

Positive Public Communication Tools for Enhancing Wildlife-Road Safety in the Chebucto  
Peninsula Region, Halifax, Canada

by

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Submitted in partial fulfilment of the requirements for the degree of  
Bachelor of Community Design: Community Design and Sustainability

at

Dalhousie University  
Halifax, Nova Scotia  
April 2019

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## DALHOUSIE UNIVERSITY

DATE: April 19th, 2019

AUTHOR: Holly K. Blackmore

TITLE: Positive Public Communication Tools for Enhancing Wildlife-Road Safety in the  
Chebucto Peninsula Region, Halifax, Canada

DEPARTMENT OR SCHOOL: College of Sustainability

DEGREE; Bachelor of Community Design:  
Community Design and Sustainability

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### Dedication

This thesis is dedicated to the wildlife of Nova Scotia,  
and to the people who devote their lives to protecting them.

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## **Abstract**

Wildlife-vehicle collisions occur frequently and are hazardous for both humans and animals involved (Huijser, et al., 2016; Fudge, Freedman, Crowell, Nette & Power, 2007; Ramp, Wilson & Croft, 2016). Urban (and other) developments are leading to habitat fragmentation, which results in the displacement of many animal species (Beazley, Snaith, MacKinnon & Colville, 2004; Fudge, et al., 2007; Perkl, et al., 2018). Fragmentation can also lead to more wildlife-road interactions, increasing the potential for collisions to occur (Fudge, et al., 2007). Human-wildlife conflict can also be related to issues regarding wildlife protection around roads and can result in negative attitudes and behaviors toward wildlife (Frank, 2015; Ramp, et al., 2016). It is important to engage the public about issues related to wildlife and roads to increase awareness and encourage human-wildlife coexistence. Futerra Sustainability Communications (2010) has determined that the best way to engage public audiences in support of biodiversity is by incorporating a “love” component and an “action” component to public communication strategies, for audiences not already invested in the issue. By employing a “Love + Action” framework (Futerra Sustainability Communications, 2010), this study develops guidelines and appropriate messages for good practices for positive public communication on the topic of wildlife protection around roads. Application of the guidelines and important messages are demonstrated through the creation of a visual communication tool (i.e., infographic) for wildlife protection around roads in the Chebucto Peninsula, which is an important area for wildlife connectivity (Halifax Regional Municipality & O2 Planning & Design, 2018). The guidelines, important messages and infographic are intended for wildlife protection around roads, but could be transferable to producing positive public communication tools for other wildlife/environmental issues.

**Key Terms:** Human-wildlife coexistence, communication strategies, wildlife conservation, wildlife protection around roads, wildlife connectivity, road-kill prevention, wildlife-vehicle collision, wildlife-road interaction, human behaviour change.



## **Glossary**

*Habitat Fragmentation:* When human development results in major changes to the natural environment, inhibiting species movement and restricting access to resources (Calow, 1998; Fudge, et al., 2007).

*Extinction of Experience:* Term coined by Robert M. Pyle to describe people's declining appreciation for the natural environment due to urbanization and lack of access to nature (Soga & Gaston, 2016).

*Infographic:* A communication tool used to share information in a creative and visual way which is easily readable to a wide audience (Boulton, 2014).

*Road Ecology:* The study of the impacts of roads and vehicles on the surrounding natural environment (Hill, n.d.).

*Wildlife Corridor:* Connects fragmented landscapes in order to protect wildlife species when crossing human dominated areas (Borneman, 2014).

*Peri-urban:* The land located between an urban designated area and a rural designated area, often on the periphery of a city (Peri-urban, n.d.).

## **Acknowledgements**

I would like to express my sincere gratitude to the people who have supported me throughout the process of completing this undergraduate thesis.

First, thank you to my parents who support me in everything I do and who encourage me to pursue my dreams. They have always reminded me to stay true to what I am passionate about, and for this I am truly grateful. It is because of their continual support and guidance that I am able to accomplish my goals, and thus have completed this undergraduate thesis.

Secondly, a special thank you to my supervisor, Prof. Karen Beazley, whose help and support has guided me throughout this process. I am appreciative for Prof. Beazley's encouragement to pursue a topic that I am passionate about, and for supporting me in this journey. I am grateful to have had the opportunity to get to know and work with someone so knowledgeable and kind. Her passion for animals and the environment is heartening and very inspirational.

I would also like to thank Prof. Steven Mannell and Prof. Andrew Bergel for their guidance and support throughout the year. All of the help they provided to me was greatly appreciated; the feedback contributed during the writing process was substantial in assisting me with the completion of my thesis.

Thank you to my peers for their continual support and encouragement throughout the year. I am glad to have had the opportunity to get to know them and to be inspired by their research and dedication to sustainability.

Lastly, thank you to all of the professionals in fields related to this study who provided me with their expertise in the early phases of this thesis. Their knowledge on Nova Scotia wildlife species was a great help, and is much appreciated.

Thank you.

## **Chapter 1: Introduction**

### **1.1 Background**

Interactions with the natural environment can, in part, determine people's attitudes and behaviours towards the environment and its wildlife inhabitants, and thus contribute to human-wildlife conflict and coexistence (Acuña -Marrero, et al., 2018; Cox & Gaston, 2018; Frank, 2015). Issues such as species extinction and endangerment are contributing to biodiversity loss, and are confirming the urgency to change human behaviours and avoid human-wildlife conflict (Carter, Shrestha, Karki, Man Babu Pradhan & Liu, 2012; Frank, 2015). This is especially pressing as human development continues to encroach on forests and other wildlife habitats; leading to forceful displacement of many wildlife species (Beazley, et al., 2004; Perkl, et al., 2018). Roads are an example of human development that is frequently the cause of conflict such as wildlife-vehicle collisions (Fudge, et al., 2007; Ramp, et al., 2016).

Effective public communication can be used to influence human behaviours and promote coexistence (Acuña-Marrero, et al., 2018; Clayton, Litchfield & Geller, 2013; Futerra Sustainability Communications, 2010). Research has been done to determine the suitability of different types of communication strategies for various environmental issues (Clayton, et al., 2013; Futerra Sustainability Communications, 2010). The effectiveness of public communication strategies may depend on people's pre-determined attitudes and opinions of the issue being communicated (Clayton, et al., 2013). However, there is evidence to support the idea that positive, *love-based* messaging strategies are most effective for public outreach aimed at initiating change towards humans valuing nature (Clayton, et al., 2013; Futerra Sustainability Communications, 2010).

This study explores the use of positive communication strategies for engaging uninitiated public audiences on issues related to wildlife-road interactions, and moving from human-wildlife conflict to coexistence. It applies a positive communication framework to a public communication tool for wildlife protection around roads in the Chebucto Peninsula region of the Halifax Regional Municipality (HRM). The Chebucto Peninsula was chosen because the area has been determined as important for wildlife connectivity by the Halifax Green Network Plan (GNP) (Halifax Regional Municipality & O2 Planning & Design, 2018).

### *The Halifax Green Network Plan*

The Halifax Green Network Plan (GNP) aims to conserve and connect Halifax's *open spaces*. It was approved in 2018, and is now in the implementation phase (Halifax Regional Municipality & O2 Planning & Design, 2018). The GNP addresses ecological issues, including wildlife corridors and pathways (Halifax Regional Municipality & O2 Planning & Design, 2018).

Implementation of the plan will require communications to foster and enhance support among the general public. The GNP gives local context to this study, including background information and rationale for focusing public communication tools for enhancing wildlife-road safety in the Chebucto Peninsula region of the Halifax Regional Municipality (HRM).

### *Wildlife-Road Interactions*

With increasing road development in peri-urban areas, wildlife habitats are being forcefully disconnected, leading to habitat fragmentation (Fudge, et al., 2007; Perkl, et al., 2018). Habitat fragmentation is often the result of roads and other infrastructure separating the natural landscape into isolated patches, and thus cutting off access for wildlife to important resources (Calow, 1998; Perkl, et al., 2018). With increasing networks of roads, wildlife vehicle collisions and animal fatality rates also increase, with more frequent animal crossings in attempts to move between fragmented patches of habitat; this is especially detrimental for those species already considered to be most at risk of population decline (Beazley, et al., 2004; Fudge, et al., 2007). According to a recent news article on wildlife-vehicle collisions in Nova Scotia, approximately 600 large mammals were killed in vehicle collisions between 2011 and 2017, however the majority of animal-vehicle collisions are not reported (Burke, 2017). For this reason, most statistics do not reveal the true severity of the issue (Burke, 2017). Of course, in addition to impacts on wildlife, there are also human safety concerns and other costs associated with wildlife-vehicle collisions (Fudge, et al., 2007; Ramp, et al. 2016).

As the natural landscape continues to be fragmented and isolated by human development there comes a greater need for public awareness on the issues related to wildlife protection around roads (Ramp, et al. 2016). Understanding the most effective communication strategies for wildlife conservation will be integral for maintaining species populations and reducing biodiversity loss (Acuña-Marrero, et al., 2018), including wildlife losses due to roads.

### *'Extinction of Experience'*

In addition to the impacts of roads on wildlife, people are losing appreciation for nature as urbanization continues to restrict convenient access and exposure to natural environments (Cox & Gaston, 2018; Miller, 2005; Soga & Gaston, 2016). This loss of human-nature connection attributes to worsening attitudes towards wildlife and the protection of wildlife habitats (Cox & Gaston, 2018; Soga & Gaston, 2016). Robert M. Pyle named this phenomenon the “extinction of experience” (Miller, 2005; Soga & Gaston, 2016). This *extinction of experience* is occurring amongst all generations, but is becoming particularly problematic in youth (Miller, 2005; Soga & Gaston, 2016). In order to motivate people to value and engage more with nature, conservation strategies must go beyond threats of extinction and species loss but, for many audiences, focus on communicating from a place of appreciation for the environment, while also identifying concrete actions that can be taken (Futerra Sustainability Communications, 2010; Clayton, et al., 2013).

## **1.2 Purpose of Study**

The purpose of this study is to develop positive guidelines, messages and a visual communication tool to encourage a shift in public attitudes and behaviours from that of human-wildlife conflict to human-wildlife coexistence, and to increase awareness of the issues regarding wildlife-road interactions in the Chebucto Peninsula region of the HRM. The target audience for the communications is members of the public who are not already invested in issues related to wildlife or wildlife-road interactions. The study is within the context of planning for safe passage of wildlife across major roads that intersect with wildlife movement pathways/corridors in the Chebucto Peninsula region, such as those identified in the GNP (Halifax Regional Municipality & O2 Planning & Design, 2018), but with potential application in similar contexts elsewhere.

This study will determine good practices for positive communication strategies in regards to wildlife conservation and road related wildlife impacts, such as habitat fragmentation and animal fatalities. The information obtained from this research will be applied in the context of the Chebucto Peninsula to determine the most appropriate wildlife conservation messaging strategy for this area of the HRM.

As more species become threatened and biodiversity loss continues, effective conservation messaging is essential for fostering coexistence between humans and wildlife

(Acuña-Marrero, et al., 2018; Frank, 2015). Research for this study involves gaining a better understanding of the shift from human-wildlife conflict to coexistence and how communication strategies can be used to improve public attitudes and behaviours toward wildlife (Acuña-Marrero, et al., 2018; Monroe, 2003). Lastly, it contributes a more positive approach to developing public communication strategies in relation to a gruesome and upsetting issue, such as road kill.

### **1.3 Research Questions**

The questions that this study aims to address are as follows:

What positive communication strategies are effective for wildlife conservation outreach to the unengaged public? And, how can these messaging strategies effectively facilitate behaviour change from a place of conflict to one of coexistence?

What positive messaging strategy would be most appropriate for use in the Halifax Regional Municipality? Particularly in the Chebucto peninsula where important wildlife corridors intersect highways 103 and 333. And, what might a visual wildlife advocacy message look like for this part of the HRM?

### **1.4 Theoretical Framework**

The framework for this study is based on the theory that positive communication strategies are most effective for engaging public audiences who are not already committed to or aware of a particular cause (Clayton, et al., 2013; Futerra Sustainability Communications, 2010). Research suggests that such audiences tend to avoid communication strategies which provoke a negative emotional response (Clayton, et al., 2013; O'Neill & Nicholson-Cole, 2009). Thus, messages that include sadness, threats or potential losses are not as effective as positive messages (Futerra Sustainability Communications, 2010; O'Neill & Nicholson-Cole, 2009).

Futerra Sustainability Communications (2010) has outlined various communication strategies and their uses for different audiences. They identify four messaging categories: “love, loss, need, and action”, which have been combined into two primary messaging strategies, one for policy makers and one for the uninitiated public (Futerra Sustainability Communications, 2010). “Love + Action” is the communication strategy that has been identified as most effective for public outreach for biodiversity conservation (Futerra Sustainability Communications, 2010),

and is thus used as the framework for this research in the context of wildlife protection around roads. Negative, sad and gruesome issues, including those related to wildlife-road interactions, such as road kill, are potentially difficult to address through positive framing. This study looks to take up this challenge.

