

Conflict in Complex Social-Ecological Systems: Understanding conservation conflicts in Canada towards their transformation

by

Lauren E. Eckert

Master of Science, University of Victoria, 2017

Bachelor of Science, University of Notre Dame, 2014

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in the Department of Geography

© Lauren E. Eckert, 2023

University of Victoria

All rights reserved. This dissertation may not be reproduced in whole or in part, by photocopy or other means, without the permission of the author.

We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and WSÁNEĆ Peoples whose historical relationships with the land continue to this day.

Conflict in Complex Social-Ecological Systems: Understanding conservation conflicts in Canada towards their transformation

by

Lauren E. Eckert

Master of Science, University of Victoria, 2017

Bachelor of Science, University of Notre Dame, 2014

Supervisory Committee

Dr. Chris T. Darimont, Department of Geography
Supervisor

Dr. Faisal Moola, Department of Geography
Departmental Member

Dr. Natalie C. Ban, School of Environmental Studies, University of Victoria
Outside Member

Abstract

In the 21st century, human pressure on Earth has resulted in widespread ecosystem degradation and biodiversity loss, and proposed solutions often spark conflict. These resulting conservation conflicts take many forms, occurring across geographical scales and locations, and within and between stakeholder groups, communities, nations, and species. These multifaceted conflicts are often considered among the most intractable problems in modern conservation sciences. Scholarly frameworks and practical methods are urgently needed to support our understanding of these conflicts, and our ability to pursue human- and environmental-well being. In this dissertation, I examine three conservation conflicts, two among people, and one between wildlife and people, which vary in scale and other system characteristics. My dissertation answers three core questions: i) How can a CCT approach inform assessment of Canadian environmental-decision making processes as they attempt to embrace multiple forms of knowledge and many interested parties?, ii) What existing bodies of scholarship and social science-derived methodologies and models might be mobilized within a CCT framework? Might some of these other models and supporting scholarship contribute repeatable methodologies to the CCT literature?, and iii) How can a CCT approach inform studies of human-wildlife conflict? Can CCT processes be aligned with ecological research assessing human-wildlife conflict to examine these conflicts more holistically? In the process of answering these questions, I develop new methods, frameworks, and data towards better understanding these and other conflicts and supporting their transformation.

In Chapter 2 (published in *FACETS*, 2020), my coauthors and I assess conflict between knowledge types in environmental decision-making processes. In the last 50 years, many western societies have used environmental assessment (EA) processes to deliberate on industrial proposals, informed by scientific information, though results of these processes often spur conflict. Recently, some EA processes have attempted to incorporate Indigenous knowledge (IK), but practitioners and scholars have criticized the ability of EA to meaningfully engage IK. We considered these tensions in Canada, a country with economic focus on resource extraction and unresolved government-to-government relationships with Indigenous Nations. In 2019, the Canadian government passed the *Impact Assessment Act*; addressing this opportunity, we examined obstacles between IK and EA via a systematic literature review and qualitative analysis. Our results identify obstacles preventing the Act from meaningfully engaging IK, some of which are surmountable (e.g., failures to engage best practices, financial limitations), whereas others are deep-rooted (e.g., knowledge incompatibilities, effects of colonization). We offer recommendations towards transforming conflicts between IK and EA towards improved decision-making and recognition of Indigenous rights.

In Chapter 3 (submitted to *Conservation Science and Practice*), my coauthors and I examine stakeholder conflict over how best to manage marine species of shared concern. A first step in overcoming conflicts is examining their roots in people's identities and beliefs - rather than focusing solely on the visible conflicts at hand. In the Salish Sea region of British Columbia (BC), Canada, conflict has emerged surrounding Southern Resident Killer Whales (SRKW) (*Orcinus orca*) and Chinook salmon (*Oncorhynchus tshawytscha*). SRKW are critically endangered due to intersecting stressors – among them depletion of Chinook. The Department of Fisheries and Oceans Canada has passed measures that restrict recreational fishing of Chinook to protect SRKW. Public response to protection measures has been conflict-laden and is especially tense between so-called angler and conservation-oriented communities – two stakeholder groups assumed to be distinct and at opposite sides of conflict. Employing social science methods, we used online surveys to examine the social identity, environmental identity, beliefs, and opinions of those involved in this conflict. Most survey participants (n = 816) self-identified as either conservation-supporters (49%) or anglers (33%). Our analyses revealed demographic differences, with anglers generally overrepresented by men, those with higher incomes, and those with 2-year terminal degrees. Both groups scored similarly high in environmental identity and stakeholder identify affiliation

scores, also showing positive correlations between the intensity of identities with participation in public discourse. Stakeholder groups differed strongly in management opinions and beliefs. Ultimately, our results identify conflicts between Salish Sea stakeholder groups as deeply-embedded. Commonalities (especially in beliefs regarding Chinook salmon), however, identify a path forward that draws on conflict transformation theory. Our approach offers new generalizable insight into the levels-of-conflict framework within conservation conflict transformation theory to inform scholarly and practical endeavours.

In Chapter 4, my coauthors and I assess the social-ecological drivers of human-wildlife conflict.

Conflict between humans and wildlife presents significant threats to human and wildlife well-being. Research that comprehensively examines the ecological and social dimensions of human-wildlife relationships can provide new insight into management interventions that promote coexistence. In BC, human-wildlife conflicts have increased substantially in the last two decades, with most occurring between humans and black bears (*Ursus americanus*). Despite mitigation attempts, conflict in the Qathet Regional District is pervasive. How social and ecological factors concurrently predict conflict is poorly understood in the region and the scientific literature. We examined the spatially-relevant ecological (e.g., bear relative use, land cover) and social (e.g., beliefs, behavior) predictors of conflict to understand how they might explain variation in its frequency and distribution. . Via a mixed methods approach, we used remote sensing, camera traps, property audits, and social surveys across 27 randomly selected 200-metre by 200-metre grids within the Qathet Regional District (n = 1,271 households). Social surveys revealed variation in participant beliefs about bears; most (52%) considered their overall experience with bears positive, while others reported neutral (32%) or negative (13%) overall experiences. Moreover, our generalized linear mixed-model and an information-theoretic approach identified which variables (or combination) predicted conflict outcomes. We found that road density, household garbage, and participant perception of risk increased the probability of conflict, whereas human density had a negative effect. An interaction term between household garbage and risk perception revealed a positive association between conflict and garbage only when risk perception was high. Relative variable importance determined that household garbage and risk perception were the most important predictors. The interplay between these social and ecological predictors and their resulting influence on conflict reveal new targets for intervention by local collaborating organizations via education, monitoring, and enforcement. More broadly, we showcase an interdisciplinary methodological framework that spans ecological and social approaches, offering promise to confront and mitigate enduring conflict between people and wildlife.

By analyzing three disparate case studies of conflict across policy, environmental decision-making, intergroup conflict, and human-wildlife conflict contexts, I contribute to scholarly understanding of the anatomy and complexity of conservation conflicts. In this dissertation, I provide new insight, methodologies, and contributions to understand and, hopefully, transform conservation conflicts.

Table of Contents

Supervisory Committee.....	ii
Abstract.....	iii
Table of Contents.....	v
List of Tables	vii
List of Figures	viii
Acknowledgements.....	ix
Dedication	xi
Positionality Statement	xii
Chapter 1: Introduction	1
Dissertation Contributions	15
Thesis Chapters	16
Methodological Approach.....	17
Chapter 2: Indigenous knowledge and federal environmental assessments in Canada: applying past lessons to the 2019 impact assessment act.....	19
Abstract.....	19
Introduction.....	19
Methods	22
Results and discussion	25
Conclusion	42
Acknowledgements.....	44
Chapter 3: Identifying opportunities towards conflict transformation in an Orca-Salmon-Human system	45
Abstract.....	45
Introduction.....	46
Case Study	49
Methods	52
Results.....	54
Discussion.....	64
Ch.4: Examining Social-ecological Predictors of Human-Wildlife Relationships: Human-black bear interactions on the West Coast of Canada	71
Abstract.....	71
Introduction.....	72
Materials and Methods.....	74
Results.....	86
Discussion.....	94

Chapter 5: Conclusion.....	101
Bibliography	113
Appendix A: Ch.2 Supplementary Material	135
Appendix B: Ch.3 Supplementary Material.....	148
Appendix C: Ch.4 Supplementary Material.....	191

List of Tables

Table 1.1 Commonly-used scholarly definitions of ‘conservation conflict’.....	2
Table 2.1. Past, current, and proposed Canadian federal environmental assessment policy.....	22
Table 2.2 Key question utilized in qualitative analysis process and code book.....	23
Table 3.1 Summary of coded themes from angler and conservation-supporter respondents.....	64
Table 4.1. Grid cell ‘legacy conflict’ categories in the qRD.....	77
Table 4.2. Top performing models in each set of models (ecological, social, and combined social-ecological models), with corresponding K, AIC, Δ AICc, and conditional R ² values.....	89
Table 4.3 Parameter estimates for all top models (those within 2 AICc of the model with lowest AICc value) in our final model set.....	91
Table A.3 Obstacles identified by scholars.....	143
Table A.4 Ways forward identified by scholars.....	147
Table B.5. Table depicting key definitions of terms.....	178
Tables B.7.1 – 7.5 Summary of demographic information and statistical analyses.....	180-185
Table C.5.1. Social and Environmental variables for probability of self-reported conflict models.....	206
Table C.5.2. Candidate models.....	207
Table C.11. Summary of Survey Responses.....	223

List of Figures

Figure 1.1 The ‘Big Picture of Conflict Transformation’, displaying stages of inquiry in the development of transformative theory and approaches.....	13
Figure 1.2, 1.3 The levels-of-conflict and conflict intervention triangle models.....	14
Figure 2.1. Obstacles and their components positioned in the context of parties involved in a typical federal environmental assessment process.....	26
Figure 2.2. Obstacles and their associated surmountable and legislative status.....	39
Figure 3.1 Proposed relationship between the value-attitude-behavior model and levels-of-conflict model.....	48
Figure 3.2 Euler diagram depicting overlapping identities.....	55
Figure 3.3 a,b. Environmental Identity (EID) Scores (a) and Social Identity Affiliation (SIA) Scores (b) of anglers and conservation-supporters.....	56
Figure 3.4. Likert responses to personal belief statements about SRKW (a) and Chinook (b), species opinion statements (c), and management opinion statements regarding SRKW and Chinook salmon by anglers and conservation-supporters (d).....	58
Figure 3.5. Mosaic plot comparing management priorities identified by anglers and conservation-supporters.....	61
Figure 3.6. Potential for Conflict (PCI2 scaled to bubble size) between and within anglers and conservation-supporters regarding support for protecting SRKW by restricting salmon fishing.....	63
Figure 3.7. Visualization of conflict and transformation in the case of SRKW and Chinook . management in the Salish Sea. An iceberg represents the levels-of-conflict, with visible and below-the-surface (more deeply rooted) elements of conflict identified.....	66
Figure 4.1. A social-ecological model of human-bear interactions in the qRD.....	75
Figure 4.2. Study Area.....	77
Figure 4.3. Likert responses to risk instrument statements.....	88
Figure 4.4. One model in our top model set contained all variables from all top performing models; we present parameter coefficients and CIs for fixed effects of that model here.....	92
Figure 4.5. Probability of reported conflict as function of (a) human density, (b) risk perception, (c) household garbage, (d) road density, and (e) household garbage x risk perception.....	93
Figure 5.1. A new conflict metaphor.....	108
Figure B.5. The Salish Sea bioregion (our case study area) displaying 2022 area-based fisheries closures and SRKW critical habitat relevant to current Department of Fisheries and Oceans Canada SRKW management protection measures.....	179
Figure C.1. Figure 1 as seen in Lischka et al. 2018.....	191
Figures C.10.1-5. Parameter coefficients and probability of reported conflict as a function of fixed effects for all top models.....	218-222

Acknowledgements

Despite the great value academic institutions and broader Western culture place on individualism, I've come to find that everything in life is fundamentally collaborative. This is especially the case for this dissertation, and all conservation science produced in an era of mounting ecological and social instability. My gratitude is owed to many people, other beings, and places – more than I have space to reasonably acknowledge herein. Nonetheless, I'd like to explicitly thank some of those whose support and guidance was critical throughout this journey.

My supervisor, Chris, inspired, guided, and formally mentored me in all of the research endeavors described herein. Chris, thank you for the immensity of time and resources you have contributed over the last six years to foster my growth as an interdisciplinary scientist, science communicator, conservation advocate, and human.

My supervisory committee – Natalie and Faisal (with special thanks to Dr. Cameron Owens, as well) – guided and supervised my research efforts and intellectual growth. Their knowledge, support, and generosity were key to navigating the challenges and opportunities presented by interdisciplinary research. Their respective careers (and Chris's) continue to serve as inspiration and guideposts as I continue on my path. Thank you also to Natalie for playing a central mentorship role in the entirety of my academic journey; her invitation to engage in M.Sc. research under her supervision in 2014 fundamentally changed my life path and made this PhD, and all to come, possible. Thank you all for seeing my potential and creating opportunities for me to flourish.

Funding to support my dissertation and research contained herein was provided by a Vanier Canada Graduate Scholarship (SSHRC), the National Geographic Society, the Canadian Geographic Society, and Raincoast Conservation Foundation (in part through a Raincoast Conservation Fellowship).

Immense gratitude is also owed to all of those who have helped me cultivate new knowledge and challenged me to think about social-ecological systems in new and often challenging ways. Whether directly or indirectly, your contributions fundamentally shaped this dissertation. Thank you to Dr. Losang Rabgey, Dr. Andrea Reid, Dr. Dalal Hanna, Dr. Christine Wilkinson, Dr. Nancy Turner, Dr. Alejandro Frid and Twyla Frid, Dr. Lauren Henson, Dr. Paul Paquet, Dr. Beatrice Frank, Elder Dr. Albert Marshall, 'Cúagilákv (Jess Housty), Dúqvaísłá (William Housty), Marge Housty, Megan Humchitt, Mike Reid, Beatrice Frank, Louisa Housty-Jones, Kelly Brown, Ilona Mihalik, Persia Khan, Tyler Jessen, Monica Short, Kate Field, Ishana Shukla, Sara Cannon, Kate Musset, Kasey Stirling, Nicole Jung, Jared Gonet, and so many more. Thanks also to my National Geographic Queer + Allies family, and the communities of the Applied Conservation Science Lab, the Centre for Indigenous Fisheries, the 2017 National Geographic Young Explorer Leadership cohort, and my Spring 2023 GEOG 353 class. Finally, thank you to Francine Madden – who brought forth Conservation Conflict Transformation to the academic literature and leads the way in its practice. It is a fool's errand trying to comprehensively thank all those I give credit to for shaping my current understanding of the world; even if I missed you in this list – thank you.

I'm also grateful to the creators who put good things into the world that undeniably buoyed my well-being and resilience throughout the Ph.D. An entirely non-exhaustive list of those I wish to thank: Mary Oliver, Nayyirah Waheed, those good good McElroy boys, Alie Ward, Lee Maracle, bell hooks, Sammy Rae & The Friends, a variety of early aughts pop-punk bands whose songs I inexplicably played on repeat while finishing this dissertation, and so many other people who create good and wholesome and kind and reverent things.

Finally, I attempt the impossible task of showing ample gratitude to all of my family, friends, and friends-made-family. Gratitude is owed to my father, Paul, who supported me in my academic journey, exposed

me to the wonders of the natural world and diverse geographies, and instilled in me a fierce sense of independence and adventure. Thanks to Ben and Reed, for the laughs, adventures and misadventures, and many conversations that buoyed this work. Thank you to Michael – who provided support in truly innumerable ways throughout the entirety of my graduate school journey – and filled my moments away from the desk with adventure, whimsy, and laughter. To Jasmine, Mack, Lupin, and Natasi; found-family who have provided the safest haven (and quite literally a roof over my head during some of my doctoral research), a social support network, and an unfathomably important sense of community, purpose, and joy. I could not have done it without you. Thanks to my entire qathet community (Zoë, Julia, Josh, Finnley, Hugo, Steven, Carlos, and more). Thank you to those people, places, and other-than-human-animals of (so-called) Coastal British Columbia and Southeast Alaska who brought me an unending font of motivation, purpose, and joy – especially in the otherwise challenging last several months of dissertation writing (and especially to Andy, who read this whole darn thing prior to final submission). Thank you to Taiga and Arrow, for bringing me comfort and unconditional love throughout this journey. Special thanks go to Arrow, my now-old-dog, who has reminded me to protect myself, drink water, eat food, and go outside and find joy since I loaded up my Ford Taurus to drive North to Canada in 2014. Most of all, I am grateful to my mom – Julie (Jules) – whose love, support, kindness, brilliance, and humour create the foundation from which all accomplishments in my life are made possible. Her infectious joy in all the beautiful and biodiverse things of the Earth – displayed to me from my earliest moments and then evermore – is the soil from which all of my intellectual curiosity, empathy, and sense of awe grow.

Dedication

This thesis is dedicated to all of the things that beckoned me into this work long ago; and the things that welcome me to begin it anew everyday –

for my mom, who taught me how to be in awe of banana slugs, how to pay attention to the sodden and bright things teeming in the streams of redwood forests,

for the sessile, seizing, sea anemones and smooth rays of Treasure Beach.

It is for the titular coyotes of Coyote Canyon,

the white-tailed deer leaping through the isolated patches of the Great Plains.

This is for the black bear trudging down the mountain in early Spring,

the brown bear, belly deep in cold water and salmon,

for the bright, sweet berries that the salmon's nitrogen feeds,

and the river otters and humpback whales and orcas and harbour porpoises.

It's for the robin, whistling and chirring this morning,

the rockfish – especially the elders of the deep,

for the purple camas flowers and the sea lions and that tufted puffin,

This is for the people that have stewarded it all since time before time, recognizing their responsibility to those to come,

for all the people that steward it now – and every single one that has stewarded me in my journey,

whether you know it or not, read it or not, use it or not -

this is for you.

Positionality Statement

I come to this work for many reasons, some known, others unknown. I have never been able to do anything but bring my whole, unbridled self to my academic and scientific endeavors. While this has not always made the passion-driven, wearying work of a PhD easy, it has (in-part) facilitated my earnest and on-going reflection of my positionality to my research and the social-ecological systems within which it is set. I thus begin this dissertation by positioning myself, following practices set forth by Indigenous scholars (Marshall & Bartlett 2009; Menzies et al. 2021; Reid et al. 2021) and social scientists (Bhattacharyya & Larson 2014; Boyce et al. 2022) in an effort to acknowledge how my intersecting identities, values, assumptions, experiences, biases (conscious and unconscious), relationships, and broader cultural milieu frame and motivate my scholarship.

Following a lifetime of delight in and fascination with the living world – in particular with other-than-human animals - I began my academic journey within the disciplines of Western environmental science and ecology in 2010. While these fields deepened my understanding of the world, its complex interconnections, and intersecting relationships, I found both fields limited in their ability to study relationships between human-animals and broader ecosystems. Driven by a desire to engage in applied conservation research, and through the generosity of many mentors and friends, I found my way into social and interdisciplinary sciences, to embracing many ways of knowing, and to a fundamental shift in my view of the world, our shared problems, and the joy in our resilience and diversity.

I am a white, non-Indigenous (settler) scholar of mixed European descent. I am a queer woman, an American, and a recent immigrant to Canada. I am also a Conservation Scientist, storyteller, artist, sister, daughter, friend, and auntie – among other intersecting and closely-held identities that, as we'll learn in Ch.4 of this dissertation, help me make sense of the world and my place in it. It is from these many places – this collective, intersecting positionality – that I arrive to this work and through which I understand the world and my place in it.

It is also through these identities and my relationships that I understand my responsibilities to the world, and the human- and other-than-human animals I share it with. I am the beneficiary of many privileges known and unknown. I write this positionality statement as a visitor on Songhees, Esquimalt, and W̱SÁNEĆ, Nations' and lək̓ʷəŋən-speaking peoples' and territory. As a white settler American and immigrant to Canada, I have directly and indirectly benefited from violent colonization (historical and on-going), white supremacy, and associated systemic racism. These realities in part inform my profound responsibility to leverage the privileges and time that I have towards equity and reconciliation – in part by

following the lead of and by supporting Indigenous Nations, leaders, scholars, colleagues, and friends in decolonial and re-Indigenizing efforts. My responsibilities are also informed by love; love for humanity, my relations, communities, youth, Elders, storytellers, biodiversity, other-than-human animals, and the mystery of it all. I recognize that it is unusual – even uncomfortable – to include words like ‘love’ and phrases like ‘the mystery of it all’ within a doctoral dissertation or Western scientific work. I include them nonetheless, both because they are fundamentally a part of my positionality and motivation in doing the research herein and also because I think it is time we reassess our own (Western academic) biases regarding their use in such context.

Despite my on-going desire to explore and reassess assumptions that underpin Western science and associated epistemologies, ontologies, values, and culture as I navigate my learning journey, my thinking, research, and scholarship remains constrained to this culturally-situated Western knowledge system. Western philosophies and assumptions frame my normative beliefs and values and may have biased my focus towards certain research efforts and away from others. I am grateful for on-going opportunities to engage with diverse knowledge holders as I attempt to identify and question these biases. I am also grateful for on-going opportunities to collaborate with others through equitable knowledge-bridging frameworks towards collectively overcoming my knowledge limitations and biases. Here, it is worth directly acknowledging that Western knowledge is culturally-situated, and influenced by concepts and values such as positivism, empiricism, cultural imperialism, colonialism, neo-liberalism, patriarchy, and anthropocentrism (among others) (Chalmers 1985; Williams et al. 2018; Eichler & Baumeister 2018; Stewart 2019; Teo 2019; Reid et al. 2021).

Ultimately, I believe that a world of multi-cultural, multi-species flourishing is possible. Fundamentally, my relationships, values, positionality, and responsibilities orient me towards doing my best to help usher that world into being. Having positioned myself, let us begin.

Chapter 1: Introduction

In the 21st century, we find ourselves in a new geological epoch – the *Anthropocene*, or perhaps more aptly the *Capitalocene* – in which collective anthropogenic pressure on Earth has resulted in the widespread degradation of ecosystems, and proposed solutions to degradation often spark conflict. Pervasive, inequitably-driven (Green et al. 2022), human-induced environmental change threatens human- and non-human animals alike by fundamentally changing our shared biosphere (Steffen et al. 2018), and threatening the resilience of interwoven social and ecological systems and their capacity to support life (Schleicher et al. 2017; Carpenter et al. 2019). Against this backdrop, conservation interventions or objectives meant to manage or protect ecosystems are increasingly coming into conflict with other human enterprises (Dickman 2010; Redpath et al. 2013; Madden & McQuinn 2014; Baynham-Herd et al. 2018). These resulting ‘conservation conflicts’ take many forms, occurring across geographical scales and locations, and within and between invested groups, communities, nations, and species (Dickman 2010; Redpath et al. 2013; Madden & McQuinn 2014; Nyhus 2016; Baynham-Herd et al. 2018). These multifaceted conflicts, marked by intersecting social and ecological factors (Dickman 2010; Madden & McQuinn 2014; McGuire & Ehlinger 2018; Carpenter et al. 2019), are often considered among the most intractable problems in modern conservation science (Dickman 2010; Redpath et al. 2013; MacDonald & Willis 2013). **Scholarly frameworks and practical methods are urgently needed to support our understanding of these conflicts, and our ability to pursue interwoven human- and environmental-well being in an era of mounting social and ecological instability** (Carpenter et al. 2019). In this dissertation, I examine three disparate conservation conflicts across three systems and scales, seeking insights and refining frameworks that may help us better understand these and other conflicts towards their transformation.

What is Conservation Conflict?

Conservation is a fundamentally human endeavor (Apostolopoulou et al. 2021), most broadly concerned with maintaining biodiversity and ecosystem functioning towards sustaining a liveable planet, among other objectives (Soulé 1985; Sandbrook 2015; MacDonald & Willis 2013). As is the case for many human endeavors, conservation initiatives and objectives are often met with opposition, owing to natural diversity in human beliefs, opinions, interests, and priorities (Redpath et al. 2013, 2015). While the resulting conflicts are diverse and complex, definitions to succinctly encapsulate these ‘conservation conflicts’ have been proposed (Table 1.1). Herein, I diverge somewhat from existing definitions of ‘conservation conflicts’, and define them as, ‘conflicts that emerge over, or are related to, conservation

objectives and/or environmental decision-making outcomes.’ I provide this relatively broad definition (rather than others offered in Table 1.1) to explicitly acknowledge that conservation conflicts may emerge between humans- and non-human animals (i.e., so-called human-wildlife¹ conflict; Madden & McQuinn 2015), especially as humans make individual and collective decisions that result in landscape modifications (Dickman 2010; Ripple et al. 2014), and that conflicts may result from environmental decision-making processes even where conservation objectives or interest groups were not explicitly involved (e.g., jurisdictional approvals of old-growth logging; Redpath 2013).

Table 1.1 Commonly used scholarly definitions of ‘conservation conflict’.

Definition	Source
situations that occur when two or more parties with strongly held opinions clash over conservation objectives and when one party is perceived to assert its interests at the expense of another’	Redpath et al. 2013
conflict between stakeholders representing biodiversity conservation and those representing other interests	Mason et al. 2018
conflict between people over the management of wildlife	St John et al. 2019
social conflicts between groups over appropriate conservation actions	Bruskotter et al. 2019
social conflict occurring in environmental conservation context, which can occur when there are clashing opinions on conservation objectives, uneven power relationships, or an economic or ecological distribution conflict such as struggles over salaries or access to fertile land	Janssens et al. 2022
conflicts over conservation endeavors	Rakotonarivo et al. 2021

Types and Impacts of Conservation Conflicts

Conflicts that emerge due to conservation actions and environmental decision-making outcomes are inevitable, and their impacts vary in consequence and intensity. Conflicts can have positive effects – they can create meaningful dialogue, give voice to diverse interested parties, bring light to previously unidentified problems, or precipitate creative solutions (Young et al. 2010). However, conservation conflicts are often destructive, costly, and harmful for human- and non-human animals and conservation objectives (Treves & Karanth 2003; Redpath et al. 2013); especially when they are poorly-handled or ignored (Redpath et al. 2013, 2015a, 2015b; Madden & McQuinn 2014, 2015). Conservation conflicts

¹ Herein, we use the term human-wildlife conflict to describe conflict that emerges between humans and other-than-human animals, acknowledging that the term has been criticized for potentially alienating humans from the rest of the animal kingdom, and oversimplifying the diverse cultural views related to non-human animals (Bhattacharyya & Larson 2014; Jolly et al. 2022).

emerge: when different individuals or groups differ in their normative beliefs and values about other species or the environment, when parties have opposed priorities, due to social or economic consequences of conservation interventions or owing to economic incentives supporting actions counterproductive to conservation, when interested parties are (or perceive they are) excluded from environmental decision-making processes, when one group is disadvantaged in conservation negotiation or environmental decision-making, when humans' and other species' overlapping territories and behaviors lead to negative interactions (or perceived negative interactions), when parties disagree about fundamental facts related to conservation interventions, and due to other complex and intersecting social, ecological, geographical, and historical factors (Treves & Karanth 2003a, 2003a; Dickman 2010; Young et al. 2010; Balint et al. 2011; Redpath et al. 2013, 2015c; McGuire & Ehlinger 2018; St John et al. 2019; Ainsworth et al. 2020; Rakotonarivo et al. 2021; Jolly et al. 2022).

In this dissertation and owing to the vast diversity and complexity of conservation conflicts, I subset conservation conflicts into three main categories for investigation, and then selected case studies associated with each; i) conflicts that emerge when other human endeavors are prioritized over conservation objectives, ii) conflicts sparked as a result of imposed conservation actions, or when conservation interventions are prioritized over other human activities iii) and human-wildlife conflicts. While there are cases of overlap among these categories – and conflicts are difficult to categorize due to their dynamic and evolving nature – these conflict categories frame insight into conservation conflicts and their diverse manifestations.

Conflict resulting from the prioritization of other human activities over conservation objectives

Conservation conflicts often emerge when top-down environmental decision-making processes result in outcomes that threaten (or are perceived to threaten) ecosystems, species, their conservation, and their collective well-being. For instance, conflict may result when authorities approve extractive or exploitative industrial projects that threaten ecosystems or species of concern. Illustrating these conflicts, mining projects proposed and enacted by corporations from the global North increasingly clash with the social, environmental, and conservation desires of communities in the global South (Özkaynak et al. 2012). In 2005, Marlin Mine became Guatemala's first industrial-scale gold mine after being approved by Guatemalan authorities (Fulmer et al. 2008; Dougherty 2011). This approval conflicted with the priorities and needs of local communities, who opposed the decision due to potential damages to local water resources and the environment, and because it conflicted with local Indigenous values, which hold that "human societies depend on and are inseparable from their relationships with the earth and the broader

environment (Fulmer et al. 2008, p.94).” This power-imbalanced conflict eventually resulted in violence, as Guatemalan security forces clashed with local and Indigenous protestors, leaving one protestor dead and 16 injured (Fulmer et al. 2008; Dougherty 2011; Urkidi 2011). Such mining conflicts, which result from the top-down imposition of environmental decisions and contrasting values and priorities of authorities and (often foreign) corporations and investors, and those values and priorities of (often disempowered) local and Indigenous communities (Fulmer et al. 2008) occur across geographies and scales (e.g., in Ghana, Peru, Chile, Tanzania, Nigeria, Canada, the U.S.A., and elsewhere; Hilson & Yakovleva 2007; Bebbington & Williams 2008; Omofonmwan & Odia 2009; Baker & Westman 2018; Bacon 2020; Carranza et al. 2020).

Conflicts over environmental decision-making outcomes, or where commercial interests are prioritized over conservation concerns, also emerge when those within *and* beyond local communities consider themselves stakeholders with a moral (or other) obligation to protect biodiversity or the environment. For instance, competing values concerning old-growth forests have resulted in so-called “wars in the woods” in British Columbia (BC) and Tasmania in the aftermath of logging approvals (Satterfield 2007; Affolderbach 2011). In these contexts, ecologically-rich, economically-valuable forests in colonial nation-states are managed by regional jurisdictions (Wilson 1998; Affolderbach 2011). While forestry corporations and regional authorities are obvious interested parties in forestry decision-making outcomes, environmental non-governmental organizations, diverse individuals, Indigenous Nations, local communities, and those representing competing industries (i.e., ecotourism) come into conflict over whether conserving ecosystems and the species within them or extracting their economic value to support economies and profits are key priorities (Wilson 1998; Affolderbach 2011). While these and other conflicts over environmental decision-making outcomes present considerable negotiating opportunities, and can result in collaborative solutions (e.g., The Great Bear Rainforest Agreement, Riddell 2005; Affolderbach 2011) they can also precipitate violence (Fulmer et al. 2008; Urkidi 2011), damage relationships (Young et al. 2010; Redpath et al. 2013; Madden & McQuinn 2014, 2015), result in protracted legal battles (Menell 1991), and lead to considerable associated expenses (e.g., see Forester 2023).

Conflicts resulting from the prioritization of conservation objectives or interventions

Conversely, conservation conflicts are also ignited when conservation actions impose limitations on other human practices, including those related to subsistence practices, recreational activities, or commercial endeavors, among others. For instance, the establishment of Marine Protected Areas (MPAs) conflict with

fisheries interests across scales and geographies (Stamieszkin et al. 2009; Chang et al. 2012; Grip & Blomqvist 2018, 2020). In Mexico, competing interests among recreational fishers, commercial fishers, and governing park authorities in the context of an established MPA resulted in conflict, degradation of inter-group trust, and unlawful use of a protected park in Loreto Bay (Steinitz et al. 2005; Stamieszkin et al. 2009).

Conservation policies that directly protect species of concern can also spark conflict, whether because the protection of one species requires controversial practices related to another (e.g., in Canada, where wolf (*Canis lupus*) culls implemented as part of a caribou (*Rangifer taranadus*) recovery plan are contested; Hervieux et al. 2014; Serrouya et al. 2019; Harding et al. 2020; Weisgarber et al. 2022), or when protecting one species reduces access to or legislates human behavior associated with another species (e.g., in the United Kingdom, hen harriers (*Circus cyaneus*) are protected birds of prey that are often illegally killed because they are perceived to threaten red grouse (*Lagopus lagopus scotica*) shooting interests, and illegal killings spark conflict; Thirgood & Redpath 2008; Redpath et al. 2013).

Finally, conflict can also emerge when wildlife are protected by higher authorities or valued by one group (e.g., local communities, conservation NGOs), but pose an actual or perceived risk to local people (e.g., farmers, livestock owners) or are valued differently by opposing groups (e.g., those invested in illegal wildlife trade) (Dickman 2010; Madden & McQuinn 2014). For example, elephants (*Loxodonta spp.*) are protected in many areas of their range in Africa, but remain threatened by poaching and trafficking, in part due to extreme local poverty (Madden & McQuinn 2014). In these contexts, intense conflict has emerged when villages have different priorities, goals, and values relating to elephants, for instance when one village was implementing programs to protect elephants from poaching, and another was found to be engaging in poaching (Madden & McQuinn 2014, Beggs 2012). While these human-human conflicts regarding how to manage and interact with wildlife dovetail with human-wildlife conflict, here I explicitly refer to conflicts between people over how best to interact with wildlife (Dickman 2010; Redpath et al. 2015a).

