus, judging when to code what and how, can have a negative impact on the transparency and reliability of the data assessment.

A last noteworthy point is that some studies do a lot of statistical tests on the same variable. For example, the study done by White, Eberstein and Scott (2018) tested the variable 'experience/direct' 31 times (see Supplementary Information for data set). As such, their study had a strong impact on the significant and insignificant levels of the variable compared to the

other articles in the analysis. Thus, these instances can have a negative influence on the data set and the research findings. However, the huge influence is lessened by the fact that the amount of significant and insignificant results of these studies are often not too far apart, thereby mostly balancing out the inequality.

6. Conclusion

Urban environments are increasingly becoming potential living environments for a variety of wildlife species. With the growing urbanization all over the world, it is especially relevant to gain knowledge of how co-existing with urban wildlife can be promoted. How interactions between humans and wildlife in such settings are shaped, perceived and responded to, is therefore relevant when designing wildlife management strategies. Future research should step away from simply measuring attitudes and the influence of socio-demographic variables on perceptions, by focusing on how these attitudes are formed and which variables are truly of relevance to explaining attitudes and human behaviour. Framing future research within a social psychological viewpoint can give discerning insights into the antecedents of human behaviour. Thus, the framework depicted in figure 5 could be an interesting and holistic starting point for future research and designing effective wildlife management strategies.

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Appendix 1: Coding scheme

Variables influencing attitudes and behaviour were coded according to the following table. For the data set of how every article was coded, see Supplementary Information.

Table 1: Coding scheme of variables based on the conceptual model (see figure 1).

No.	Variable	Explanation	Operationalization
1	Species	What species is mentioned in the article	a) Fox b) Badgers c) Pigeons d) Corvids e) Starlings f) Coypus g) Wild boar h) Porcupine i) Deer j) Stone marten k) Bear l) Wolf m) Flying squirrel n) Upland goose o) Wild dogs p) Feral cats
2	Region	Region the article is focusing on	a) Netherlands b) UK c) Germany d) France e) Estonia f) Greece g) Italy h) Spain i) Etc.
3	Stakeholder group	The categories of respondents surveyed in the reviewed articles	a) Animal conservators b) Adults c) Students d) Other
4	Experience	The extent to which the respondents are exposed to or interact with wildlife species	a) Personal experience (direct) - the frequency of interacting with certain species or experiencing conflict with species b) Psychological distance to conflict (indirect) - when not having any personal experience with species, but individuals in close proximity with respondents do or respondents

			nonetheless feeling exposed to species
5	Species characteristics	Features of the species as perceived by respondent	a) Type of species b) Physical size c) Attractiveness d) Rarity e) Other perceptions
6	Socio-demographic characteristics	Sociological and demographical characteristics of the respondent	a) Wealth b) Religion c) Age d) Gender e) Education
7	Damage	The type of damage sustained in the conflict situation	a) Tangible costs i) Car collisions ii) Attacks on humans iii) Disease transmission iv) Damage to landscaping and gardening v) Raiding of garbage bins vi) Noise vii) Attacks on pets viii) Property damage ix) Other b) Intangible costs – the indirect costs as perceived by the respondent i) Risk perception ii) Fear iii) Perception of danger c) None
8	Benefits	A perception of receiving positive outcomes from living alongside wildlife	a) Tangible benefits – receiving direct monetary benefits from interacting / living alongside urban wildlife i. Subsidies for implementing mitigation measure ii. Recreational, such as tourism iii. Compensation b) Intangible benefits – perceiving psychological benefits from interacting / living alongside urban wildlife i. Aesthetic value ii. Existence value of the species iii. Cultural purposes b) None

9	Salience	The importance respondents' feel the species, wildlife or nature in general to be	a) General environmental concern a. Positive b. Negative c. neutral b) Interest in animals a. Positive b. Negative c. Neutral c) Values
10	Attitude	A favorable or unfavorable evaluative reaction towards somethings or someone, rooted in one's beliefs and exhibited in one's feelings and inclinations to act	a) Positive b) Negative c) Neutral
11	Social factors	Social and cultural factors that influence attitudes	a) Folklore, myths – any mention of myths and folklore that influenced the respondents i. Fearsome ii. Untrustworthy iii. Dirty iv. Friendly v. Aggressive vi. Etc. b) Framing – if identified by respondents how relevant species are framed in the media and perceived to be influenced by this i. Negative ii. Positive iii. Neutral c) Intergroup-hostility – distrust towards other social groups that might influence attitudes towards urban wildlife d) Social norms – what norms and values about wildlife exist in the social group the respondent belongs to i. Normative beliefs ii. Motivation to comply
12	Legal status	The legal status of the relevant species in the country where the respondent lives	a) Protected b) Unprotected
13	Perceived control	The perceived ability a person believes to have in	a) Control beliefs b) Power beliefs

		actually performing that behaviour	
14	Behavioral intention	A person's readiness to carry out a certain behaviour	a) Mention of specific behavior relevant to the concept studied
15	Conflict management strategy	Strategies proposed or imposed to manage conflict situations with wildlife or to avoid conflict.	a) Lethal control b) Non-lethal control c) Other

Additional information

An Excel sheet with the analysed articles, including the full coding and data set, can be provided on request.