### **1.5 Research Assumption**

Communication strategies which emphasize human-wildlife coexistence and safe wildlife movement across roadways through positive, emotional and *action-based* conservation messaging are most effective for influencing public attitudes and behaviour change for otherwise unengaged audiences. In the case of the Chebucto Peninsula, positive, *love-based* messaging could be an effective strategy for inspiring sustainable action to address issues regarding wildlife and roads in this area of the HRM. Communication strategies based on the economic value of wildlife conservation or fear-based strategies which focus on immediate and future threats to wildlife would be less effective for this public audience, though they may be appropriate for outreach to policy makers on such issues in the Chebucto Peninsula region.

### **1.6 Methods**

For the purpose of data collection and analysis, a systematic literature review was conducted on both peer-reviewed and grey literature, including reports and websites associated with similar studies and applications. Search topics included positive communication strategies in relation to nature conservation, road ecology, wildlife protection, human-wildlife coexistence, effectiveness of infographics and other visual communication tools, etc. Preliminary research expanded beyond the specific focus of this study to obtain background information on various types of communication strategies for evidence purposes. Identified sources were qualitatively analyzed relative to key categories and themes to organize relevant information which was used to determine two sets of guidelines and important messages (see Methods Chapter for more information regarding guidelines and important messages).

This research was applied to the Chebucto Peninsula region of the HRM. An overview of the Chebucto Peninsula is provided (see Methods Chapter) including a brief description of the major wildlife pathways and roads that intersect, as identified in the GNP. A visual communication tool (i.e. infographic) was produced for the purpose of communicating “Love +

Action” messages (Futerra Sustainability Communications, 2010) around issues related to wildlife-road interactions in the Chebucto Peninsula. The infographic was developed using the guidelines and important messages informed by the literature.

### **1.7 Scope, Limitations and Research Bias**

The scope of the research presented in this study is based on the hypothesis that positive communication strategies are most effective for wildlife conservation in terms of public outreach (Clayton, et al., 2013; Futerra Sustainability Communications, 2010). Therefore, it will focus on positive communication strategies which pertain to the not-yet-invested public, rather than exploring fear-based, economy based, or other strategies that are considered more effective for those already engaged, such as environmentalists, animal rights and other advocates or policy makers (Futerra Sustainability Communications, 2010). However, other communication strategies will be researched during the preliminary research phase to a minor extent, as explained in the methods section. The research will focus on the movement away from human-wildlife conflict to human-wildlife coexistence (e.g., Acuña-Marrero, et al., 2018; Frank, 2015). Road ecology will also be explored in a preliminary way, with emphasis on wildlife movement and pathways.

One of the deliverables of this research is an infographic, which has been chosen due to its versatility for information sharing (e.g., email, print, social media, etc.), among other reasons (Lazard & Atkinson, 2014; Trinh, 2017). Infographics can be effective public communication tools due to the fact that people are generally able to understand visual communications more quickly than text-based communications (Evans, 2016; Lazard & Atkinson, 2014; Shelley, 2017).

The Chebucto Peninsula region of the HRM was chosen to further refine the scope of this study, as well as to apply the research to a real world example. Wildlife pathways which intersect highways 103 and 333 have been identified in the GNP as important corridors for wildlife movement (Halifax Regional Municipality & O2 Planning & Design, 2018), and thus are the geographical focus of this practical research application.

One limitation to this study is the time constraint: there was not time to pursue a complete marketing survey of the final product. Another limitation is that there is limited peer-reviewed research directly related to wildlife conservation communication strategies and therefore, this



study relies more on research conducted on conservation messaging for other environmental issues, as well as grey literature.

This study has research bias due to my supportive position of human-wildlife coexistence as well as my appreciation for wildlife and the natural environment; that is the view from which I am delivering this research. Also, because I am a sustainability student I have pre-conceived ideas of sustainable practices related to a variety of environmental topics including road ecology and biodiversity, which may attribute to research bias in this study. Finally, I am strongly supportive of positive, *love-based* messaging around animal-related issues.

### **1.8 Chapter Summary**

There is currently a need to improve communication and public outreach to inspire behaviour change which promotes love and appreciation for wildlife and their habitats (Acuña-Marrero, et al., 2018; Clayton, et al., 2013; Futerra Sustainability Communications, 2010). The goal of this research is to address the issues of wildlife around roads by applying the “Love + Action” communication framework from Futerra’s *Branding Biodiversity* (Futerra Sustainability Communications, 2010), and producing an infographic aimed at increasing general public awareness of these issues. All as part of fostering a transition from human-wildlife conflict to human-wildlife co-existence.

## **Chapter 2: Literature Review**

### **2.1 Chapter Introduction**

The purpose of this chapter is to gain a better understanding of the current state of peer-reviewed and grey literature that has been published on the topics of road ecology, effective communication strategies, human-wildlife coexistence and human connection to nature. The gathered literature has been reviewed for the purpose of identifying any contradictions or consensus between authors, important pieces of information and any gaps in the literature as a whole; it has been thematically categorized by key topics. The literature review aims to provide background on topics which are broadly related to this thesis.

In order to gather a sufficient amount of literature for this review, multiple databases and search terms were used. A list of primary search terms was created and then built upon as my research progressed using key terms taken from relevant articles (see Table 1). Google Scholar, Web of Science and ProQuest were the three primary databases used for gathering research from peer-reviewed sources, however, other databases were used periodically. Google was the search engine used to source all grey literature.

The original searches provided a large number of results, which needed to be reduced. All articles found during initial database searches are refined using the following method: (1) article titles are interpreted for their relevance to the thesis topic; (2) article key words are read to further determine their relevance; (3) abstracts of the articles determined to have relevance to the thesis topic are read; (4) the introduction sections of remaining articles are read to verify their relevance. All articles which are determined relevant are read and reviewed in their entirety and analyzed for information regarding important messages, communication guidelines, and design guidelines for communication tools. More refined searches were conducted by adding additional key words, and narrowing the publication date range to include only more recent articles. This process identified approximately 50 papers that were fully reviewed.

Through this literature search and review, it was found that there is currently a paucity of literature published about wildlife conservation messaging, notably in the peer-reviewed literature. Existing wildlife conservation messaging literature is predominantly focused on wildlife management in cities, and conservation messaging and education in zoos. Information specifically related to wildlife conservation messaging around roads and road kill prevention is

mostly absent from peer-reviewed literature. There are good examples in the grey and popular literature, however, such as on websites of nongovernmental organizations.

Table 1: Search Terms

<b>Road Ecology</b>	<b>Human-Wildlife Coexistence</b>	<b>Communication Strategies</b>	<b>Human Connection to Nature</b>
Road kill	Human wildlife coexistence	Messaging for wildlife vehicle collisions	Human connection to nature
Road kill prevention	Human wildlife conflict	Wildlife conservation messaging	Environmental attitudes and behaviours
Roads and wildlife	Human wildlife interactions	Positive communication strategies	<i>Extinction of Experience</i>
Habitat fragmentation	Coexistence and conservation	Conservation communication	Human nature interaction
Wildlife vehicle collision	Wildlife habituation	Visual communication tools	Attitudes towards wildlife
Wildlife road mitigation	Wildlife and urban development	Effectiveness of infographics	
		Infographics for conservation	

Qualitative analysis of the literature resulted in the organization of key themes within five broad categories: (1) human-wildlife conflict and coexistence; (2) conservation messaging strategies; (3) infographics as a communication tool; (4) human connection to nature; and (5) road ecology. Each broad thematic category is summarized in the following sections.

## **2.2 Human-Wildlife Conflict and Coexistence**

The topic of human-wildlife conflict and coexistence due to positive and/or negative encounters is widely discussed in peer-reviewed literature. There is evidence to suggest that human-wildlife encounters influence public attitudes and can ultimately determine the amount of support given to wildlife conservation initiatives (Acuña-Marrero, et al., 2018; Ballantyne, Packer, Hughes & Dierking, 2007; Frank, 2015; Carter, et al., 2012). Consensus seems to exist that in order to move from a place of conflict to coexistence, public attitudes and behaviours toward wildlife must change (Dubois, et al., 2017; Frank, 2015; Dickman, 2010). However, whether or not

conservation efforts should foster human-wildlife coexistence over other conservation strategies is debated (Frank, 2015).

In an article on human-wildlife conflict and coexistence, Frank (2015) explains that conservation efforts which pertain to minimizing the threats associated with human-wildlife conflict are often ineffective, as they do not portray a positive conservation message. The language used in conservation efforts is often ineffective and potentially disconcerting for the audience, as both the terms “conflict and coexistence” and “coexistence and tolerance” are used throughout the body of literature related to human-wildlife interactions (Frank, 2015). To address this, Frank (2015) has determined a ranking system titled the “conflict-coexistence continuum”, which explains the various levels of ‘intolerance, conflict, tolerance and coexistence’ related to human attitudes and behaviours towards wildlife.

A few of the articles included in this body of literature refer to human-wildlife conflict as being partially dependant on wildlife proximity to cities and areas of high density (Carter, et al., 2012; Dubois, et al., 2017). These authors explain that conflict often arises from human development due to the resulting displacement of wildlife species (Carter, et al., 2012; Dubois, et al., 2017). Forceful wildlife relocation and/or habituation occurs due to rapid urbanization, therefore increasing the probability for human-wildlife conflict (Dubois, et al., 2017).

A common theme throughout the coexistence and conflict literature is the need to understand people’s attitudes towards wildlife, as an underlying framework for effective conservation (Acuña-Marrero, et al., 2018; Carter, et al., 2012; Dickman, 2010; Echeverri, Chan & Zhao, 2017; Frank, 2015). This theme is also noted in the literature related to *Human Connection to Nature* (see section 2.5). There seems to be some debate between authors regarding human-wildlife relations, as well as the pros and cons around using examples of conflict for conservation purposes (Frank, 2015). However, in general, there seems to be agreement on the importance of human-wildlife coexistence for wildlife conservation and the need to gain a better understanding of human attitudes towards wildlife to foster stronger conservation efforts (Acuña-Marrero, et al., 2018; Carter, et al., 2012; Dickman, 2010; Frank, 2015).

### **2.3 Conservation Messaging Strategies**

For the purpose of conservation messaging to a general public audience, many researchers assert,

in both peer-reviewed and grey sources, that positive messaging strategies are effective for influencing change (Ballantyne, et al., 2007; Bekessy, Runge, Kusmanoff, Keith & Wintle, 2018; Echeverri, et al., 2017; Futerra Sustainability Communications, 2010; Frank, 2015; Veríssimo., 2017). A number of articles discuss the importance of positive messaging for public communication. Ballantyne, et al. (2007) state that in order to gain public support for wildlife conservation and issues around wildlife species and their habitats, conservation efforts must influence a greater appreciation for wildlife through emotion-based communication. In a web-based article about the effectiveness of positive communication and story telling for conservation, Veríssimo (2017) discusses various conservation efforts that have been successful due to their optimistic approaches. One of these efforts is the “Lost and Found Project” which highlights the rediscovery of animal species which had previously been recorded as extinct (Veríssimo., 2017).

In contrast to ‘positive communication’ strategies, commonly used ‘messaging’ strategies in the literature include ones which describe an immediate threat, such as species loss or extinction (Futerra Sustainability Communications, 2010), and economy-based messaging such as ‘ecosystem services’, which gives the natural environment an economic value from which to encourage conservation (Bekessy, et al., 2018). Both Bekessy et al. (2018) and Futerra Sustainability Communications (2010) state that monetary-based messaging strategies for biodiversity or environmental issues are only effective for communication to policy makers, while positive, emotion-based messaging strategies are much more widely accepted by a public audience. Threat- and fear-based communication strategies are only effective for individuals who are already invested in the issue under consideration (Bekessy et al., 2018; Futerra Sustainability Communications, 2010). Clayton, et al., (2013) also express the need for messaging strategies that are audience specific and explain how fear-based messages often result in a negative response from public audiences.

Like many other articles relevant to effective communication strategies, Echeverri, et al., (2017) focus on understanding people’s behaviours and the relationship between those behaviours and how various messages are perceived. In their study on the effectiveness of various types of communication for information-sharing regarding endangered sea otters, they found that a positively framed message rendered the most proactive response for protecting the

species (Echeverri, et al., 2017). Another study, conducted for shark conservation, also focused on understanding behaviours and attitudes, in this case towards sharks, and based their conclusions on the identified human behaviours (Acuña-Marrero, et al., 2018). Their findings lead to a number of conclusions regarding shark conservation and wildlife conservation in general, one of which being that positive imagery, which evoked feelings of admiration for the species, was most effective for fostering positive attitudes towards sharks (Acuña-Marrero, et al., 2018).