Human-wildlife conflict

Conservation conflicts also emerge between humans and other animals. Scholars differ in whether they include this multispecies conflict in their categorization of conservation conflicts (Table 1.1). I incorporate human-wildlife conflicts within my working definition of conservation conflict for two primary reasons: i) to avoid the biases of anthropocentric paradigms that place humans as superior to or

separate from other animals, instead adopting an ecocentric approach where humans are one of many interconnected species within shared ecosystems (Leopold 1949; Naess 1973; Eichler & Baumeister 2018; Menzies et al. 2021), and ii) in an effort to support the growing paradigm shift that calls scientists and policy-makers to recognize the rights of other species and their position as an invested party in conservation conflicts (Chapron & López-Bao 2020; Menzies et al. 2021). I present human-wildlife conflicts as conservation conflicts, however, with the caveat that assuming that other species are ‘conscious human antagonists’ in the context of conflict is problematic, and can be harmful (Young et al. 2010, Peterson et al. 2010, Redpath et al. 2015a).

Regardless of intention, wildlife and humans nonetheless find themselves in conflict where wildlife behaviors (foraging ecology, movement patterns, etc.) bring them into close proximity with humans, where human ranges overlap with those of wildlife, and when their presence is perceived or actualized as a threat (e.g., via livestock depredation, property damage, physical injury) (Peterson et al. 2010a; Dickman 2010). Non-human animals are typically the parties that bear the majority of consequences that emerge from these conflicts (e.g., individual wildlife suffering or death, population-level threats), even though their actions are likely not a result of direct or conscious antagonistic behavior. For example, lions (*Panthera leo*) in South Central Africa can and do kill or injure livestock and people, and people often respond using lethal measures; between 2014-2016, villagers killed 30-50% of the local lion population in the Okavango Delta in response to livestock depredations (LeFlore et al. 2019, 2020).

Recognizing the diversity of these conflicts, and the costs and opportunities they present, it is perhaps obvious that no single paradigm can comprehensively inform their investigation, management, or resolution (White et al. 2010; Redpath et al. 2013). Indeed, conceptual frameworks and approaches deriving from the social and natural sciences, humanities, and other ways of knowing (e.g., Indigenous knowledges) are concurrently required to understand and manage conservation conflicts (White et al. 2010; Redpath et al. 2013; Madden & McQuinn 2014; Redpath et al. 2015b; Lischka 2018; Ainsworth et al. 2020; Rakotonarivo et al. 2021). Prior to outlining the multidisciplinary frameworks that exist for addressing conservation conflicts (the ‘how’ of understanding and confronting conflict), I provide insight into ‘why’ a conservation conflict lens is a useful one through which to examine, describe, and leverage conflict towards improved conservation outcomes.

Why Conservation Conflict? Criticisms of and support for a conflict-focused lens

Likely owing to the inevitability of conflict, and its pervasiveness across all realms of conservation (e.g., science, policy, objective-setting, actualization, education, implementation, etc.), academic focus on conservation conflicts has steadily increased (Nyhus 2016; Chapron & López-Bao 2020), and this increase is likely to continue (Chapron et al. 2019; Redpath et al. 2013). Some scholars have challenged the utility of ‘conservation conflict’ as a research or problem-solving lens, suggesting that conservation scholarship may have entered a ‘conflict hype’ (Chapron & López-Bao 2020). For instance, Chapron and López-Bao (2020) express concern that conservation conflict studies overrepresent conflicts in which human interests have (or ultimately do) prevail over those of other species, exclude ‘nature’² from conflicts, transfer blame for the conflicts that emerge surrounding degrading ecosystems from human actions to conservation interventions, and ignore ethical obligations to preserve species or ecosystems, instead focusing on resolving human-human conflict or improving human relationships (Chapron & López-Bao 2020). While these criticisms raise some important concerns – namely, that collective human needs or desires are currently almost ubiquitously prioritized over those of other species or functioning ecosystems (Linnell 2010; Cardinale 2012; Pearl 2018; Chapron & López-Bao 2020), they also fundamentally misunderstand the value and purpose of studying conservation conflicts. Throughout my 6 years studying conservation conflicts and associated scholarly frameworks to understand and confront them, I found that scholarly criticisms, perhaps counterintuitively, helped me better understand *why* studying conservation conflict is vital. Owing to this, I leverage opposing scholarly viewpoints to summarize criticisms of a conservation conflict lens, ultimately explaining the value of this approach.

Studying conservation conflicts fundamentally requires focusing a great deal of resources and scholarship on understanding humans – this focus has in part contributed to interpretations that conservation conflict studies prioritize human well-being over that of other species and shared ecosystems. Beyond their primary role in conservation conflicts, humans have served as a principal force of ecosystem modification and transformation for at least 10,000 years³ (Stephens et al. 2019), and have engaged in complex environmental decision-making processes for millennia (Turner et al. 2000; Trosper 2003; McGregor 2004; Menzies & Butler 2007; Berkes 2012; Garnett et al. 2018). The collective influence of our

² Chapron and López-Bao (2020) do not define nature but do seem present it as the collective physical world defined in opposition to or separate from humans, human priorities, and human creations. This concept of ‘nature’ aligns with Western concepts of pristine nature or ‘wilderness’, independent from and threatened by humans (Oelschlaeger 1993; Smith 1998). I note here that such framings of nature or wilderness as inherently separate from humanity, or only intact in the absence of human inhabitants or modification, are criticized by Indigenous and other scholars and have been weaponized to displace Indigenous Peoples from their territories (Cronon 1995; Wolfe 2006; Gissibl 2016; Kashwan 2017; Liboiron 2021; Fletcher et al. 2021).

³ This reality disrupts largely Western cultural and scientific beliefs that large-scale global anthropogenic change is a recent phenomenon.

endeavors, decisions, conflicts, and systems have only grown; today, at least 75% of the Earth's ice-free surface is directly modified by humans (Ellis and Ramankutty 2008), human biomass and that of our livestock accounts for 96% of mammalian biomass on the planet (Bar-On et al. 2018), and human-induced climate change and mass extinctions intersect to threaten our shared biosphere (Folke et al. 2021). Given this profound influence of humans on the planet and our collective role as primary ecosystem decision-makers, it is critical that we understand people in the pursuit of enduring conservation solutions (Endter-Wada et al. 1998; Bennett et al. 2017; Bennett & Roth 2019). Critics of a conservation conflict lens misunderstand a research focus on conflict as a choice to mask the “pervasive influence of humans on species decline and extinction and on nature conservation in general (Chapron & López-Bao 2020)...” and position conservation actions as the primary cause of emergent conflict (Chapron & López-Bao 2020). Rather than acting to mask the inextricable (and often, but not solely, damaging) influence of humans on other species and ecosystems⁴, a conservation conflict lens embraces humans' individual and collective roles in global ecosystems, taking seriously the work of examining, understanding, and managing human behavior and the consequences of conflict for human wellbeing alongside conservation outcomes (Redpath et al. 2013, 2015a, 2015b). A conservation conflict lens further embraces that, while conservation actions can and do spark social conflict, conservation interventions themselves are not to blame for the resulting tensions. Rather, emergent conflicts are the inevitable result of pursuing means to protect biodiversity, human wellbeing, and our shared biosphere in a complex, human-dominated world. Simply put, conservation will not be successful or enduring if we do not focus immense resources towards understanding humans – our beliefs, values, politics, cultures, knowledges, opinions, well-being, conflicts, and more (Endter-Wada et al. 1998; Bennett et al. 2017; Bennett & Roth 2019).

Critics of a conservation conflict lens express concerns that attempts to examine conflict towards management or mitigation will ‘defang’ conservation policies and approaches, and result in compromises to conservation actions that reduce their efficacy in support of human wellbeing (Chapron & López-Bao 2020). This concern assumes that conservation actions can prove successful in the absence of local support, or even when they spark conflict. However, ample evidence supports that top-down conservation approaches⁵ will likely fail in the long-term without local support and collaboration (Leong et al. 2011), or if conservation policy-makers ignore conflicts that they foment (Dickman 2010; Balint et al. 2011;

⁴ Recognizing that humans can and also do have positive impacts on biodiversity and ecosystems (McGregor 2004; Berkes & Turner 2014; Atlas et al. 2021).

⁵ Top-down conservation policies can also perpetuate harmful colonial injustices. Fortress conservation practices, for example, have violently dispossessed Indigenous peoples from their territories across the globe and resulted in poverty and permanent intergroup hostility (Hartter & Goldman 2011; Rai et al. 2021).

Peterson et al. 2013; Madden & McQuinn 2014, 2015). While it is the case that some superficial conflicts resulting from conservation actions can or even should be reasonably ignored (i.e., are best resolved or transformed passively, as people adapt to change and policies; Chapron & López-Bao 2020), and conflicts themselves are not necessarily negative (Cosser 1956), disregarding more substantive or deep-rooted conflicts may result in only short-lived conservation success (Rothman 1997b), exacerbate pre-existing conflict, and hamper conservation progress (Redpath et al. 2013b; Madden & McQuinn 2014).

Alternatively, research has shown that conservation interventions are more likely to succeed when interested parties feel heard, understood, and involved (Madden & McQuinn 2014, 2015). Studies and practice that examine and confront conservation conflict, then, do not aim to ‘defang’ conservation policies, but instead exist with the explicit goal of ensuring conservation interventions are successful and enduring.

Finally, reasonable concerns about justice, compromise, and conflict emerge when framing conservation conflicts and their solutions. There is a pressing concern that conservation conflict studies are normative in favor of people (over ‘nature’ or other species), and some scholars advocate that conflicts regarding conservation must be ‘won’ rather than studied, resolved, managed, or transformed (Chapron et al. 2019; Johns 2019; Chapron & López-Bao 2020). Justice-centered concerns are well-founded; modern ecological crises result in (and will increasingly result in) suffering of those human- and non-human animals that have contributed least to anthropogenic climate change, biodiversity extinction, pollution, and other consequential catastrophes (McMichael 2020; Liboiron 2021; Robinson & Carlson 2021; Abbas et al. 2022; Stoett 2022). Those who bear the unbalanced consequences of environmental crises also tend to be those whose voices and power may be diminished in conservation conflicts (Chapron & López-Bao 2020). In these consequential contexts, reaching societal agreements on what qualifies as just or ethical action is immensely challenging, especially in the presence of power imbalances (Maiese 2003). But it is precisely social conflicts - arising in diverse contexts and moments across systems and scales - that create opportunity for natural societal processes to elicit change (Cosser 1956; Lederach 1996). Indeed, conflict provides an opportunity to assess, experiment with, and transform normative societal values and associated ethical practices (Lederach 1996; Maiese 2003; Madden & McQuinn 2014; Carpenter et al. 2019). Conservation scholars and practitioners (in collaboration with diverse other scientists) can best leverage arising conservation conflicts towards just outcomes if we have tools in place to understand, examine, and respond to conflict; a conservation conflict lens serves us well towards this end.

Approaches to Understanding and Confronting Conservation Conflicts

The study of conservation conflicts is supported by a rich body of conflict literature from which potential tools and theories to examine and respond to conflict arise. Generally, scholarly pursuits aimed at identifying, understanding, and overcoming conflict have derived from social science traditions. Scholars in the fields of sociology and psychology have developed a variety of definitions for conflict. At their core, these definitions encapsulate antagonistic relationships between two or more entities (individuals or groups) in which behaviors, goals, values, or other important traits of the involved entities are at odds (Coser 1956; Litterer 1966; Smith 1966; Fink 1968; Schelling 1980; Kahn 1988). Commonly-used theoretical frameworks for examining and proposing solutions to conflict include: i) functionalism (Coser 1956) and conflict resolution theories (Bercovitch 1986) in which conflict is perceived as an opportunity to overcome anachronistic social norms and spark progressive reform across emergent context (Coser 1956), ii) conflict management theories (Costantino & Merchant 1996) that understand conflict instead as a manageable signal of systemic dysfunctionality – asserting that conflict is always latent or dormant and thus impossible to resolve in the long-term, and iii) conflict transformation theory (Lederach 1996), which asserts that conflict is an opportunity to transform individual and communal character and interrelationships, eventually sparking collective moral growth (Lederach 1996; Botes 2003; Miall 2004).

In this dissertation, I follow the recent tradition of other conservation scholars (Madden & McQuinn 2014, 2015; Minnes et al. 2020; Bennett 2020; Rakotonarivo et al. 2021; Glikman et al. 2022; White et al. 2023) and leverage conflict transformation theory to better understand conservation conflicts in hopes of informing their transformation. While there is considerable overlap between conflict theories (Miall 2004), conflict transformation theory is differentiable from conflict resolution or conflict management theories in that it does not seek to intervene in conflict through transcending it by reframing the positions of parties (conflict resolution), nor through settlements or containment (conflict management), but instead seeks to understand and transform the very structures and relationships of those involved in conflict (Miall 2004). Given that conservation conflicts are diverse and often complex, multifaceted, and deeply-embedded, I believe a conflict transformation approach aligns well with the challenges and opportunities that arise in navigating them.

I recognize here that the approaches to understanding conflict defined above (and the transformative approaches mobilized in this dissertation) are collectively grounded in Western epistemologies. More-than-Western approaches to understanding and moving beyond conflict exist (including Indigenous approaches, see Wolf 2000; Osamba 2001; Olowu 2017; Harper et al. 2018) and are critical to holistically understanding, confronting, and transforming conflict. Mobilizing frameworks and collaborative action to bridge Western and Indigenous ways of knowing and approaching conflict will guide future research, but

requires equal partnerships and ownerships beyond the scope of an individually-authored dissertation. Among its potential benefits (described below) conflict transformation may provide structures to embrace multiple cultures, ways of knowing, and pluralism more generally towards informing future knowledge-bridging approaches.

Conflict Transformation Theory

Conflict transformation theorists propose that modern conflicts require more than “the reframing of positions and the identification of win-win outcomes” (Miall 2004) or the cooperative negotiation approaches that typically frame conflict resolution and management approaches (Miall 2004). Instead, conflict transformation theory emphasises that peacebuilding (coexistence) is only possible through a fundamental shift in the relationship between parties involved in conflict, accomplished only by considering context and historical aspects beneath the presenting conflict, and when all parties involved in conflict recognize their role in peacebuilding (Väyrynen 1991; Lederach 1996; Miall 2004).

Conflict transformation theory emerged in the 1990s, in part in response to criticisms of conflict resolution approaches (Miall 2004) and owing to the difficulty of or ephemeral successes associated with negotiating win-win outcomes in response to conflicts (Bloomfield 1995). Conflict transformation theory draws conceptual building blocks from European structural theorists who analyzed conflict formation processes and identified conflicts as complex, nested, and natural social processes constructed of both life-affirming and life-destroying aspects (Galtung, 1996; Krippendorft 1973; Senghaas 1973). Further scholarship identified the role of asymmetrical relationships and power imbalances in the context of conflicts (Curle 1971), and the importance and possibility of transforming these relationships should peace and justice be achieved (Miall 2004). Conflict transformation theory also builds upon scholarship identifying the dimensions and characteristics of complex, protracted contemporary conflicts, which can spiral into intractable conflict when equitable solutions are not achieved (Azar 1990). Finally, conflict transformation theory builds upon Väyrynen’s (1991) assertions that actors, systems, and issues must be deeply understood in the context of protracted conflicts should enduring coexistence be achieved. In 1997, John Paul Lederach comprehensively defined and solidified conflict transformation theory for both scholars and practitioners (Lederach 1997).

Conflict transformation is,

“a capacity to envision ...[and] a willingness to respond [to]...conflict positively, as a natural phenomenon that creates potential for constructive growth. Change is understood both at the level of immediate presenting issues and that of broader patterns and issues... Conflict transformation focuses on the dynamic aspects of social conflict. At the hub of the transformational approach is a convergence of the relational context, a view of conflict-as-opportunity, and the encouragement of creative change processes (Lederach, 2015, p.5 in Madden & McQuinn 2014).”

As both theory and approach, conflict transformation is simultaneously well-established and flexible (Miall 2004). Fundamentally, the field of conflict transformation explores and describes processes by which conflicts can be analyzed, interventions devised and applied, and solutions measured for their efficacy (Lederach 1996, 2015; Miall 2004). Because conflict transformation theory is oriented towards direct application to real-world conflicts, theory and practice must be continuously revisited and evolve in response to the changing nature of conflicts (Miall 2004). Even in the context of this flexibility, however conflict transformation is supported by several foundational components, attitudes, and approaches (Lederach 2015). A transformational theory and approach entails: i) a positive orientation towards conflict and associated willingness to engage in the conflict towards positive change, ii) an understanding of conflicts as dynamic and embedded within greater patterns of human relationships and cultural structures, and iii) emphasizing relationships between and among people, culture, and structures (rather than content or substance of disputes) as key to understanding and transforming conflict (Miall 2004; Lederach 2015). To approach conflicts from this transformation framework entails three points of inquiry in the development of a response to conflict (Figure 1.1; Lederach 2015).

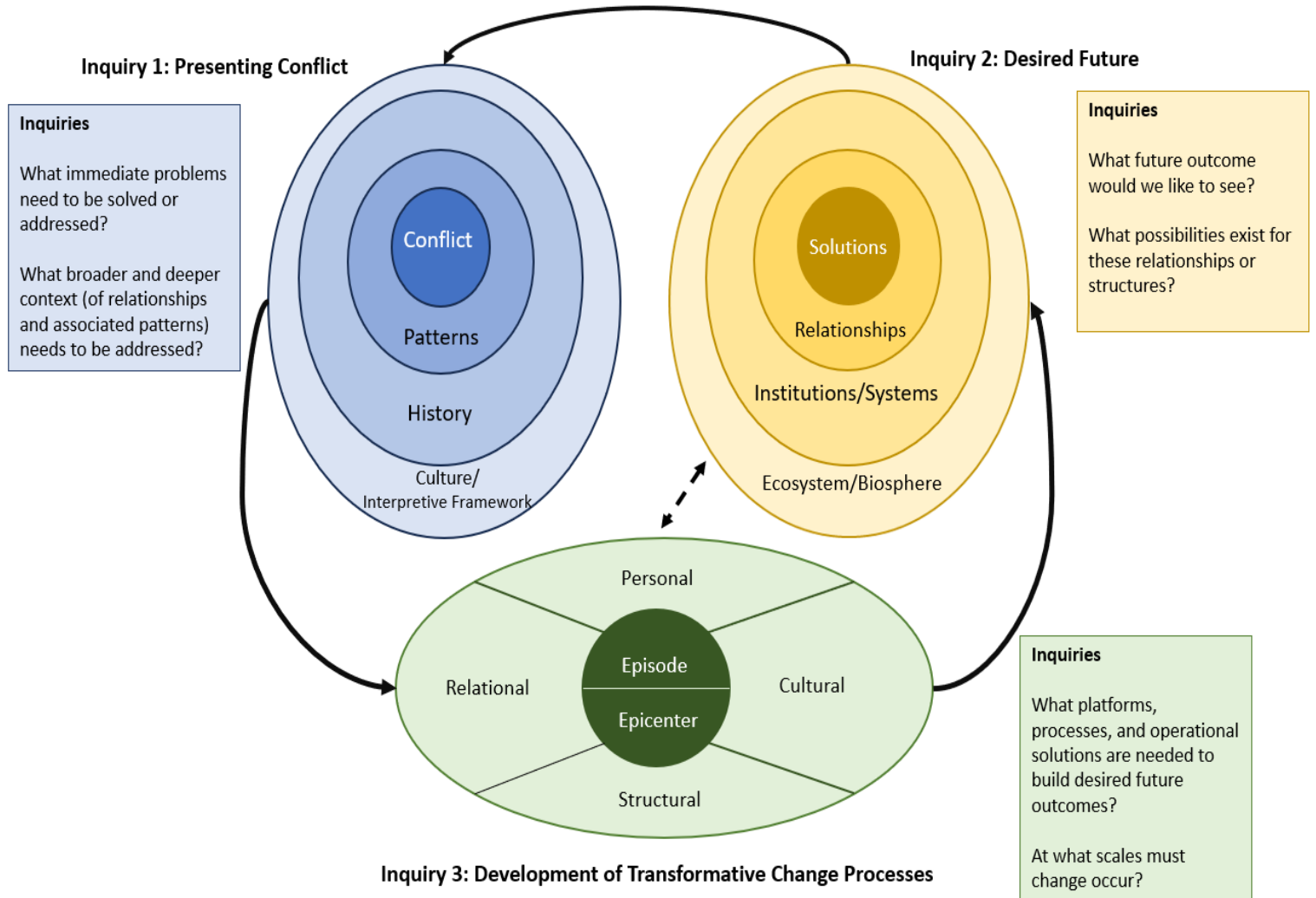
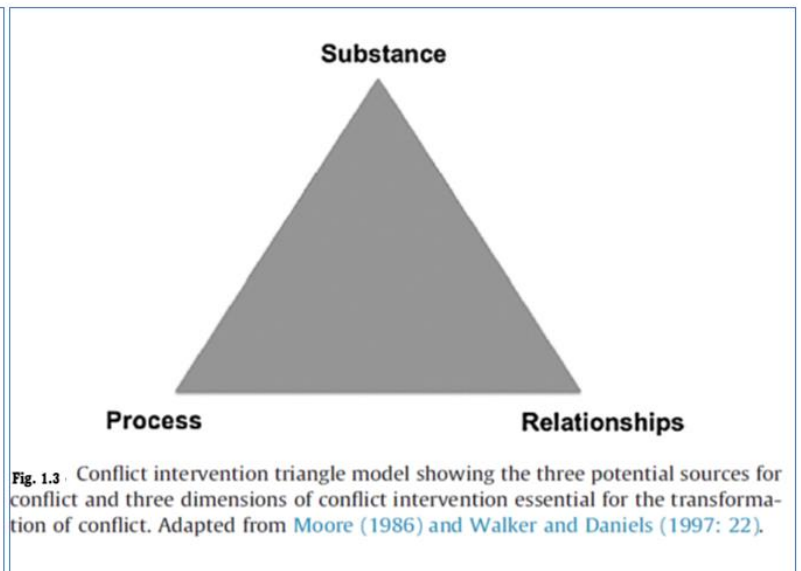
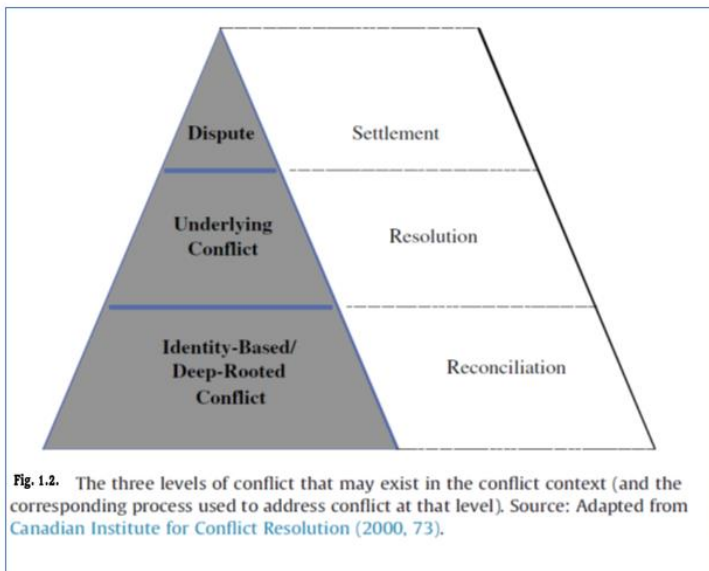


Figure 1.1. The ‘Big Picture of Conflict Transformation’, displaying stages of inquiry in the development of transformative theory and approaches. This figure is derived from Lederach (2015), with modifications and additions to illuminate how this flexible inquiry structure might apply to a conservation conflict. This dissertation largely engages in research that addresses processes associated with ‘Inquiry 1’.

Conservation Conflict Transformation

Conservation Conflict Transformation (CCT) adapts processes and principles from the field of conflict transformation and peacebuilding to attend to the needs of conservation conflicts, and is considered by proponents as the “blind spot” or “missing link” in modern conservation sciences (Madden & McQuinn 2014). CCT is defined by authors as a set of principles and processes proposed to “reorient conservation’s understanding of and approaches for addressing conflict (Madden & McQuinn 2014 p. 98).” CCT leverages orientations and approaches from broader conflict transformation theory, asserting that conservation conflicts are rarely examined for both their superficial presenting problems (e.g., immediate conflicts over resources or environmental management plans) and their deeper roots (e.g., clashes in human values, historical processes, broader cultural relationships, etc.) simultaneously, and recognizes that a failure to transform the relationships between parties that drive these deep roots of conflict can further embed already intractable conflict (Rothman 1997b; Madden & McQuinn 2014). CCT theory proposes an analytical examination of levels of conflict (Figure 1.2,1.3) followed by use of the “conflict intervention triangle” (Figure 1.3) to transform conflicts. Despite the rich body of conflict transformation theory and these practical tools to guide conflict examination and confrontation (Figures 1.2 and 1.3), CCT remains minimally applied, perhaps in part owing to the fact that clear methodological approaches to actualize CCT tools in the academic realm remain minimally developed.

Figure 1.2 and 1.3 as they appear in Madden & McQuinn 2014 (pgs. 100 and 102, respectively,



originally Figures 1 and 2 in text).

The novel processes proposed by CCT have the potential to reorient how scientists approach conservation conflict for the better, allowing the incorporation of complex socioecological variables, diverse actors, and recognition of context and historical processes in analyzing conflict – but limitations yet constrain its

utility. Indeed, empirical methods for analyzing the deep roots of conservation conflict remain under-developed. Furthermore, case studies proposed in the nascent publication suggesting the application of CCT (Madden & McQuinn 2014) provide useful insight into the effective use and potential of CCT, but only incorporate situations of conflict between small groups of human actors regarding an explicit local conservation action as case studies. CCT could be expanded to also incorporate human-human conflict across scales (e.g., political, national, etc.) and consider dimensions of human-wildlife conflict, increasing its utility and methodologies to support it.

Dissertation Contributions

In this dissertation I aim to provide conceptual contributions, methodological tools, and meaningful recommendations to implement a CCT lens in novel and, ideally, replicable ways. Even this work – analyzing conflicts through a lens oriented towards transformative solutions – was riddled with complexities and challenges. But as conflict transformation approaches require, this research invited me, and will invite others, into the deep-roots of conflict and associated relationships, offering opportunities and insights that will inform peaceful transformation. Herein, I do not do the work of conflict transformation. This is because the work of conflict transformation requires entire communities of practice and iterative, long-term processes that often occur over decades.

My dissertation questions emerged iteratively as I found myself (and my scholarly pursuits) transformed by the research and a CCT lens. Broadly, I asked:

1. How can a CCT approach inform assessment of Canadian environmental-decision making processes as they attempt to embrace multiple forms of knowledge and many interested parties?
2. What existing bodies of scholarship and social science-derived methodologies and models might be mobilized within a CCT framework? Might some of these other models and supporting scholarship contribute repeatable methodologies to the CCT literature?
3. How can a CCT approach inform studies of human-wildlife conflict? Can CCT processes be aligned with ecological research assessing human-wildlife conflict to examine these conflicts more holistically?

Ultimately, this dissertation offers conceptual frameworks, methodological tools, and cross-disciplinary syntheses for assessing diverse conservation conflicts both academically and practically. Because conservation conflicts require multidisciplinary approaches, I focused a diverse suite of social and

ecological tools and the conflict transformation inquiry (Figure 1.1) and levels-of-conflict models (Figure 1.2) to develop ways to assess conservation conflicts through a CCT approach. To this end, I also provide three case study investigations of entrenched conservation conflict in Canada, applying principles of CCT in novel ways (e.g., in terms of scales, methodologies, and conflict contexts). For the purposes of this dissertation, I selected case studies that were relevant (i.e., timely, high-profile within local communities, and in need of practical suggestions towards solutions) and that spanned the three conservation conflict categories I define herein (conflicts that emerge when: i) other human endeavors are prioritized over conservation, ii) conservation takes priority over other human interests, and iii) humans and wildlife experience negative interactions). I also endeavored to select case studies that would complement each other and support my more comprehensive understanding of conservation conflicts by ensuring that the conflicts examined occurred at diverse scales (i.e., national, multijurisdictional, and regional) and between diverse types of actors (i.e., between governments and associated knowledges and policy desires, between stakeholder groups, between people and other species). My dissertation assesses the anatomy of these conflicts and contributes methodologies and concepts applicable elsewhere, but the work of these (and other conflicts') transformation now lies in relationship-building and transformation, education, outreach, collaboration, mutual humanization, and a great deal of vulnerable, challenging, hopeful community-building.

Thesis Chapters

Chapter 2 applies CCT principles to epistemological and political clashes in Canada's environmental decision-making processes and generates methods to examine the deep roots of these conflicts by investigating the recent historical and modern relationships between Indigenous knowledge and Western Environmental Assessment processes. An iterative, constructivist approach (Olsen 1999) guided this first qualitative research chapter, and the resulting insights fundamentally informed the approach of the rest of the dissertation, and led to the adoption of CCT approaches.

Chapter 3 seeks to create quantitative methods to examine the complexities of conservation conflict between two stakeholder groups in British Columbia. In this chapter, I aim to examine the levels-of-conflict (Figure 1.2) underpinning current conflict between recreational fishers and conservationists surrounding Southern Resident Killer Whale protection measures.

Chapter 4 aims to explore the application of CCT processes and practices to a local case study of human-wildlife conflict and generate a methodological approach that can rectify the persistent challenges of

incorporating social and ecological variables and corresponding data types in socioecological human-wildlife conflict research.

Chapter 5 summarizes key contributions, emergent conceptual frameworks, and lessons learned, also highlighting current limitations and abundant opportunities for future research in the areas of conservation conflict and CCT.

While I introduced this dissertation by acknowledging our shared (and precarious) position in the *Anthropocene*, it is my hope that this scholarship contributes to optimism even in the face of entrenched, complex, and increasing conservation conflicts. As many other scholars have identified, conservation scholarship, practice, and storytelling must fundamentally include a re-envisioning and transformation of human relationships to the rest of the living world (McGregor 2004; Spiegel 2020; Menzies et al. 2021; Apostolopoulou et al. 2021). It is my belief, informed by the experiences that defined this dissertation, that a CCT approach can contribute to these necessary relationship transformations and a world of multi-cultural, multi-species flourishing.

Methodological Approach

I relied on a diverse suite of methodologies deriving from the ecological and social sciences to accomplish my dissertation goals. I used literature review (Chapter 2), social surveys (Chapters 3 and 4), qualitative coding approaches (Chapters 2,3, and 4), spatial data collection and associated analyses, wildlife camera traps, and observational data collection (Chapter 4). These methodological approaches and associated qualitative and quantitative analyses were collectively set within an intentionally creative (Aslan et al. 2014), interdisciplinary research framework oriented towards applied conservation outcomes. My desire to better understand challenges facing conservation in Canada – and ultimately conservation conflicts - pushed me to further my journey into interdisciplinary studies and find opportunities to blend, harmonize, and integrate diverse disciplinary inputs towards creative insights. This approach (which integrated theories, concepts, and tools from environmental psychology, conflict studies, sociology, geography, spatial ecology, political science, and more) was conceptually integrative and pluralistic, allowing me to leverage some of the theories, concepts, assumptions, epistemologies, and methods that contribute to each discipline towards understanding conservation conflicts more holistically (Council et al. 2014; Peek & Guikema 2021).

More broadly - and owing to my positionality as a white woman of mixed-European descent - it was also my desire to ground my research in an equity-oriented, intersectional, and community-engaged approach (Bennett et al. 2021; Liboiron 2021; Apostolopoulou et al. 2021; Harris et al. 2023). Fundamentally, this approach entailed on-going practices of humility and recognition of personal and cultural biases and assumptions, efforts to question and address structures underpinning or upholding colonial power (e.g., capitalism, cultural imperialism), assessment of my positionality and values (Beck et al. 2021; Boyce et al. 2022), and engagement with my communities regarding conservation concerns. Finally – and despite limitations imposed by the COVID-19 pandemic –this research follows a community-based and -engaged approach (Berkes 2004, 2007; Rathwell et al. 2015). This means (among other things) that collaboration with academics, practitioners, community members, and mentors was at the core of each data chapter. Chapter 2 was fundamentally guided by staff at the Heiltsuk Integrated Resource Management Department (particularly Kelly Brown), and my examination of Environmental Assessments in Canada was enriched and informed by a team of collaborative and dedicated co-authors, who brought their diverse positionalities and expertise to bear on the question of Indigenous knowledge in the context of federal Environmental Assessments. The research questions posed in Ch.3, and future delivery of results to stakeholder groups of relevance, was and will be guided by co-authors directly involved in ecosystem management in the Salish Sea, who have experienced the conflict described firsthand (including Misty MacDuffee, Dave Scott, and Dr. Paul Paquet). The deeply interdisciplinary approach in Chapter 4 was made possible by the help of an expert team of co-authors (ecologists, geographers, and social scientists) and was guided in critical early stages by Dr. Beatrice Frank, Joanna Klees Van Bommel, and experts with the BC Conservation Officer Services and WildsafeBC. Finally, as identified in the *Acknowledgements* section, Chapters 1 and 5 (and my scholarship in generally) have evolved and been transformed by relationships and collaborations with a diversity of scholars, community-members, and mentors across fields, geographies, and positionalities. My motivations to engage in this research arise (in part) out of my desire to support communities (of which I am part) navigating conservation conflicts towards enduring solutions that support intertwined human- and ecological-wellbeing. Beyond the academic work contained herein, this community-engaged approach will continue to inform my approaches and responsibilities to share my work and ensure its applicability through education, outreach, further community-building, and the publication of materials for policy- and decision-makers.