There seems to be consensus among authors that positive messaging is most effective for the uninitiated public; and, that there is a direct correlation between effective communication and public attitudes and behaviours towards a particular topic of concern (Acuña-Marrero, et al., 2018; Clayton, et al. 2013; Echeverri, et al., 2017; Futerra Sustainability Communications, 2010). In general, there seems to be more literature related to zoo animal conservation than related to wildlife conservation in urban and peri-urban settings, in this body of literature.

#### **2.4 Infographics as a Communication Tool**

Visual communication tools have been used for generations for the purpose of effective information sharing (Lazard & Atkinson, 2014). Infographics can be used to acquire public support on a variety of topics and issues; due to their ability to reach a wide audience, they are used across many disciplines as a visual communication tool (Otten, Cheng & Drewnowski, 2015). There is evidence to suggest that infographics are generally more effective for active information sharing than text-only messages (Evans, 2016; Lazard & Atkinson, 2014; Shelley, 2017). In particular, the evidence suggests that infographics can be particularly effective for environmental conservation purposes (Lazard & Atkinson, 2014).

A study was conducted to determine the effectiveness of infographics and visual learning on the topic of pro-environmental behaviour for individuals with various “learning preferences” such as visual, auditory or text-based learning (Lazard & Atkinson, 2014). Previous studies suggest that learning preference models such as the “Dunn and Dunn Model of Learning-Style Preferences” can be used to determine how people best learn in an educational setting (Dunn, et al., 1995). It is thought that various learning preferences may contribute to the effectiveness of some communication strategies, however, the study completed to determine the effectiveness of

infographics for pro-environmental behaviour found that in most cases, visual communication is effective for people of all learning preferences (Lazard & Atkinson, 2014).

Infographics are used for information sharing amongst many disciplines (Otten, et al., 2015). The field of medicine, in particular, seems to have a high volume of literature around the usefulness of infographics and visual communication, however none of these articles were used for this research, as many did not seem general enough for such a different application.

Infographics are mentioned in few articles related to the environment (e.g., Lazard & Atkinson, 2014), and there does not appear to be any directly related to wildlife conservation or road ecology.

There is a relatively large amount of grey literature available on infographics, with many of the articles including specific information on how to create effective infographics in terms of layout and design. Information from these web-articles is used to inform a set of guidelines regarding infographic design principles (see Guidelines section of Methods Chapter, section 3.3).

## **2.5 Human Connection to Nature**

A number of authors have discussed the correlation between urbanization and a declining appreciation for nature. The term “extinction of experience” was coined by Robert M. Pyle, in relation to this correlation, aiming to express a growing concern for human’s lack of connection to the natural environment (as cited in Gaston & Soga, 2016; Miller, 2005). These authors mention that the body of literature related to the *extinction of experience* is limited but that it is an important topic, not only for nature conservation but also human health and urban development practices (Gaston & Soga, 2016).

In the literature gathered on the topic of human-nature connection, there is consensus between all authors that the major causes of people’s declining appreciation for and connection to nature are urbanization and the growing popularity of city living (Soga & Gaston, 2016; Cox & Gaston, 2018; Miller, 2005; Richardson, 2017). In his article written on biodiversity and the *extinction of experience*, James R. Miller (2005) explains how urbanization has dramatically decreased the amount of biodiversity in cities. A lack of biodiversity in cities results in people being exposed to only a small number of plant and animal species which can contribute to a declining appreciation for nature (Miller, 2005). The declining appreciation for nature is affecting all generations, but is generally considered particularly problematic for youth (Soga &

Gaston, 2016; Cox & Gaston, 2018). Although, one study conducted on university student's feelings towards the natural environment demonstrated that the majority had a strong connection to nature and showed affection for wildlife (Soga, Gaston, Koyanagi, Kurisu & Hanaki, 2016).

Soga and Gaston (2016) found that more time spent in nature is directly related to people's positive attitudes towards environmental conservation efforts. A study conducted by Johnathan Hicks and William Stewart (2018) examined people's most memorable experiences in nature. This article connects with those written on the *extinction of experience* and is included in the same body of literature because it emphasizes the importance of these meaningful experiences for maintaining people's compassion for the natural environment (Hicks & Stewart, 2018). Additionally, a web-article written by Dr. Miles Richardson discusses the benefits of nature for general well-being, as well as the importance of human-nature interaction for supporting conservation efforts, explaining that these interactions are "beneficial for the well-being of both humans and the natural world" (Richardson, 2017).

Overall, there seems to be consensus among all authors in this body of literature, that a growing lack of exposure to nature due to increased urbanization is causing an *extinction of experience*, that children and youth are most affected, and as a result, a decrease in appreciation for and connection to nature is occurring (Soga & Gaston, 2016; Cox & Gaston, 2018; Miller, 2005; Richardson, 2017). This decrease in human-nature interactions and connection can have negative consequences on conservation efforts (Richardson, 2017).

## **2.6 Road Ecology**

The body of literature published on habitat fragmentation, wildlife-vehicle collisions, and species loss is quite substantial, possibly due to increasing threats and concerns posed by on-going urbanization and road development. There is consensus among road ecology researchers that roads are a major threat to wildlife individuals and populations, and that habitat fragmentation and wildlife-vehicle collisions are detrimental to the survival of many species (Beazley, et al., 2004; Fudge, et al., 2007; Havlick, 2004; Ramp, et al., 2016). In general, there seems to be more literature on the impacts of human-wildlife vehicle collisions in terms of risks to humans and property, and less on risks to wildlife, as acknowledged by Ramp, et al. (2016), who examine the effects of wildlife-vehicle collisions, particularly on wildlife species.

Much of the literature related to protection of wildlife species and road ecology pertains



to road mitigation measures such as wildlife crossing structures (e.g., Huijser, et al., 2016; Rytwinski, et al., 2015; McCollister & Van Manen, 2010). The effectiveness of mitigation measures varies greatly depending on the species, as all species have different habitat requirements (Roberts, 1987) and behaviours around roads (Beier & Loe, 1992; Fudge, et al., 2007). Due to spatial, economical and other factors, crossing structures are often designed to aide in the crossing of a variety of species (Huijser, et al., 2016). There is consensus among authors that the choice of the most appropriate wildlife crossing strategy is entirely dependant on the species which will be using the crossing, as well as the terrain and the road characteristics where the crossing is located (Havlick, 2004; Huijser, et al., 2016). Huijser, et al. (2016) explain how the inappropriate placement of crossing structures can actually increase the risks to particular wildlife species.

Overall, there seems to be more literature published on the use of large crossing structures and complex mitigation strategies than on solutions or guidance aimed at individual drivers, for their protection and the protection of animals. In general, there is consensus among authors that wildlife-vehicle collisions and roadways have various adverse effects on a wide range of wildlife species and their habitats, to the extent that population viability is often affected (e.g., Fudge, et al., 2007; Havlick, 2004; Huijser, et al., 2016; Ramp, et al., 2016; Beazley, et al., 2004).

## **2.7 Chapter Summary**

By conducting this literature review, peer-reviewed and grey literature was examined on the broad topics of human-wildlife coexistence, conservation messaging strategies, infographics as communication tools, human connection to nature, and road ecology. No peer-reviewed, and few grey literature sources were found that directly related to the topic of positive communication strategies for wildlife protection around roads and road kill prevention. Information was limited on conservation messaging strategies in regards to wildlife in urban and peri-urban areas, as well as for the *extinction of experience* and road kill from the perspective of species protection and animal safety, with the exception of non-governmental organizations' animal conservation websites. A large body of literature was revealed on infographic effectiveness, however, few were directly related to wildlife conservation and wildlife-road interactions.

There seems to be consensus among authors on most of the topics addressed in the literature. Key points and pieces of information were similar amongst many of the articles under the same topic category. Much of the research gathered for this literature review was similar and had some information overlap, but was not directly related to the topic of this study, in all categories. The results of the literature review provide the background and framework for this thesis.

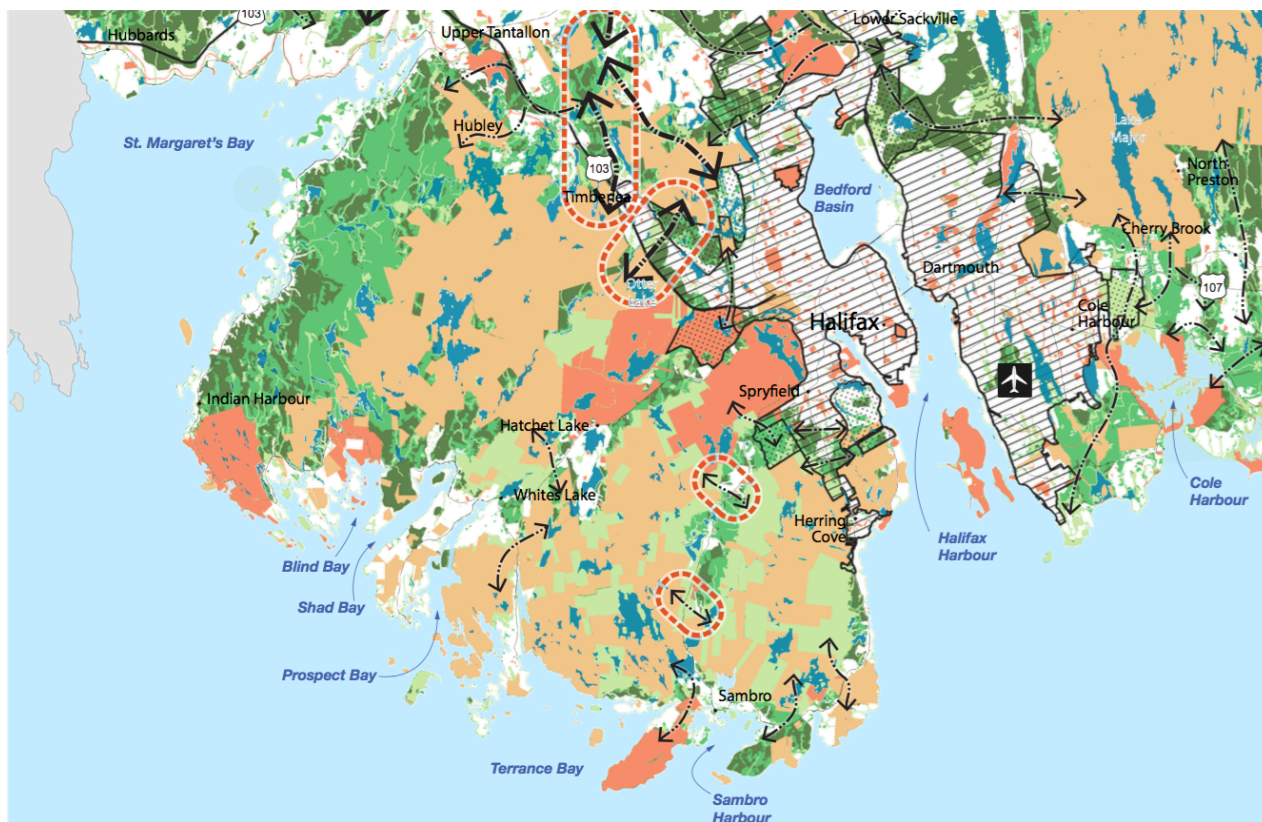
## **Chapter 3: Methods**

### **3.1 Approach**

A qualitative approach best describes the methods conducted for this study, as they do not involve calculations and are based on literature analysis and identifying best practices for public communication (Palys & Atchison, 2014). The methods demonstrate a “pragmatic worldview” and an “advocacy worldview”, being issue-based, research-centered and for the purpose of creating positive change (Pasquini, 2012 & Creswell, 2008). Both worldviews are suited to conducting mixed methods and qualitative research (Creswell, 2008).

### **3.2 Location Description**

A main objective of this study is to develop a positive communication tool for fostering public support for wildlife safety around roads in the Chebucto Peninsula, the methods for which are explained later in this chapter. The Chebucto Peninsula is part of the HRM and is located in an area which is highly forested, but is separated from the rest of mainland Nova Scotia by a major highway and a secondary road (Halifax Regional Municipality & O2 Planning & Design, 2018). The Halifax Green Network Plan has identified ‘important’ and ‘essential’ wildlife corridors throughout the Chebucto Peninsula (see Figure 1), some of which cross major roads such as Highway 103 and Highway 333 (Halifax Regional Municipality & O2 Planning & Design, 2018). These wildlife corridors connect forested landscapes and resources and are essential for wildlife survival (Halifax Regional Municipality & O2 Planning & Design, 2018). The development of these highways and other roads in the Chebucto Peninsula has led to a separation of natural landscapes, therefore restricting wildlife access to important resources (Halifax Regional Municipality & O2 Planning & Design, 2018).