Chapter 2: Indigenous knowledge and federal environmental assessments in Canada: applying past lessons to the 2019 impact assessment act

Authors: Lauren E. Eckert, Nick XEMFOLTW_ Claxton, Cameron Owens, Anna Johnston, Natalie C. Ban, Faisal Moola, and Chris T. Darimont

Publication: [FACETS](#)

13 February 2020

<https://doi.org/10.1139/facets-2019-0039>

Abstract

Policy-makers ideally pursue well-informed, socially just means to make environmental decisions. Indigenous peoples have used Indigenous knowledge (IK) to inform decisions about environmental management for millennia. In the last 50 years, many western societies have used environmental assessment (EA) processes to deliberate on industrial proposals, informed by scientific information. Recently EA processes have attempted to incorporate IK in some countries and regions, but practitioners and scholars have criticized the ability of EA to meaningfully engage IK. Here we consider these tensions in Canada, a country with economic focus on resource extraction and unresolved government-to-government relationships with Indigenous Nations. In 2019, the Canadian government passed the Impact Assessment Act, reinvigorating dialogue on the relationship between IK and EA. Addressing this opportunity, we examined obstacles between IK and EA via a systematic literature review, and qualitative analyses of publications and the Act itself. Our results and synthesis identify obstacles preventing the Act from meaningfully engaging IK, some of which are surmountable (e.g., failures to engage best practices, financial limitations), whereas others are substantial (e.g., knowledge incompatibilities, effects of colonization). Finally, we offer recommendations for practitioners and scholars towards ameliorating relationships between IK and EA towards improved decision-making and recognition of Indigenous rights.

Introduction

In increasingly complex social, political, and environmental landscapes, decision-making about resource management can work to either resolve or stoke tensions as divergent communities and cultures offer and process information, knowledge, and values. Environmental assessment (EA) processes have provided a central paradigm by which many societies (predominately western societies and colonial nation states)

make environmental decisions. EA is a process used by decision-makers to predict and evaluate ecological, social, health, and economic impacts of proposed development, activities, and strategic undertakings (Cashmore et al. 2004; Murray et al. 2018)—its proper application in theory supports sustainability, environmental conservation, deliberative dialogue, and biodiversity management goals in the face of proposed projects (Gibson et al. 2005). However, EA processes and outcomes are increasingly criticized for their inability to incorporate the best available environmental knowledge, or the needs and cultures of diverse communities that they ultimately impact (O’Faircheallaigh 2017).

Whereas scientific knowledge and political systems rooted in historical imperialism have dominated EA processes and related dialogue over the past several decades, other societies (e.g., Indigenous Nations) have used Indigenous knowledge (IK) or local knowledge to support decision-making about the environment outside of an EA paradigm. In the context of contemporary decision-making, IK systems offer an alternative source of knowledge, often complementary to western science (Johannes 1978; Turner et al. 2000; Drew 2005; Gilchrist et al. 2005; Berkes 2012). Over thousands of years of observation and culturally transmitted learning, Indigenous peoples of the world have established complex management and conservation strategies to steward local environments (Johannes 1998; Huntington 2000; Turner and Berkes 2006; Menzies and Butler 2007; Berkes 2012; Housty et al. 2014). Despite growing recognition of the complementary nature of IK and science (Ferguson and Messier 1997; Drew 2005; Berkes 2012; Housty et al. 2014; Service et al. 2014; Eckert et al. 2017; Ban et al. 2018) and recognition of the stand-alone value of IK (which has and continues to support environmental management and decision making by sovereign Indigenous Nations) (e.g., Agrawal 2002; McGregor 2004; Turner and Spalding 2013), theoretical and empirical gaps plague modern discussion surrounding IK as it relates to environmental management, policy, and assessments (Stevenson 1996; Paci et al. 2002; Vidler and Elhaimer 2016).

Examining the contemporary relationship between IK and EA processes is increasingly relevant in the context of expanding global environmental degradation (Scheffer et al. 2001; Bopp et al. 2013; IPBES 2019), increased attention to the rights of Indigenous peoples (e.g., United Nations Declaration on the Rights of Indigenous Peoples; UN General Assembly 2007), and growing conflict resulting from EA decisions that poorly align with local knowledge, values, and interests (O’Faircheallaigh 2017). Canada provides a globally relevant case study to address the relationship between IK and EA. It is a country with heavy economic focus on natural resource extraction (Rosser 2006), where exploitation occurs on lands considered sovereign by many Indigenous Nations. Relatedly, Canada has a long history of problematic government-to-government relationships with Indigenous peoples, often over resource extraction.

EA occurs across scales in Canada, but we focus in this paper on the intersection of one such scale with IK. Canada has a federal form of government, where jurisdiction and legislative authority is divided between the national and provincial or territorial governments with constitutionally protected rights afforded to Indigenous peoples. Federal, provincial, and some Indigenous governments have all developed EA processes, but we focus here on EA policy enacted at the federal level. Such attention is justified, given the passing of a new federal EA Act (The Impact Assessment Act, 42nd Parliament, 1st session, 2019), which presents a contemporary context in which to investigate the relationship between EA and IK in Canada. Furthermore, insights gained from assessing the contribution of IK to federal EA policy have relevance for EA processes across other scales, as federal EAs are likely to impact large-scale environmental issues (such as those that effect Canadian oceans and global climate). Notably, Indigenous peoples in Canada have expressed concerns about EA across jurisdictions for similar reasons (Booth and Skelton 2011a).

Indigenous and non-Indigenous practitioners' concerns regarding Canada's federal EA processes have been previously documented (e.g., Booth and Skelton 2011a, 2011b; Udofia et al. 2017). Such critiques are traceable to the initial Canadian Environmental Assessment Act in 1995 (Stevenson 1996; Usher 2000; Paci et al. 2002). These historical and contemporary tensions surrounding EA policy have arisen in Canada partially as a result of the functional exclusion of Indigenous Nations as decision-makers in federal EA processes (Usher 2000; Carrier Sekani Tribal Council 2007; Manuel and Derrickson 2015). Despite the reality that a myriad of proposed projects, and the federally led EAs that follow, occur on sovereign territory occupied and managed by First Nations, Inuit, and Métis peoples, the degree to which local or IK is incorporated effectively into EA processes and decisions are often not considered adequate, consistent, or comprehensively understood (Stevenson 1996; Usher 2000; Paci et al. 2002; Vidler and Elhaimer 2016). Canadian EA Acts have also been criticized for lagging behind judicial court decisions. When resolving resource management conflicts, even Canada's legal systems have increasingly recognized knowledge, Constitutional rights—and in one case, title—of Indigenous peoples (Usher 2000; Paci et al. 2002; *Tsilhqot'in Nation v. British Columbia* 2014; Manuel and Derrickson 2015). Indeed, a recent high-profile legal decision emphasized the importance of improving engagement between Indigenous peoples and their knowledge in federal EAs when the Federal Court of Appeal overturned Canada's National Energy Board's approval of the Kinder Morgan Trans Mountain Pipeline expansion project, holding that the federal government failed in its duty to meaningfully consult First Nations in the EA process (*Tsleil-Waututh Nation et al. v. Attorney General of Canada et al.* 2018).

Against this background, here we assess how IK might be engaged in a potentially new chapter of EA in Canada. The emergence of the new Impact Assessment Act (enacted by the Liberal administration in 2019 to replace the 2012 Canadian Environmental Assessment Act) provides an opportunity to analyse how the federal government intends to apply IK in assessments and regulatory reviews as well as to examine the relationship between IK and EA under previous federal EA frameworks (Table 2.1). Synthetic literature reviews that summarize the contemporary application of IK in EA processes in any area remain largely absent (Gardner 2016; Vidler and Elhaimer 2016). Whereas some have examined the relationship between IK and EA since the initiation of formal Canadian EA processes (e.g., Stevenson 1996; Usher 2000; Paci et al. 2002; Booth and Skelton 2011b), to our knowledge no recent synthetic review of this body of literature has been completed. We recognize that IK is embedded in complex worldviews, cultures, governance systems, and recognition of sovereignty of Indigenous Nations. Our analysis, however, focuses on the application of the knowledge itself in federal EA processes. Here we analysed related peer-reviewed literature (i) to identify key obstacles preventing meaningful engagement of IK in the Canadian EA process and (ii) to use identified obstacles as criteria to assess if and how the Impact Assessment Act might engage IK.

Act title	Proposal	Year enacted
<i>Environmental Assessment and Review Process Guidelines Order (EARPGO)</i>	SOR/84-467, issued under the <i>Government Organization Act, 1979</i>	1984
<i>Canadian Environmental Assessment Act (CEAA)</i>	Bill C-78	1995
<i>Canadian Environmental Assessment Act (CEAA)</i>	Bill C-19	2010
<i>Canadian Environmental Assessment Act (CEAA) and National Energy Board Act (NEB)</i>	Bill C-38	2012
<i>Canadian Impact Assessment Act and Canadian Energy Regulator Act</i>	Bill C-69	2019

Table 2.1. Past, current, and proposed Canadian federal environmental assessment policy (Government of Canada 2016, 2018).

Methods

Literature review

We performed a systematic literature review, using several online databases (Google Scholar, The University of Victoria Electronic Libraries, and EBSCOhost). Search terms were: “Indigenous knowledge” or “traditional knowledge” or “traditional ecological knowledge” or “Aboriginal knowledge” or “Indigenous wisdom” or “Indigenous Law” and “Canada” and “Environmental Assessment”. We included peer-reviewed publications published between 1973 (the year of the informal, but influential assessment Mackenzie Valley Pipeline Inquiry) and 2018 that focused explicitly on Canadian federal EA processes.

We approached our analysis in ways that supported reproducibility of our qualitative research. We used a qualitative content analysis approach (Krippendorff 2018). We considered papers as sampling units and corresponding sentences as units of analysis. In this systematic process, we focused on the context of relevant text, considering sentences within the greater context of paragraphs, paper sections, and within the entirety of the scope of the paper. We followed an emergent coding process; although we began our analysis with a list of key questions (Table 2.2), we identified additional themes and categories from the texts themselves, rather than establishing them prior to analysis (Charmaz 2006; Charmaz and Belgrave 2012). We created a code book (Appendix A) to describe in detail our analyses.

Key questions
Does the paper indicate that the author(s) find the relationship between Indigenous knowledge and federal environmental assessment adequate and positive, either implicitly or explicitly?
Does the paper indicate that the relationship between Indigenous knowledge and federal environmental assessment in Canada is in some way flawed or inadequate, either implicitly or explicitly?
Does the author explicitly indicate obstacles that prevent a positive and effective relationship between Indigenous knowledge and federal environmental assessment in Canada? If so, what are these obstacles?
Does the paper identify ways forward in repairing or improving the relationship between Indigenous knowledge and federal environmental assessment either explicitly or implicitly? If so, what are these suggestions?

Table 2.2. Key questions utilized in qualitative analysis process and code book.

Papers we analysed spanned a range of geographical locations and project types. While some papers broadly analysed the federal EA process across geographies, several examined case studies. Papers included in the review covered federal EA study cases across Canada; five papers (26%) commented on projects undertaken in the Northwest Territories, two (11%) occurred in Saskatchewan, three (16%)

discussed processes that occurred in Ontario, three (16%) papers focused on processes in British Columbia, one (5%) in Alberta, and five (26%) were not geographically specified beyond Canada. All qualitative analyses were performed through NVivo-QSR software (NVivo qualitative data analysis Software 2012). One person (LEE) read selected papers, coded answers to questions established prior to reading the papers (Appendix A), and identified emergent themes. We conducted an iterative coding process; novel themes were coded into broad categories, and then further into sub-categories. As new categories and sub-categories emerged, all papers underwent a second round of analyses.

Relating themes to the impact assessment act

We used the identified obstacles from our literature review as criteria to assess the Impact Assessment Act. We coded all identified obstacles from the literature search (Appendix A: Question B1), and then sub-coded obstacles into finer categories (Historical Obstacles, Procedural Obstacles, Legal Obstacles, Epistemological Obstacles, Political Obstacles, and Resource Limitations), and finally into obstacle components (e.g., Unresolved Treaty and Title Rights, Historical Colonization, Financial Limitations, etc.). Then, we qualitatively analysed the Impact Assessment Act using key search terms and with identified obstacles in mind (see Appendix A). While analyzing the Act, we focused on the Act's language relating to addressing these obstacles within the broader context of the legislation itself. Similar to our literature analysis, we used a code book to guide, inform, and appropriately constrain our analysis of the Act and our interpretation (Appendix A). This code book used the key search terms we relied upon in our literature review (excluding "Canada" and "Environmental Assessment"), as well as new search terms (See Appendix A for additional information).

Finally, we evaluated whether identified obstacles were surmountable or addressed by the Impact Assessment Act based on this guided qualitative review and information that emerged in the literature review. In this context, we defined surmountable as reasonably able to be overcome within the confines of current Canadian federal governance norms. We defined addressed as a directed, actionable written statement acknowledging an obstacle to engaging IK in the EA process, which will likely contribute to that obstacle's remediation. Using these definitions and the text of the Impact Assessment Act, we evaluated whether the Act identified or addressed obstacles (see Appendix A for more details and methodological examples). To identify whether or not obstacles were surmountable, we consider how embedded they were within systems typically resistant to change (e.g., colonial systems, worldviews, etc.).

Personal experience

We complemented the literature search with authors' personal experiences, especially in our interpretation of analysis in the Discussion and Conclusion. Our team's experiences with federal EA processes were diverse and contributed to understanding the potential practical applications of recently passed EA legislation, given that analyzing a recently passed Impact Assessment Act (rather than an established Act) generates limitations in understanding how the proposed Act will be applied. Two authors (LEE, NCB) are engaged as ethnoecological researchers hired to investigate environmental and cultural impacts after an industrial contamination in Indigenous territory. One author (NXC) has testified in the context of federal EA hearings representing the Tsawout Nation's concerns and positions on proposed industrial projects, in recognition of shared Tsawout responsibility to manage their traditional territories. One author (CTD) has been engaged in a federal EA process as an official Intervenor. One author (AJ, a lawyer) has represented Indigenous clients in federal EAs, served on a multi-interest advisory committee appointed by the government to advise on the Impact Assessment Act, and has appeared before the House of Commons and Senate committees reviewing the bill.

Here we also address our positionality as authors. We recognize the inherent biases and limitations that influence our analyses and results. We attempt to reflect critically on our positionality as scholars, practitioners, and non-Indigenous and Indigenous authors. The Euro-Canadian scholars among us recognize that, as individuals who have benefitted directly and indirectly from forces of colonization and who are embedded within the cultural milieu of western society, there are aspects of IK and culture that we will never comprehend. The same limitation may be applicable to many of the authors whose publications were reviewed in this paper, most of whom were non-Indigenous.

Results and discussion

Literature review

Nineteen papers (Appendix A) matched our search criteria for review. None identified the relationship between IK and Canadian federal EA as adequate and positive. All papers explicitly identified obstacles in engaging IK in Canadian federal EAs, and nearly 90% (16 papers) suggested ways, either explicitly or implicitly, by which these obstacles could be confronted.

Obstacles identified

We identified six categories of obstacles to engaging or incorporating IK appropriately in Canadian federal EA. We divided each obstacle into three components (Figure 2.1).

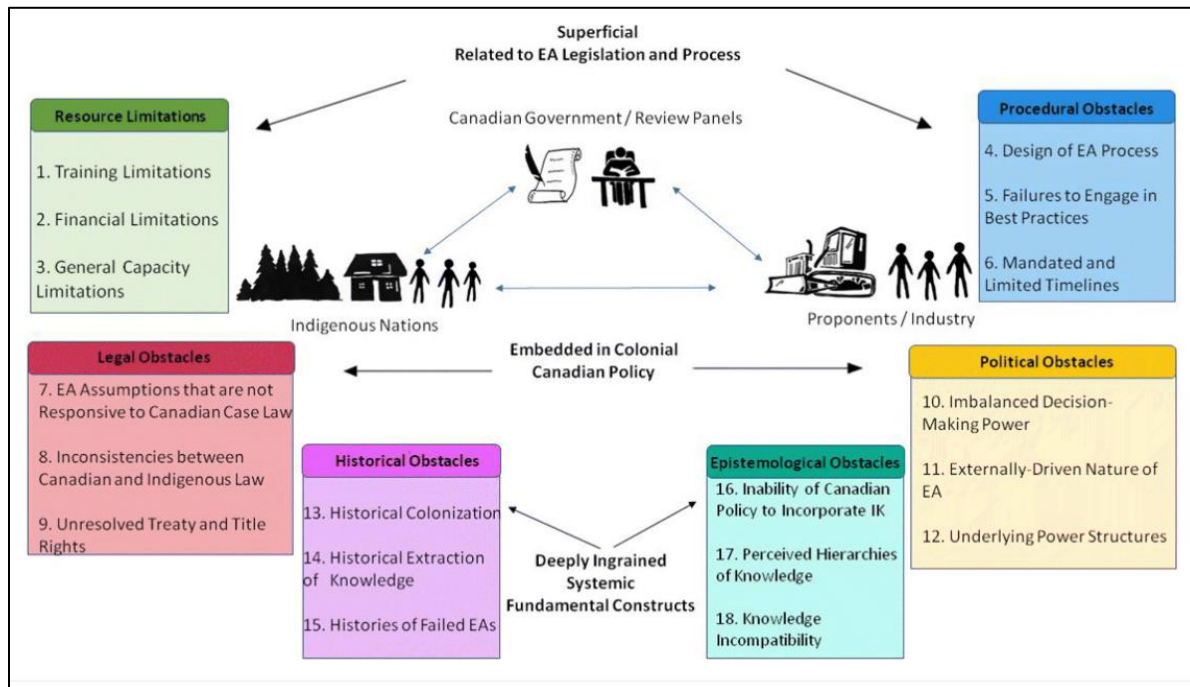


Figure 2.1. Obstacles and their components positioned within the context of parties involved in a typical federal environmental assessment process.

Historical obstacles

Fifteen papers cited historical obstacles as barriers to including IK meaningfully into the federal EA process (Appendix A). Eleven papers (58%) acknowledged historical colonization of Indigenous peoples (Figure 2.1) and associated harms by the Canadian government. Baker and Westman (2018), for example, posited that the Chipewyan Lake EA health survey failed to capture the potential impacts of a proposed mining operation for Bigstone Cree Nation members living in the community of Chipewyan Lake, and appropriately engage their knowledge, "...because they [Indigenous peoples] did not trust the researchers (potential government co-conspirators) and feared loss of hunting and harvesting rights, considering the past and current government activities in limiting rights and movements of Aboriginal peoples in Canada" (Baker and Westman 2018, p. 148).

The historical and continuing impacts of colonization in Canada are increasingly discussed beyond the context of federal EA and have serious implications for the use of IK in the context of assessments. The significant and continuing impacts of colonization are well-documented (Enviroics Research Group

2008). Engaging in reparative, reconciliatory nation-to-nation relationships with Indigenous peoples is a voiced and oft emphasized goal of the modern Canadian federal government (e.g., Canada's Truth and Reconciliation Commission (Environics Research Group 2008)). Despite the Canadian government's attention to reconciliation, many considered that Canadian EA policy fails to recognize the historical and ongoing impacts of colonization explicitly or meaningfully (e.g., Usher 2000; Paci et al. 2002; Ellis 2005).

Eight papers (42%) cited the historical extraction of IK (Figure 2.1) by state governments or scientific researchers for its role in Indigenous hesitation to offer their knowledge in the context of EA processes. Supporting this concern, Usher (2000) noted, "[t]here is a risk that any knowledge, taken out of the context in which it was generated, can be misinterpreted or even deliberately misused" (Usher 2000, p. 192). Several other authors and practitioners recognized that "there is resistance by indigenous people to [IK's] integration, seen by some as continued colonization and exploitation" (Paci et al. 2002, p. 117). The risk of extraction of knowledge is recognized as a barrier across research and practice that spans IK and western science. Indeed, such hesitation on the part of Indigenous peoples to engage in externally led scientific research is echoed across the practitioner (Booth and Skelton 2011a) and Indigenous experience (Nadasdy 1999; Menzies and Butler 2007) and beyond the peer-reviewed literature analysed in this paper. The exercise of "integrating" IK is seen by some as a form of neo-colonization, which assumes that the complexities of IK construe simply a new source of "data" to be subsumed within the cultural assumptions of westernism and science and the management structures that support these systems (Nadasdy 1999). Under this framework, knowledge is extracted from its cultural and spiritual context, and knowledge holders are expected to conform to the institutional, cultural, and political norms of the western world. Once knowledge is extracted, the power to control said knowledge is removed from the knowledge holder and nation (Nadasdy 1999; Paci et al. 2002; Ellis 2005; Butler and Menzies 2007; O'Faircheallaigh 2007). Many examples of this extraction of knowledge exist (e.g., Nadasdy 1999; Agrawal 2002; Berkes 2012), and no legislated safeguards assure participants that knowledge contributed to the EA process will not be de-contextualized or misused in the hands of western scientists or decision-makers.

Eight papers (42%) noted that histories of failed EAs (Figure 2.1) continue to prevent Indigenous involvement and willingness to share knowledge in the EA process. These EA process failures most often take the form of inadequacy of decision-making structures to respond to Indigenous concerns. These process failures may culminate in several ways: Indigenous resistance to engage (Udofia et al. 2017), participant exhaustion (Baker and Westman 2018), perceptions of wasted resources and time by

Indigenous Nations, and the perpetuation of poor relationships between governments and proponents (Booth and Skelton 2011b; Baker and Westman 2018). Baker and Westman (2018) studied the exhaustion and disappointment perpetuated by historical impacts of EAs that have failed to engage IK, stating:

“The cumulative effect of this disappointment (with consultations and impact assessment) is a psychological and spiritual fatigue... They [Indigenous participants] are tired of expressing the same concerns and telling the same stories, which seem to have no effect on the course of development...” (Baker and Westman 2018, p. 145).

Together, these identified historical obstacles are inherently interrelated, and deeply ingrained in Euro-Canadian cultural and political systems (Figure 2.1). These historical barriers inform behavior, attitude, and practice of Indigenous and Canadian governments as well as project proponents, informing worldviews, and bureaucratic processes explicitly and implicitly. We consider this obstacle as profoundly embedded within the experiences of the federal Canadian government, EA practitioners, and First Nations (Figure 2.1), recognizing that historical obstacles allow for and are inherently interrelated with more superficial, though still problematic, obstacles identified below.

Epistemological obstacles

Eighteen papers (Appendix A) cited epistemological obstacles to appropriately engaging IK in the EA process. Sixteen (~85%) identified existing EA framework deficiencies (i.e., the inability of Canadian policy to incorporate IK; Figure 2.1) as preventing a positive and collaborative relationship between IK and Canadian EA. Poorly understood or defined nature of IK in EA processes comprises a frequently cited deficiency in legislation framework. Stevenson (1996) emphasized this obstacle:

“...the role of traditional knowledge in [Environmental Impact Assessment] EIA in the North is often not adequately understood or appreciated by government and industry, partly because this requirement is relatively new, and few examples exist to serve as models... Thus, there appears to be a general misunderstanding of what traditional [Indigenous] knowledge is, how it is constructed and what role it has in EIA” (Stevenson 1996, p. 279).

Whereas nonexistent or inadequate definitions of IK are an oft-cited EA framework deficiency, a variety of additional framework challenges arose in our literature review. Beyond failures to define IK explicitly or accurately (a common challenge at the intersection of IK and ecological research; Nadasdy 1999; Agrawal 2002; Berkes 2012), authors also recognized overwhelmingly that past and modern EA

legislation is simply neither constructed to allow equitable, respectful, and appropriate knowledge sharing (Paci et al. 2002; Roue and Nakashima 2002; McCreary and Milligan 2013; Vanclieaf 2014; Hoogeveen 2016; Sandlos and Keeling 2016), nor have past EA Acts explicitly required the incorporation of IK into EAs. These failures are arguably rooted in the colonial nature of Canadian legislation itself and the implicit values that reflect cultural assumptions and uphold the asymmetrical prominence of scientific knowledge and project approval (Paci et al. 2002; Ellis 2005; Butler and Menzies 2007; Berkes 2012).

Thirteen papers (~70%) acknowledged perceived hierarchies of knowledge (Figure 2.1)—namely, the problematic perception that scientific knowledge is superior to IK, as a barrier to engaging IK in federal EAs equitably. Scholars acknowledged that implicit assumptions throughout the EA process, and in other processes and sciences in which IK is invoked, can unintentionally position IK as the supplementary “handmaiden” of science (Stevenson 1996). Similarly, EA processes value IK only after its problematic “scientization” (Ellis 2005, p. 72) into a form palatable to western managers, scientists, and policy-makers (Roue and Nakashima 2002; Ellis 2005; O’Faircheallaigh 2007; Sandlos and Keeling 2016). Despite growing recognition that Indigenous and local knowledge have functioned as independent approaches in environmental management for millennia (Turner et al. 2000; Trospen 2003; Houde 2007; Berkes 2012; Housty et al. 2014) and increasing scrutiny of the dominance of western scientific knowledge (Latour 1998, 1999; Menzies and Butler 2007) this perception of knowledge hierarchy limits the efficacy of the application of IK to federal policy processes.

Fifteen papers (~80%) cited fundamental knowledge incompatibilities (Figure 2.1) as a core component of this obstacle. Hoogeveen (2016) discussed these epistemological clashes as they relate to impacts on culturally important fish species defended by the Tsilhqot’in Nation during the Prosperity Mine proposal and following federal EA:

“The distance between Indigenous epistemologies of fish and the quantification of trout matters here greatly. For the Tsilhqot’in... fish represent much more than ‘a limbless cold-blooded vertebrate animal with gills and fins living wholly in water’ as defined by the Oxford English Dictionary... It would seem this definition, however, fits within the biological renderings supposed in mining feasibility studies” (Hoogeveen 2016, p. 363).

This excerpt represents a frequently arising problem in federal EAs; values that inform Indigenous and western knowledge systems are oftentimes at odds with each other (Houde 2007; Berkes 2012). In seeking the inclusion of IK in a Canadian bureaucratic and political process, proponents and practitioners

seek to represent the complexities of IK in quantitative, economic, and often incompatible western terms (Baker and Westman 2018). This fundamental disconnect, shaped by divergent worldviews and cultures in which western and IK systems are embedded, comprises a fundamental hurdle in the exercise of invoking IK in federal EAs (Tsuji et al. 2011; Vanclieaf 2014; Hoogeveen 2016; Sandlos and Keeling 2016).

Epistemological obstacles were the most frequently cited throughout our literature review. We perceived these barriers as deeply embedded within the assumptions and values that constitute Indigenous and Canadian worldviews, cultures, and inform governance, thus positioned similarly to historical obstacles. Therefore, epistemological obstacles comprise a platform on which forthcoming obstacles emerge and are interwoven throughout identified obstacles and components.

Legal obstacles

Seven papers (Appendix A) cited legal obstacles as obstructions to engaging IK appropriately in Canadian federal EA processes. Five (~25%) cited EA policy assumptions that have not responded to modern and unfolding Canadian case law decisions (Figure 2.1) as problematic when attempting to engage IK in EAs. Paci et al. (2002) reflected that the “current federal legislation [CEAA 1995] ignores the federal fiduciary responsibilities to Aboriginal people and hampers community-based planning efforts” (Paci et al. 2002, p. 120).

Disconnects between Canadian legal precedents and policy are evident throughout scholarly examination of relationships between IK and EA. Indeed, modern Canadian case law reflects a growing recognition of the treaty and unceded title rights of Indigenous Nations (e.g., *Delgamuukw v British Columbia* 1997; *Gladstone v. Attorney General of Canada* 2005; *Tsleil-Waututh Nation et al. v. Attorney General of Canada et al.* 2018). However, these judicial decisions and legal realities are at odds with legislation and top-down decision-making powers exercised in historical, modern, and newly passed federal EA. Crawford (2018) contended that Canada’s former and new EA policies categorically fail to fulfill Canada’s Crown duty to consult with Indigenous Nations during these processes.

Three papers (~15%) identified inconsistencies between Canadian and Indigenous law (Figure 2.1) as a hurdle in interweaving IK with the federal EA process. These papers asserted that living and historical Indigenous legal systems are neither considered in, nor are congruent with, western laws as applied through the federal EA process (O’Faircheallaigh 2007; Booth and Skelton 2011b; McCreary and

Milligan 2013). While Indigenous rights and title are constitutionally recognized in Canada, Indigenous legal systems are not currently recognized explicitly under Section 35 of the Canadian Constitution Act (Canadian Charter of Rights and Freedoms 1982). Although their application may not extend widely in the eyes of the Crown, these laws hold great impact and authority for the Indigenous Nations and peoples that created and enforce them (Borrows 2005). Modern Canadian EA laws and policies do not recognize, and often result in decisions that are contradictory to, local legal systems (McCreary and Milligan 2013).

Finally, five papers (~25%) acknowledged that unresolved legal treaty and title rights of many Indigenous Nations within the country currently known as Canada (Figure 2.1) hamper the use of IK in the context of EAs. These authors noted that, while Indigenous Nations frequently make their interpretation of unresolved title or treaty rights clear, the federal EA process fails repeatedly to do so explicitly (Booth and Skelton 2011b). This failure, combined with the unsettled answer of legal land rights in locations where developments are proposed, is recognized as a core obstacle preventing the meaningful incorporation of IK in EA processes (Wiles et al. 1999; O’Faircheallaigh 2007; Booth and Skelton 2011b; Udofia et al. 2017). A pervasive challenge for Indigenous participants in EA processes is that Canadian EA as legislated does not provide the appropriate process to settle these lingering, unresolved, and consequential legal queries (Wiles et al. 1999).

The legal obstacles synthesized in this review are related to, and impact, Canadian policy and legislation far beyond the federal EA process and its relationship to IK and knowledge-holders (Figure 2.1). Nonetheless, these legal inconsistencies and barriers directly affect individual EA processes, despite being embedded in a larger construct of Canadian political assumptions.

Political obstacles

Thirteen papers (Appendix A) identified political obstacles towards meaningfully engaging IK in the federal EA process. Eight (42%) identified imbalances in decision-making powers (Figure 2.1) as substantially hindering a positive relationship between IK and EA. Current top-down federal EA processes may engage IK in the process of assessment but do not place Indigenous Nations or Knowledge Holders in a position to mobilize their expertise towards impacting decision-making (Sallenave 1994; Stevenson 1996; O’Faircheallaigh 2007; Kirchhoff et al. 2013), let alone recognize Indigenous decision-making authority under their own laws and United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Scholars asserted that this barrier is consequential, and inherently challenging to surmount:

“The ...perhaps most overwhelming barrier to the inclusion of traditional knowledge is the political obstacle. The decision-making process for EIAs would have to be altered significantly to accommodate the use of [traditional ecological knowledge] TEK and such alteration may not be politically palatable to policy makers” (Sallenave 1994, p. 6).

Nine papers (47%) suggested that the externally driven nature of the EA process (Figure 2.1), with its focus on project approval, forms a barrier to appropriately engaging IK in EAs. Baker and Westman (2018) recognized that the approval-focused nature of the current federal EA process often obfuscates important information and diminishes opportunities for authentic consultation, leading to the exclusion of important information regarding public safety and environmental impacts in exchange for reassurances about the project’s safety and legitimacy (Baker and Westman 2018, p. 247).

The suggested approval-oriented nature of the process is supported outside of the peer-reviewed literature. Compelling evidence to support the approval-oriented function of modern Canadian federal EA processes exists in contemporary responses to the Impact Assessment Act, condemned by some due to its “...potential effect on our [Canada’s] ability to harness our natural resources and potential negative affect on our economy [and creation of] enormous uncertainty, more red tape and increased court challenges” (Findlay 2018). The assumption underlying this public pushback to EA reform may be embedded in an understanding that EA in Canada should primarily serve to increase efficiency of bureaucratic processes (e.g., Udofia et al. 2017) and decrease hurdles in the way of industrial project approvals.

Ten papers (~50%) identified underlying political power structures (Figure 2.1) (e.g., suppression of IK in policy-making, socioeconomic structures, colonial practices in current Canadian political systems, etc.) as barriers between IK and the EA process. Ellis (2005) identified this “underlying political reason” as a core cause of failure for strategies to incorporate IK in federal in EA in the Northwest Territories (Ellis 2005). He reflected that overcoming this barrier challenges systemically embedded power structures: “Simply stated, advocacy of traditional knowledge threatens the stability of conventional power structures rooted in the Western industrial complex. The driving force behind this complex is growth and, consequently, industrial development... To empower traditional knowledge and its aboriginal holders on their own terms necessarily means to give voice to a system of understanding that may oppose the objectives and practices of Euro-Canadian institutions...” (Ellis 2005, p. 74).

These elicited power structures play a foundational role in relating IK and EA. Underlying political power structures, embedded in federal decision-making and EA processes, are evidently at odds with government mandates to engage in reconciliatory ways with Indigenous Nations and with an improved relationship between IK and EA (Sallenave 1994; Paci et al. 2002; Ellis 2005; Vanclieaf 2014). As Ellis (2005) contended, overcoming this obstacle would require a fundamental shift in sociopolitical systems towards power sharing.

The political barriers we synthesize are influenced by historical and epistemological barriers and in turn influence other identified obstacles (Figure 2.1). Authors suggested that overcoming these barriers will challenge the status quo of Euro-Canadian governance systems and the western cultural assumptions that inform them (Paci et al. 2002; Ellis 2005; Vanclieaf 2014), making political obstacles inherently challenging to surmount.

Procedural obstacles

Fifteen papers (Appendix A) acknowledged procedural obstacles at the interface of IK and federal EA in Canada. Twelve (~66%) identified the fundamental design of the EA process (Figure 2.1) (based on colonial and neoliberal presumptions) as poorly modeled to understand or incorporate IK in decision-making adequately. Indeed, EA procedure in Canada has evolved to match the colonial and capitalistic values that underlie Canadian federal policy. These values are frequently at odds with IK and the practical processes its appropriate inclusion in EA would require (O’Faircheallaigh 2007; Kirchhoff et al. 2013; Udofia et al. 2015; Sandlos and Keeling 2016). Udofia et al. (2015) examined how the demand for increased efficiency in the Canadian EA process prevented meaningful engagement and the associated inclusion of IK and Indigenous Nations:

“A... challenge to ensuring effective engagement in EA concerns recent streamlining efforts to achieve greater efficiencies. The main efficiency concerns in any EA process are the time and cost involved ... Industry proponents are expressing concerns about needless delays, often caused by consultation requirements, echoing the need to ensure efficiency in EA processes ...” (Udofia et al. 2015, p. 103).

Twelve papers (~66%) cited a lack of articulated or implemented best practices (Figure 2.1) that restrict the relationship between IK and EA. Some of these failures in best practices included failures: by proponents to engage in early consultations with Indigenous Nations (e.g., Udofia et al. 2015), to address

language barriers (e.g., Baker and Westman 2018), to include socio-cultural or historical concerns in EA processes (e.g., Udofia et al. 2015), to consider scoping practices that include all relevant Nations in assessments (e.g., Tsuji et al. 2011), to appropriately or adequately define IK (e.g., Stevenson 1996), to engage appropriate experts (e.g., Gardner et al. 2015), and to give enough notification of hearings or consultations to involved Nations (e.g., Gardner et al. 2015).

While best practice failures were diverse and frequently cited by scholars, they represent obstacles that could likely be overcome via additional legislated requirements within Euro-Canadian systems. However, without explicit requirements for these practices, proponents and government authorities often establish research and assessment agendas without best practices in mind, missing opportunities to engage IK and improve relationships with involved Indigenous Nations (Sallenave 1994; Wiles et al. 1999; O’Faircheallaigh 2007; Tsuji et al. 2011; Gardner et al. 2015; Sandlos and Keeling 2016).

Seven papers (~37%) cited limited and mandated timelines (Figure 2.1) as a core procedural obstacle in relating IK and EA appropriately. Scholars contended that limitations on EA process timelines (e.g., 365 days for the Canadian Environmental Assessment Act 2012) made it difficult for Indigenous Nations to participate fully, and share their knowledge, in federal EAs. Resource limitations, logistical challenges for remote or isolated Nations, relationship building, and conflicts with timelines of Indigenous decision-making protocols require extensive, flexible, and perhaps even case-by-case timelines (O’Faircheallaigh 2007; Udofia et al. 2017). However, tailoring timelines to match Indigenous needs is at odds with persistent demands from industry proponents and government officials to streamline EA processes and avoid delays they may consider “needless” (O’Faircheallaigh 2007; Kirchhoff et al. 2013; Udofia et al. 2017).

The procedural obstacles we synthesized and described emerge as superficial barriers to improving the relationship between IK and EA (Figure 2.1). We identify these obstacles as superficial because they are directly related to the EA process and legislation itself, and while inherently intertwined with more fundamental obstacles (e.g., historical and epistemological obstacles), there is a greater opportunity to overcome them through law and policy changes. We note, however, that despite their superficial nature, their impacts throughout the EA process can be nonetheless profound.

Resource limitations

Twelve papers (Appendix A) cited resource limitations (Figure 2.1) as perpetuating obstacles between IK and EA. Five (26%) recognized training limitations (e.g., lack of technical training available to Indigenous participants, lack of cultural training or formal training to understand IK for technical practitioners, etc.) as barriers to improved relationships (Stevenson 1996; Booth and Skelton 2011b; Vanclieaf 2014; Gardner et al. 2015; Udofia et al. 2015). While mandated training opportunities could assist in overcoming these cross-cultural barriers, they are not legislated in modern EA processes. Booth and Skelton (2011b) reflected on the impacts of this limitation:

“...[O]ne key complaint that we heard from industry participants, and some government officials, was that they themselves lacked an understanding about what would work to facilitate First Nations’ engagement during an EA.

If we knew what it was we were aiming at. Then we would do our darndest to meet it... but if the standard, the scale and the expectations are not thoroughly defined up front; are subject to interpretation and criticism, before, during and after, the lack of certainty makes things very, very difficult. (Industry Proponent 1)” (Booth and Skelton 2011b, p. 50).

Eleven papers (~60%) cited financial limitations (Figure 2.1) as a key obstacle to improving relationships between IK and EA. Engaging in federal EA processes, and sharing knowledge in these contexts, requires substantial financial resources. Nations must often hire experts and lawyers to carry out studies, fund travel to facilitate expert and leadership involvement in EA hearings, pay for internal technical training, and fund monitoring projects after industrial proposals are approved (Sallenave 1994; O’Faircheallaigh 2007; Booth and Skelton 2011b; Kirchhoff et al. 2013; Vanclieaf 2014; Udofia et al. 2015). Without adequate funds to support these costs, meaningful inclusion of IK in EAs is difficult. Where funding does exist, its distribution on an ad hoc basis limits the efficacy of research or locally specific studies; such studies are often responsive to industrial proposals, and funding is not available to engage in long-term baseline, cumulative effects or monitoring programs.

Finally, six papers (~33%) noted that general capacity limitations (Figure 2.1) (e.g., lack of available staff, community capacity, technical expertise, or understanding of IK, etc.) prevented a meaningful role for IK in federal EAs (Kirchhoff et al. 2013; Udofia et al. 2015, 2017). These procedural barriers affect the ability of Nations to engage their knowledge meaningfully, or at all, in federal EA processes (O’Faircheallaigh 2007; Booth and Skelton 2011b; Udofia et al. 2017).

We interpret resource limitation obstacles as superficial barriers in the context of federal EA (Figure 2.1). While these barriers are intertwined with others, we suggest that they could be overcome by provisions that account for them in EA legislation. Scholars contended that abating resource limitations for Indigenous Nations and practitioners may also assist in improving nation-to-nation relationships, and strengthening data collection and monitoring surrounding industrial proposals (O’Faircheallaigh 2007; Udofia et al. 2015).

Emergent suggestions towards improvement

Higher-order themes emerged across papers to move beyond identified obstacles, preventing an appropriate relationship between IK and federal EA (Appendix A). Suggestions towards improving this relationship did not necessarily correspond with identified obstacle categories or components, although some consistencies did emerge.

Epistemological changes

Nine papers identified a need for political and cultural shifts in epistemological understanding as foundational to improving relationships between IK and Canadian EA. Namely, scholars contended that incorporating IK equitably into federal EA processes will require reflection on the assumptions inherent to western science and value systems, and more equitable means towards approaching different knowledge types. Paci et al. (2002), for example, suggested, “[i]t is important to recognize the Western constructs utilized as value free in managing natural resources. TEK requires changing the way things are done, envisioning knowledge as a quilt made up of many smaller cognitive maps, possibly representing more closely ecosystems thinking” (Paci et al. 2002, p. 119).

We interpret this suggestion as inherently challenging to enact, given the resistance of bureaucratic systems to change (Rickson et al. 1990), particularly change that requires large-scale value shifts (Kluckhohn and Strodtbeck 1961). However, many authors (e.g., Stevenson 1996; Paci et al. 2002; Roue and Nakashima 2002; Sandlos and Keeling 2016) framed this suggestion as fundamental to discussions surrounding the inclusion of IK in EA. Without extensive consideration of the assumptions, cultural biases, and power structures that shape western EA—and an increased acceptance of the essential ways in which IK and associated worldviews differ—western EA practices and IK cannot be appropriately or equitably intertwined.

Power shifts

Eight papers explicitly called for fundamental power shifts to overcome obstacles towards an improved relationship between IK and EA. These power shifts included “[p]utting more control in the hands of communities, who would help direct the assessment and determine its findings...” (Baker and Westman 2018, p. 152), and there was a frequent assertion across papers that, to ameliorate current obstacles, Canadian EA “must confer on [I]ndigenous participants a real and substantial role in decision making, rather than merely affording them an advisory or titular role” (O’Faircheallaigh 2007, p. 325). Other authors cited a broad socio-political need for power shifts in political, social, economic, and institutional realms in Canada. This call for fundamental power shifts is well summarized by Ellis (2005):

“There must be a shift in the balance of power, a reformulation of the values, practices, and knowledge that underlie environmental decision-making processes. Power over land-based knowledge and the consequent power over land must be asserted by aboriginal peoples, taken out of the exclusive realm of science and Euro-Canadian institutions, and taken into a realm where traditional ways of knowing and doing share equal influence” (Ellis 2005, p. 75).

Similar to author suggestions for epistemological shifts, creating power shifts is difficult to enact because it challenges the assumed authority of the Canadian government. However, authors emphasized that, until real decision-making and political power is conferred upon Indigenous participants in EA, it is not feasible to harmonize the two knowledge types towards informed decision-making (Sallenave 1994; O’Faircheallaigh 2007; Booth and Skelton 2011b; Udofia et al. 2015).

Procedural changes

To overcome obstacles at the intersection of IK and EA, twelve papers (Appendix A) in our review suggested procedural changes to modern Canadian EA processes. Namely, these suggestions included, “...new institutions or bodies created by EAs [that] should have EIA follow-up and promotion of [I]ndigenous participation as explicit and central components of their mandates” (O’Faircheallaigh 2007, p. 322) as well as formalization of the consultation process (Baker and Westman 2018), the creation of professional designations and standards for researchers and industry engaging with IK and peoples during EA processes (Baker and Westman 2018), the creation of formal laws and regulations that govern the inclusion of IK (Vanclieaf 2014), and the formation of agreed-upon and inclusive definitions of IK (Stevenson 1996).

Suggestions for procedural changes emerge as practical and concrete responses to identified obstacles between interweaving IK and federal EA. These suggested changes (e.g., O’Faircheallaigh 2007; Tsuji et al. 2011; Kirchhoff et al. 2013; Baker and Westman 2018, etc.) present practical ways that EA (and the proposed new EA Act) could procedurally shift towards more equitable standards for incorporating IK.

Best practices defined

Finally, 14 papers (Appendix A) suggested the identification and formalization of best practices in the EA process as a means of better engaging IK in current EA policy frameworks. Suggestions for best practices included: early and formal consultation and engagement with involved Indigenous Nations (e.g., Booth and Skelton 2011b; Baker and Westman 2018); inclusion of socioeconomic, health, and cultural considerations and research in federal EAs (e.g., Sandlos and Keeling 2016); the creation and implementation of on-going monitoring programs after an EA has been approved (e.g., O’Faircheallaigh 2007); adherence of proponents and Canadian federal policy to UNDRIP (e.g., Baker and Westman 2018); and appropriate funding provisions for Indigenous engagement and knowledge engagement (e.g., Gardner et al. 2015) among others. Authors recognized that these best practices could improve the relationship between IK and EA within the confines of current top-down federal EA practices (Stevenson 1996; Ellis 2005; Whitelaw et al. 2009; Gardner et al. 2015) and could be implemented within Act language or requirements.

Assessing the newly passed impact assessment act

We used the obstacles we summarized as criteria to assess the Impact Assessment Act. We examined how and if the Act addresses the obstacles that authors asserted have plagued former versions of Canadian federal EA policy in its capacity to meaningfully engage IK. We also considered and described whether each identified obstacle is likely surmountable within current EA processes (Figure 2.2).

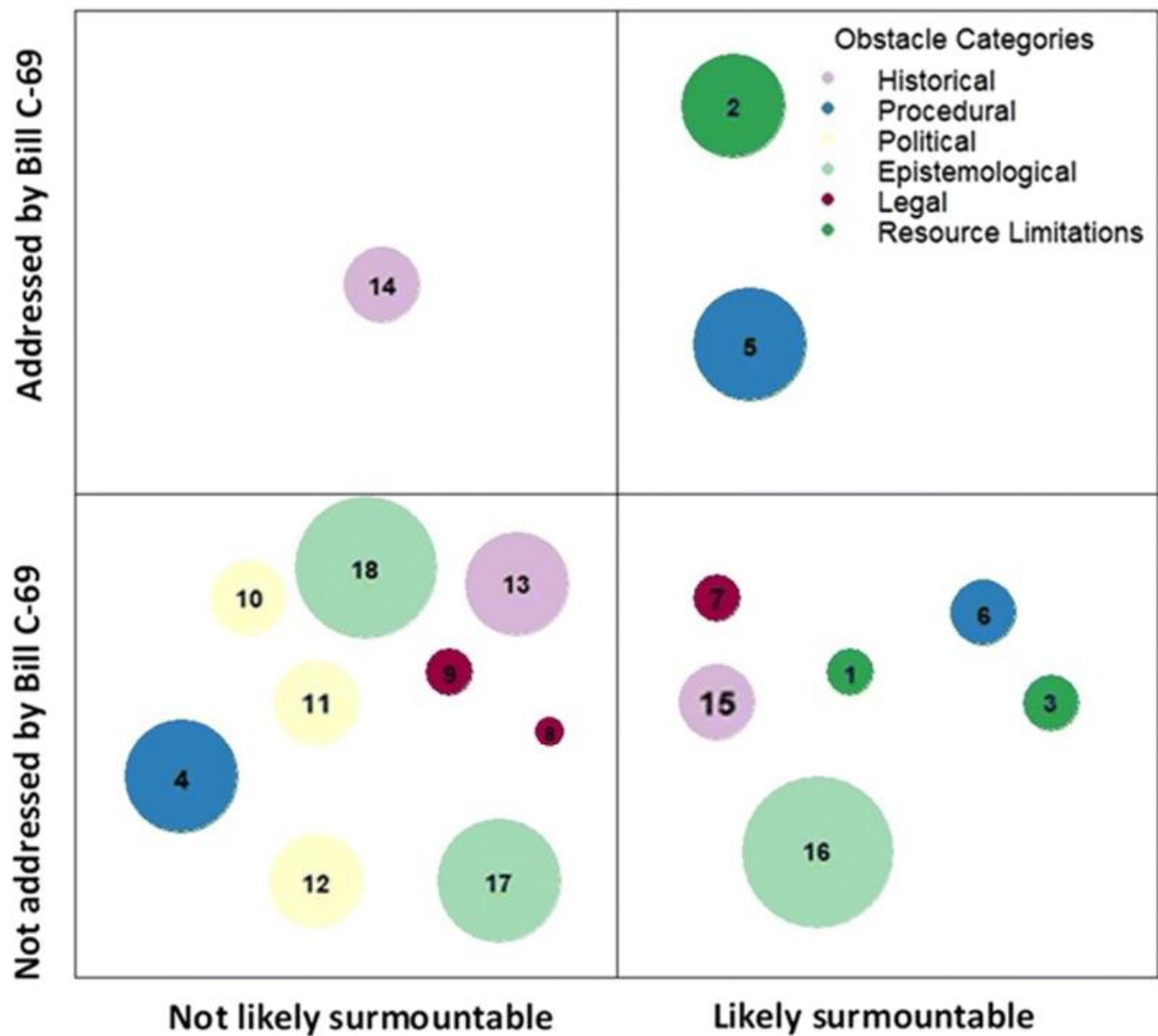


Figure 2.2. We examined whether obstacles preventing integration of Indigenous knowledge are likely surmountable (x-axis) and addressed by the Impact Assessment Act (y-axis). Numbers correspond to obstacle components (as labeled in Figure 1.1), colors represent obstacle category, and the size of each bubble corresponds to the number of reviewed papers that cited the obstacle component. The specific location of each circle within each quadrant, however, is arbitrary, and designed for optimal visualization.

Our results suggested that Impact Assessment Act responds to some of the identified obstacles in ways that improve upon past federal EA Acts, but it falls short of guaranteeing a measurable improvement. While the Act legislates some best practices (e.g., Impact Assessment Act 2018, s 64 (1)), provides financial opportunities for involved First Nations (e.g., Impact Assessment Act 2018, s.75 (1)), and aims to overcome historical impacts of wrongful extraction of IK (Impact Assessment Act, s.119) by legislating provisions respecting the confidentiality and use of IK, it either fails to address entirely, or

fails to ensure that EAs under the legislation are mandated to fully address, 15 of 18 obstacle components we identified in this literature review. Our criticisms of the Impact Assessment Act are also situated among other scholarly and public criticisms of the Act and preceding bill, including its failure to effectively legislate use of scientific knowledge as evidence (Westwood et al. 2019), the broad discretion it confers on decision-makers (Assembly of First Nations Quebec-Labrador 2019), and its incapacity to fulfill the Canadian Crown's duty to consult Indigenous Nations in the broader consultation process (Crawford 2018).

There are several key improvements in the Act that, while they do not adequately overcome obstacles defined, do acknowledge them. We recognize that the requirement to include and explain the use of IK in EA reports (Impact Assessment Act, s. 22) is a critically important step to ameliorating the current relationship between IK and EA (Impact Assessment Act, ss. 28(3.1), 33(2.1) and 51(1)(d)(ii.1)). The third-reading amendment that explicitly requires information on how IK has been collected and incorporated into decision-making and assessment reports, requested by Indigenous stakeholders, is critical to improving the interweaving of IK and federal EA. We interpret this requirement as an opportunity that will allow the exploration of what strategies work—and fail—in including IK in EA. Furthermore, the Act includes language that makes the integration of IK, upholding the rights of Indigenous peoples, and the implementation of the United Nations Declaration of the Rights of Indigenous Peoples explicit purposes (Impact Assessment Act, Part 1, Preamble). While this language does not overcome histories of colonization or underlying political powers by intention alone, it does signal intent to advance reconciliation.

Several limitations were inherent in our analyses, and in the categorizations described in Figure 2.2. First, the coarse categories we used (e.g., “Addressed”, “Not Addressed”, “Surmountable”, “Not Surmountable”) do not address the complexity and variation inherent in the surmountability of, or ability of the Impact Assessment Act to address in practice a given obstacle component. However, we believe that this coarse categorization is appropriate given the qualitative nature of our data and analyses. We were limited to legal and theoretical interpretation when seeking to understand if the Act addresses emergent obstacles, as materials that emerge to supplement the Act and on-the-ground interpretation of policies cannot be analysed at this time. Nonetheless, our shared and diverse perspective as scholars (LEE, CTD, NCB, CO, NC, FM), EA participants (NXC, CTD, FM), and legal experts (AJ) provide us insight to engage in this interpretation and emerge with new understanding of the Act's capacity to engage with IK and knowledge holders. Furthermore, while we cannot predict with any certainty how the Act will be implemented, our analysis of the legislative language does illuminate possible directions in

implementation, as well as the spirit of the Act—its intentions, constraints, and parameters in the context of historically pervasive obstacles.

Our results suggest that many obstacles are potentially surmountable within the constraints of top-down Canadian federal EA processes, yet are not addressed by the Impact Assessment Act (bottom right quadrant in Figure 2.2). Thus, one suggestion that emerged from our research is that policy-makers focus their energy and resources on these surmountable obstacles (e.g., framework deficiencies, resource limitations, congruency of Canadian law and EA policy, etc.) as steps towards aligning the Impact Assessment Act with improved capacity to engage IK.

Surmountable obstacles not addressed by the Act (e.g., mandated and limited timelines, training limitations, etc.) may yet to be overcome by regulations, policy guidance, and on-the-ground implementation of the Act. For example, our literature review revealed that a dearth of technical and cross-cultural training opportunities for Indigenous and non-Indigenous EA participants imposes a barrier to improving the relationship between IK and EA in Canada. Establishing regulations that require the Impact Assessment Agency of Canada to establish a training program, along with funding to support that training, would provide a means to overcome this barrier in future iterations of EA legislation in Canada. Longer-term capacity funding for Indigenous groups could assist Nations in proactive engagement in federal decision-making. The Information and Management of Time Regulations could be amended to allow for timelines to be suspended when requested by an Indigenous authority or rights-holder, when required to gather or consider IK, and for meaningful consultation and Crown-Indigenous cooperation. Similarly, the Information and Management of Time Regulations should be amended to provide principles and requirements respecting the weaving of IK and western science, to prevent any “knowledge hierarchy” from prevailing in EAs under the new legislation.

While we encourage re-evaluation of Canada’s federal EA legislation in the context of identified obstacles, we recognize that many are not easily surmountable via modifications to modern Canadian EA legislation. Indeed, our results show that most obstacles identified in this review are neither addressed by the Act, nor likely readily surmountable within the context of top-down Euro-Canadian political systems (Figure 2.2). The embedded, fundamental nature of many obstacles (e.g., histories of colonization, underlying political power structures) and their inherent inflexibility to change, casts doubt on whether Canadian federal EA can ever appropriately and equitably engage IK while informed solely by western cultural assumptions and values, or when the decision-making power conferred upon Indigenous Nations

is left to the discretion of the Minister. Simply stated, our results suggest that top-down colonial EA processes, as currently envisioned and enacted, are inherently at odds with equitable knowledge sharing.

Conclusion

Our research draws upon scholarly interpretation of the relationship between IK and federal EA in Canada over the last three decades to understand obstacles and ways forward at the interface of these two systems. Moreover, we examined whether the Canadian government's Impact Assessment Act addresses these obstacles. Our results suggest that, while the Impact Assessment Act makes some measurable improvements to appropriately engaging IK in EA processes, it ultimately fails to wholly ensure that most obstacles identified in our literature review will be addressed—namely by leaving actions that may address them to the discretion of the Minister, rather than legislating an outright solution. While some of these obstacles may yet be overcome with future revisions to Canada's federal EA legislation, through the development of its regulatory and policy framework or in implementation with the assistance of the Indigenous Advisory Committee provided for under the Impact Assessment Act (s 158), overcoming most of them would require actions and changes that are likely inherently at odds with existing Euro-Canadian policy and legal systems and the power imbalance that supports them.

Our results are nested within expert and practitioner dialogue that considers relationships between Canadian EA and Indigenous peoples. Despite the practically defined and narrow scope of our search criteria, the obstacles and suggestions that emerged from our review align well with the publications and recommendations of Indigenous peoples and expert panels involved in Canadian EA review. These review processes described similar barriers to engaging IK and peoples in the EA process (e.g., failures to recognize Indigenous rights or legal traditions, mischaracterization and misuse of IK, Indigenous hesitancy to engage in EA processes due to framework deficiencies and histories of colonization, capacity limitations, etc.) (Canadian Environmental Assessment Agency 2017). Recommendations from these panels were similar to the suggestions that emerged from our literature review and called for: Indigenous power in the decision-making process, explicit recognition of land and treaty rights, legally binding adherence to UNDRIP, increased funding programs and opportunities, oversight of IK by Indigenous peoples, and recognition of fundamental differences in western and IK, culture, and worldview (Canadian Environmental Assessment Agency 2017). While the Impact Assessment Act does provide provisions for the protection of IK, and owing to amendments made by the House of Commons does invoke UNDRIP, many of the panels' additional recommendations remain unaddressed.

That the new Canadian EA legislation fails to adequately address obstacles that emerge from both expert panel reports and decades of relevant scholarly literature is problematic for Indigenous Nations and the efficacy of the EA process itself. Around the world and across landscapes in the region now known as Canada, complex values, worldviews, cultures, and knowledge systems inform diverse societal approaches to environmental decision-making. In this review, we examined Canada as a case study towards better understanding the relationship between IK and western EA processes. Despite substantive scholarly discussion surrounding the relationship between IK and peoples and modern Euro-Canadian EA processes, even the most contemporary federal EA framework in Canada ultimately fails to ensure the engagement of the critically important knowledge of Indigenous peoples in environmental decision-making. Furthermore, while we identify that Impact Assessment Act fails to substantially improve the relationship between IK and EA, it has faced severe and continuing backlash (e.g., Findlay 2018; Elliott 2019; Friedman 2019; JWN Staff 2019) from industry proponents and many non-Indigenous Canadians for the few improvements it does make. Canadian EA thus misses opportunities to inform environmental decisions with the best available knowledge and to support Indigenous rights, sovereignty, and well-being. This failure is supported by a fundamental assumption of Canadian federal power, authority, and ownership of land that is increasingly challenged in modern legal landscapes. Given Canada's mandate to engage in reparation and reconciliation with Indigenous peoples, unresolved nation-to-nation conflicts, and the reality that Canadian social, economic, and environmental well-being are dependent upon well-informed, inclusive, and sustainable environmental decision-making practices, harmonizing IK and Canadian federal environmental decision-making remains singularly important.

The Canadian government has opportunities to fulfill their reconciliation agenda while likewise upholding well-informed, regionally specific, comprehensive EAs. Given that many identified fundamental obstacles are unlikely to be surmountable without direct inclusion of Indigenous peoples in EA decision-making processes, we suggest widespread recognition of Indigenous-led EA (e.g., Bruce and Hume 2015; O'Faircheallaigh 2017; Gibson et al. 2018) as a way forward, alongside cooperative assessments designed by Crown and Indigenous authorities. Indigenous-led EA, which is fortified by millennia of experience in natural resource management and environmental decision-making practices (Turner et al. 2000; Trospen 2003; Butler and Menzies 2007; Berkes 2012; Housty et al. 2014; O'Faircheallaigh 2017), is on-going in Canada and represents a reassertion of Indigenous management rights that may respond comprehensively to legal, historical, epistemological, and political obstacles. This process, developed specifically by and for Indigenous Nations, has the potential to improve relationships between governments, project proponents, and practitioners while upholding human rights (Paci et al. 2002). The Impact Assessment Act does legally allow for Indigenous-led EA through substitution and delegation powers (Impact

Assessment Act, ss. 29 and 31), as did its predecessors. Furthermore, Indigenous-led EA is already blazing a trail for new decision-making processes palatable to industry proponents and informed by local cultural values and legal traditions. For example, in 2018 the Squamish Nation approved the development of the Wood Fibre LNG with specific and community-driven mandatory regulations (Bruce and Hume 2015). While we recognize that this example—an independently led Indigenous EA—is not broadly generalizable across Canada, we note that other structures of Indigenous-led EA exist (e.g., co-management or co-creation structures, see Gibson et al. 2018) alongside other power-sharing opportunities between Indigenous and Canadian federal governments. Continued implementation of Indigenous-led EA and recognition of the validity of these processes by Canada’s federal government provides an opportunity to improve government-to-government relationships, promote environmental decisions that respond to local social and ecological heterogeneity, and overcome fundamental and superficial barriers in relating IK and Canadian EA.

Acknowledgements

We wish to express our gratitude to all those who contributed to the formation of this manuscript both indirectly and directly, in particular to colleagues in the Applied Conservation Science Lab at the University of Victoria and to Central Coast First Nations and other Indigenous Nations and scholars who inform, lead, and enrich scholarship in this arena. This research was made possible by funding through the Raincoast Conservation Foundation and the Vanier Doctoral Graduate Scholarships program.

Chapter 3: Identifying opportunities towards conflict transformation in an Orca-Salmon-Human system

Authors: Lauren E. Eckert; Natalie C. Ban; Misty MacDuffee; David Scott; Paul Paquet; Faisal Moola; Cameron Owens; Chris T. Darimont

Submitted: [*Conservation Science and Practice*](#), March 2023

Abstract

Conservation interventions increasingly clash with other activities, often resulting in conflict among people, communities, and wildlife. Such ‘conservation conflicts’ can result from divergence in objectives and beliefs, and can elude solutions. One step in overcoming conflicts is examining their roots in identities and beliefs. In the Salish Sea region of Canada, conflict has emerged surrounding Southern Resident Killer Whales (SRKW) and Chinook salmon. The Department of Fisheries and Oceans has enacted measures that restrict recreational Chinook fishing to protect critically endangered SRKW. Public response has been conflict-laden, especially between ‘angler’ and ‘conservation-supporter’ communities – two stakeholder groups assumed to be distinct and opposed. We used online surveys to examine the social identity, environmental identity, beliefs, and opinions of stakeholders. Most survey participants (n = 727) self-identified as either conservation-supporters (53%) or anglers (34%). Our analyses revealed demographic differences, with anglers generally overrepresented by men, those with higher incomes, and 2-year degrees. Both groups scored similarly high in environmental identity and stakeholder identity affiliation scores, also showing association between the intensity of identities with public engagement in management discourse. Stakeholder groups differed strongly ($\chi^2 = 156.27$, $p < 0.001$) in management beliefs – with conservation-supporters frequently prioritizing conservation (82%), whereas anglers were divided over prioritizing protection of economically-valuable natural resources (32%), conservation (36%), or a balanced approach (32%). Conservation-supporters were more likely to assert that the loss of SRKW would have a negative impact on them than were anglers. Ultimately, our results identify conflicts between stakeholder groups as deeply-embedded. Commonalities (especially in beliefs regarding Chinook salmon), however, identify a path forward that draws on conflict transformation theory. Broadly, our approach offers new generalizable insight into the levels-of-conflict framework within conservation conflict transformation approaches to inform scholarly and practical endeavours.

Positionality Statement

Conflicts emerging due to sociopolitical factors provide opportunity for, and perhaps require, researchers' reflexivity. Indeed, when researchers fail to identify their values and worldviews, they can foment conflict (Boyce et al. 2022). Thus, we begin by identifying our positionality; we are non-Indigenous scholars and scientists who currently live in colonized Indigenous territories within contemporary Canada. The lead author (LEE) is a white woman of mixed European descent, motivated by personal values oriented towards upholding conservation that benefits people, ecosystems, and wildlife equitably, and trained in Western ecological and social sciences. This research is motivated by shared experiences with and interest in ameliorating conservation conflict. The lead author and several team members (LEE, DS, FM, MM, CTD) are affiliated with Raincoast Conservation Foundation an organization engaged in public advocacy relevant to the conflict we describe.

Introduction

Conservation interventions intended to protect ecosystems and species increasingly clash with other human activities, often resulting in tense conflict among people, communities, and wildlife (Dickman 2010; Young et al. 2010; Redpath et al. 2013). These 'conservation conflicts' can result from clashes in goals, competing priorities, and deeply-rooted beliefs, and often seem intractable because of this complexity and resistance to solutions (Redpath et al. 2013; Madden & McQuinn 2014; Cusack et al. 2021).

Divergences in people's beliefs, particularly as they relate to conceptions of self-identity, play a central role in such conflicts. Identity here refers to the socially- and personally-constructed qualities, traits, beliefs, and values that help satisfy basic human needs of self-concept and self-understanding. (Tajfel & Turner 1986; Oyserman et al. 2012; Lüders et al. 2016). In short, identities help people make sense of the world; challenges to identity or identity-based beliefs or behaviors constitute a threat to our psychological stability and even perceived threat to our physical well-being (Hicks 2001).

Several facets of identity can relate to conflict. Among them, **environmental identity** (Clayton 2003; Clayton & Opatow 2003) and **social identity** (Tajfel & Turner 1986; Hogg & Turner 1987) can foment and escalate interpersonal and social conflicts (Table 3.1). In this context, identity is understood as one of many sets of beliefs that form self-concepts – and everyone possesses multiple and hierarchical identities as they relate to their world and others (Oyserman et al. 2012).

Considering the role of identity can provide opportunity for conservation scholars and practitioners to seek means to understand and potentially transcend conflict. One promising approach is Conservation Conflict Transformation (CCT) (Madden & McQuinn 2014, 2015). CCT is considered by proponents as the ‘blind spot’ in modern conservation sciences, and aims to “reorient conservation’s understanding of, and approaches for, addressing conflict (Madden & McQuinn 2014).” CCT follows other social science concepts (i.e., conflict transformation (Lederach 1997), human needs theory (Burton, 1990)) in asserting that conflict is a natural phenomenon and presents opportunities to improve relationships in social species. A CCT approach requires that conflicts are examined for their superficial presenting problems (e.g., immediate conflicts over management plans) and their deeper roots (e.g., clashes in identities) simultaneously, and recognizes that failure to transform the relationships between parties that underlie conflict can further embed conflict (Madden & McQuinn 2014). CCT approaches have proven effective in transforming entrenched conflict surrounding cougar (*Puma concolor*) management between multiple stakeholders in the Western U.S.A., and among villagers, village leadership, and conservation organizations struggling to reach consensus on elephant (*Loxodonta*) management in Mozambique, among other examples (Madden & McQuinn 2014).

CCT processes and principles are well-developed. They include an analytical examination of levels-of-conflict (Figure 3.1) followed by use of the ‘conflict intervention triangle’ to transform how conservation conflicts are examined and approached (Madden & McQuinn 2014). Despite the potential efficacy of CCT approaches, research into conflicts that apply CCT principles remains limited. Herein, we used social science measurement instruments (especially those related to identity) to apply a CCT approach to better understand a case study of entrenched conservation conflict.