**Map 9: GREEN NETWORK (ZOOMED INTO THE CHEBUCTO PENINSULA)**

LEGEND

Airports	Parks	Regulated Areas
Roads	Protected Areas	Areas of High Environmental Value Overlap
Planned Roads	Proposed Protected Areas	Core Areas and Corridors
Lakes	Essential Corridor	Minimal Value to Regional Green Network
	Important Corridor	Urban Reserve
	Priority Area	Urban Settlement

Figure 1: ‘Green Network (Zoomed into the Chebucto Peninsula)’ [Map]. *Halifax Green Network Plan*. (Halifax Regional Municipality & O2 Planning & Design, 2018).

Wildlife species require various habitat conditions, including movement across landscapes for spatial, resource and other requirements (Beier & Loe, 1992). Therefore, safe passage between landscapes is essential for many species (Beier & Loe, 1992; Fudge, et al., 2007). Opportunities are currently available to improve the safety of the Chebucto Peninsula area for wildlife species if protections are put in place before the remaining tenuous connections are severed completely and permanently (Halifax Regional Municipality & O2 Planning & Design, 2018). There is a need, however, for more enhanced public and political awareness and support for implementation of mitigation efforts to better protect animals, as urban and peri-urban human

infrastructural developments continue (Halifax Regional Municipality & O2 Planning & Design, 2018). This study focuses on encouraging greater human-wildlife-road coexistence in the Chebucto Peninsula, through effective public communication and awareness, rather than on specific roadway infrastructural mitigation strategies.

### **3.3 Data Collection and Analysis Methods**

The methods conducted for this thesis include a literature-based analysis, the development of two sets of guidelines derived from literature findings (i.e., guidelines for creating positive communication messages and guidelines for creating effective visual communication tools), two lists of important messages (i.e., *love* and *action* messages), and the creation of a visual communication tool (i.e., infographic), each of which is detailed in the following sections.

#### *Literature Analysis*

As summarized in the Literature Review (Chapter 2), a systematic literature search and review was conducted on peer-reviewed and grey literature related to the topics of human-wildlife conflict and coexistence, human connection to nature, road ecology, conservation messaging strategies, effective public communication tools, and infographics as a communication tool (see Chapter 2 for summary results, and Tables 5, 6 and 7 in the Appendix Chapter for lists of search databases and search terms).

In order to determine important information for the creation of communication guidelines, key messages, and a communication tool, an in-depth analysis was conducted on the most relevant peer-reviewed and grey literature. As indicated in Chapter 2, a thematic-coding method was used to organize key information into thematic categories. The literature was then refined into sub-themes by identifying similar information throughout multiple articles and sources.

Best practices for public communication and crafting important conservation messages were identified from the analysis and used to inform the first set of guidelines as well as the important messages. Preliminary research has determined that infographics are effective for public communication (Evans, 2016; Lazard & Atkinson, 2014; Shelley, 2017), and for this reason it has been chosen as the communication tool for application in this research. Results

from analysis of the literature regarding effective visual communication tools, and specifically infographics, informed the development of a second set of guidelines (Section 4.2, Table 3).

Much of the peer-reviewed literature that is related to nature or wildlife conservation messaging strategies focus on issues other than the topic of wildlife protection around roads. These articles, although they are not directly related, are helpful for determining best practices for positive public communication. General information regarding effective communication was gathered from these articles and used to inform the messaging guidelines for wildlife safety around roads.

### *Creation of Guidelines*

Two sets of guidelines were produced to aid in the creation of communication tools for wildlife conservation, and more specifically for wildlife protection around roads. These guidelines were used to inform the creation of an infographic for increasing safety for both humans and animals around roadway interactions in the Chebucto Peninsula (see Visual Communication Tool Section for details). One set of guidelines is for producing positive messages for public communication strategies directed at audiences not already invested in wildlife-related issues. This set of guidelines is primarily based on the *Branding Biodiversity* “Love + Action” framework (Futerra Sustainability Communications, 2010). The second set of guidelines comprises of design principles and practices for the creation of effective visual communication tools, including information regarding effective layouts, text, visuals, etc. and is specific to infographic design.

Both sets of guidelines were created using best practices found in the literature regarding different types of environmental conservation messaging and creating effective infographics. The guidelines for informing positive messages, are primarily based on the *Branding Biodiversity* “Love + Action” framework, as it was developed for public communication towards uninitiated audiences (Futerra Sustainability Communications, 2010).

### *Important Messages*

Lists of important *love* and *action* messages regarding wildlife road interactions, road kill prevention and human-wildlife coexistence were produced, in connection with the *Branding Biodiversity* “Love + Action” framework (Futerra Sustainability Communications, 2010) that is employed in this research. Information from both peer-reviewed and grey literature was used to inform these messages. Much of the information related to road kill prevention, wildlife road

interactions and animal protection derives from non-governmental organizations' conservation related web-sources. The language and nature of the information from these sources is more directly relevant to this study's focus on these topics and to general public audiences. Peer-reviewed literature is incorporated primarily on the topics of human-wildlife coexistence and safe passage for wildlife. The infographic uses a sub-set of these important messages, which were chosen for their relevance to the issue in the Chebucto Peninsula and to public audiences.

### *Creation of Infographic*

An infographic was created for wildlife road safety in the Chebucto Peninsula using the best practice guidelines developed for this purpose. The best practices informed the layout and positioning of information on the infographic, as well as message content, colour selection, and imagery. Much of this information is derived from grey sources, such as blogs and social news articles, a number of which are identified for this purpose. For example, on her blog post, Lisa Toner (2015) explains the “do's and don'ts for creating effective infographics”.

Various software programs for creating infographics were considered, some of which include Canva (<https://www.canva.com>), Piktochart (<https://piktochart.com>) and Visme (<https://www.visme.co>). After conducting a trial of a few software options, Canva was chosen due to the wider range of available wildlife imagery, and its versatile capabilities.

The purpose of the infographic is to increase general public awareness of and support for the importance of human-wildlife coexistence around roads, and road safety for wildlife species in the Chebucto Peninsula. The infographic is directed to a public audience that is not already invested in wildlife related issues. Messages taken from the *important messages* identified through the literature are used on the infographic; all messages are communicated using a positive, *love-based* approach without the use of negative, sad, or fear-based language, as recommended for communicating with uninitiated public audiences by Futerra's *Branding Biodiversity* (Futerra Sustainability Communications, 2010).

### **3.5 Chapter Summary**

This chapter provides detail on the research methods and the practical application methods undertaken to produce defensible results, including the creation of a visual communication tool, and inform discussions, recommendations and conclusions. Specifically, this chapter outlines

steps taken to conduct a systematic literature review; produce two sets of guidelines; produce lists of important *love* and *action* messages regarding wildlife safety around roads; and, lastly, to create an infographic for enhancing public awareness of the need for wildlife safety around roads in the Chebucto Peninsula.



## **Chapter 4: Findings and Analysis**

This chapter summarizes the results found from conducting a literature analysis of both peer-reviewed and grey literature, and applying these findings to create guidelines for and an example of a visual communication tool for wildlife protection around roads in the Chebucto Peninsula. It includes a summary of key themes and the relationships among them as derived from analysis of the literature (Figure 2); two sets of guidelines for (1) positive messaging and (2) creating effective visual communication tools; examples of *love-based* messages and *action* messages for wildlife protection around roads (Table 3); and a visual communication tool (i.e. infographic; Figure 3) for wildlife protection around roads in the Chebucto Peninsula.

### **4.1 Common Themes and Connections in the Literature**

Much of the literature collected for this thesis has connecting elements. As summarized in the literature review (Chapter 2), five key categories of themes emerged through qualitative analysis of the literature: (1) human behaviour change, (2) human connection to nature, (3) messaging strategies, (4) infographic design, and (5) road ecology. Numerous themes emerged in relation to each category, and connections and relationships among categories were identified and mapped (Figure 2). Connections were also made to associate categories and themes with the findings for guidelines and important messages. Each will be briefly described in this section.

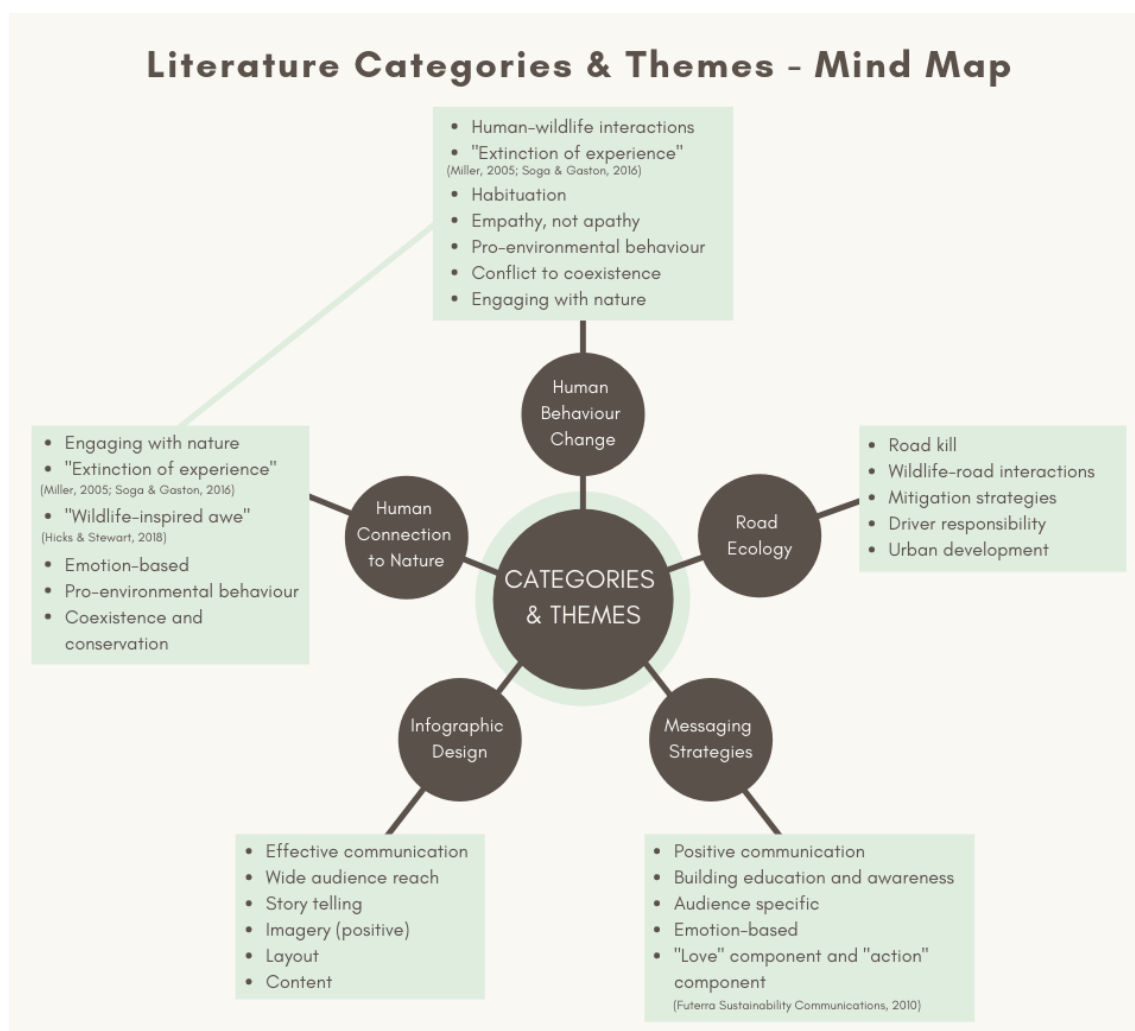


Figure 2: Literature categories and themes. (Canva, n.d.; Clayton, et al., 2013; Cox & Gaston, 2018; Dickman, 2010; Futerra Sustainability Communications, 2010; Havlick, 2004; Hicks & Stewart, 2018; Miller, 2005; Monroe, 2003; Perkl, et al., 2018; Ramp, et al., 2016; Richardson, 2017; Soga & Gaston, 2016; Trinh, 2017).

*Human behaviour change* and *human connection to nature* are two of the categories that emerged as important throughout the literature. They have key, interconnecting themes, such as 'pro-environmental behaviour'. Pro-environmental behaviour is a recurring topic throughout much of the literature (e.g., Clayton, et al., 2013; Cox & Gaston, 2018; Lazard & Atkinson, 2014; Monroe, 2003), although it is not always directly stated, and is dependent on an individual's values as well as their experiences (Clayton, et al., 2013). The *extinction of experience*, another connecting theme in these categories, is contributing to a decline in pro-

environmental behaviour (Soga & Gaston, 2016; Miller, 2005). Pro-environmental behaviours can be developed and enhanced with positive exposure to the many elements of nature, including wildlife (Clayton, et al., 2013; Monroe, 2003). Conservation efforts are largely dependent on people's desire to protect what they care about (Clayton, et al., 2013; Futerra Sustainability Connections, 2010). This is directly related to the purpose of this thesis and the creation of a visual communication tool for wildlife protection around roads. The visual communication tool was in part created to encourage human-wildlife coexistence and thus enhance pro-environmental/wildlife behaviours and attitudes.