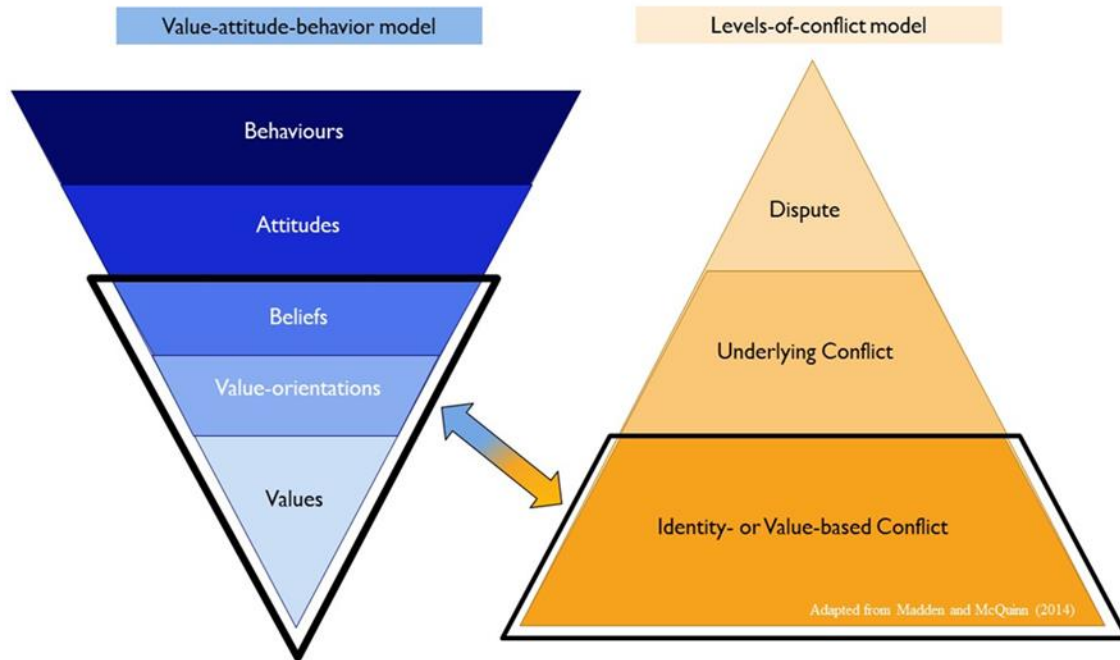


Figure 3.1. Proposed relationship between a value-attitude-behavior model (right; Fulton and Manfredi 1996) and levels-of-conflict model (left; Madden and McQuinn (2014). Bold outlines highlight concepts and connection on which we focus.

In addition to concepts and instruments measuring environmental and social identity, we use the cognitive hierarchy model and align it with a CCT approach. Also referred to as the value-attitude-behavior model (Homer & Kahle 1988), it is frequently-used in the context of wildlife management research (e.g., Fulton et al., 1996; Manfredi et al., 2020; Whittaker et al., 2006). It is a well-supported model (e.g., Jerry J. Vaske, 1999; Milfont et al., 2010) that indicates that “influence should theoretically flow from abstract values to mid-range attitudes to specific behaviour (Homer & Kahle, 1988, p. 638)” (Figure 3.1). Of particular interest to examining conflict is the connection between human beliefs (including self-identities) and deep roots of conflict (Appendix B, Table B.5, Figure 3.1). Many scholars have identified beliefs and values as deep drivers of conflict (Lederach 1996; Dickman 2010; Redpath et al. 2013b; Madden & McQuinn 2014).

Here we rely on this body of scholarship and models to propose a new, formalized relationship between models. Specifically, we unite the value-attitude-behavior model (Homer & Kahle 1988; Fulton et al. 1996) and levels-of-conflict model (Madden & McQuinn 2014). Identifying the relationship between these models allows us to explicitly identify what social science tools (created and implemented to measure facets of identity) may be applied to understand the anatomy of conservation conflict, as required

by CCT. Specifically, we use the relationships between the value-attitude-behavior and levels-of-conflict models to inform our choice of methodological instruments.

There are additional benefits to understanding concepts of environmental- and social-identity in the context of conservation conflict. Understanding core drivers of human behavior can allow managers and decision-makers to understand human behavior as it relates to the environment (Clayton 2003; Gatersleben et al. 2014) and predict public responses to management plans (Manfredo et al. 2016 al.). For example, a 2019 study (van Eeden et al. 2019) found that social identities were useful predictors of the acceptability of potential wildlife management options in Australia.

Examining individual identities also offers another useful vantage to understand conflict and inform policy makers. Whereas many conservation conflicts are initially perceived as intractable, first assessments of such conflicts, often lacking information about deep roots driving conflict, rarely capture the narrative of an entire affected audience. Furthermore, media outlets often represent a more polarized account than that of the beliefs and opinions of stakeholders (Prior 2013), which in many places are the only existing analysis of relevant local conflict. Examining the beliefs within groups involved in conflicts may produce opportunities to represent diverse voices and capture a more accurate narrative regarding those affected by environmental management actions than available media narratives or those data collection exercises that do not assess roots of conflict. Finally, examining beliefs and identities of those involved in, or proximal to, conservation conflict could contribute to new, transferable methods useful to practitioners and researchers.

Our objective is to apply social survey instruments examining beliefs to better understand the deep roots of conservation conflict and inform its transformation, with a focus on aligning social models and instruments towards this end. We do so through a case study examining conflict that has arisen over Southern Resident Killer Whale (*Orcinus orca*, hereafter, “SRKW”) protection measures in the Salish Sea bioregion of coastal British Columbia (BC), Canada, which include spatial restrictions on Chinook salmon (*Oncorhynchus tshawytscha*) fishing.

Case Study

Our study area included the land and communities adjacent to the Salish Sea (Appendix B; Figure 1). The Salish Sea is a system of Pacific inland waterways and fjords spanning a surface area of approximately 18,000 km² and modern-day Washington State (U.S.A.), BC (Canada), and the territories of the Coast

Salish Nations (Appendix B). Owing to different management prescriptions of the US and Canada, we focused study efforts and data collection on Canadian communities.

We targeted stakeholder groups purportedly involved in public disputes. Here, we define stakeholders as non-Indigenous residents of the region who self-identify their interest in the management of SRKW and Chinook. We exclusively identify non-Indigenous peoples as stakeholders because Indigenous peoples within the region are rights-holders (i.e., they hold an inherent, constitutionally-protected right to fish within their territories, *Constitution Act, 1982 Section 35*) and decision-makers, whose rights-based fisheries are acknowledged as having priority over privilege-based fisheries by the Government of Canada, even where priorities are not implemented (Manning 2013).

SRKW are a genetically- and culturally-distinct population of killer whales local to the Salish Sea (as well as Southwest Vancouver Island and the West coast of the United States). They rely primarily on Chinook salmon with species like chum (*Oncorhynchus keta*), coho (*Oncorhynchus kisutch*), and steelhead (*Oncorhynchus mykiss*) consumed seasonally (Ford 1998; Fisheries and Oceans Canada 2018; Hanson et al. 2021). SRKWs are threatened by intersecting stressors, key among them decreases in abundance of principal prey items (particularly Chinook salmon, (Ford 1998; Couture et al. 2022), though this statement is contested to various degrees, (see Hilborn et al. 2012), increases in vessel-driven noise pollution (National Research Council 2005), and other compounding stressors – such as local environmental contaminants (Ross 2006), increases in human activity (Osborne 1999), and climate change (Lacy 2017). SRKWs were listed as endangered under Canada’s Species at Risk Act (SARA) in 2003 (Fisheries and Oceans Canada 2018). Population viability assessments indicate that SRKW face a 25-50% risk of extinction within the next 100 years if threats are not mitigated (Lacy 2017).

Chinook salmon also face multiple stressors. They are managed by DFO under the annual Integrated Fisheries Management Plan (Fisheries and Oceans Canada 2009). Chinook stressors include overfishing, climate change, and habitat destruction and alteration, among others (Teffer et al. 2018). Approximately one third of Chinook salmon conservation units in BC are categorized as in the “red zone” (poor status) (Baxter & Hamilton 2017) and another 19 in southern BC are assessed as Threatened or Endangered (COSEWIC 2020). Chinook salmon are important culturally and economically to Indigenous, commercial, and recreational fishers (henceforth, “anglers”).

The challenges faced by SRKW and Chinook have been addressed by managers. Beginning in 2019, DFO implemented measures to protect SRKW, which include area-based fishing closures, interim sanctuary

zones, and voluntary seasonal vessel slowdown areas, along with other voluntary measures (DFO 2019). In 2021 DFO refined its fishing closure protocol for the Southern Gulf Islands recreational salmon fisheries, where fishery closures are triggered by the first confirmed presence of SRKWs in the area (DFO 2021).

Measures to protect SRKW have been controversial. Particularly, those related to seasonal Chinook fisheries closures have resulted in substantial conflict amongst stakeholders (e.g., Keep Canada Fishing, 2019; Laird, 2018; Watts, 2019). DFO has engaged the public by releasing multiple “protection measures” scenarios and seeking public feedback before implementing a final management decision. The debate regarding SRKW protection measures has been polarized and centered on conflicting parties interested in protection measures for diverse reasons, which include conservation-supporters, policy makers and scientists, anglers, ecotourism operators, and others (Laird 2018; Keep Canada Fishing 2019; DFO 2021).

Herein, we focus on two seemingly polarized and distinct groups involved in this conflict. We refer to them as ‘conservation-supporters’ (BC residents who actively support conservation) and ‘anglers’ (BC residents who legally fish under a recreational fisher’s license). In public consultations that followed announcement of 2019 protection measures, the DFO recorded substantial concerns from anglers in coastal communities, including those who engage in or rely on recreational Chinook fishing (DFO 2021). During stakeholder consultation sessions, local anglers communicated concerns that recreational fishing posed only a small part of the problem facing SRKW populations, and suggested fish hatcheries and pinniped culls as preferred conservation solutions (DFO 2021). Concurrently, conservation-supporters assert that SRKWs are cultural icons in BC, ecologically important, and that measures to conserve them, and to protect biodiversity as a whole, are ethical prerogatives (Owen 2019). In citing moral obligations to safeguard SRKWs (often aligned with obligations to protect biodiversity, e.g. J. Benson, 2000), conservation-supporters often assert that the whales’ unique culture and family groups justify their protection. Whereas conservation-supporters’ public messaging recognizes that many stressors affect SRKWs, many conservation stakeholders and local NGOs nonetheless support seasonal fisheries closures as a key step to SRKW recovery. Some researchers also assert that increasing the availability of Chinook salmon for SRKW is key to recovery (Lacy 2017). Moreover, the first objective of the SARA recovery strategy is to ensure adequate, accessible food supply for SRKWs (DFO 2018).

Conflicts between anglers and conservation-supporters are commonly framed as quarrels over Chinook fisheries closures (Keep Canada Fishing 2019; Watts 2019; DFO 2021) but might instead reflect deeper

tensions. Elsewhere in North America, social conflict over conservation is common (e.g. Douglas & Veríssimo, 2013; Madden & McQuinn, 2014), and may be in-part driven by self-identities. However, discussions regarding conflict portrayed in BC’s media, through DFO, and via stakeholders on personal platforms (e.g., social media) have been predominantly focused on the temporary fishing closures put in place to protect SRKW – and not the deep roots of escalating conflict. Accordingly, we examine this conflict, employing a CCT approach and social science instruments to: i) assess the viability of self-identity instruments for studying conservation conflicts, ii) determine if the conflict is superficial or driven by deeper-rooted, identity-oriented beliefs, and iii) provide insight into the diversity of individuals and self-identities involved. We also aim to provide evidence-based insight from the social sciences to guide governments (colonial and Indigenous) in the Salish Sea region in management processes.

Methods

Survey Instrument

We developed a survey (Appendix B) with 72 response items designed to assess self-concepts of social identity and environmental identity, as well as sociodemographic information, engagement in public discourse, opinions, and beliefs (details in Appendix B). We pre-tested and refined the survey for clarity with several individuals familiar with study objectives. We instructed participants to self-select their *social identity* from a group of relevant identity options, and participants could select all relevant identities and/or declare which identity is most important to them (i.e., their ‘salient identity’). We then measured the intensity of participants’ salient identity using a three-item Social Identity Affiliation measure (hereafter, “**SIA**”) (Postmes et al. 2013). Environmental identity was measured using the 24-item measure Environmental Identity Scale (**EID**; Clayton 2003).

Data Collection

We targeted individuals who were 18 years or older, residents of BC, and self-identified as a stakeholder regarding Chinook salmon and SRKWs via non-random recruitment methods. We focused our survey distribution efforts on individuals associated with the angler and conservation communities. Survey data were collected between April 2020 and August 2021 via SurveyMonkey (an online, cloud-based survey software) hosted by the University of Victoria. We used two methods to recruit survey participants, which varied in their approach and responses. The first method involved reaching out to representative public-facing angler and conservation-supporter groups in the region to request that they share our survey with

their members and supporters. The second involved use of Facebook advertisements to target participants (Appendix B).

This research was conducted with approval from the Human Research Ethics Board of The University of British Columbia (H20-00359-A004). All participants were offered an opportunity to enter to win one of three Amazon gift-cards in a raffle upon survey completion.

Survey Analysis

We analyzed 727 complete surveys when assessing responses of all participants, and 638 complete surveys when assessing differences between anglers ($n = 255$) and conservation-supporters ($n = 383$). We compared responses to identity, environmental identity, sociodemographics, beliefs, and opinions between anglers and conservation-supporters using Pearson's Chi-squared, Wilcoxon Rank Sum, and student's t-tests and permutational multivariate analysis of variance (PERMANOVA in R, Anderson 2017). We used the Kruskal-Wallis H test to determine the relationship between participant frequency of participation in public engagement and EID/SIA scores.

We were also interested in understanding consensus (or lack thereof) regarding management of SRKW and Chinook salmon within groups. We assessed intra- and inter-group variation in responses to SRKW and salmon management opinion and belief items using the Potential for Conflict Index (PCI₂, Manfredro et al. 2003; Vaske et al. 2010) via Microsoft Excel (D₁; Power=1; Vaske 2018). The PCI₂ assesses the consensus within groups and across participants.

Content analysis

We analyzed participant responses to open-ended survey questions and respondents' comments on advertised Facebook posts using a qualitative, constructivist approach (Olsen 1999). We identified themes that arose using NVivo software (QSR International Pty Ltd. Version 14).

We were also interested in examining tonal differences between survey respondents and social media commenters. Accordingly, we coded the nature of the sentiment of comments derived from Facebook and our survey in NVivo. The sentiment of each comment or response was identified by coding the apparent tonality of each comment as a whole. Supported by previous research (Oz et al. 2018; Humprecht et al.

2020), we defined a ‘hostile’ sentiment as one that included an expression of anger or frustration, offensive contempt, violence, victimization, distrust, or hate (Appendix B).

Before the final stages of publication, we presented our results to DFO SRKW-Salmon management working groups. This was meant to facilitate early conversation so that those stakeholders most involved in public management conversations did not feel blind-sided by results, so to avoid further fomenting conflict, and in hopes of creating opportunities for building trust.

Results

Survey Analysis: Demographics and Identities

Most participants who completed their survey ($n = 727$) self-identified as either conservation-supporters (52.5%, $n = 383$) or anglers (34.8%, $n = 255$; Appendix B). However, most participants (53.8%) identified with more than one stakeholder group, with considerable overlap represented between angler and conservation-supporter groups (32.5% of those with salient conservation-supporter identities also identified as anglers, and 47.8% of those with salient angler identities also identified as conservation-supporters; Figure 3.2). Despite self-identification overlap, cluster analyses and summary PERMANOVA testing revealed significant differences between anglers and conservation-supporters (pseudo- $F = 31.688$, $R^2 = 0.046$, $p < 0.05$, Appendix B). Pearson’s chi-squared tests revealed demographic differences (Appendix B) between those with salient angler and conservation-supporter identities, with anglers generally overrepresented by men (89.4% of anglers), those with higher incomes (25.9% of anglers had an annual income of \$150,000 or greater, while only 13.0% of conservation-supporters reported the same), and those with 2-year terminal degrees (38.8% of anglers). Conservation-supporters were generally overrepresented by women (54.2% of conservation-supporters), and those with advanced degrees (36.71% of conservation-supporters). Most participants self-identified as white (82.7%), followed by those who did not say (6.9%), selected multiple identities (4.4%), and identified as Indigenous (1.6%).

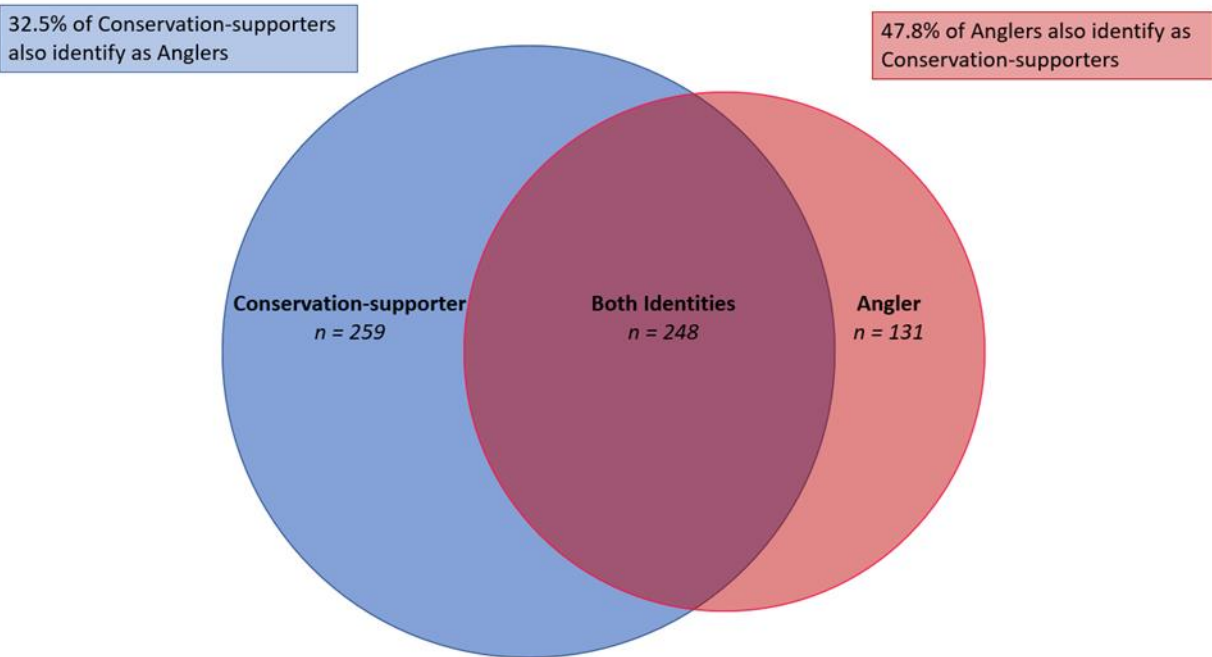


Figure 3.2. Euler diagram depicting the relationship between angler and conservation-supporter identity groups (n = 727 participants). Data in text boxes show how many participants with angler salient (i.e., primary) identities also identified (to a lesser extent) as conservation-supporters, and vice versa.

Survey Analysis: Environmental Identity and Social Identity Affiliation Scores

Anglers and conservation-supporters expressed different EID and SIA scores (Figure 3.3a, b). Mean EID scores for anglers were lower (5.70) than conservation-supporters (6.25, Wilcoxon Rank Sum test, $W = 23954$, $p < 0.001$). Mean SIA for anglers was 6.13, and mean for conservation-supporters was 6.40 (Wilcoxon Rank Sum test, $W = 42495$, $p = 0.005$).

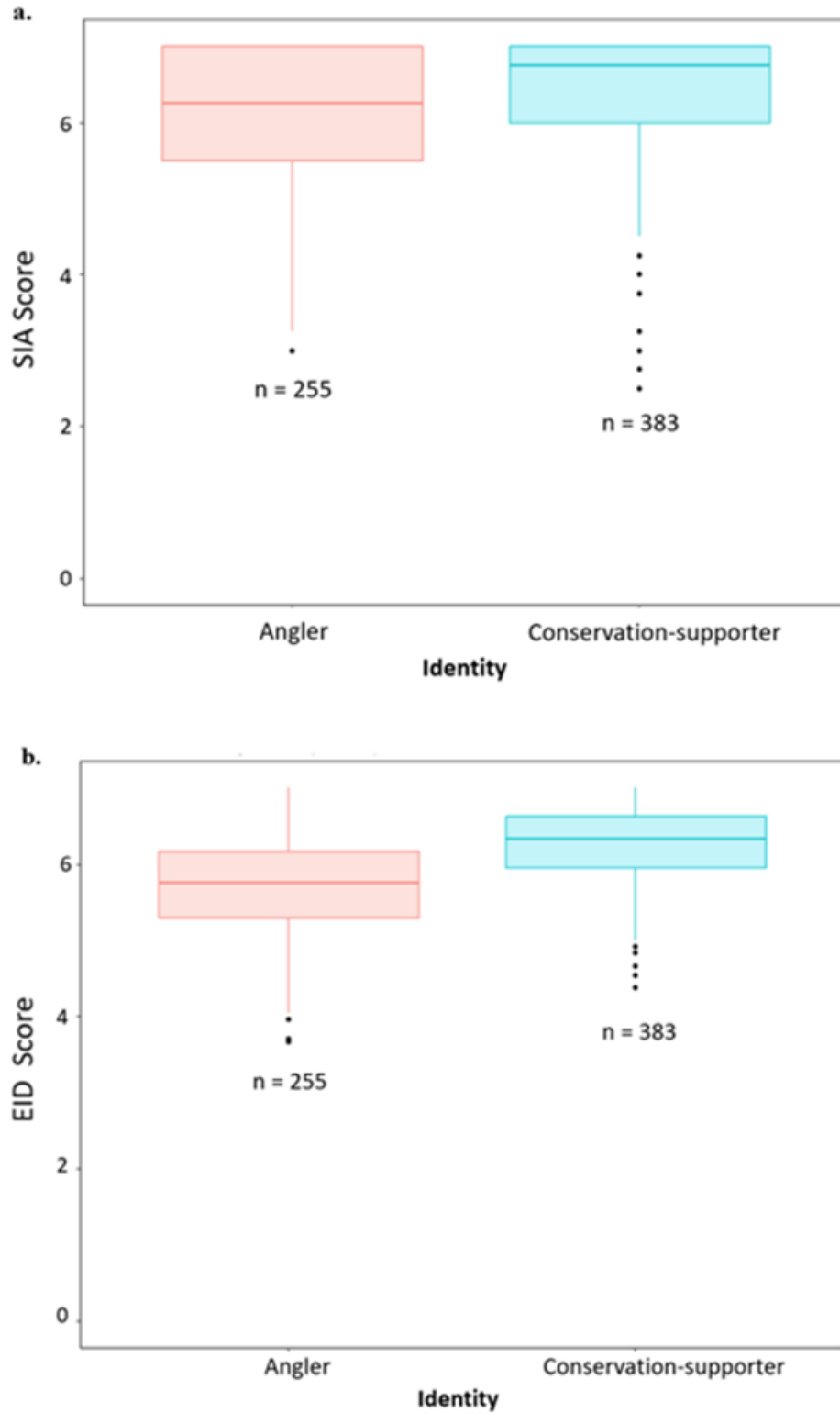
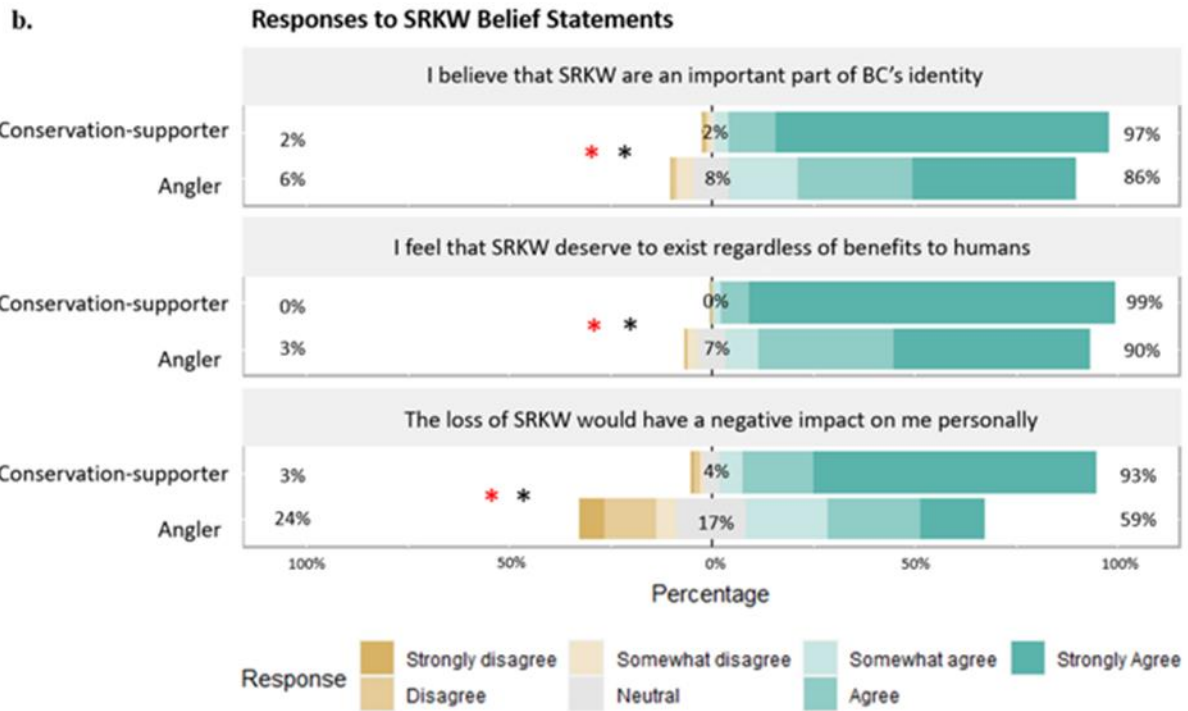
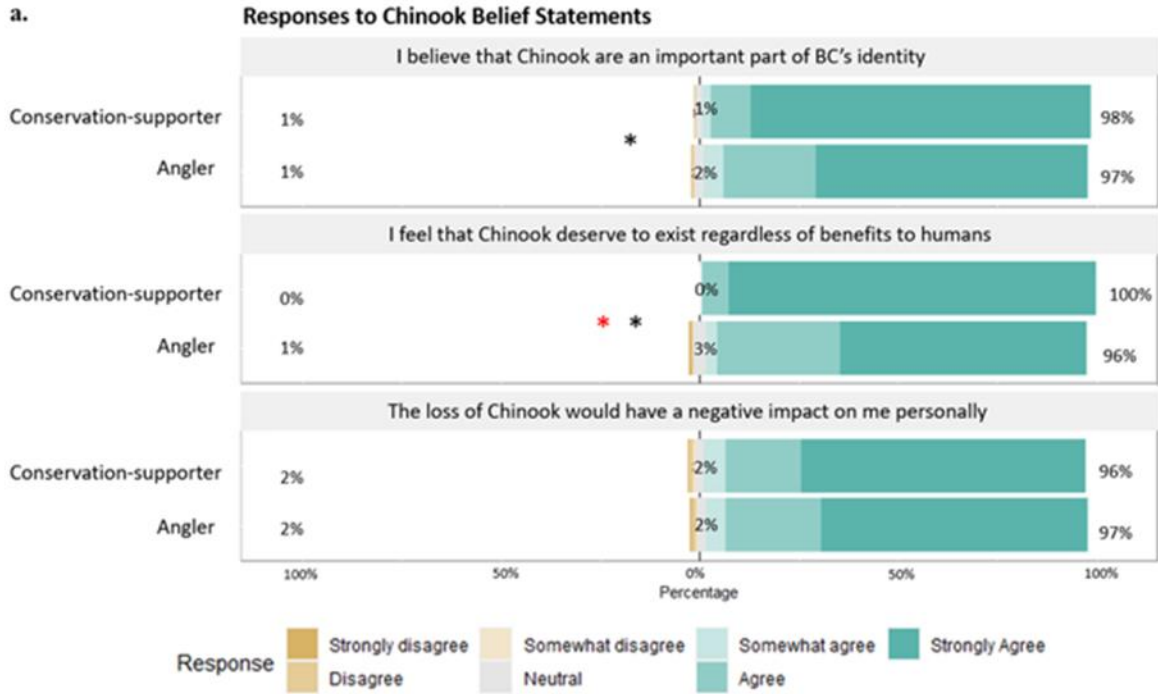


Figure 3.3a,b. Environmental Identity (EID) Scores (a) and Social Identity Affiliation (SIA) Scores (b) of anglers and conservation-supporters.

Survey Analysis: Opinions and Beliefs

Angler and conservation-supporters also diverged in their opinions and beliefs regarding SRKW, Chinook salmon, and management of both (Figure 3.4, Appendix B). Regarding beliefs about whales, conservation-supporters were more likely to agree that SRKW are an important part of BC's identity, feel that they deserve to exist regardless of benefit to humans, and believe that the loss of SRKW would have a negative impact on them than were anglers. Conservation-supporters were also more likely to agree that Chinook salmon deserve to exist regardless of their benefit to humans than were anglers. Anglers were more likely to agree with the statements that Chinook are abundant and minimally affected by humans than were conservation-supporters, that SRKW experience natural population cycles and are not currently threatened, and that SRKW threaten the health of Chinook than were conservation-supporters. Anglers were also more likely to agree that harvesting should be the core priority of management, and that they would oppose management interventions that limited fishing access than were conservation-supporters.

There were three statements in which Likert responses were not significantly different between anglers and conservation-supporters, all of which related to Chinook salmon and management. Both groups responded similarly about the value of Chinook to them as individuals and to society, generally strongly agreeing with the statements: "The loss of Chinook would have a negative impact on me personally"; and "I believe that Chinook are an important part of BC's identity". Both strongly disagreed with the statement that; "DFO is doing a good job managing Chinook." (Figure 3.4a,b,c,d)



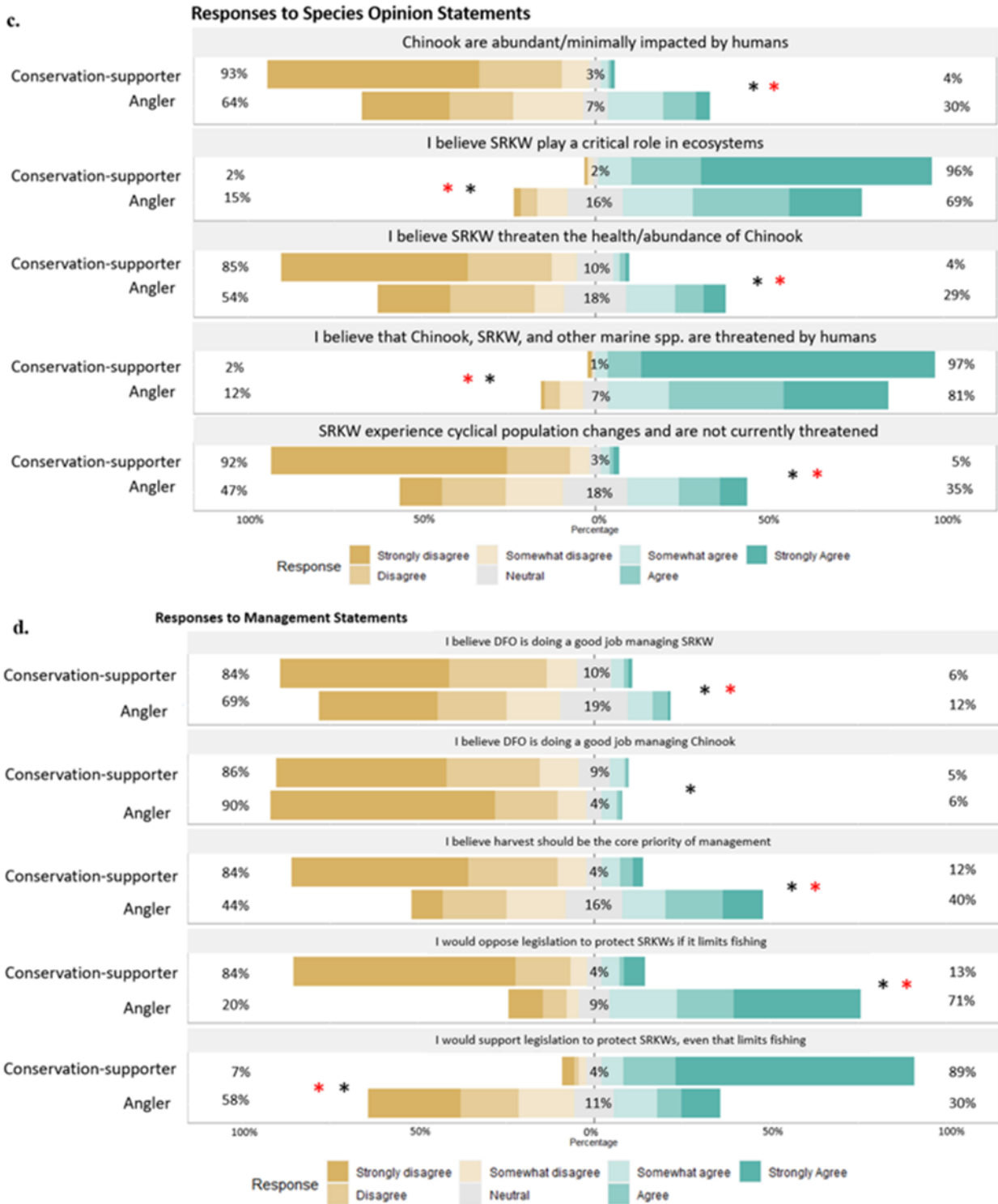


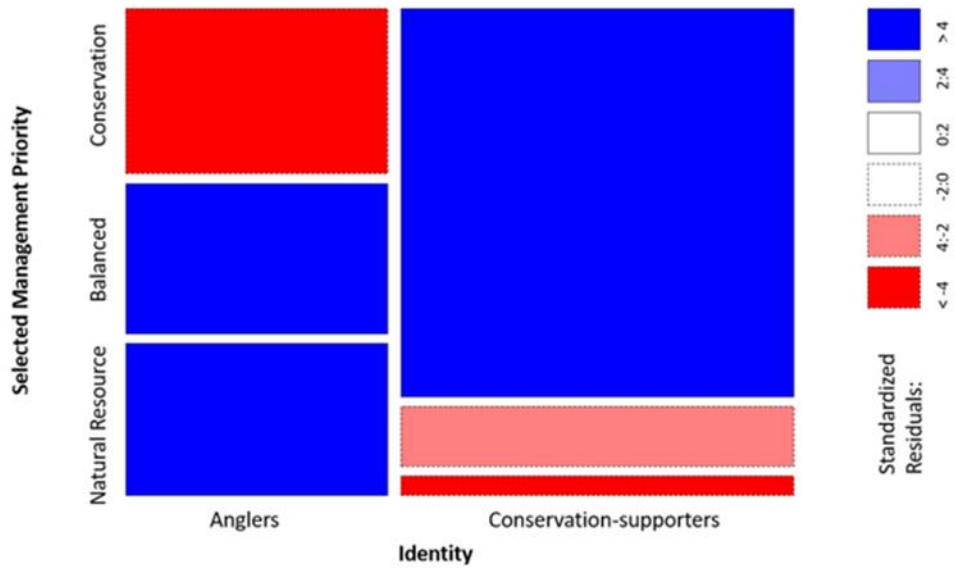
Figure 3.4. Likert responses to personal belief statements about SRKWs (a) and Chinook (b), species opinion statements (c), and management opinion statements regarding SRKW and Chinook salmon by

anglers and conservation-supporters (d). A black asterisk denotes a significant difference between angler and conservation-supporter groups between all Likert responses. A red asterisk denotes a significant difference between angler and conservation-supporter groups when responses are binned into ‘positive’ (‘Somewhat agree’, ‘Agree’, ‘Strongly Agree’), ‘neutral’ (‘Neither agree nor disagree’) and ‘negative’ (‘Somewhat disagree’, ‘Disagree’, ‘Strongly Disagree’) responses (Appendix B).

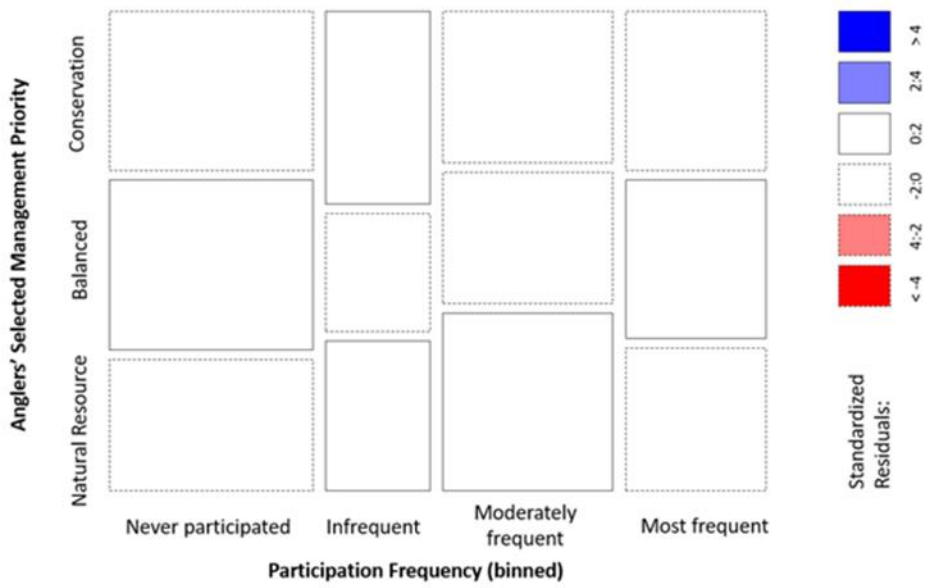
Survey Analysis: Management Priorities

Finally, we identified differences in management priorities supported by respondents. Anglers were more diverse in their responses, with natural resource (32.2%; i.e., selected “Wildlife, fisheries, and marine management in BC should prioritize conserving species that provide direct economic opportunity” or “Sustaining the ability of humans to use natural resources should be the core priority of wildlife and marine management in BC”) or balanced priorities (32.2%; i.e. selected that “Wildlife, fisheries, and marine management in BC should balance the needs of humans with conservation of species not directly useful to humans) for management approaches overrepresented in their responses (Figure 3.5). In contrast, conservation-only priority responses (35.7%; i.e., “Conservation of species should be the core priority of wildlife and marine management in BC, regardless of the species’ benefits to humans”) were underrepresented compared with the null model prediction (Figure 3.5). Conversely, conservation-supporters prioritized conservation (82.29%) more than anticipated in the null model (Figure 3.5), and their responses to prioritize a balanced (12.76%) or natural resource-oriented approach (4.43%) were less than expected under the null model (Figure 3.5a). These priorities within stakeholder groups differed little across different public engagement frequencies (i.e., the number of times expressed with a range, that participants engaged publicly regarding SRKW and salmon management) within stakeholder groups (Figures 3.5a,b,c).

a.



b.



c.

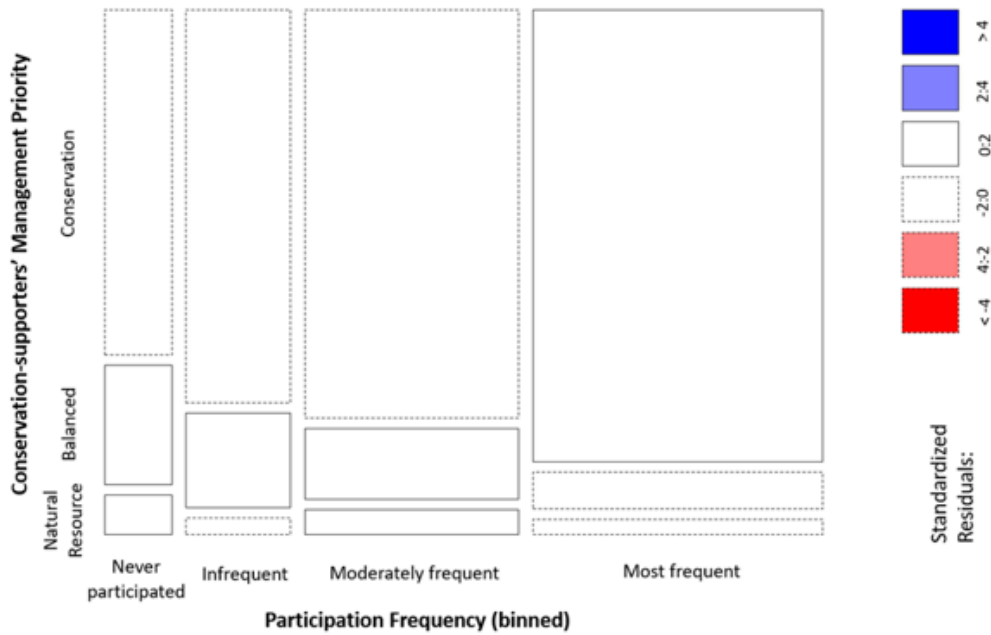


Figure 3.5. Mosaic plot comparing management priorities identified by anglers and conservation-supporters (a). Mosaic plot comparing public engagement frequency across those with different management priorities within the angler group (b) and the conservation-supporter group (c). The color of cell represents the standardized residuals for that cell and the size of the cell corresponds to proportion of respondents.

Conflict, Public Participation, and Social Media

In the context of conflict over management actions, conservation-supporters ($PCI_2 = 0.17$) were more internally aligned in their responses than were anglers ($PCI_2 = 0.44$). Conservation-supporters largely agreed (88.8%) that they would support legislation or management decisions that limited recreational fishing to protect SRKW, while far fewer anglers agreed that they would support such restrictions (30.2%, $W = 19158, p < 0.001$). Taken together, all respondents (including those with salient identities other than anglers and conservation-supporters) had a higher PCI_2 (0.54) than either stakeholder group (Figure 3.6).

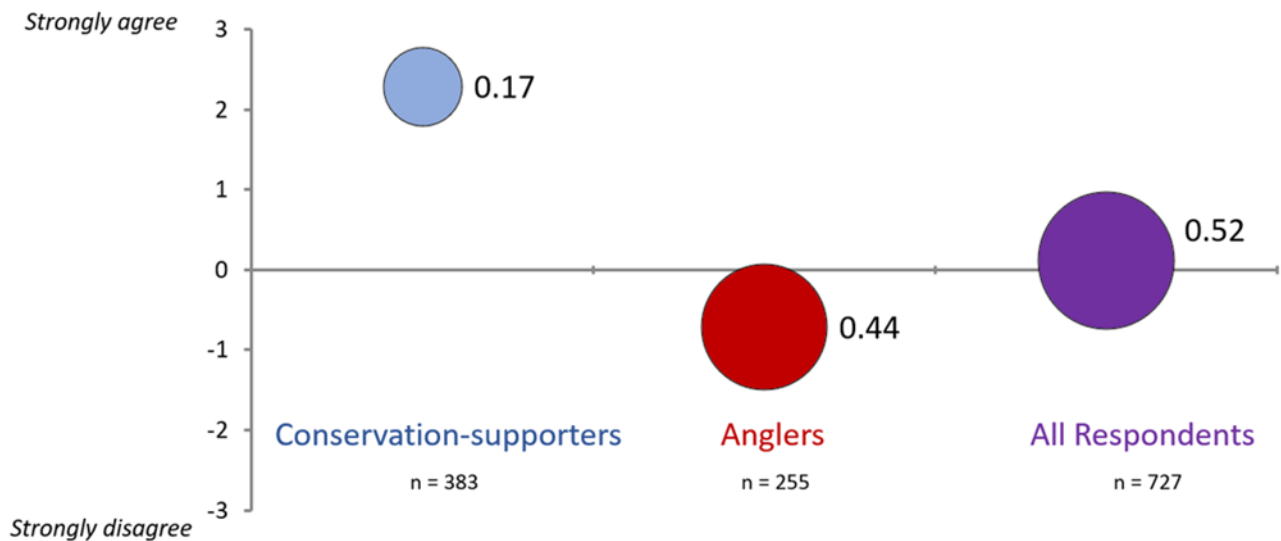


Figure 3.6. Potential for Conflict (PCI₂ scaled to bubble size) between and within anglers and conservation-supporters regarding support for protecting SRKW by restricting salmon fishing.

We identified significant differences in frequency of public engagement regarding SRKW and Chinook management (our proxy for conflict) within stakeholder groups (Appendix B). Higher frequencies of public engagement correlated with higher EID and SIA scores in both angler and conservation-supporter groups during bivariate analyses; Kruskal-Wallis H test supported association between public engagement frequency and EID and SIA scores in conservation-supporters (EID $p < 0.001$, $H = 0.075$, moderate effect size / SIA $p < 0.001$, $H = 0.080$, moderate effect size), and to a lesser extent in anglers (EID $p = 0.001$, $H = 0.052$, small effect size / SIA $p = 0.032$, $H = 0.023$, small effect size).

Content Analysis

Finally, we identified a diverse array of open-ended responses from angler and conservation-supporters. Most responses were associated with additional concerns for salmon and SRKW or expressed criticism or distrust (Table 3.1). We also found that Facebook comments (64.1% of comments, $n = 128$) were significantly more likely to include hostile sentiment than open-ended responses to our survey (37.5% of responses, $n = 338$, $\chi^2 = 25.233$, $p < 0.001$).

Code	% Angler Respondents	% conservation-supporter respondents
<i>Expressed criticism or distrust</i>		
<i>Criticism of DFO/government</i>	35.0%	13.7%
<i>Distrust of DFO/government</i>	32.9%	10.5%
<i>Criticism of survey</i>	11.9%	13.0%
<i>Distrust in media</i>	14.0%	1.0%
<i>Distrust in researcher</i>	4.9%	0.0%
<i>Distrust in science</i>	3.5%	1.0%
<i>Other concerns for Salmon and SRKWs</i>		
<i>Habitat degradation</i>	10.4%	19.0%
<i>Pinnipeds</i>	22.9%	2.1%
<i>Commercial fishing</i>	13.9%	10.0%
<i>Depletion of forage fish (e.g., herring)</i>	9.7%	11.1%
<i>Indigenous fishing</i>	13.3%	5.3%
<i>Fish farms</i>	9.7%	7.4%
<i>Expressed emotion</i>		
<i>Anger/frustration (at other stakeholder group or decision-makers)</i>	8.4%	4.1%
<i>Anger/frustration (at others, ambiguous)</i>	5.6%	5.2%
<i>Feelings of victimization</i>	7.7%	1.6%
<i>Expressed importance of Indigenous fishing/management rights</i>	2.6%	4.7%

Table 3.1. Summary of coded themes from open-ended survey comments; $n = 333$ open-ended responses analyzed, $n = 190$ conservation-supporter respondents, $n = 143$ angler respondents.

Discussion

We found that although anglers and conservation-supporters differed in their demographic compositions and beliefs about management priorities, they showed diversity within groups and overlap between them. Despite divergences in beliefs and ecological management priorities, many more individuals self-identified as *both* anglers and conservation-supporters than one would expect based on existing media portrayals of the debate, or the more acrimonious content we revealed in our qualitative analysis of social media posts. Finally, participants across identity groups aligned in beliefs regarding the value of salmon and the inefficacy of current management practices. Within these overlaps that bridge self-identities, we identify opportunity to begin the work of conflict transformation.

Although our research offers insight for practitioners and scientists faced with conservation conflict, there were several limitations. First, our survey results are not necessarily representative of our target

populations; it was not possible for us to randomly sample populations of interest. As reflected in the potentially high EID and SIA scores observed across participants, we expect our sample may be more likely to include those most invested in the conflict (i.e., individuals who have identified their interests in angling or conservation on their Facebook pages, belong to a relevant organization's email listserv, and/or are willing to take the time to complete our survey). If the case, however, such a sub-sample would allow focussed insight into conflict. We also acknowledge that unknown biases in sampling may have arisen due to recruitment platforms, which were restricted to those individuals who could be reached electronically. Moreover, we lack information regarding the advertising algorithms used via Facebook recruitment. Representation on social media in North America can overrepresent the voices of English-speaking, wealthy, urban individuals, among other potential biases (Ghermandi & Sinclair 2019). Finally, a major dimension of many conflicts is the formation of in-group and out-group biases, which can promote in-group cohesion but may lead to polarization and further embed conflict (Dion 1973; Douglas & Veríssimo 2013; Denning & Hodges 2022). Although there appears to be substantial identity overlap in our sample, suggesting that rigid group polarization may have not yet occurred, we did not examine this bias by asking participants how they feel about potentially antagonistic social identity groups.

Despite potential limitations and with caution we share some important information emerging from our research, including demographic patterns. We noted several demographic differences between identity groups. Men were largely overrepresented in our angler sample compared to women. This pattern is consistent with national trends, which identify only 21% of anglers as women (DFO 2019). These gender imbalances reflect the larger state of underrepresentation of women in the angling community (Schroeder et al. 2006; Carini & Weber 2017). Meanwhile, women were overrepresented in our conservation-supporter sample, a result consistent with other research that suggests that women tend to have higher rates of pro-environmental concern than men (Gifford & Nilsson 2014). In addition to gender, education levels also correlate with pro-environmental or pro-wildlife behaviors; Manfredo et al. (2020) indicated that higher statewide levels of education correlated with higher rates of mutualism (a set of values that reflect a view of wildlife as deserving of rights and compassion). We also identified apparent differences between typical education and income levels between anglers and conservation-supporters. Other research has indicated that low availability of financial resources is one factor that negatively affects the likelihood of recreational fishing participation (Arlinghaus et al. 2015).

Transcending purely demographic differences, our results affirmed that broader, less-tangible differences in belief are associated with – and thus might – underlie conflict. Our results affirmed a superficial incompatibility between conservation-supporters' and anglers' support (or lack thereof) for restricting

fishing, but also revealed broader disagreements. These included divergences in beliefs about for whom and to what end we should be managing ecosystems, and how humans affect SRKW and salmon. Indeed, overarching management priorities diverged between groups, indicating that the disagreement regarding SRKW and salmon management is just one symptom of more deeply-embedded disagreements (Figure 3.7).

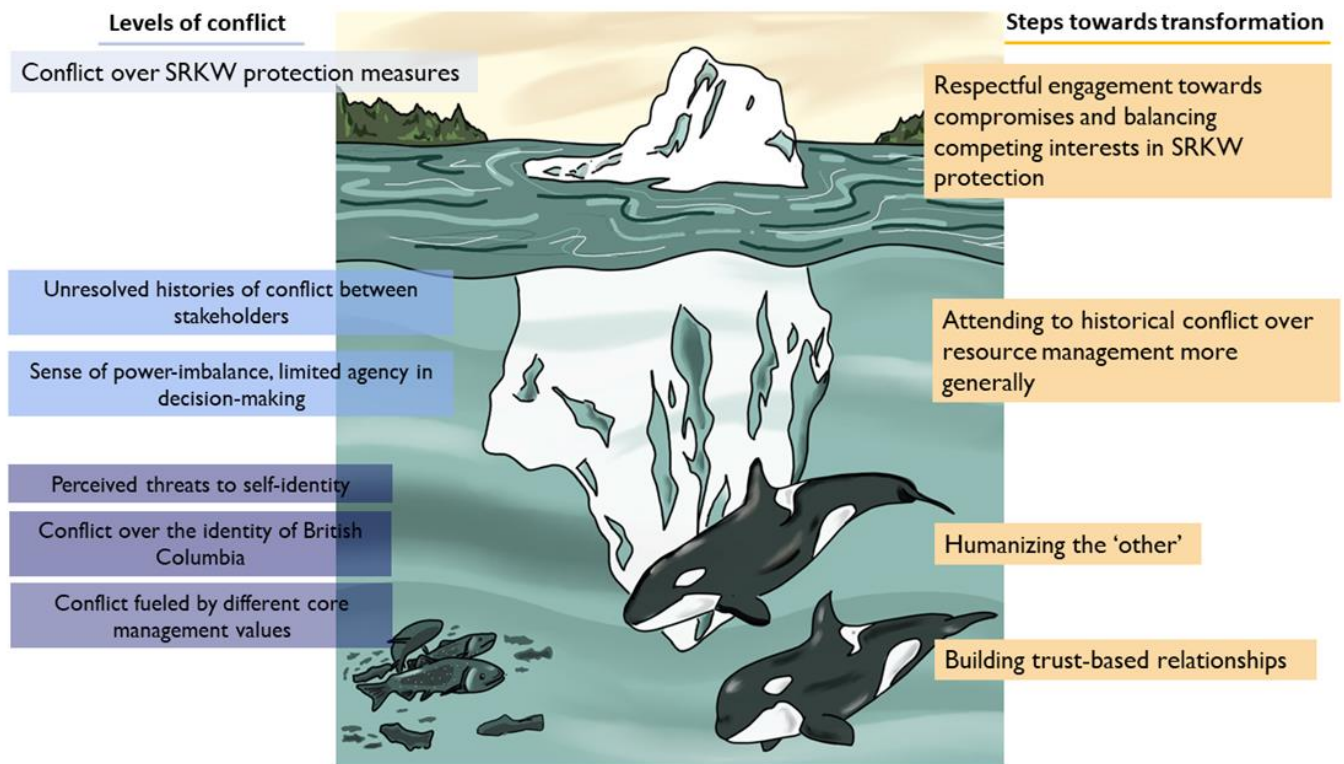


Figure 3.7. Visualization of conflict and transformation in the case of SRKW and Chinook management in the Salish Sea. An iceberg represents the levels-of-conflict, with visible and below-the-surface (more deeply rooted) elements of conflict identified.

Beyond differences in preferred management priorities, our results indicated that less material psychological drivers, such as social identity, may underlie conflict. In other environmental management contexts, the intensity of social identity affiliation can explain attitudes towards different types of wildlife management (e.g., acceptability of lethal management practices) (van Eeden et al. 2019). The intensity of affiliation of both angler and conservation-supporter participants reveals one potential dimension of the deeper social roots of conflict. Specifically, when stakeholders' identity group of intense affiliation are threatened (whether by fishing restrictions, potential loss of an important species, or by an antagonistic stakeholder group/decision-maker), the result can be individual discomfort, anxiety, and uncertainty that

is often assuaged by strengthening group identity and affirming group beliefs (Lüders et al. 2016). This group affirmation can ultimately lead to hostility to perceived out-groups or those perpetuating the identity-threat (e.g., managers) (Tajfel & Turner 1986; Lüders et al. 2016), leading to a spiral of conflict that cannot be attended to simply through managing superficial disputes (Madden & McQuinn 2014, 2015). Indeed, EID and SIA scores were significantly associated with frequency of engagement in conflict by participants in our study, providing potential evidence for such dynamics.

A consequence of increasing hostility between and within groups in the face of identity-based threats is a breakdown of individual and group relationships. Such a breakdown is often characterized by distrust not only in other groups involved but also in individuals or organizations that attempt to remediate conflict, and can further embed already challenging conflict (Madden & McQuinn 2014). As an example of distrust, one commenter remarked,

“The DFO is doing a horrible job of managing the Chinook [sic] fishery. They don’t make science based [decisions] and are entirely driven by political motivations.”

Such distrust in authorities to make science-informed decisions, and general lack of faith in decision-makers to manage SRKW and salmon, is not unique to the conflict at hand. For instance, distrust in other stakeholders and authorities escalated the degradation of relationships between parties engaged in managing mountain lions (*Puma concolor*) in the Western U.S. to social crises prior to CCT intervention (Madden & McQuinn 2014).

Beyond expressed distrust, we observed other hostile sentiments that provided insight into the emotions experienced by stakeholders. Notably, we showed that hostile sentiments occurred significantly more on social media (Facebook) than in response to our survey (via responses to our open-ended question). These apparent differences in tone and frequency of hostility, though emerging from a small and opportunistic sample, may be due in part to the opportunity presented by back-and-forth comments in the social media format. Indeed, we observed conflict escalating between individuals, from expressed disagreement over current management decisions to expletive insults or, in few cases, violent language. Elsewhere, scholars have asserted that social media influences social conflicts by reducing the cost of communication and increasing the speed of information dissemination (Zeitsoff 2017), and revealed that exposure to antagonistic views on social media can exacerbate political polarization and out-group biases (Bail et al. 2018). Thus, alternating comments on our Facebook advertisements that increased in hostility may

represent a feedback loop in which individuals become increasingly polarized when exposed to divergent beliefs.

Open-ended responses to our survey also offered understanding into additional emotions and concerns relevant to conflict. Many participants expressed emotions (fear, victimization, anger) that reflect the felt experiences of individuals involved in identity- and belief-based conflicts, and may signal the formation of collective or group-based emotions that often exacerbate conflict (Bar-Tal et al. 2007). Furthermore, comments suggested different understandings between anglers and conservation-supporters about what challenges SRKW and salmon face. For instance, those with salient angler identities were more likely to express concern about pinniped consumption of salmon (or associated support for pinniped culls) and the impacts of Indigenous fishing. Conservation-supporters were in contrast more likely to express concern about environmental degradation. Conflicts between pinnipeds and fishers are not unique to this case study; elsewhere, data have supported that those who fish tend to have a negative perception of seals and sea lions, perceive them as threatening local fish species, and support culling programs (Cook et al. 2015; Schakner et al. 2019). Assumptions and fears regarding the impact of Indigenous fisheries are also not exclusive to our results. One study indicated that 37% of non-Indigenous anglers identified First Nation fisheries as a threat to fish and their access to them, whereas only 11% of First Nations fishers identified recreational fishing as a threat (Nguyen et al. 2016). While perceptions of Indigenous fishing as destructive pervade among non-Indigenous user groups, these concerns are misguided compared with reality; impact of Indigenous fishing systems across modern-day Canada are low compared to with mixed-stock commercial fisheries and recreational fishing (Morishima & Henry 2000; Atlas et al. 2021). Ultimately, the group differences identified in open-ended responses may represent divergence in values and worldviews that underlie conflict between groups (Tajfel et al. 1971; Tajfel & Turner 1986).

Despite these differences, respondents aligned on several shared concerns. These included the impact of salmon aquaculture, depletion of forage fish, and the impacts of commercial fishing. Shared recognition and concern about these tangible threats suggests that both groups may approve of science-supported management strategies to protect salmon. Among these more “acceptable” management strategies and beyond the restriction of recreational fisheries could be habitat protection, freshwater/estuarine habitat restoration, invasive species and pollution management, and the phasing out of open-net pen salmon aquaculture (Chalifour et al. 2022).

While opportunities towards conflict transformation are presented in part through shared concerns, they also emerge in the form of internal identity group variance. Though anglers are often identified as a

distinct, unified group of stakeholders in media portrayals of this conflict, we observed less consensus (greater diversity of responses) within angler participants than within conservation-supporters. For example, anglers were not as internally consistent in their responses to Likert items regarding support or opposition for policies that protect SRKW by restricting fisheries (Figure 3.4). Moreover, anglers were divided in their identified core management priorities (Figure 3.5). Taken together, these observations suggest that those with salient ‘angler identities’ are not easily generalizable by virtue of their management priorities or even their responses to SRKW protections that limit fishing opportunities, suggesting that anglers may share more in common with conservation-supporters (and other diverse identity groups) than may otherwise be expected.

Whereas the conflict we examined superficially relates to the management of SRKW and salmon, it likely signals deeper clashes over priorities, beliefs, and non-material social and psychological needs. These deeper aspects of conflict can neither be easily attended to through economic or political fixes, nor through stakeholder negotiation or feedback sessions (Madden & McQuinn 2014, 2015). Indeed, processes that attend only to superficial dimensions of conflict may serve to make conflict more intractable (Madden & McQuinn 2014). Given this, we suggest that DFO and other authorities consider a CCT framework, and focus on the creation of long-term solutions that attend to decision-making design, equity, substance, and strengthening trust-based relationships before approaching details of management plans (Madden & McQuinn 2014; Lederach 2015).

While CCT-supported transformation takes many shapes, and must be context-dependent, examples of successful strategies are many. These include multi-day capacity building workshops between stakeholders moderated by external conflict transformation professionals, and social-cohesion exercises focused not on conflicts but instead on mutual humanization of others (especially those within perceived out-groups) (Madden & McQuinn 2014). Although these processes are slow, energy-intensive, and require experts trained in conflict intervention, they offer the prospect of durable solutions that contribute towards successful conservation outcomes and continued opportunity to face evolving conflicts as a unified community (Lederach 1996; Madden & McQuinn 2014).

Beyond our case study, our research suggests that Environmental Identity and Social Identity instruments as well as the value-attitude-behavior model may provide useful methods to understand conservation conflict. When attending to conservation conflicts, researchers and practitioners must first acutely understand the depth and breadth of the conflict at hand before proposing context-based, sustainable solutions (Madden & McQuinn 2014; Lederach 2015). Acknowledging the relationships among human

values, beliefs, attitudes, and behaviors, and examining dimensions of beliefs through pre-existing self-identity instruments, provides a promising way for researchers to analyze conflicts prior to developing interventions. Under the processes and principles of CCT, we suspect that these tools will assist scientists and practitioners in a world increasingly in need of approaches to transform conflict towards solutions.

Ch.4: Examining Social-ecological Predictors of Human-Wildlife Relationships: Human-black bear interactions on the West Coast of Canada

Authors: Lauren E. Eckert, Joanna Klees Van Bommel, Jason Kelley, Christine Wilkinson, Cole Burton, Chris T. Darimont

Abstract

Conflict between humans and wildlife presents significant threats to human and wildlife well-being. Research that comprehensively examines ecological and social dimensions of human-wildlife relationships concurrently can provide new insight into management interventions that promote coexistence. In British Columbia, Canada, human-wildlife conflicts have increased in the last two decades, with most occurring between humans and black bears (*Ursus americanus*). Despite mitigation attempts, conflict in the Qathet Regional District (on the Sunshine Coast of British Columbia) is similarly increasing. Accordingly, we examined the spatially-relevant ecological (e.g., bear relative use, land cover) and social (e.g., beliefs, behavior) predictors to understand how they might explain variation in the probability of conflict. Via a mixed methods approach, we used remote sensing, camera traps, property audits, and social surveys across 27 randomly selected 200-metre by 200-metre grids within the Qathet Regional District (n = 1,271 households). Social surveys revealed variation in participant beliefs about bears; most (52%) considered their overall experience with bears positive, while others reported neutral (32%) or negative (13%) overall experiences. Moreover, our generalized linear mixed-model and an information-theoretic approach identified which variables (or combination) predicted conflict outcomes. We found that road density, household garbage, and participant perception of risk increased the probability of conflict, whereas human density had a negative effect. An interaction term between household garbage and risk perception revealed a positive association between conflict and garbage only when risk perception was high. Relative variable importance determined that household garbage and risk perception were the most important predictors. The interplay between these social and ecological predictors and their resulting influence on conflict reveal new targets for intervention by local collaborating organizations via education, monitoring, and enforcement. More broadly, we showcase an interdisciplinary methodological framework that spans ecological and social approaches, offering promise to confront and mitigate enduring conflict between people and wildlife.

Introduction

Conflict between humans and wildlife presents significant threats to human and wildlife wellbeing globally. These conflicts, manifesting across species, geographies, and cultures, are often considered intractable due to their inherent complexity and the persistence of intersecting drivers (e.g., social, cultural, spatial, ecological, biological, etc.) (Dickman 2010; Pooley et al. 2017; Lischka 2018). Human-wildlife conflict is on the rise in many regions globally, where human populations are expanding into wildlife habitat, or where carnivores are re-colonizing historical ranges (Woodroffe et al. 2007; Dickman 2010; Nyhus 2016), with diverse consequences (Peterson et al. 2010b; Bruskotter & Wilson 2014; Sabatier & Huveneers 2018; Frank et al. 2019). Whereas consequences for humans involved in conflict can include destruction of property or crops, livestock depredation, disease transmission, and – in rarer cases injury or death – consequences for wildlife are frequently lethal, conferring population-level threats in a number of species (Treves & Karanth 2003; Woodroffe et al. 2005; Thirgood et al. 2005; Dickman 2010; Pooley et al. 2017).

As research focus has shifted from overcoming conflict to promoting coexistence, applied scholars have consistently recommended interdisciplinary approaches to examine and address human-wildlife relationships comprehensively. Dickman (2010) suggested that long-term mitigation efforts often fail to resolve interspecies conflict because researchers and managers regularly make incorrect assumptions about what prompts human engagement in conflict, missing the complexities that influence human actors (e.g., factors such as risk perception, power inequities, underlying beliefs and values, sociodemographic variables, etc.; Dickman, 2010). Many studies of human-wildlife interactions have focused primarily on ecological dimensions of conflict (Peterson et al. 2010; Lischka 2018) – for instance, by studying wildlife food availability, demographics, behavior, and movement, and/or how anthropogenic landscape attributes (human density, road density, etc.) influence wildlife ecology and human-wildlife interactions (e.g., Merkle et al. 2011; Lewis et al. 2015; Klees van Bommel et al. 2020; Bommel et al. 2022). While studies have increasingly examined social predictors of human-wildlife conflict (e.g., by measuring peoples' wildlife value-orientations, tolerance, trust in authorities, how media influences perceptions, among many other examples) (e.g., Gusset et al. 2009; Peterson et al. 2010; Houston et al. 2010; Zajac et al. 2012a; Bruskotter & Wilson 2014; Hayman et al. 2014; Redpath et al. 2015a; Sabatier & Huveneers 2018), and others have considered these social factors within landscape-scale context (Frank et al. 2019), few have concurrently and comparatively considered social and ecological predictors to understand the correlates of conflict in case studies (Dickman 2010; Lischka et al. 2018; but see Wilkinson et al. 2021). This oversight may well be due to the challenges presented by the complexity of such research. Indeed, integrating social

and ecological data concurrently can be difficult, owing to differences in resolution of respective data, gaps in specialists' understanding and preferred methodologies across disciplines, as well as limited data availability, among other challenges (Bruskotter & Wilson 2014; Lischka et al. 2018).

Despite these challenges, scholars contend that developing interdisciplinary methods to examine conflict in social-ecological systems will strengthen our ability to comprehensively identify the causes of conflict (or coexistence) between humans and wildlife (Manfredo & Dayer 2004; Dickman 2010; Manfredo et al. 2014; Pooley et al. 2017). Scholarship has recently emerged to support interdisciplinary endeavors to this end. Lischka et al. (2018) proposed a social-ecological conceptual framework as a means for understanding nested factors and interrelationships between social and ecological predictors (Appendix C). Carter et al. (2019) further proposed integrated spatial analysis (spanning social and ecological variables) to predict and understand human-wildlife conflict and coexistence. Contributing to interdisciplinary methods to address and move beyond conflict, Conservation Conflict Transformation (CCT; Madden & McQuinn 2014) offers processes and principles to address conservation conflicts, including those that arise between humans and other species. While CCT and associated tools (e.g., the levels-of-conflict model, the conflict intervention triangle) could guide social-ecological approaches to examine the anatomy of human-wildlife conflicts and inform mitigation, they are yet to be operationalized to explicitly address conflict that arises between humans and other-than-human animals (though processes have been operationalized to transform conflict between stakeholders regarding contentious wildlife management; Madden & McQuinn 2014). Despite the current momentum behind social-ecological approaches to understanding and transforming conflicts, research that operationalizes these frameworks and empirically relates individual human attributes directly to wildlife ecology to probe drivers of conflict are still lacking (Manfredo et al. 2014; Lischka et al. 2018; Carter et al. 2019; Wilkinson et al. 2021).