Positive communication strategies can foster a stronger appreciation for wildlife and other environmental causes (Clayton, et al., 2013; Futerra Sustainability Connections, 2010). This leads into another literature category determined important throughout the literature: *messaging strategies*. Public messaging strategies are often used in conservation efforts (Futerra Sustainability Connections, 2010), and the topic of positive communication for public audiences is widely discussed in the literature (e.g., Clayton, et al., 2013; Futerra Sustainability Connections, 2010; O'Neill & Nicholson-Cole, 2009; Verissimo, 2017). Public communication tools commonly aim to increase education and awareness around a particular issue. This is true for the visual communication tool created for this study, in relation to increasing education and awareness on issues regarding wildlife and roads in the Chebucto Peninsula. Producing messaging strategies is both audience and subject specific (Clayton, et al., 2013; Monroe, 2003).

*Infographic design* is also audience and subject specific (Patel, 2019), which is why the visual communication tool created for the Chebucto Peninsula is designed to be easily relatable to a wide public audience. In the case of creating public messages for wildlife protection around roads, the messages should be positive and motivating, hence the creation of guidelines for developing positive communication messages.

In order to educate and increase awareness of a particular issue, the issue must be clearly stated and communicated with the intended audience (Futerra Sustainability Communications, 2010). The issues related to wildlife and roads are closely linked to *road ecology* which is the final literature category determined through this research. In the context of wildlife protection, the literature related to road ecology is largely focused on road mitigation strategies such as wildlife crossing structures (e.g., Huijser, et al., 2016; Rytwinski, et al., 2015; McCollister & Van Manen, 2010). Although this study is not specifically focused on roadway infrastructural

mitigation for wildlife, it is an important component of effective solutions to road kill. Instead, this study focuses on encouraging positive public awareness and attitudes around human-wildlife coexistence near roadways, on an individual level. The two aspects are not entirely unrelated, however. For example, one important *action* message identified in this thesis encourages people to contact their local city councillor and/or Member of the Legislative Assembly to advocate for wildlife protection around roads (K. Beazley, personal communications, 2019). This may result in future policies, planning and implementation of wildlife-roadway mitigation strategies such as crossing structures within the Chebucto Peninsula and other regions.

The categories and themes presented in this section represent key findings from the literature analysis and are used to illustrate connections that tie broader topics together. Making these connections is important for this research as there are a number of different elements associated with the topic of developing positive communication tools for wildlife protection around roads.

## **4.2 Guidelines**

Producing effective positive communication tools is a challenge in itself and good practices have been developed for wildlife and biodiversity messaging, and other related environmental communication aims. The following sets of guidelines were developed from a review of the literature to identify best or good practices that could be used for the purpose of effective positive communication for wildlife protection around roads. These guidelines could also be transferrable to other wildlife or environmental topics. They are developed specifically for use with public audiences who are not already engaged in or committed to the issues related to wildlife around roads. The first set of guidelines is for creating positive communication messages (Table 2); the second is for creating effective visual communication tools (Table 3). Both sets of guidelines are subsequently used to inform the creation of an infographic for wildlife protection around roads in the Chebucto Peninsula. Although the information for these guidelines was derived from both grey and peer-reviewed sources, more grey sources were used due to the direct relevance of the information available on the topic, such as those produced by wildlife and communications agencies and organizations.

### *Guidelines for Creating Positive Communication Messages*

The following guidelines (Table 2) are compiled from the literature for the purpose of informing the creation of positive messaging strategies for wildlife conservation. Much of this information derives from Futerra’s *Branding Biodiversity* (2010) and other sources. These guidelines share similarities which relate to the “Love + Action” framework employed in this study (Futerra Sustainability Communications, 2010). Many indicate the use of positive wording and imagery, which contributes a *love* component (Futerra Sustainability Communications, 2010). An *action* component is present in guidelines which encourage messages to be motivating and inspiring (Futerra Sustainability Communications, 2010). The guidelines also relate to human-wildlife coexistence and fostering a connection with nature.

Table 2: Guidelines for creating positive communication messages.

Guideline	Source	Used to Inform Infographic
<b>Render a positive emotional response.</b>	Acuña-Marrero, et al., 2018; Futerra Sustainability Communications, 2010; K. Beazley (p.com), 2019.	X
<b>Make people feel hopeful about the issue, not hopeless.</b>	O’Neill & Nicholson-Cole, 2009.	X
<b>If images are included, they should be positive images that evoke happiness, awe, and admiration for the species, not sadness or fear.</b>	Acuña-Marrero, et al., 2018; K. Beazley (p.com), 2019.	X
<b>If images are included, consider incorporating positive images of ‘flagship species’ which may be more appealing to wide audiences.</b>	Acuña-Marrero, et al., 2018; Ballantyne, et al., 2007; K. Beazley (p.com), 2019.	
<b>Focus on coexistence, rather than conflict.</b>	Acuña-Marrero, et al., 2018; Frank, 2015; K. Beazley (p.com), 2019.	X
<b>Make people feel <i>empowered</i> to act.</b>	Monroe, 2003.	X
<b>Make readers optimistic that their actions can make a difference.</b>	Monroe, 2003.	X
<b>Make people feel empathetic for the species, but not sad.</b>	Futerra Sustainability Communications, 2010.	X
<b>Foster a connection between the reader and the species.</b>	Futerra Sustainability Communications, 2010; Rost, n.d.	

<b>Promote actions that are achievable.</b>	Clayton, et al., 2013; Monroe, 2003.	X
<b>Easily re-communicated.</b>	Rost, n.d.	X
<b>Relate to human experience(s) (e.g., location and common species).</b>	Clayton, et al., 2013; Futerra Sustainability Communications, 2010.	X
<b>Should not only inform, but also motivate to take action.</b>	Futerra Sustainability Communications, 2010; Monroe, 2003.	X
<b><i>Biophilia</i> describes human’s connection to nature. Remind people of this connection and encourage it to strengthen.</b>	Futerra Sustainability Communications, 2010.	X
<b>A desire to protect nature may stem from the positive feelings that it provides, messages should evoke these feelings.</b>	Cox & Gaston, 2018; Futerra Sustainability Communications, 2010.	
<b>Messages should include a “love” component and an “action” component to get the reader to first care about the issue and then want to do something about it.</b>	Futerra Sustainability Communications, 2010.	X
<b>“Action” messages should promote both long and short term changes.</b>	Futerra Sustainability Communications, 2010	X
<b>Include aspects that are familiar to the reader, or that they already “value”.</b>	Clayton, et al., 2013; Futerra Sustainability Communications, 2010; Monroe, 2003.	X
<b>Use examples of <i>success</i> to motivate people to take action and make change.</b>	Futerra Sustainability Communications, 2010; Monroe, 2003.	

### *Guidelines for Creating Effective Visual Communication Tools*

The following guidelines (Table 3) are compiled for the purpose of creating effective visual communication tools for use with public audiences. Most of which are specific to creating infographics, however, others could be applied to various visual communication tools. These guidelines are mainly derived from grey sources such as online blogs. Also included in this table are ideas for positive *love* and *action* based images (Futerra Sustainability Communications, 2010), for wildlife protection around roads, that could be used on visual communication tools, such as infographics. Most of the guidelines are quite general, and could be applied to many topics, due to the sources from which the information was derived. However, some have been elaborated upon to be more specific to infographics for positive communication regarding

wildlife protection. A reoccurring recommendation among sources was *simplicity*; asserting that this is one of the key components of an effective infographic (Canva, n.d.; Patel, 2019; Evans, 2016; Toner, 2015). The guidelines also relate to the importance of story telling, which can be effective for conservation messaging and other engagement efforts (Rost, n.d.).

Table 3: Guidelines for creating effective visual communication tools.

(Note: Imagery ideas are mostly derived from the author’s experience and own suggestions for wildlife conservation images).

Guideline	Source	Imagery Ideas
<b>Make content and graphics specific to the intended audience.</b>	Patel, 2019.	Wildlife family & human family (we are the same) (K. Beazley (p.com), 2019).
<b>Begin with a vision for the infographic and determine its purpose.</b>	Nediger, 2018; Evans, 2016.	Make connection between a forest and a home.
<b>Avoid overcomplicating the communication tool with too many elements.</b>	Canva, n.d.; Patel, 2019; Toner, 2015.	Wildlife crossing the road safely.
<b>Include elements of a story (e.g., background, problem and solution(s)).</b>	Canva, n.d.; Evans, 2016.	Driver being attentive on the highway.
<b>Use a maximum of four colours.</b>	Canva, n.d.	Wildlife crossing structures (bridges, underpasses, etc.).
<b>Suit colour scheme to the subject matter. For ‘positive’ messaging use bright, cheerful colour schemes.</b>	Busche, n.d; Canva, n.d.; K. Beazley (p.com), 2019.	Photographs highlighting the beauty of wildlife.
<b>Colours taken from nature are typically more pleasing to the reader, and should be used as colour inspiration. In the case of infographics for wildlife conservation, colour inspiration could be taken from forests, rivers and other wildlife habitats, or from the animal species themselves.</b>	Busche, n.d.	Person directing wildlife to safety.
<b>Organize information in a logical manner, consider using “grid/section” layouts for this purpose.</b>	Nediger, 2018; Evans, 2016.	Make connection between a wild animal and a domesticated animal (e.g., a fox and a dog) (Futerra Sustainability Communications, 2010).
<b>Put emphasis on the visuals, supplement with text.</b>	Evans, 2016.	

<b>Choose basic fonts that are easily readable, as they are typically more effective for ease of communication.</b>	Lazard & Atkinson, 2014.	
<b>Organize content in such a way that key information is most predominant.</b>	Evans, 2016.	

### 4.3 Important Messages

‘Important messages’ are those related to wildlife protection around roads in the Chebucto Peninsula that align with the *Branding Biodiversity* “Love + Action” framework, and thus include both *love* messages and *action* messages (Futerra Sustainability Communications, 2010). Many of the important messages identified for this purpose (Table 4) may also be transferrable to other animal/conservation communication strategies. To reflect *love-based* messaging, all messages aim to increase feelings of awe, empathy and connection to wildlife, and are relevant to fostering positive feelings and to encourage human-wildlife coexistence. Action messages include practical examples of things that people can do to act upon these feelings of connection and love, thereby engaging in pro-wildlife human behaviours. For wildlife protection around roads, the action messages have been organized into four categories, which include (1) driver responsibility, (2) socio-political support (3) socio-political engagement, and (4) reconnecting with nature.

Table 4: Love and action messages.

(Note: Important messages without an information source are derived from the author’s own experience).

Love		Action	
<b>Your actions can make a difference. If not to all, at least to one.</b>	Wildlife Conservation Quotes, n.d. [Quote by Paul Oxton].	Driver Responsibility	
<b>Wildlife are our neighbours.</b>		<b>Report wildlife-vehicle collisions and injured or deceased animals.</b>	Watch for Wildlife, n.d.
<b>Animals do not have a voice. Be their voice.</b>	Morlin-Yron, 2014.	<b>Be mindful of your speed and surroundings while driving: scan for wildlife on shoulders.</b>	Watch for Wildlife, n.d.; Wildlife Collision Prevention Program, n.d.; Wootton, 2017;



		<b>Drive no faster than the speed limit.</b>	K. Beazley (p.com), 2019.
<b>We're guests in their home.</b>		<b>Alert other drivers of wildlife on the road (e.g., flash headlights).</b>	Watch for Wildlife, n.d.
<b>Coexisting can bring about a better environment for all.</b>	Acuña-Marrero, et al., 2018; Frank, 2015.	<b>Honk if an animal is on the road.</b>	Watch for Wildlife, n.d.; Wildlife Collision Prevention Program, n.d.
<b>Their desire to live is the same as ours.</b>		<b>Dispose of garbage properly to reduce the amount of litter on and around roads.</b>	Watch for Wildlife, n.d.
<b>"Share the world with wildlife."</b>	Baxter, 2017. Watch for Wildlife blog.	<b>Be cautious that animals do not usually travel alone. If you see one, there could be more.</b>	Watch for Wildlife, n.d.
<b>"Sharing the road" does not only apply to humans.</b>	Baxter, 2016. Watch for Wildlife blog.	<b>Ensure that your vehicle is in proper working condition at all times.</b>	Wildlife Collision Prevention Program, n.d.
<b>"We are all animals." We are all the same.</b>	PETA, n.d.; K. Beazley (p.com), 2019.	<b>If possible, abstain from highway driving at dusk and dawn. If possible, abstain from highway driving during peak migration and other times of seasonal wildlife movement.</b>	Wootton, 2017; K. Beazley (p.com), 2019.
<b>"Because they matter".</b>	Because they Matter (n.d.) <i>Hope for Wildlife</i> (Slogan).	<b>Socio-Political Support</b>	
<b>Wildlife species are beautiful and awe inspiring.</b>	Futerra Sustainability Communications, 2010; K. Beazley (p.com), 2019.	<b>Support local wildlife organizations.</b>	Frank, 2015.
<b>The forest is their home.</b>		<b>Join the conversation by using online platforms.</b>	K. Beazley (p.com), 2019.
<b>They care for their families, as we do.</b>	K. Beazley (p. com), 2019.	<b>Find out more about local wildlife and wildlife organizations.</b>	K. Beazley (p.com), 2019.
<b>Coexistence is key for conservation.</b>	Frank, 2015.	<b>Look for volunteer opportunities with local wildlife organizations</b>	

<b>Your actions can help protect our forest friends.</b>		Socio-Political Engagement	
		<b>Contact your local Member of the Legislative Assembly (MLA) and/or municipal councillor about the importance of wildlife pathways, passageways, and road mitigation in the region.</b>	K. Beazley (p.com), 2019.
		Reconnecting with Nature	
		<b>Take time to experience nature and encourage others to do the same.</b>	Cox & Gaston, 2018; Futerra Sustainability Communications, 2010.