Here, we aim to fill gaps in the human-wildlife interactions literature by examining the components of human social systems alongside ecological dimensions of human-wildlife conflict. Specifically, we examine human-black bear (*Ursus americanus*) interactions in British Columbia using integrated social-ecological models of human-wildlife interactions (i.e., Lischka et al. 2018; Figure 4.1). **The objectives of this research are to:** i) contribute a new interdisciplinary analytical approach to bridge social and ecological predictors of human-wildlife interactions and associated conceptual models, ii) apply CCT analytical principles to scenarios of human-wildlife conflicts, and iii) generate data and analyses that can be applied locally to support efforts towards transformation of human-bear conflicts to coexistence.

Case Study

When approaching human-wildlife conflict and assessing what factors might predict conflict or coexistence outcomes, it is critical to examine the unique local context of human-wildlife relationships. Indeed, each human-wildlife interaction and associated outcome occurs in a local setting of complex social, ecological, cultural, economic, historical, and geographic contexts (Madden 2004). Incorporating local considerations, human actors, local organizations, and a suite of other complex and interrelated factors in research processes and the dissemination of results is considered key to engaging productively in human-wildlife interaction research (Dickman 2010; Manfredo et al. 2014; Redpath et al. 2015a). We engaged in a case study in the Qathet Regional District (qRD), including the adjacent towns of Powell River (also, 'Qathet') and Lund in British Columbia (BC), in the lands now also known as Canada (Figure 4.2). Powell River, Lund, and surrounding areas together host a population of approximately 14,000 residents (Statistics Canada 2021). Both Powell River and Lund are colonial settlements on the territories of the Tla'amin (Sliammon) Nation, a Coast Salish Nation whose economic, political, and spiritual systems are based on unique relationships to their territory historically and today (Tla'amin Nation 2014).

The qRD has faced substantial sociodemographic shifts, pronounced in the last three decades. The (settler) community has shifted from a predominately extraction-based economy (forestry) towards home-based businesses and tourism, and population has increased (there was a 7.1% population increase in the qRD between 2016-2021) (Statistics Canada 2021). Preceding shifts to this settler-community, historical changes include the violent attempted colonization of Tla'amin Nation, who are reasserting their cultural practices and land management rights and currently moving into self-governance (Tla'amin Nation 2014). Alongside social changes within this intersectional community, the region has witnessed substantial changes in human-wildlife interactions. Anecdotally, the qRD has experienced increases in human-bear conflict, pronounced since 2015 (Bolster 2017), with 77% of all reported conflict in 2019 occurring between humans and black bears (*Ursus americanus*) (WildSafeBC 2020). Local experts in the region (Conservation Officers and WildSafeBC coordinators) perceived the last decade's increase in reported conflict as predominately driven by human behavior related to attractant management (Bolster 2017). Accordingly, local outreach aimed at mitigating human-wildlife conflict has primarily targeted human behavioral interventions, encouraging safe management of wildlife attractants. How such efforts could be allocated optimally (i.e., spatially, or with specific educational instruments), however, is unknown.

Materials and Methods

We used mixed methods incorporating landscape-scale ecological data, bear detection data, and social data regarding human behavior, experiences, beliefs, and demographics to assess human-bear conflict in our case study social-ecological system (Figure 4.1). Our data collection methods included property audits, camera trap surveys, GIS characterization of landscapes, and social surveys distributed to households. These approaches were informed by increasing calls to concurrently analyze and integrate social- and ecological- drivers of bear-human conflict, and by CCT analytical models that calls researchers to analyze the anatomy of conflicts – including their complex roots – to inform interventions.

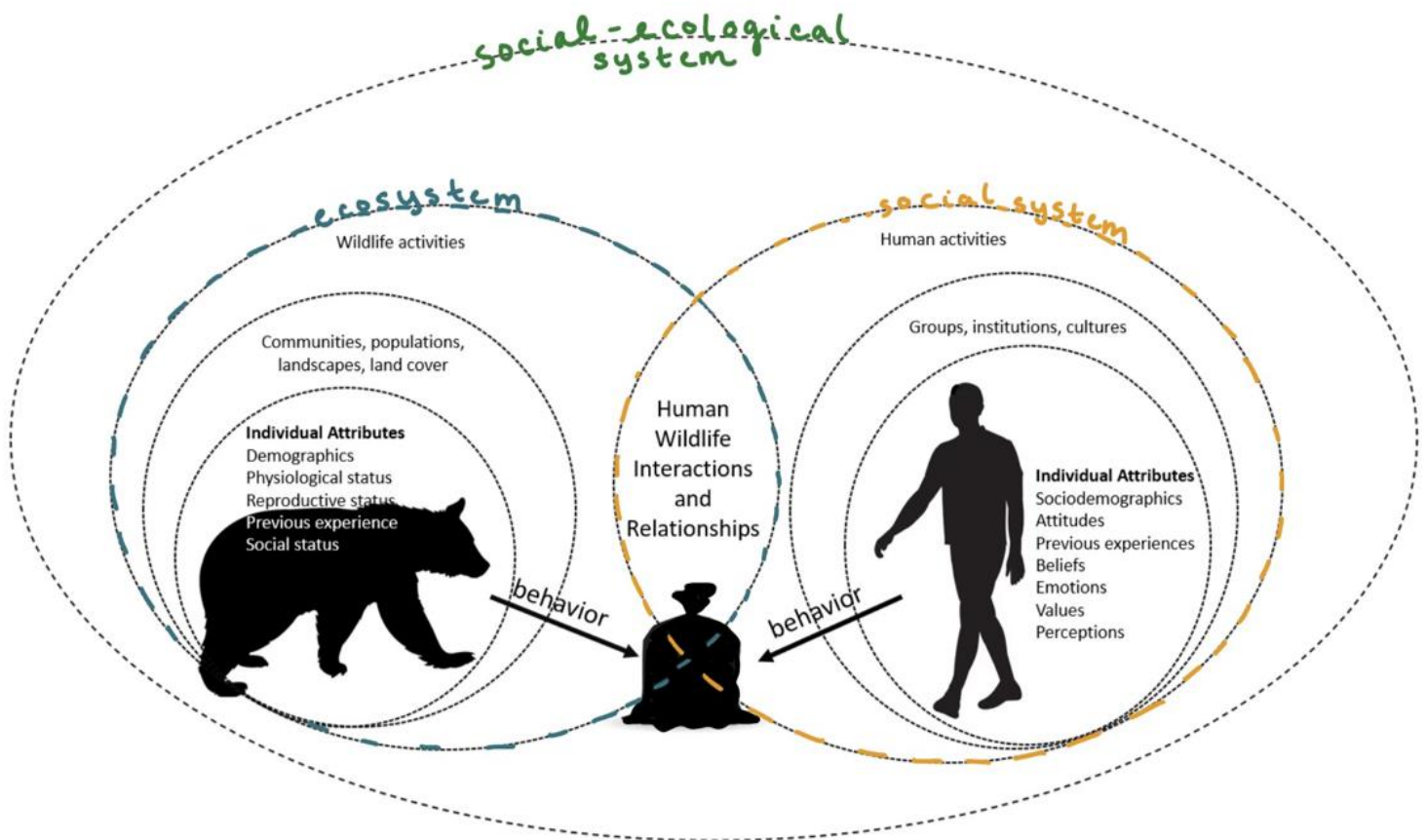


Figure 4.1. A social-ecological model of human-bear interactions in the qRD. Black bears and humans share a social-ecological system, and their behavior (including how it relates to bear-human interactions) is nested within and influenced by complex individual, institutional/community and eco- or social-system attributes.

Study Area

We restricted the geographical scope of sampling areas by creating a polygon (149.6 km²) in ArcMap 10.6.1 (ESRI) representing a joined 1km buffer around recent historical conflict locations reported to the

British Columbia Conservation Officer Services (BCCOS) between 2013-2019 and recorded in the BCCOS Human Wildlife Conflict Reporting Database (n = 1,900 conflicts) (BCCOS 2019) in the qRD (Figure 4.2). We overlaid these study areas with a 200m x 200m grid (using the ‘Fishnet’ tool in ArcGIS) and then categorized each resulting grid cell according to its recent history (‘legacy’) of conflict. The database contains reports about black bear (and other wildlife) interactions from residents throughout British Columbia (BC), including information on the type of interaction, species, date, time, location, and call outcome, among other data. We removed reports of interactions with species other than black bears and categorized reports as either ‘conflict reports’ (e.g., damage to property, reports of antagonistic behavior by bears, etc.) or non-conflict reports (i.e., sightings; Klees Van Bommel et al. 2020). This resulted in 1,319 conflict occurrences across the 149.6 km².

To capture variation in social and ecological variables (and human-bear interaction outcomes) across our study areas, we categorized grid cells into three categories. We used natural Jenks breaks in the data to define low, medium, and high ‘legacy’ conflict grid cells (Table 4.1).

Limitations of these conflict data exist. Namely, the COS data only represent conflict reported to local Conservation Officers (COs), the COS call centre, or WildSafeBC personnel (a BC-wide non-profit organization). Conflict report data may additionally have biases (i.e., those individuals who choose to report may possess shared traits that makes them more likely to formally report conflict, or may have different thresholds for defining perceived conflict). However, research elsewhere has determined that sociodemographic factors had little influence on whether or not an individual reported an interaction with a black bear (Wilbur et al. 2018). Accordingly, despite these limitations, the interactions reported to the BCCOS likely represent a reliable index of human-wildlife interaction; indeed, the conflicts reported in the dataset are real for those who experienced and reported them, and reports of conflict may result in negative consequences for wildlife regardless of severity of conflict (Thirgood et al. 2005).

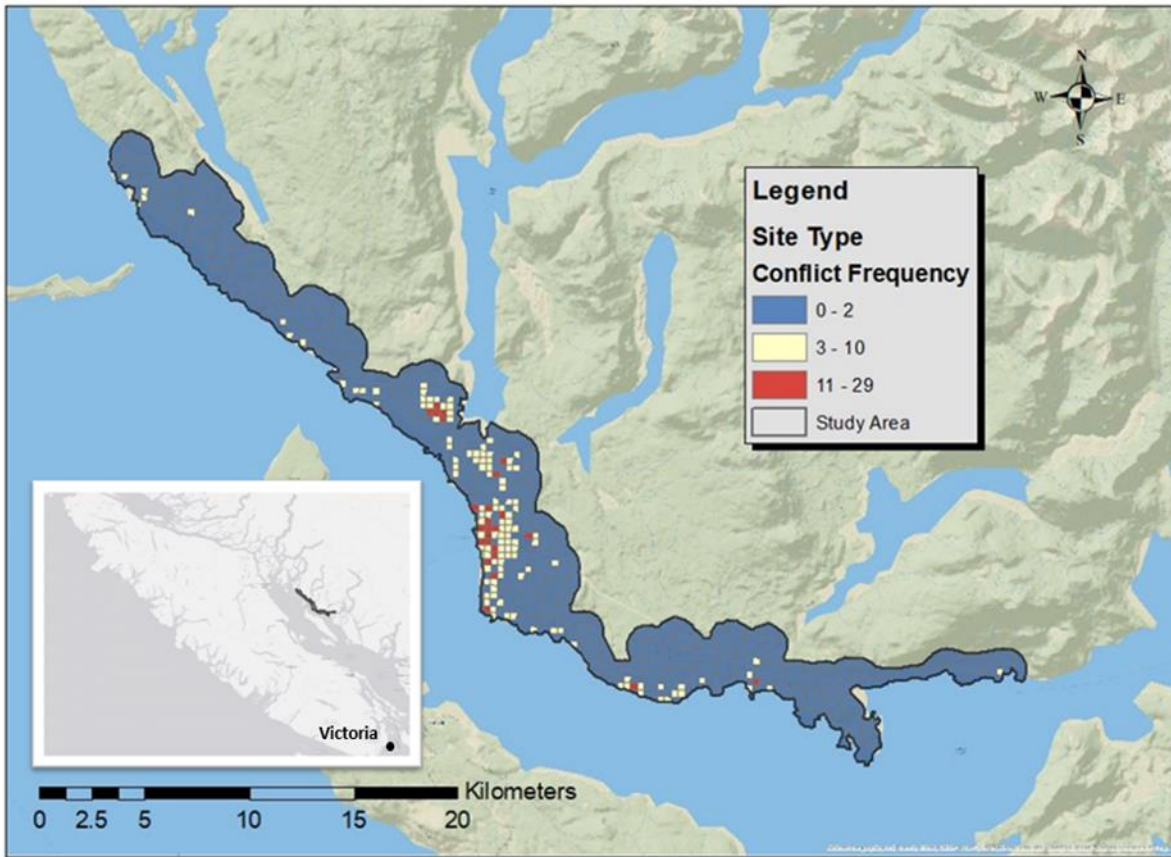


Figure 4.2. Study Area. The Qathet Regional District (Tla’amin and Coast Salish Nations territories), with study area restricted to within a 1km buffer of recent historical conflict (legacy) reports (BCCOS, 2013-2019). Grid cell site type (Table 4.1) indicated by color.

Grid Cell Type	Number of Conflicts Reported	Total Grid Cells	Selected Grid Cells
Low Conflict Legacy	0-2	n = 768	n = 6
Medium Conflict Legacy	3-10	n = 119	n = 14
High Conflict Legacy	11-29	n = 25	n = 7

Table 4.1. Grid cell ‘legacy conflict (2013-2019)’ categories in the qRD.

Site Selection

We removed all grids cells that contained no households, and we did not include any potential grid cells within defined Tla'amin Private Lands (Indigenous and Northern Affairs Canada et al. 2016), given that the Nation engages in their own research programs and environmental management processes. In total we omitted 835 grid cells. Our research timeline did not reasonably correspond with co-creating a project with Tla'amin Nation Lands Administration. We then randomly selected sampling sites (selected grid cells) among the remaining 912 grid cells to sample across our study area ($n = 27$), considering each grid cell's assignment to category of legacy conflict (Table 4.1).

After classifying grid cells, we randomly selected 15 grid cells of each grid cell type with the goal of selecting 27 sites total (we selected more grid sites during this process than we required in total, assuming that we would not be able to find a suitable camera host volunteer within each grid cell). After randomly selecting grid cells, we assessed if we had any camera trap volunteers in our database from previous scoping surveys (in early 2020 we distributed public survey gauging community interest in our project, which included a question regarding whether participants would potentially be interested in hosting a wildlife camera on their property) and then distributed flyers (Appendix C) to households in all of the randomly selected grids where no previously-identified camera host lived. These flyers, left in publicly accessible mailboxes or mailed to those addresses with community mailboxes, introduced residents to the project with the additional aim of soliciting interest from residents in hosting a camera trap on their property. After waiting two weeks to hear from potential camera hosts, we resampled grids (selecting 1 new grid from each category remaining) and distributed flyers to residences in the new randomly sampled grid soliciting interest in hosting a camera until camera hosts were identified and grid sites finalized. Trail camera hosting occurred on a first-come, first-served basis, and grid sites were not selected until a trail camera host was identified.

We stratified our sampling approach across different categories (Table 4.1) according to what percent of historical conflict each category represented. In the qRD 27% of past reported conflicts occurred in low conflict sites ($n = 355$ of 1,319 conflicts), 43% in medium conflict sites ($n = 567$), and 30% occurred in high conflict sites ($n = 397$). Thus, we aimed to sample proportionally similar (i.e., representative) distribution of grids, but were constrained in our proportional efforts by our ability to identify camera hosts in randomly selected sites; we ultimately sampled 7 high-conflict grids (26%), 14 medium-conflict grids (52%), and 6 low conflict grids (22%).

Response Variable: Conflict

We were interested in understanding how social and ecological predictor variables related to spatial variation in self-reported conflict occurrences in the qRD. To identify patterns of conflict and their predictors, we collected data using an online survey (*SurveyMonkey* hosted by The University of Victoria; details below) completed by a subset of residents (n = 202) in the qRD (Appendix C) as our response variable. ‘Conflict’ was a binomial variable representing whether the survey participant had or had not experienced a negative interaction with a black bear in the last year (2021) and associated with a single residential address and individual.

Predictor Variables

We considered potential predictor variables as informed by the human-wildlife conflict literature and the characteristics of our study system. We focussed on relevant studies regarding black bears, especially a recent and nearby case study (i.e., Klees Van Bommel et al. 2020). From this potential list we selected ecological and social variables that previous research supports may influence human-bear interactions and likely contributed to variation in conflict in the qRD (Appendix C). We identified variables as social or ecological according to their common use elsewhere in the literature (e.g., Zajac et al. 2012a; Campbell 2012; Bommel & Klees 2019; Carter et al. 2019; Lischka et al. 2019) and in relation to management implications should they be identified as key drivers of conflict in the region. For example, we categorized landscape-scale variables (e.g., urban land cover, human density, road density) that relate to spatial ecology of bears as ‘ecological variables’, despite their ultimate anthropogenic origin. Conversely, we categorized predictor variables that related to individual people (e.g., human behavior, beliefs) as social for the purposes of our study. We recognize however, that these distinctions might seem fuzzy and, in some cases, contestable. Certainly, this is in part because human animals (and associated individual behaviors and collective landscape changes) are fundamentally integrated into broader ecosystems, and reciprocally impact and are impacted by these ecological contexts. However, these social and ecological variables are often treated as discrete in the literature – a reality we attempt to confront in this work by reintegrating social and ecological variables in analytical approaches explained below.

Ecological Predictor Variables: Landscape Variables

We relied on ecological predictor variables determined during Klees Van Bommel et al.’s (2020) previous work, which used a resource selection approach to identify ecological predictors of black bear-human

conflict in the nearby Capital Regional District. We specifically selected those variables that had significant associations with conflict (Appendix C) to inform our ecological variables and candidate models for the qRD. The CRD is an administrative district encompassing Southern Vancouver Island, approximately 250 km from the qRD. We reasoned that landscape scale ecological variables across these two geographically proximate and similar districts would influence the potential for human-bear conflict in similar ways.

We prepared ecological data following Klees Van Bommel et al.'s (2020) methods. Specifically, we developed raster layers to estimate distances from households within our sampling grids to the closest edge of the following land cover classes (using the 'Euclidean Distance' tool in ArcMap 10.6.1): agriculture, urban, intact forest and forest patches, using a 5 m resolution land cover raster we developed using publicly available light detection and ranging (LiDAR) data (Appendix C). Aligned with Klees Van Bommel et al. (2020) and Larkin et al. (2004), we differentiated 'intact forest' from 'forest patches' (based on a break point of 300 m²), given that black bears show different use patterns between disturbed forest patches and larger, core forest habitat (Larkin et al., 2004). Owing to differences in the distribution and quantity of agricultural land cover between the qRD and CRD (the qRD has considerably lower levels of agriculture than the CRD), and limitations in accurately spatially defining agriculture in the qRD, we did not include 'distance to agriculture' as a predictor in our candidate models. We also followed Klees Van Bommel et al. (2020) in estimating human density. We extracted data from the Gridded Population of the World (GPWv4, v.4.11_2015) and elevation from the ASTER Global Digital Elevation (NASA/METI/AIST 2009). We generated road and trail densities using the Line Density tool (in ArcMAP 10.6.1; ESRI 2018) with data accessed through BC Provincial databases and the qRD (qRD 2020). We extracted all spatial data around residences using a 150 m weighted buffer (weighted buffers proportionally reduce the contribution of raster cells not fully within each buffer). We extracted data in a weighted buffer in order to replicate processes used by Klees Van Bommel et al. (2020), and to account for potential spatial discrepancies in conflict locations, potential location divergences created when converting residence addresses to coordinates and corresponding spatial points, and to facilitate incorporating data regarding surrounding attractants that may influence human-bear interactions at residences. Because we were explicitly interested in residential conflict occurrences, we did not include 'trail density' in our models.

Prior to modeling, we standardized extracted spatial variables by subtracting the mean and dividing by one standard deviation (aligned with Klees Van Bommel et al. 2020). Deviating from Klees Van Bommel et al. (2020), we did test for a quadratic (non-linear) relationship with human density, owing to

differences in human population density between the two regional districts. While Klees Van Bommel et al. (2020) predicted that conflict would increase in areas of intermediate human density in the CRD (where the largest city, Victoria, has a population of approximately 92,000 people (Statistics Canada 2022)). The qRD's largest city includes only 13,000 residents, all living in close proximity to intact and patch forests. Thus, we predicted that conflict between people and bears would have a positive relationship with human density, as we reasoned that human density would not reach the threshold to reduce bear presence (as was assumed to be the case in the CRD). We excluded estimates of elevation in our candidate models, as this variable's inclusion consistently resulted in model overfitting, and elevation varied little across our study area (range: 0 to 377 m).

Ecological Predictor Variables: Relative Bear Detection

In addition to landscape-scale spatial variables, we included a 'bear relative detection' score for each 200m x 200m grid we sampled in the qRD. This metric was developed using bear detections on trail cameras throughout our sampled sites, and we assumed that the detection rate at each camera reflected the intensity of use of that site (grid cell) and thus hypothesized that the likelihood of conflict would increase with increasing bear use. We established trail cameras ('camera traps') (Browning® Strike Force APEX 18MP and Extreme 22 Trail Cameras, n = 27) on a volunteer camera host's property within each sampled grid, according to their knowledge of bears' movements through their property and to maximize the likelihood that the camera would detect bears on the property (Klees van Bommel et al. 2022). Camera traps are a non-invasive means to detect terrestrial animals, and their use encompasses a wide range of applications, including detecting wildlife, assessing distribution, behavior, and more (Burton et al. 2015). Cameras were active between April 10 – November 15, 2021, and retrieved between November 10 – 15, 2021. Each site contained one established camera, and each camera was affixed to a tree (or similar stable structure) at approximately one meter of height (aligned with Klees van Bommel et al. 2022). Cameras were set at high sensitivity to take a series of 4 images separated by 0.3 seconds ('rapid fire shots') with each detection event. We visited cameras once monthly while active to verify functionality, retrieve images, and replace batteries as needed. We classified independent black bear detections (those separated by 10 minutes) in Microsoft Excel (Microsoft Corporation 2018) and counted sows with cubs as multiple detection events (i.e., a sow with 2 cubs was recorded as 3 detection events), as we assumed each individual bear posed the potential for a conflict outcome. We summed detection events at each site as a measure of relative bear detection, recognizing that imperfect detection limits our ability to reliably estimate relative activity among sites (Burton et al. 2015), and that sampled households within each grid

site varied in their distance to the established camera (up to 200m away from an established camera). However, because we are interested in the potential for conflict occurrence and its potential relationship to bear activity, we believe these detection events (in conspicuous locations, on private properties) nonetheless provide useful information for each site and our model, especially given bears foraging behavior (i.e., that bears forage extensively in urban environments and at fine scales will balance energy budgets and individual safety by moving frequently to preferentially select high-energy, proximate attractants, like garbage; Merkle et al. 2013; Lewis et al. 2015). Per our University of Victoria Ethics protocol, we deleted any images resulting from detections of people, vehicles, or pets, and all camera hosts signed a Research Consent Form (University of Victoria RAIS, #20-0076).

Social Predictor Variables

We drew from the relevant literature regarding social variables that have been shown to influence conflict occurrences between people and carnivores, with a focus on relationships between people and black bears in North America. Across the literature, conflicts between humans and black bears are often linked to anthropogenic attractants (e.g., garbage, vegetable gardens, bird feeders, fruit trees, etc.) that bring black bears into close proximity with people and their properties (Beckmann & Berger 2003; Campbell 2012; Elfström et al. 2014). Thus, human behavior as it relates to attractant management can play a direct role in conflict occurrence. We measured the attractant management behavior of all residents within our selected sites in the qRD using standardized property audits (Campbell 2012) as a proxy for attractant management behavior. Each residence across the qRD (n = 1,271) was visited once monthly between April – November 2021 (8 visits total), and all visible bear attractants (Appendix C, derived from Campbell 2012) were recorded via type count (presence/absence of each attractant was recorded) (Campbell 2012). While we recognize that some attractants may not have been visible from the public spaces (i.e., roads, sidewalks) that we were able to observe properties from, we reason that areas of the property that were visible provide a reasonable representative metric for relative attractant presence. Each round of property audits took approximately one week, and sampling was scheduled to avoid garbage collection days where relevant. While engaging in property audits, we remained on public property (i.e., sidewalks or roads) and followed an established observational protocol approved by the University of Victoria Human Research Ethics Board (Appendix C, University of Victoria RAIS, #20-0076). Because we reasoned that anthropogenic attractant (i.e., garbage, fruit trees, pet food, etc.) of neighboring yards may draw bears to or near surrounding homes – even those that do not have attractants on their property – we also extracted attractant data in a 150m circular buffer (‘neighborhood attractants’) surrounding each residence (thus including household attractants and those of surrounding houses within the buffer in our

‘neighborhood attractants’ metric). To account for the fact that attractant data were spatially limited to our 200m x 200m grids (i.e., some circular buffers around residences included areas where we did not gather attractant data), we extrapolated collected attractant data to the proportion of each 150m circular outside of our 200m x 200m grid sites.

Beyond (and influencing) human behavior (including practices of attractant management), cognitive antecedents affecting human tolerance (often referred to synonymously with ‘acceptance’ or ‘wildlife acceptance capacity’) of black bears are often cited as associated with human-bear conflict (Zajac et al. 2012; Lischka 2018; Lischka et al. 2019). Researchers and practitioners increasingly seek to understand variation in human tolerance of carnivores, as these deeper psychological attributes may mediate their perception of interactions with them (including conflict) and vice versa (Cleary et al. 2021). We selected and assessed ‘risk perceptions’ (an individual’s intuitive evaluation of the threat posed by black bears; Slovic 1987, McDaniels et al. 1996, Zajac et al. 2012) of participants in the qRD as our primary psychological model variable. While we recognize that many other interrelated human attributes may influence interaction outcomes between people and black bears (i.e., attitude, acceptance, assessment of benefits, demographics, etc.), we chose risk perception scores as our primary psychological variable because of its well-supported ability to explain variation in human tolerance for black bears (Zajac et al. 2012; Lischka et al. 2019). We diverge from many other studies in not including sociodemographic variables in our candidate models; we did not include these variables (i.e., age, education, gender, etc.) because of limited sample size and because Kansky and Knight (2014) determined that demographic attributes were generally poor predictors of peoples’ attitudes towards black bears in a meta-analysis identifying factors associated with varying attitudes to four groups of terrestrial mammals (elephants, primates, ungulates, and carnivores) (Kansky & Knight 2014).

To measure self-reported conflict (our response variable), risk, and other social information to understand our study population and inform local management (i.e., beliefs, sociodemographics, etc.) we developed a 47-item survey (Appendix C). Its design was guided by the existing literature and several experts in the area, including both a former and current WildSafeBC coordinator, BCCOS officer, and CRD social scientist (BF) with expertise regarding human-black bear interactions. To measure risk perceptions, we used a 7-item measure, which included statements that required participants to answer with response options that ranged from -3 (strongly disagree) to 3 (strongly agree), resulting in a single mean quantitative risk score (hereafter, ‘risk perception’) (Zajac et al. 2012, Slovic 1987; Appendix C). We assessed internal consistency of our risk survey instrument using Cronbach’s α (Cortina 1993). Our administered survey also included questions about conflict experience (our response variable in the qRD),

behavioral intentions, beliefs, past experiences with bears, demographic questions, and an open-ended response. Our survey contained extensive social data collection tools beyond those social variables contained in our models. We included additional questions to address desires of our collaborators (BCCOS, WildSafeBC) and towards future practical reports for qRD personnel and leadership. We only included social variables best supported by pre-existing research in our models, aligned with principles of parsimony and to avoid model overfitting. We piloted our survey with local experts and approximately 10 individuals familiar with our study goals to ensure that our language was understandable and assess typical response time required of participants. Between January – April 2022, we distributed survey invitations (paper invites with QR code directed to our online survey) twice to all houses within our grid sites in the qRD. If houses had community mailboxes rather than accessible mailboxes, we mailed survey invites. To encourage survey participation, all survey participants had the opportunity to enter a drawing for one of two \$150 gift cards to a local store of their choice. Participants also had an opportunity to contact the researcher to request a paper copy of the survey to complete but were informed that their anonymity would be limited if they completed the survey this way (their data, however, remained confidential).

We collected all field and survey data between April 2021 and May 2022.

Analysis

Social Survey

We analyzed 202 complete surveys; using RStudio (version 4.3.0, R Core Team 2023) to summarize survey responses.

Candidate Models

Using social and ecological variables and based on our predictions about what variables (or combination thereof) best explain self-reported conflict, we developed a candidate model set (Appendix C). Because we were interested in understanding whether a combination of ecological and social variables explained more variation in conflict outcomes than either ecological or social variables alone, we undertook a two-staged approach to model selection. We first competed models within ecological and social variables, and then competed the best models (those within 2 AICc of, and including, the top model) from these categories against each other, as well as against combined models containing both social and ecological

variables. This approach allowed us to determine whether ecological, social – or as we predicted, the interaction between the two – best explained variation in conflict in the qRD.

Our ecological model set included our suite of ecological variables derived from Klees Van Bommel et al. (2020). Our social model set included variables related to attractants and participant risk perceptions. In our social model set, we used ‘household garbage’ (Table 2) or ‘household attractants’ (Appendix C, Table C.5.2) as alternative variables across models (i.e., some model sets contained ‘household garbage’ instead of ‘household attractants’; Appendix C), reasoning that, based on findings elsewhere, garbage may be more influential in attracting bears to properties than other attractants (Lewis et al. 2015). We also considered interaction terms in some models between household attractants (or its ‘household garbage’ substitute) and ‘risk perception’, reasoning that the association between the presence or quantity of attractants and conflict outcomes depended on the risk perception of the household occupants. We expect that when perceived risk levels are high and a bear is observed disrupting attractants, an individual may perceive this as a conflict whereas those with low risk perceptions may not. We also included an interaction term between household attractants (and its ‘household garbage’ substitute) and ‘neighborhood attractants’, reasoning that if a neighborhood is dense with attractants, it will potentially mediate whether a household attractants influence conflict at a given residence (either by drawing bears to a given residence because of the density of attractants nearby, or by reducing the likelihood that a bear will visit a residence if it is drawn to other, high-reward nearby attractants). When competing our models, we included a null model, and a model containing all variables in each model set.

Prior to modeling, we assessed raw data from property audits and surveys. We removed all residences with addresses that could not be verified through BC Address Geocoder (Province of British Columbia 2023), and any surveys that were not completed or did not include a complete address within one of our sampled grids ($n = 90$). After these removals, we included 202 complete observations in our model and related analysis.

We centred and scaled all continuous variables prior to modeling. We prepared our predictor variables by inspecting collinearity with Pearson correlation coefficients (Freedman et al. 2007). No variables showed evidence of collinearity (all $r < 0.7$). We modeled the probability of conflict using a generalized linear mixed effects model (GLMM) in R employing a binomial distribution and logit link function (package `glmmTMB`; Brooks et al. 2017), introducing a random effect (‘individual’) to account for unmeasured heterogeneity among survey participants. To identify which of our explanatory variables and corresponding set of candidate models best predicted conflict occurrence in our study region, we

employed information-theoretic model selection via Akaike's Information Criterion corrected for small sample size (AICc; Sugiura 1978), thereby testing to account for model fit and parsimony (normalizing model likelihoods to Akaike weights to estimate relative support of each candidate model) and corrected for small sample size (Burnham and Anderson, 2002). We considered top models those that ranked within 2 AICc of the model with the lowest AICc value (Burnham and Anderson 2002; Grueber, Nakagawa, Laws, and Jamieson 2011). To account for model uncertainty, we engaged in multimodel inference; we interpret and present results for all models where Δ_{AICc} is < 2 (Appendix C). We did not engage in model-averaging in part owing to the presence of an interaction term in our top model set; model averaging in the presence of interaction terms can result in misleading or inaccurate results (Cade 2015). To support detailed inference about specific variables, we calculated relative variable importance (RVI) for each predictor variable in our top models (standardized by the numbers of models including the variable) to determine which effects have the strongest influence on performance of models in our top model set (Kittle et al. 2008). Finally, we report conditional R^2 values (Nakagawa & Schielzeth 2013) as a measure of overall model fit (variance explained) for models within our top model set, noting that there are criticisms of and limitations to using R^2 in the context of generalized and non-normal models (e.g., Cox and Wermuth 1992).

Qualitative Analyses

We also analyzed participant responses to open-ended survey questions using a qualitative, constructivist approach (Olsen 1999). We identified themes that arose using NVivo software (QSR International Pty Ltd. Version 14) in answer to our open-ended survey question, "In your ideal world, what would the relationships between people and black bears in Powell River and Lund look like?" We coded participant responses into coarse categories (i.e., human responsibility to improve relationships, problem bears, coexistence) and then finer sub-categories. Each statement could be coded more than once (i.e., if the statement included content related to more than one code).

Results

Social Survey

Our estimated response rate for our administered surveys was 23% (n = 292 responses of 1,271 invitations). We analyzed completed surveys (n = 202), which originated from 25 of 27 of our sampled grid sites. Across these surveys, participants varied in sociodemographics, beliefs, and experiences

(Appendix C). Briefly, about 45% of respondents were men, 52% percent women, and 3% gender non-binary, or did not wish to share. The mean age of respondents was 57.8 years (median = 60 years, range = 18 – 91 years), and the mean time in the qRD was 27.3 years (median = 23 years, range = 0 – 80 years). About 17% of respondents earned an advanced degree as their highest level of education, 20% received a bachelors, and 33% received a 2-year terminal degree.