#### 4.4 Visual Communication Tool (Infographic)

An infographic (Figure 2) was created to encourage human-wildlife coexistence and to educate public audiences on issues regarding wildlife around roads in the Chebucto Peninsula. It is designed specifically to reach a public audience who is not already invested in the issues surrounding wildlife and roads, such as wildlife corridor conservation, habitat fragmentation and road kill. The infographic is titled “Travelling the Road to Coexistence”. It consists of context on the issue and study area (Chebucto Peninsula), and includes a *love* component and an *action* component, as recommended for public communication by Futerra Sustainability Communications (2010) for *Branding Biodiversity*. Consistent with the guidelines, the *love* component aims to evoke feelings of empathy, awe and admiration for wildlife, and the *action* component gives practical examples of actions which can help protect wildlife around roads (Futerra Sustainability Communications, 2010).

All imagery included on the infographic is positive. The infographic does not include any negative images such as images of road kill or injured animals. Images of various, carefully selected species are incorporated on the infographic, to ensure that readers understand that the information is regarding a variety of wildlife species. Species are chosen based on their presence

in the Chebucto Peninsula area and their ability to resonate with a public audience, as identified through literature, such as literature related to selection of focal species for conservation (e.g. charismatic, vulnerable, keystone, flagship etc.) (e.g., Ballantyne, et al., 2007; Beazley, et al., 2004). Examples of positive imagery that may be included on an infographic such as this are: wildlife crossing a road safely, a wildlife crossing sign or crossing structure, vehicles with attentive drivers, etc. The infographic was produced with Canva online software, using the guidelines developed for creating positive communication messages and effective visual communication tools, and a selection of the *love* and *action* messages developed within this study.

# TRAVELLING THE ROAD *To* COEXISTENCE

**WHAT YOU CAN DO TO PREVENT WILDLIFE-VEHICLE COLLISIONS**

Wildlife-vehicle collisions are hazardous for both humans and animals involved. It is important for your safety and the safety of wildlife that you remain attentive while driving. Collisions are possible at anytime, but many occur at dusk and dawn. You can help protect yourself and wildlife from these accidents.

## THE CHEBUCTO PENINSULA

The Chebucto Peninsula is part of the Halifax Regional Municipality. It contains a large amount of forested area and important wildlife habitats. In many cases, access to these habitats is cut off or divided by major roads. This can lead to more wildlife-road interactions.

*The forest is their home*



Coexistence is key

*They care for their families*



for conservation

*Your actions CAN make a difference* ♥



*If not to all, at least to one*



*Please help keep me safe*

## HOW CAN YOU HELP PROTECT WILDLIFE?



**Be mindful of your speed and surroundings**

Honk if an animal is on the road



**Support local wildlife organizations**

Contact your local MLA and/or municipal councillor



**Properly dispose of garbage to reduce litter around roads**



**Report wildlife-vehicle collisions and injured animals**



**Connect with nature and encourage others to do so**



**Join the conversation by using online platforms**

Find out more about local wildlife and wildlife organizations...the more you know the better you can help.

**Your actions can help protect our forest friends!**

Map Data Source: Statistics Canada, (2016). Province/Territories Cartographic Boundary File - 2016 Census. Shapfile. <https://open.canada.ca/data/open/dataset/883614-0c0e-4c64-84d4-d4612678126c?format=shp>.  
 Information Sources: (1) Futera Sustainability Communications. (2020). Branding Biodiversity: The New Nature Message [PDF]. United Kingdom: Futera.  
 (2) Parks, B. (2020). Human-Wildlife Conflicts and the Need to Rebuild Tolerance and Coexistence. *At Insectary Conference: Society & Nature*. Providence, RI, 739-743. doi:10.33066/2020.2015.1103388  
 (3) Halifax Regional Municipality & R2 Planning & Design. (2020). Halifax Green Network Plan. Retrieved from [https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/R2NP-Final%20Report\\_01181726\\_updated.pdf](https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/R2NP-Final%20Report_01181726_updated.pdf)  
 (4) K. Beasley. (2019). Personal Communication.  
 (5) Rivers, D., Nelson, V. K., & Cook, D. B. (2018). Construction and Complacency Shape Attitudes Towards the Toll of Roads on Wildlife. *Animals*, 6(4), 1-15. doi:10.3390/ani6040104  
 (6) Wild2 for Wildlife: Preventing Collisions with Wildlife on Our Roads. (n.d.). Retrieved January 14, 2019, from <http://www.wild2forwildlife.ca/>  
 (7) Wildlife Collision Prevention Program: When Do Collisions with Wildlife Occur? (n.d.). Retrieved from <http://www.wildlifeconservation.ca/wildlife.htm>  
 (8) Wildlife Conservation Quotes [Quote by Paul Orlow]. (n.d.). Retrieved from <https://www.goodreads.com/quotes/tag/wildlife-conservation>

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Made with Canva  
Images from Canva



Figure 3: Travelling the Road to Coexistence (Infographic).

Infographic sources: (Futtera Sustainability Communications, 2010; Frank, 2015; Halifax Regional Municipality & O2 Planning & Design, 2018; K. Beazley. (p. com), 2019; Ramp, et al., 2016; Watch for Wildlife, n.d.; Wildlife Collisions Prevention Program, n.d.; Wildlife Conservation Quotes, n.d.).

Map data source: Statistics Canada. (2016).

#### **4.5 Chapter Summary**

The results of this research, provided in this chapter, include two sets of guidelines for creating positive communication messages and effective visual communication tools, two lists of important *love* and *action* messages and a visual communication tool (i.e., infographic) for wildlife protection around roads in the Chebucto Peninsula region of the HRM. Connections are made in relation to the topics of wildlife protection around roads and positive communication strategies regarding results from producing guidelines and important messages. Detail is also provided on relationships identified between categories and themes that emerged from conducting a literature review.

## **Chapter 5: Discussion and Conclusion**

This thesis contributes to scholarly bodies of literature related to positive communication strategies for conservation, human-wildlife coexistence, human behaviour change and wildlife protection around roads. It demonstrates how positive communication tools can be produced for a melancholic topic and how to apply positive communication principles to real world situations in ways that are accessible for the unengaged or uncommitted general public. The infographic communication tool selected to illustrate the application of the guidelines developed in this research has relevance to today's popular communication styles, as it can be shared in numerous ways, including social media (Lazard & Atkinson, 2014).

Two sets of research questions were posed in the Introduction Chapter of this study. The first set of questions related to positive communication strategies for wildlife conservation, specifically for uninitiated public audiences. Through this research it was found that positive communication is most effective for engaging uninitiated public audiences (Futtera Sustainability Communications, 2010), and that positive communication can foster positive attitudes toward wildlife species (Clayton, et al., 2013; Acuña-Marrero, et al., 2018). Encouraging positive attitudes can facilitate behaviour change to move from a place of conflict to coexistence (Frank, 2015). Thus answering the first set of research questions. The second set of questions was also resolved through this research as the "Love + Action" messaging strategy (Futtera Sustainability Communications, 2010) was used to inform the creation of a visual communication tool (i.e., infographic) for wildlife protection around roads in the Chebucto Peninsula region of the HRM.

### **5.1 The Chebucto Peninsula**

For this study, an infographic was made for the purpose of encouraging human-wildlife coexistence and increasing public awareness of the issues related to wildlife around roads in the Chebucto Peninsula. It is an interesting study area in which to develop and apply messaging guidelines to encourage human-wildlife coexistence and increase public awareness of such issues. The Chebucto Peninsula is important to wildlife, but movement between the peninsula and mainland Nova Scotia is increasingly fragmented (Halifax Regional Municipality & O2 Planning & Design, 2018). The connection between the peninsula and the mainland has been severed by highways 333 and 103, making access difficult and life threatening for many wildlife

species (Halifax Regional Municipality & O2 Planning & Design, 2018). Wildlife-vehicle collisions attribute to both animal population-level impacts, as well as individual mortalities (Fudge, et al., 2007; Ramp, et al., 2016). Wildlife-vehicle interactions also pose a risk for human safety and collisions often result in economic costs (Fudge, et al., 2007). The Chebucto Peninsula is a prime example of a location in which environmental and social benefits could be gained from an increase in public awareness and support for wildlife safety near roads, and human-wildlife coexistence in general.

It is important to highlight the significance of areas like the Chebucto Peninsula for wildlife by creating public communication tools. If carefully developed and widely shared, public communication tools such as the one created for this study could be valuable for enhancing public support around wildlife protection near roads, and in the Chebucto Peninsula region in general. Such tools should also be used to foster support for future road mitigation projects in the area, such as improved signage and wildlife crossing structures (e.g., fencing, overpasses, underpasses, bridges, enlarged culverts, etc).

## **5.2 Opportunities and Challenges**

A review of literature shows that, to engage public audiences who are not already invested in the issue, positive communications are the most effective (Clayton, et al., 2013; Futerra Sustainability Communications, 2010; Verissimo, 2015). In contrast, communication strategies that speak to threats against wildlife, and that aim to enhance support for wildlife through economic and ecosystem servicing arguments are more effective for audiences such as environmentalists and policy makers (Bekessy, et al., 2018; Futerra Sustainability Communications, 2010). However, members of the general public, outside of these groups, are more likely to avoid fear- and threat-based messages, and instead be attracted to *love-based* messages and motivated by examples of direct actions they can take to make a difference (Futerra Sustainability Communications, 2010). Accordingly, the use of positive communication for unengaged public audiences will likely be influential for informing wildlife conservation strategies in the future. It is important to understand which types of messaging strategies are most appropriate for a range of audiences, in order to inspire positive human behaviour change (Clayton, et al., 2013; Futerra Sustainability Communications, 2010).

The visual communication tool produced for this study was created to be adaptable to a number of different circumstances, and thus could be used as a template. The infographic could for example, be changed to highlight other important wildlife-road areas by replacing the map and photographs to reflect the location and species. Similarly, the messages and images used on the infographic could be applied to other communication formats, such as road-side signage, billboards, or short videos. The content could also be changed for the purpose of positive public communication for different environmental issues, such as species at risk, or climate change.

Other findings from this study can similarly inform communication strategies for a variety of topics. The guidelines for creating visual communication tools are general due to the nature of the information and the sources from which the information is derived, and therefore could be used when producing other visual communication tools for a wide range of wildlife, nature or biodiversity topics. Further, the guidelines for deriving positive messages could be used to inform communication strategies for other human-wildlife coexistence and environmental topics.

Infographics are flexible in the ways they can be shared via social media, print, personal networks, etc. (Lazard & Atkinson, 2014). The infographic created for this thesis was designed for a wide public audience, with the hope of reaching people of all ages. Although the infographic primarily aims to reach an adult audience, of driving age (drivers and passengers), it is also important to engage youth to encourage positive attitudes and behaviours towards wildlife, from a young age (Cox & Gaston, 2018). The visuals on the infographic that represent the *love* and *action* components could be simplified and used to foster children's (and adults) connection to wildlife, and nature in general, in a variety of ways. Visual communication tools could be created for the purpose of educating about wildlife protection during significant seasons. For example, at/before spring time, messages could urge people to be cautious of offspring that could be present near roads, as it is baby season for many species (Fudge, et al., 2007). These examples demonstrate how the deliverables produced for this thesis could be applied to various environmental causes, although most specifically to wildlife conservation, as they were intended.

The infographic created for the Chebucto Peninsula could be used to gather public support on issues regarding wildlife and roads in the area, and for future road mitigation strategies. It could be shared in a number of ways including online via social media platforms,



sent to local politicians, sent to local wildlife organizations, and local planning authorities; distributed at schools (multi level), and to student drivers; and through hard copies posted at Access Nova Scotia, at community centres, etc. The infographic could be used in education programs about the importance of protecting animals around roads by wildlife organizations and schools. Nova Scotia's Department of Transportation and Infrastructure Renewal could use the messaging strategy for fostering support for wildlife crossing structures or other mitigations related to roadway, bridge and culvert planning and infrastructure development. NS Lands and Forestry departments could use it for enhancing collaborations around key wildlife pathways and habitat conservation through road-dense landscapes. It could potentially be of use to the HRM, in relation to the Green Network Plan, most specifically to the Chebucto Peninsula, but also throughout the municipality where other 'essential' and 'important' wildlife pathways and roadways intersect. It may also be adopted for use by non-governmental organizations, and for use by The Nature Conservancy of Canada in its citizen science and road ecology work in the Chignecto Isthmus region. Lastly, the infographic could be used to gain support for private land conservation for wildlife pathways in areas that provide for safe (or safer) passage across roads.

This thesis has created an opportunity for future studies to go a step further and test this and other visual communication tools with public audiences to assess its effectiveness. Such tools could be based on the guidelines created for positive communication messages and effective visual communication tools produced for this study. This would help verify the effectiveness of positive communication for melancholic topics such as road kill, for public audiences not already invested in the issue.

### **5.3 Strengths and Weaknesses**

The creative nature of this study makes it unique to its application in the particular geographic region and to the study's objectives, and thus to the associated literature. This could be considered a strength, as it includes a practical application with potential for social-ecological change, and therefore is not strictly scholarly. In contrary, the 'best practice' guidelines are transferable to other related topics, and could be useful beyond the specific example developed herein. This research is multidisciplinary and therefore is relevant to various scholarly fields, including road ecology, human-wildlife coexistence, human behaviour change, wildlife conservation, and public communication, design and education.

Due to time constraints, the infographic was only shown in an academic setting; it was not tested on a public audience to determine its effectiveness. The infographic was only tested against the guidelines which were derived through literary research, and not based on public input or feedback. The body of peer-reviewed literature available for the information used to create the guidelines and important messages is limited; therefore, most of the information included in these deliverables derives from grey sources. Nonetheless, the basic underlying guidelines derived from the literature are based on studies in other, relevant fields, such as public communications and pro-environmental attitude and behaviour change, which are well substantiated and show general agreement.

Although these various limitations and delimitations exist, the findings still serve as an important contribution of a novel application for framing an upsetting and often gruesome reality in a positive way. If it is found to be effective, it has the potential to influence positive change, and to be widely transferable to other, similar, conservation/environmental topics.

#### **5.4 Conclusion**

A review of the literature shows that positive communication is more effective for engaging uninitiated public audiences than communication strategies based on sadness, fear, threat, loss or economic value (Clayton, et al., 2013; Bekessy, et al., 2018; Futerra Sustainability Communications, 2010; O'Neill & Nicholson-Cole, 2009; Verissimo, 2017). It is challenging to foster public awareness and behaviour change around the issue of road kill due to the upsetting nature of the topic. Wildlife-vehicle collisions are common and often life threatening for the animals and humans involved. For this reason, positive public communication messaging guidelines and an illustrative tool were developed for wildlife protection around roads in the Chebucto Peninsula. A literature review was conducted to inform good practices for public messaging related to wildlife protection. Futerra's "Love + Action" framework for *Branding Biodiversity* (Futerra Sustainability Communications, 2010) was chosen as an underlying conceptual basis given that it demonstrates best practices derived from the literature. Two sets of guidelines were developed from the literature for informing the creation of (1) positive messages, and (2) effective infographics. Lists of important positive (*love* and *action*) messages for wildlife-road safety were also developed. Lastly, these important messages and guidelines were employed to produce a visual communication tool for the topic, as a practical illustration of the

findings, and for potential use in the region. It is important to create public communication strategies on issues such as wildlife protection around roads to increase awareness and to encourage pro-wildlife attitudes and behaviours. Wildlife share their homes with us, so we must do our part to live in coexistence with them.

## Bibliography

- Acuña-Marrero, D., Cruz-Modino, R. D., Smith, A. N., Salinas-De-León, P., Pawley, M. D., & Anderson, M. J. (2018). Understanding human attitudes towards sharks to promote sustainable coexistence. *Marine Policy*, *91*, 122-128. doi:10.1016/j.marpol.2018.02.018
- Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. *Environmental Education Research*, *13*(3), 367-383. doi:10.1080/13504620701430604
- Baxter, W. (2017, September 6). Baby gulls trying to learn to fly get killed on city streets. How can we change this kind of thing from happening, and share the world with wildlife? [Web log post]. Retrieved from <http://www.watchforwildlife.ca/blog/baby-gulls-trying-to-learn-to-fly-get-killed-on-city-streets-how-can-we>
- Baxter, W. (2016, October 28). Sharing the Road - it's time to include Wildlife Crossing Needs in Road Design and adjust our Thinking as Drivers [Web log post]. Retrieved from <http://www.watchforwildlife.ca/blog/sharing-the-road-it-s-time-to-include-wildlife-crossing-needs>
- Beazley, K. F., Snaith, T. V., MacKinnon, F., & Colville, D. (2004). Road Density and Potential Impacts on Wildlife Species Such as American Moose in Mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science*, *42*(2), 339-357.
- Because they Matter. (n.d.). *Hope for Wildlife*. Retrieved from <https://www.hopeforwildlife.net/>
- Beier, P., & Loe, S. (1992). In My Experience: A Checklist for Evaluating Impacts to Wildlife Movement Corridors. *Wildlife Society Bulletin*, *20*(4), 434-440. Retrieved from <https://www.jstor.org/stable/3783066>.

- Bekessy, S. A., Runge, M. C., Kusmanoff, A. M., Keith, D. A., & Wintle, B. A. (2018). Ask Not What Nature Can Do for You: A Critique of Ecosystem Services as a Communication Strategy. *Biological Conservation*, 224, 71-74. doi:10.1016/j.biocon.2018.05.017
- Borneman, E. (2014, September 15). Introduction to Wildlife Corridors. Retrieved from <https://www.geolounge.com/introduction-wildlife-corridors/>
- Boulton, J. (2014). Infographics. In *100 ideas that changed the web*. London, UK: Laurence King. Retrieved from <http://ezproxy.library.dal.ca/login?qurl=https%3A%2F%2Fsearch.credoreference.com%2Fcontent%2Fentry%2Fkingideas%2Finfographics%2F0%3FinstitutionId%3D365>
- Burke, D. (2017, October 7). Roadkill Deaths Driving Some Species to the Edge. *CBC News*. Retrieved October 12, 2018, from <https://www.cbc.ca/news/canada/nova-scotia/roadkill-deaths-driving-some-species-to-the-edge-1.4343495>
- Busche, L. (n.d.). 10 color inspiration secrets only designers know about – Learn. Retrieved from <https://www.canva.com/learn/color-tips/>
- Calow, P (Ed.). (1998). Fragmentation of habitats and conservation. In *The encyclopedia of ecology and environmental management, Blackwell science*. Oxford, UK: Blackwell Publishers. Retrieved from [http://ezproxy.library.dal.ca/login?qurl=https%3A%2F%2Fsearch.credoreference.com%2Fcontent%2Fentry%2Fbkeem%2Ffragmentation\\_of\\_habitats\\_and\\_conservation%2F0%3FinstitutionId%3D365](http://ezproxy.library.dal.ca/login?qurl=https%3A%2F%2Fsearch.credoreference.com%2Fcontent%2Fentry%2Fbkeem%2Ffragmentation_of_habitats_and_conservation%2F0%3FinstitutionId%3D365)
- Canva. (n.d.). Retrieved from <https://www.canva.com>
- Canva. *Infographic Design - Tips and Inspiration By Canva – Learn*. (n.d.). Retrieved from <https://www.canva.com/learn/how-to-design-infographics/>

- Carter, N. H., Shrestha, B. K., Karki, J. B., Man Babu Pradhan, N., & Liu, J. (2012). Coexistence between wildlife and humans at fine spatial scales. *PNAS*, 1-6.  
doi:www.pnas.org/cgi/doi/10.1073/pnas.1210490109
- Clayton, S., Litchfield, C., & Geller, E. S. (2013). Psychological Science, Conservation, and Environmental Sustainability. *Frontiers in Ecology and the Environment*, 11(7), 377-382.  
doi:10.1890/120351
- Cox, D. T., & Gaston, K. J. (2018). Human–Nature Interactions and the Consequences and Drivers of Provisioning Wildlife. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1745), 1-9. doi:10.1098/rstb.2017.0092
- Creswell, J. W. (2008). The Selection of a Research Design. In *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (4th ed.). Retrieved from  
[https://www.sagepub.com/sites/default/files/upm-binaries/27395\\_Pages5\\_11.pdf](https://www.sagepub.com/sites/default/files/upm-binaries/27395_Pages5_11.pdf)
- Dickman, A. J. (2010). Complexities of conflict: The importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation*, 13(5), 458-466.  
doi:10.1111/j.1469-1795.2010.00368.x
- Dubois, S., Fenwick, N., Ryan, E. A., Baker, L., Baker, S. E., Beausoleil, N. J., . . . Fraser, D. (2017). International consensus principles for ethical wildlife control. *Conservation Biology*, 31(4), 753-760. doi:10.1111/cobi.12896
- Dunn, R., Griggs, S. A., Olson, J., Beasley, M., & Gorman, B. S. (1995). A Meta-Analytic Validation of the Dunn and Dunn Model of Learning-Style Preferences. *The Journal of Educational Research*, 88(6), 353-362. doi:10.1080/00220671.1995.9941181
- Echeverri, A., Chan, K. M., & Zhao, J. (2017). How Messaging Shapes Attitudes Toward Sea Otters as a Species at Risk. *Human Dimensions of Wildlife*, 22(2), 142-156.  
doi:10.1080/10871209.2016.1272146

- Evans, R. (2016). Infographics on the brain. *Computers in Libraries*, 36(6), 4-8. Retrieved from <http://ezproxy.library.dal.ca/login?url=https://search-proquest-com.ezproxy.library.dal.ca/docview/1826446524?accountid=10406>
- Frank, B. (2015). Human–Wildlife Conflicts and the Need to Include Tolerance and Coexistence: An Introductory Comment. *Society & Natural Resources*, 29(6), 738-743. doi:10.1080/08941920.2015.1103388
- Fudge, D., Freedman, B., Crowell, M., Nette, T., & Power, V. (2007). Road-kill of Mammals in Nova Scotia. *The Canadian Field-Naturalist*, 121(3), 265. doi:10.22621/cfn.v121i3.474
- Futerra Sustainability Communications. (2010). *Branding Biodiversity. The New Nature Message* [PDF]. United Kingdom: Futerra. Retrieved from [https://www.wearefuterra.com/wp-content/uploads/2015/10/Branding\\_Biodiversity.pdf](https://www.wearefuterra.com/wp-content/uploads/2015/10/Branding_Biodiversity.pdf)
- Green Network (Zoomed in the Chebucto Peninsula) [Map]. (2018). In *Halifax Green Network Plan* (p. 51). Halifax, Nova Scotia: Halifax Regional Municipality & O2 Planning & Design. Retrieved from [https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/HGPN-Final Report\\_20180726\\_updated.pdf](https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/HGPN-Final Report_20180726_updated.pdf)
- Halifax Regional Municipality & O2 Planning & Design. (2018). Halifax Green Network Plan. Retrieved from [https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/HGPN-Final%20Report\\_20180726\\_updated.pdf](https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/HGPN-Final%20Report_20180726_updated.pdf)
- Havlick, D. (2004). Road Kill. *Road Ecology: Science and Solutions*, 5(1), 1-4. Retrieved from <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1526-4629.2004.tb00081.x>
- Hicks, J. R., & Stewart, W. P. (2018). Exploring potential components of wildlife-inspired awe. *Human Dimensions of Wildlife*, 23(3), 293-295. Doi: 10.1080/10871209.2018.1419518

Hill, J. (n.d.). The Environmental Impact of Roads. Retrieved from <https://www.environmentalscience.org/roads>

Huijser, M. P., Fairbank, E. R., Camel-Means, W., Graham, J., Watson, V., Basting, P., & Becker, D. (2016). Effectiveness of short sections of wildlife fencing and crossing structures along highways in reducing wildlife–vehicle collisions and providing safe crossing opportunities for large mammals. *Biological Conservation*, *197*, 61-68. doi:10.1016/j.biocon.2016.02.002

K. Beazley. (2019). Personal Communications.

Lazard, A., & Atkinson, L. (2014). Putting Environmental Infographics Center Stage. *Science Communication*, *37*(1), 6-33. doi:10.1177/1075547014555997

McCollister, M. F., & Van Manen, F. T. (2010). Effectiveness of Wildlife Underpasses and Fencing to Reduce Wildlife–Vehicle Collisions. *Journal of Wildlife Management*, *74*(8), 1722-1731. doi:10.2193/2009-535

Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. *Trends in Ecology & Evolution*, *20*(8), 430-434. doi:10.1016/j.tree.2005.05.013

Monroe, M. C. (2003). Two Avenues for Encouraging Conservation Behaviours. *Research in Human Ecology*, *10*(2), 113-125. Retrieved March 19, 2019, from <http://www.humanecologyreview.org/pastissues/her102/102monroe.pdf>

Morlin-Yron, S. (2014, August 18). The animals can't speak up for themselves - so we must do it for them. Retrieved from <https://theecologist.org/2014/aug/18/animals-cant-speak-themselves-so-we-must-do-it-them>



- Nediger, M. (2018, November 30). How to Make an Infographic in 5 Steps - Venngage.  
Retrieved from <https://venngage.com/blog/how-to-make-an-infographic-in-5-steps/>
- O'Neill, S., & Nicholson-Cole, S. (2009). "Fear Won't Do It" Promoting Positive Engagement with Climate Change Through Visual and Iconic Representations. *Science Communication*, 30(3), 355-379. doi:10.1177/1075547008329201
- Otten, J. J., Cheng, K., & Drewnowski, A. (2015). Infographics and Public Policy: Using Data Visualization to Convey Complex Information. *Health Affairs*, 34(11), 1901-1907. doi:10.1377/hlthaff.2015.0642
- Palys, T. & Atchison, C. (2014). Perspectives on Research. In *Research Decisions: Quantitative, Qualitative and Mixed Methods Approaches* (5th ed., pp. 1-25). Toronto, Ontario: Nelson Education.
- Pasquini, L. (2012, September 09). What's Your Research Methods Worldview? Retrieved from <https://techknowtools.com/2012/09/08/whats-your-research-methods-worldview/>
- Patel, N. (2019, February 15). 12 Infographic Tips That You Wish You Knew Years Ago. Retrieved from <https://neilpatel.com/blog/12-infographic-tips/>
- Peri-urban. (n.d.). In *Merriam-Webster Online*. Retrieved from <https://www.merriam-webster.com/dictionary/peri-urban>
- Perkl, R., Norman, L. M., Mitchell, D., Feller, M., Smith, G., & Wilson, N. R. (2018). Urban growth and landscape connectivity threats assessment at Saguaro National Park, Arizona, USA. *Journal of Land Use Science*, 13(1-2), 102-117. doi:10.1080/1747423x.2018.1455905
- PETA. ["We are all animals" Quote]. (n.d.). Retrieved from <https://www.peta.org>

Piktochart. (n.d.). Retrieved from <https://piktochart.com>

Ramp, D., Wilson, V. K., & Croft, D. B. (2016). Contradiction and Complacency Shape Attitudes Towards the Toll of Roads on Wildlife. *Animals*, 6(40), 1-15.  
doi:10.3390/ani6060040

Richardson, M. (2017, January 3). Why Our Connection with Nature Matters. Retrieved from <https://www.psychreg.org/connection-nature-matters/>

Roberts, T. H. (1987). Construction of Guilds for Habitat Assessment. *Environmental Management*, 11(4), 473-477.

Rost, R. (n.d.). Strategy Share: The Power of Storytelling for Conservation [Web log post]. *National Geographic, Education Blog*. Retrieved from <https://blog.education.nationalgeographic.org/2018/10/08/strategy-share-the-power-of-storytelling-for-conservation/>

Rytwinski, T., Ree, R. V., Cunnington, G. M., Fahrig, L., Findlay, C. S., Houlahan, J., . . . Grift, E. A. (2015). Experimental study designs to improve the evaluation of road mitigation measures for wildlife. *Journal of Environmental Management*, 154, 48-64.  
doi:10.1016/j.jenvman.2015.01.048

Shelley, R. (2017, April 12). Are Infographics Still Effective? Retrieved October 10, 2018, from <https://www.smamarketing.net/blog/are-infographics-still-effective>

Soga, M., & Gaston, K. J. (2016). Extinction of experience: The Loss of Human–Nature Interactions. *Frontiers in Ecology and the Environment*, 14(2), 94-101.  
doi:10.1002/fee.1225

- Soga, M., Gaston, K. J., Koyanagi, T. F., Kurisu, K., & Hanaki, K. (2016). Urban residents' perceptions of neighbourhood nature: Does the extinction of experience matter? *Biological Conservation*, 203, 143-150.  
<http://dx.doi.org/10.1016/j.biocon.2016.09.020>
- Statistics Canada. (2016). *Provinces/Territories Cartographic Boundary File – 2016 Census. Shapefile*. <https://open.canada.ca/data/en/dataset/a883eb14-0c0e-45c4-b8c4-b54c4a819edb?fbclid=IwAR33oOlsG-vuf7VNgtz0NaWrRt-k6F-9i9N1nA7zxnwFJqRtP8cc-GQP-X0> (accessed March, 2019)
- Toner, L. (2015, October 20). 8 Dos and Don'ts for Creating Effective Infographics [Free eBook]. Retrieved from <https://blog.hubspot.com/marketing/dos-and-donts-infographic-creation>
- Trinh, G. (2017, October 25). 15 Valid Reasons to Use Infographics. *Piktochart*. Retrieved October 10, 2018, from <https://piktochart.com/blog/15-reasons-to-use-infographics/>
- Veríssimo, D. (2017). Will optimistic stories get people to care about nature? Retrieved from <https://theconversation.com/will-optimistic-stories-get-people-to-care-about-nature-76641>
- Visme. (n.d.). Retrieved from <https://www.visme.co>
- Watch for Wildlife. *Preventing Collisions with Wildlife on Our Roads*. (n.d.). Retrieved from <http://www.watchforwildlife.ca/>
- Wildlife Conservation Quotes [Quote by Paul Oxtan]. (n.d.). Retrieved from <https://www.goodreads.com/quotes/tag/wildlife-conservation>
- Wildlife Collisions Prevention Program. *Hints for the Highway*. (n.d.). Retrieved from <http://www.wildlifecollisions.ca/hints.htm>

Wootton, J. (2017). 5 tips for avoiding highway collisions with wildlife. Retrieved from <https://cottagelife.com/outdoors/5-tips-for-avoiding-highway-collisions-with-wildlife/>

## Appendices

Note: Searches documented in tables 5, 6 and 7 were conducted without the use of a filter to generate results of peer-reviewed articles only. The number of results is representative of all literature types, as this study was informed by both peer-reviewed and grey literature.

Table 5: Literature Search (Google Scholar).

Database: Google Scholar

<b>Road Ecology</b>	# of results	<b>Human-Wildlife Coexistence</b>	# of results	<b>Communication Strategies</b>	# of results	<b>Human Connection to Nature</b>	# of results
Road kill	10,700	Human wildlife coexistence	5,380	Messaging for wildlife vehicle collisions	965	Human connection to nature	29,600
Road kill prevention	1,100	Human wildlife conflict	16,400	Wildlife conservation messaging	16,200	Environmental attitudes and behaviours	17,800
Roads and wildlife	208,000	Human wildlife interactions	15,300	Positive communication strategies	1,870,000	<i>Extinction of Experience</i>	652,000
Habitat fragmentation	209,000	Coexistence and conservation	130,000	Conservation communication	1,660,000	Human nature interaction	93,200
Wildlife vehicle collision	14,900	Wildlife habituation	14,500	Visual communication tools	1,710,000	Attitudes towards wildlife	42,300
Wildlife road mitigation	28,800	Wildlife and urban development	1,270,000	Effectiveness of infographics	14,700		
				Infographics for conservation	2,410		

Table 6: Literature Search (Web of Science).

Database: Web of Science

Note: Results are from years 1990-2018.

<b>Road Ecology</b>	# of results	<b>Human-Wildlife Coexistence</b>	# of results	<b>Communication Strategies</b>	# of results	<b>Human Connection to Nature</b>	# of results
Road kill	1,581	Human wildlife coexistence	212	Messaging for wildlife vehicle collisions	5	Human connection to nature	1,746
Road kill prevention	85	Human wildlife conflict	1,824	Wildlife conservation messaging	66	Environmental attitudes and behaviours	6,169
Roads and wildlife	1,889	Human wildlife interactions	1,386	Positive communication strategies	4,234	<i>Extinction of Experience</i>	3,547
Habitat fragmentation	16,644	Coexistence and conservation	1,190	Conservation communication	4,340	Human-nature interaction	11,556
Wildlife vehicle collision	442	Wildlife habituation	161	Visual communication tools	2,184	Attitudes towards wildlife	365
Wildlife road mitigation	344	Wildlife and urban development	536	Effectiveness of infographics	14		
				Infographics for conservation	2		

Table 7: Literature Search (ProQuest).

Database: ProQuest

Note: Results from articles dated before 2019.

Note: Some search terms may have been altered to refine results; any search term modifications are not documented.

<b>Road Ecology</b>	# of results	<b>Human-Wildlife Coexistence</b>	# of results	<b>Communication Strategies</b>	# of results	<b>Human Connection to Nature</b>	# of results
Road kill	649,043	Human wildlife coexistence	17,815	Messaging for wildlife vehicle collisions	650	Human connection to nature	1,630,579
Road kill prevention	112,990	Human wildlife conflict	105,652	Wildlife conservation messaging	2,768	Environmental attitudes and behaviours	693,786
Roads and wildlife	291,742	Human wildlife interactions	150,282	Positive communication strategies	1,572,033	<i>Extinction of Experience</i>	248,120
Habitat fragmentation	112,770	Coexistence and conservation	55,318	Conservation communication	477,326	Human nature interaction	2,498,506
Wildlife vehicle collision	18,904	Wildlife habituation	5,865	Visual communication tools	709,970	Attitudes towards wildlife	58,404
Wildlife road mitigation	41,374	Wildlife and urban development	139,929	Effectiveness of infographics	2,038		
				Infographics for conservation	617		

# DEVELOPING POSITIVE COMMUNICATION TOOLS FOR WILDLIFE PROTECTION AROUND ROADS

## With a Focus on Wildlife Movement in the Chebucto Peninsula

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The purpose is to develop a positive public communication tool to encourage human-wildlife coexistence and to increase public awareness of the issues regarding wildlife and roads in the Chebucto Peninsula.

### Context

- Positive communication is often more effective for engaging public audiences than communication strategies based on fear, loss or economic value<sup>1,2,3,5</sup>
- Wildlife-vehicle collisions occur frequently and are problematic for both humans and animals<sup>3</sup>
- Urban and other human developments are leading to habitat fragmentation; animals therefore have to cross roads to access resources<sup>2,10</sup>
- Developing a positive communication tool to address the issue of wildlife-vehicle collisions is challenging due to the melancholic nature of the topic

### Study Area

The Chebucto Peninsula is located in the Halifax Regional Municipality. It contains a large amount of forested area and important wildlife corridors which cross major roads, as identified in the Halifax Green Network Plan<sup>7</sup>. Issues regarding wildlife safety around roads exist in the Chebucto Peninsula due to interactions with large roads and highways in the area.<sup>7</sup>

### Methods

Peer reviewed and grey literature were analyzed to produce:

- Guidelines for creating positive communication tools for wildlife protection
- Guidelines for creating visual communication tools
- Important love-based messages
- Important action messages
- Infographic for wildlife protection around roads in the study area



The "Love + Action" framework by Futerra<sup>8</sup> is employed in this research



### Guidelines

Used to inform infographic

#### Positive Messaging Guidelines

- Make the reader optimistic that their actions can make a difference<sup>8,9</sup>
- Render a positive emotional response<sup>10</sup>
- Include both a "love" component and an "action" component<sup>8</sup>
- Relate to human experience(s)<sup>1,8</sup>
- Focus on coexistence, rather than conflict<sup>17,10</sup>

#### Infographic Guidelines

- Make content and graphics specific to the intended audience<sup>2</sup>
- Include elements of a "story" (background, problem & solution(s))<sup>15</sup>
- Suit the colour scheme to the subject matter; use a maximum of four colours<sup>5</sup>
- Avoid overcomplicating the infographic with too many elements<sup>12,14</sup>

### Important Messages

#### Love

- Your actions can make a difference, if not to all, at least to one<sup>8</sup>
- Coexistence is key for conservation<sup>7</sup>
- Wildlife species are beautiful and awe inspiring<sup>10</sup>
- Help protect our forest friends

#### Action

- Contact a local wildlife organization to report wildlife-vehicle collisions and injured animals<sup>16</sup>
- Properly dispose of garbage to reduce litter on and around roads<sup>16</sup>
- Be mindful of your speed and surroundings while driving<sup>16,7</sup>

Findings identify best practices for positive communication with public audiences not already invested in the topic. An infographic is created to demonstrate these findings for wildlife protection around roads in the Chebucto Peninsula.



Figure 4: Thesis Poster.

Note: This poster contains an early version of the infographic for wildlife safety around roads in the Chebucto Peninsula.