Respondents varied in their beliefs about and experiences with bears. Most survey respondents (52%) considered their overall experience with bears positive (17% rated their experience as ‘very positive’, and 34% as positive); 14% of respondents reported an overall negative experience with bears (13% ‘negative’ and 2% ‘very negative’); 32% of participants considered their overall experience with bears neither negative nor positive.

Despite a majority of participants reporting overall positive experiences with bears, many participants also reported experiencing negative interactions. Approximately 47% of participants reported a negative interaction with a black bear at some point, and 22% reported having experienced a negative interaction in 2021 (our response variable). Of those who had experienced a negative interaction and provided details about that interaction, 90% reported that a bear had damaged their property, 12% reported that a bear had harassed them directly, or that they had felt threatened by them, and 10% reported that a bear had attacked or harassed their pets or livestock (participants could select more than one interaction type). Notably, only 34% of respondents who had experienced a negative interaction with bears (at any point) had reported the interaction to the BCCOS. Even more survey respondents reported having positive interactions with black bears. 81% of participants also shared that they had positive experiences with bears, including seeing a bear and feeling curious, excited, or delighted (70.3%), or more connected to nature (93.3%), among others.

Participants also varied in their preferences about black bear populations (a single-item measure often used to assess acceptance of wildlife). Most (65%), however, considered bear populations at a level ‘as they should be’. More (22%) considered them too high (3% responded ‘much too high’, 7.9% responded ‘too high’, and 11.9% responded ‘slightly too high’) than too low; 12.4% of respondents felt that populations were too low (1.5% responded ‘much too low’, 4.0 ‘too low’, and 6.9% ‘slightly too low’).

Participants varied in their perceived risk associated with black bears (Figure 4.3); the mean risk perception score was 3.1 (median = 3, range = 1-7, SD = 1.05).

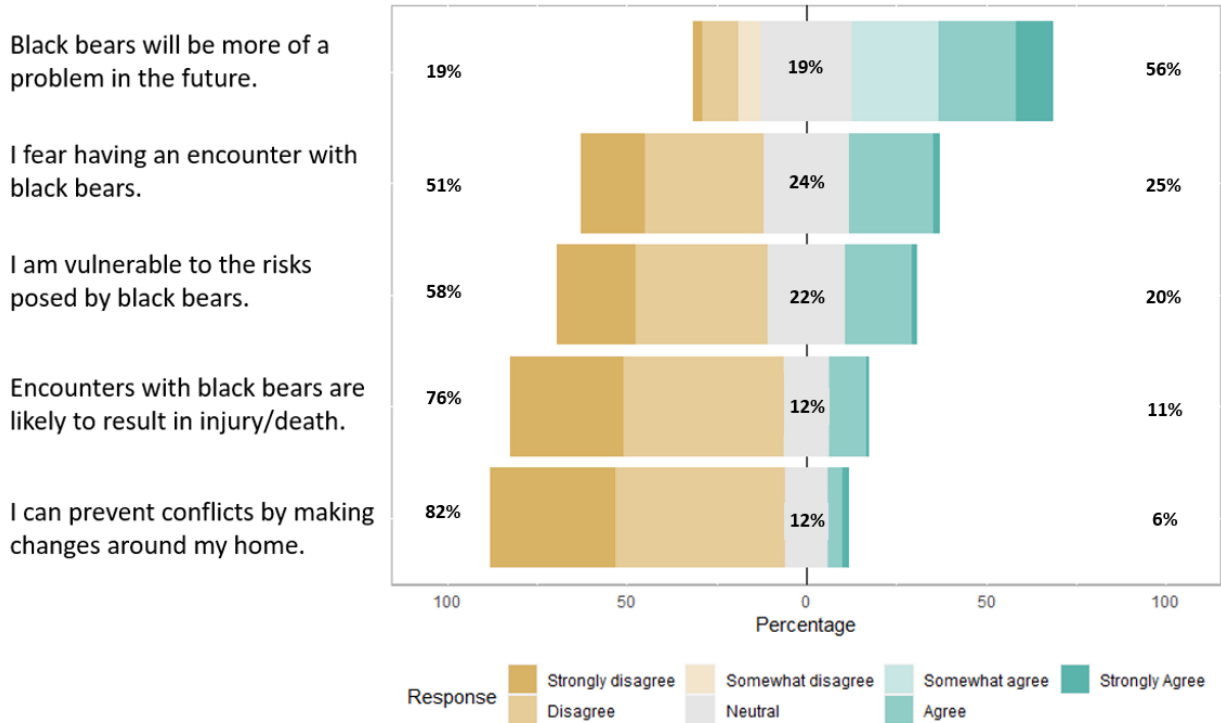


Figure 4.3. Likert responses to risk instrument statements. Percentages represent the proportion of respondents who disagreed with statements (left side of figure; ‘strongly disagree’, ‘disagree’, or ‘slightly disagree’), those who were neutral (central in figure; ‘neither agree nor disagree’), or who agree with statements (right side of figure; ‘strongly agree’, ‘agree’, ‘somewhat agree’).

qRD Attractant Summary

Participant attractant management behavior varied across households. We used the median attractant number across our eight observations as a single variable representing attractant behavior over time at each residence. The mean of this estimate was 1.7 (median = 1.5, range = 0 – 8, SD = 1.41). The mean neighborhood attractant type sum (in a 150m circular buffer around and including households of interest) as 68 attractants (median = 69, range = 6 – 145.6 attractants, SD = 28).

Survey respondents generally reported that they secured their attractants in order to avoid conflict with black bears, but property audit observations suggested otherwise. Notably, 171 survey respondents (~85% of total) indicated that they secured all of their attractants to manage interactions with black bears. However, approximately 81% of these respondents had attractants visible on their property during

property audits (survey respondents were asked to provide their address). Additionally, ~ 17.5% of those who reported securing all of their attractants had a resulting household attractant median of 3 or more.

Models of Reported Conflict

Ecological variables alone performed poorly in explaining conflict. Among our *a priori* ecological models, those in our top model set ($< 2 \Delta AICc$) included human density and road density (and our null model; Table 4.2). Contrary to our prediction, the relative probability of conflict with bears decreased with increasing human density. On the other hand, conflict increased with road density, as expected (though 95% CIs for both parameter coefficients overlapped 0; Table 4.3). These models explained limited variation in conflict probability (conditional $R^2 = 0.05$ to 0.06 ; Table 4.2), and the strength of effect of human and road density is uncertain given the fixed effect 95% CI overlap with 0.

Model set	Model	K	AICc	$\Delta AICc$	Weight	ρR^2
Ecological models	Human density + Road density + individual	4	211.83	0.00	0.34	0.06
	Human density + individual	3	212.80	0.97	0.21	0.05
	1 + individual (<i>null model</i>)	2	213.23	1.39	0.17	0.00
Social models	Household garbage + Risk perception + individual	4	207.87	0.00	0.36	0.08
	Household garbage*Risk perception + Household garbage + Risk perception + individual	5	208.83	0.97	0.22	0.19
Social-ecological models	Human density + Household garbage sum + Risk perception + individual	5	207.29	0.00	0.23	0.14
	Human density + road density + Household garbage + Risk perception + individual	6	207.57	0.27	0.20	0.12
	Household garbage + Risk perception + individual	4	207.87	0.58	0.18	0.08
	Human density + Household garbage*Risk perception +	6	208.46	1.17	0.13	0.25

Household garbage sum + Risk perception + individual					
Household garbage*Risk perception + Household garbage + Risk perception + individual	5	208.83	1.54	0.11	0.19
Human density + Road density + Household garbage*Risk perception + Household garbage + Risk perception + individual	7	209.04	1.75	0.10	0.19

Table 4.2. Top performing models in each set of models (ecological, social, and combined social-ecological models), with corresponding K, AIC, ΔAIC_c , and conditional R^2 values. Full model sets in Appendix C.

Social-only models explained more variation in reported conflict outcomes (conditional R^2 9-19% of conflict variation; Table 4.2). Among our *a priori* social models, the top models included risk perception, household garbage, and an interaction between the two. The relative probability of conflict with bears increased with both household garbage and individual risk perception. In the second model, human density overlapped with 0 (Table 5). Social models explained 9-19% of conflict variation (Table 4.2).

Combining the ecological and social variables included in the preceding models created candidate models that performed better than those with solely ecological or social components. The top model set included human density, road density, household garbage, risk perception, and the interaction between household garbage and risk perception. Most of the variation (95% CIs) of our effects of predictors in these top models, however, overlapped 0, excluding ‘risk perception’ (Table 4.3) and ‘risk perception’ and ‘household garbage’ (Table 4.3) in a subset of models. Social-ecological models outperformed ecological- and social-only models, explaining up to 25% of conflict variation. The directional association of each variable was relatively uniform across our top model set, including in the presence of interaction terms (Table 4.3).

Model type	Model	Intercept	HD	RD	Risk	Garbage	Risk*Garbage
Social-ecological	Human density + Household garbage sum + Risk perception + individual	-1.44 (-2.74, -0.15)	-0.30 (-0.76, 0.14)	-	0.44 (-0.06, 0.94)	0.34 (-0.06, 0.75)	-
Social-ecological	Human density + road density + Household garbage + Risk perception + individual	-1.42 (-1.79, -1.05)	-0.39 (-0.80, 0.02)	0.27 (-0.13, 0.68)	0.41 (0.08, 0.76)	0.30 (-0.03, 0.64)	-
Social	Household garbage + Risk perception + individual	-1.38 (-1.74, -1.02)	-	-	0.43 (0.09, 0.76)	0.34 (0.01, 0.67)	-
Social-ecological	Human density + Household garbage*Risk perception + Household garbage sum + Risk perception + individual	-1.57 (-3.27, 0.13)	-0.32 (-0.80, 0.16)	-	0.47 (-0.12, 1.05)	0.37 (-0.13, 0.87)	0.19 (-0.27, 0.65)
Social	Household garbage*Risk perception + Household garbage + Risk perception + individual	-1.50 (-3.09, 0.10)	-	-	0.44 (-0.09, 0.97)	0.36 (-0.12, 0.84)	0.21 (-0.27, 0.68)
Social-ecological	Human density + Road density + Household garbage*Risk perception + Household garbage + Risk perception + individual	-1.50 (-2.93, -0.06)	-0.39 (-0.89, 0.10)	0.27 (-0.18, 0.71)	0.43 (-0.12, 0.98)	0.32 (-0.12, 0.75)	0.15 (-0.27, 0.58)

Table 4.3. Parameter estimates for all top models (those within 2 AICc of the model with lowest AICc value) in our final model set; parameter estimates that do not overlap 0 are reported in bold. 95% confidence intervals are reported in parentheses.

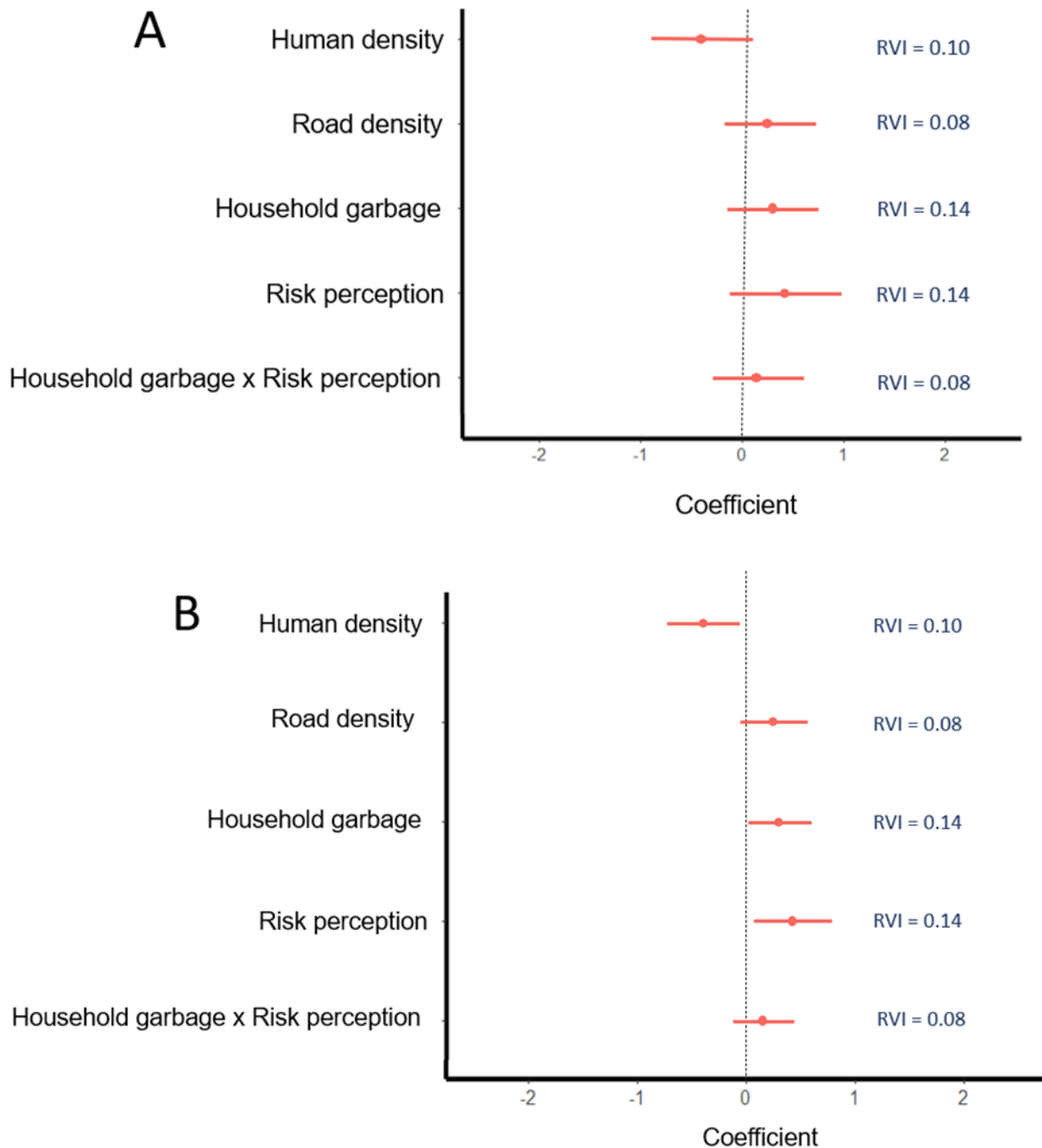


Figure 4.4. One model in our top model set contained all variables from all top performing models; we present parameter coefficients and CIs for fixed effects of that model here (see Appendix C.10 for all other top models). Red dots represent the magnitude of effect on probability of conflict, and red lines (a) span 95% CIs and (b) span 90% CIs. Calculated RVI is presented for fixed effects.

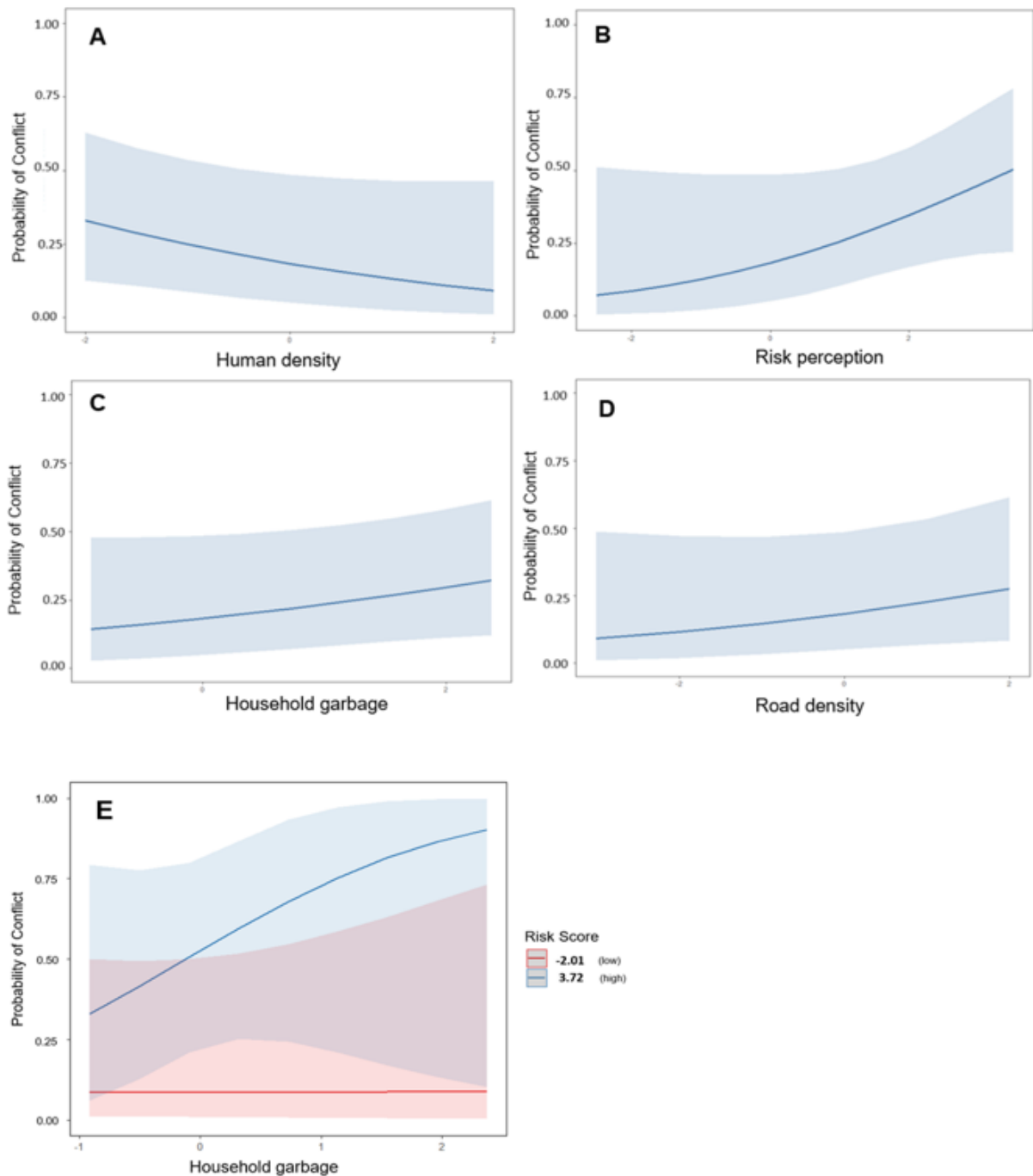


Figure 4.5. Probability of reported conflict as function of (a) human density, (b) risk perception, (c) household garbage, (d) road density, and (e) household garbage x risk perception (visualized with lowest and highest standardized risk perceptions). Curves represent predictions from the model within our top models that contained all fixed effects within our top model set, with shaded regions represent model-averaged 95% prediction confidence.

Our top model set suggests that human density, road density, household garbage, risk perception, and the interaction between household garbage and risk perception best predict conflict outcomes. Household garbage and risk perception were present in all top models. Relative Variance Importance (RVI) of coefficients in our top model set suggests that household garbage and risk are more important than other predictor variables; both were ~1.4 times as important than human density and ~ 1.6 times as important as road density or the interaction term between household garbage and risk.

Qualitative Analysis

Participants varied in their description of ideal relationships between black bears and people, identifying different ideal outcomes and ways to achieve them. We qualitatively coded 170 open-ended answers, and found that approximately 65% of respondents identified that achieving an ideal relationship between people and black bears would require humans taking more responsibility in managing the environment and their behavior (i.e., attractant management, public education, local policies, habitat protection). Another 22% of respondents identified that the ideal relationship between people and bears would be one of coexistence (or peace, mutual respect, etc.). Fifteen percent of respondents believed that bears in or near urban environments in Powell River/Lund were inherently a problem, sharing that in their ideal world bears would be removed, culled, would have lower populations, or would only be found in nature or wilderness areas. Finally, six respondents (~ 4%) responded that relationships between people and black bears do not require any changes.

Discussion

We used interdisciplinary data to understand concurrent and intersecting social-ecological drivers of human-wildlife conflict, identifying a prominent role of social dimensions. Our analysis: 1) indicated that social-ecological models best explained conflict probability (though two models in our top model set included only social predictor variables), and 2) revealed that social variables (participant risk perception and household garbage, which both had a positive influence on conflict probability) were more important than ecological predictors in explaining conflict variation. Our results have implications for human-wildlife conflict mitigation efforts in the qRD, and for broader human-wildlife research and practice.

Predictors of Human-Bear Conflict

Despite the prominence of social predictors of conflict, ecological variables were also important. Road density and human density had consistent associations with conflict in our results where they appeared in top model sets. Although 95% CIs of both road and human density overlapped zero (though 90% CIs did not; Appendix C.10), human density nonetheless occurred in two of our three top ecological models and road density in one of three. Other studies have also determined that road density (especially density of paved roads) were positively associated with conflict (McFadden-Hiller et al. 2016; Wynn-Grant et al. 2018; Klees van Bommel et al. 2020; Hagani et al. 2021). Mechanisms likely relate to use of paved roads by bears as travel routes to access attractants, or to access better habitat (Carter et al. 2010), as well as increased visibility by people while using roads. We reason that conflict probability decreased with increasing human density because bears likely avoid areas of highest human density when foraging to reduce risk (Lyons et al. 2003). Other studies indicated that conflict is most likely in areas of medium human density (Baruch-Mordo et al. 2008), and thus there may be a non-linear relationship between human density and human-black bear conflicts (Klees van Bommel et al. 2020). Interestingly, none of our top models contained land cover classes (i.e., urban, intact forest, or forest patch), which have been important predictors of human-bear conflict in other contexts (Merkle et al. 2011, Klees Van Bommel et al. 2020). We suspect these land cover classes did not explain conflict variation in our system owing to local geography; all sampled houses were within several kilometres of large tracts of intact forest that provides bear habitat, potentially reducing the influence of other landcover classes on conflict variability. Finally, our coarse measure of relative bear abundance (detection rate at one camera site per cell) was not associated with conflict probability, potentially because a single camera could not reliably estimate activity across our grid cells - a heterogeneous region of space - (though this methodology has been reliably used elsewhere, see Klees van Bommel et al. 2022) or because the relative presence of bears was not as important as other factors in predicting whether conflict occurred.

Ecological variables were neither able to comprehensively explain variation in conflict probability, nor were the most important variables. Rather, social variables (and resulting social-ecological models) best explained conflict. Although 95% CIs of both household garbage and participant risk perception overlapped zero in some (but not all, and not 90% CIs, see Table 4.3 and Appendix C.10) of our top models, both occurred in all top models in our social and social-ecological model sets, and showed consistent positive associations with conflict. Compared to counts of all attractant types, household garbage had the most influence on human-bear conflict probability. This pattern is well-supported by adjacent ecological literature, which indicates that black bears preferentially forage on garbage while balancing energy budgets and safety (Lewis et al. 2015). Participant risk perception was equally important in explaining conflict variation. In other studies examining exclusively social predictors of conflict with,

or acceptance of, bears, risk perception had a large (or the largest) influence (Zajac et al. 2012, Lischka et al. 2019).

Interactions between social variables were also important. Specifically, after accounting for the effect of garbage alone, only those individuals with relatively high risk perception reported more conflict corresponding with more unmanaged garbage observations. Some context is required to interpret this pattern. Perceived risk is an intuitive and rapid evaluation of the threat something (in this case, a black bear) poses to the observer (Zajac et al. 2012; Slovic 1987), and does not necessarily reflect actual risk or past experiences of the observer (Slovic 1987), though it can be influenced by negative interactions (Bruskotter & Wilson 2014, Lischka et al. 2019). While it may seem intuitive that those with high risk perceptions would manage their garbage to avoid interactions with bears, perceptions of risk often but not always result in proactive risk-avoidance behavior (Luce & Kahn 1999; Johnson et al. 2002; Brewer et al. 2007; Carvalho et al. 2008), especially if people perceive that they have little control over reducing risk (Slovic 1987; Zajac et al. 2012; Bruskotter & Wilson 2014). Given this background, one potential interpretation of this result is that perhaps those individuals with high risk scores and high observed household garbage have a history of failing to manage their garbage (consistent with observations during our study), resulting in increased negative interactions with bears that were drawn to their garbage, thereby increasing risk perception over time.

Another interpretation is possible. Risk perceptions may instead not derive from lived experience, but rather emerge due to their broader cultural milieu (Douglas 1992), exposure to various media portrayals (Gore et al. 2005), or from elsewhere (Slovic 1987; Gore et al. 2005; Decker et al. 2010). Participants with high risk perception may also fail to manage garbage because they perceive it will not diminish the likelihood of negative interactions (Zajac et al. 2012). Accordingly, whether an attractant (in this case, garbage) and associated interaction with a bear is perceived as conflict by the observer may be a result of pre-existing individual psychological attributes (in our case, risk perception) rather than the interaction itself. While it is likely that intensely damaging interactions with a bear (e.g., physical altercations or extensive property damage, etc.) would be considered negative interactions by participants across the risk perception spectrum, this result emphasizes that for less intense interactions, pre-conceived risk perception will determine the observer's understanding of the interaction. For instance, we expect that two participants with different risk perceptions could experience the same interaction (a bear inspecting or disturbing their garbage) and report different interactions; the individual with low-risk score would likely consider the event positive or neutral, and the individual with high risk perception may report the interaction as negative (i.e., report conflict).

Study Limitations

Although our research offers insight into social-ecological predictors of human-black bear conflict, there were several limitations. As is often the case across social and ecological research, data were limited by resources, time, and survey response rate. More data across larger temporal scales could provide insight into whether conflict patterns change annually or seasonally, especially owing to changes in seasonal foraging behaviors (Davis et al. 2006). There were also limitations associated with social survey data; although revealing individual differences, beliefs, and experiences of individuals, there may be unknown biases associated with survey respondents (e.g., those with more extreme beliefs or attitudes towards black bears may be more likely to engage in our survey). Furthermore, we recognize that multiple people (family members, renters, guests, etc.) beyond the survey respondent may live at each household and influence attractant management and interactions. However, our survey data nonetheless provide important insight into lived experiences of participants, and associated variation in conflict experiences and cognitive antecedents. Potential biases may also have emerged while identifying camera hosts; those already interested in learning about bears on their property, or who have a positive association with bears, may have been more likely to volunteer as a camera host. Finally, we did not include an exhaustive list of potential predictors in our models, owing to data collection and analysis limitations. Future research and models may benefit from incorporating predictor variables regarding: participant perception of benefits of black bears (Zajac et al. 2012, Lischka et al. 2018, 2019), participant trust in authorities to manage bears (Zajac et al. 2012), wildlife value orientations (Manfredo & Dayer 2004; Lischka et al. 2018, 2019), more detailed data regarding bear population density and behavior, and natural food availability (Merkle et al. 2013; Lewis et al. 2015), among others.

Management Implications for the qRD

Informed by the results of our social-ecological analysis, several management strategies to promote human-black bear coexistence in the qRD can be considered. Our research provides empirical support for the importance of personal and jurisdictional garbage management (e.g., waste management polices enacted by the qRD), which could include the distribution of bear-resistant garbage containers to households within regional refuse collection areas (Creel 2007, Johnson et al. 2018, Can et al. 2013) and creation of regional policies that create disincentives (e.g., fines) for failing to manage garbage. While the qRD distributed new garbage bins to all residential households within refuse collection areas in 2021, these bins have no locking mechanism to prevent or deter foraging bears. Bear-resistant garbage bins have reduced bears' ability to access refuse and conflict in other jurisdictions (often substantially, e.g., in a Durango, Colorado case study, reported trash-related conflicts were 60% lower where bear-resistant containers were in use; Johnson et al. 2018) (Greenleaf et al. 2009; Barrett et al. 2014; Johnson et al.

2018). While garbage management is perhaps an obvious first step to address and reduce bear-human conflict, we hope these empirical data inform prioritizing investment in bear-resistant containers in the qRD, where jurisdictional investment is currently lacking.

Principles and processes outlined and supported by Conservation Conflict Transformation (CCT) also offer direction for future conflict mitigation. Our results determined that conflict between people and bears is driven by intersecting social and ecological factors, some of them (risk perception) particularly deep-rooted (occurring beneath the superficial aspects of the conflict at hands; Madden & McQuinn 2014). Thus, beyond jurisdictional approaches to managing household garbage, our results also indicate that targeted, transformative education initiatives may help reduce conflict and promote coexistence, but likely only if delivered by trusted community members. While education alone will not easily change undesirable human behavior (Dietsch et al. 2017), targeted education materials (i.e., those that relate to risks and benefits related to bears, and attractant management) provided by trusted community members or leaders (Trettin & Musham 2000; Decker et al. 2010; Gustafson et al. 2020) may improve interaction outcomes. Evidence also supports that prioritizing relationship-building, deliberative discussion, multiple forms of knowledge, and listening processes when sharing information on risk increases education efficacy (Trettin & Musham 2000; Decker et al. 2010; Gustafson et al. 2020). Capacity-building workshops outlined, identified, and currently mobilized by CCT practitioners (Madden & McQuinn 2014) could support these collaborative, community- and relationship-centered approaches to education regarding realistic risks posed by black bears. Taken together, these practices support a community-embedded and -aligned approach to transformation, which recognize that the very structure of human relationships to bears within the qRD must be changed through transformative approaches (including the educational approaches we suggest) should coexistence be achieved. Notably, most participants in our study had either an overall positive or neutral perception of bears, and most reported having at least one positive experience associated with them. Most participants also categorized bears as (overall) good, beneficial, and positive (Appendix C). Leveraging these overall positive perceptions and community-engaged processes, education programs specifically focused on the actual risk bears pose, how these risks may be reduced or controlled, and the ecological, economic, and simultaneous benefits black bears provide will likely improve the outcome of human-black bear interactions (Zajac et al. 2012; Slagle et al. 2013; Bruskotter et al. 2019).

Finally, our results also support that further education is required to help residents identify potential attractants and management strategies, as most residents who identified that they reduced the likelihood of conflict by managing their attractants had visible attractants on their properties. These education

initiatives tailored for the qRD must be supported by a combination of other coexistence strategies (e.g., jurisdictional approaches, aversive conditioning of bears, attractant management, creation and enforcement of bylaws, etc.), researched to assess their efficacy in changing human perception and behavior (Dietsch et al. 2017), and customized to address socio-cultural norms, concerns (McKenzie-Mohr 2000), and inequities in access to mitigation strategies (Hayden & Deng 2013) if they are to result in persistent improvements.

Implications Beyond the qRD

The qRD is not alone in confronting challenges managing human-black bear interactions, and our methodologies and results employed in the region potentially hold insight for other jurisdictions. In this interdisciplinary study, we united key findings from social and ecological studies of human-black bear conflict to determine how these diverse predictors interact to in part explain variation in human-black bear conflict. Black bears are a species of increasing concern in human-wildlife conflict contexts in BC and throughout North America, due in part to their behavioral patterns, omnivory, willingness to encounter humans, and other factors and rapid human expansion into bear habitat (Lyons et al. 2003; Davis et al. 2006; Greenleaf et al. 2009; Lewis et al. 2015). Accordingly, we hope that our study design and methodological approach are applicable elsewhere where human-black bear conflict presents as a complex and enduring challenge. We believe that the social-ecological study design and analytical approach we employ could be mobilized across communities and geographies to help researchers, managers, and other practitioners identify key local predictors of conflict, which could then be addressed in a targeted and efficient manner aligned with local resource constraints.

More broadly, our results empirically support the validity of increasing calls for integrated social-ecological approaches in the context of human-wildlife interaction research. While many studies probe the ecological or social drivers of human-wildlife interaction outcomes independently, very few to our knowledge (but see Wilkinson et al. 2021) actualize these recommendations towards interdisciplinary approaches. Our results showcase that, in the context of our study, social and ecological variables together best explained spatial variation in conflict. We were in part also motivated to engage in this interdisciplinary approach in line with CCT principles, which suggest that scholars and practitioners empirically assess the complex anatomy of conflict (i.e., variables predicting conflict) prior to engaging in mitigation or transformation. Not only did a CCT lens help us to identify diverse potential social and ecological factors related to conflict, but also the presence of risk perception as a key predictor of conflict in top models brings into sharp focus the potential value of CCT framework in the context of human-wildlife interaction studies. Risk perception is a deep-rooted, psychological driver of conflict outcomes

and changing it requires community- and trust-building, alongside transformative educational approaches. CCT processes and principles provide practical ways forward to address such deep-rooted human attributes associated with conflict (Madden & McQuinn 2014b, 2017). Accordingly, assessing and transforming the pervasive global challenges of human-wildlife conflict could likewise benefit from more widely embracing integrative, interdisciplinary, and CCT-informed approaches like that illustrated in our interdisciplinary method.

Chapter 5: Conclusion

Conservation conflicts are pervasive, diverse, and naturally occurring. These conflicts, occurring across geographies, scales, systems, and among and between actors, present opportunity to collaboratively forge enduring conservation solutions and transform discordant relationships (Madden & McQuinn 2014, 2015). However, within current systems of and approaches to conservation scholarship and practice, these conflicts are often misunderstood, mishandled, or ignored (Dickman 2010; Balint et al. 2011; Doucey 2011; Madden & McQuinn 2014). Failures to account for the complexities and deep roots of conflict – and missed opportunities to seek collaborative, community-building solutions – may hinder conservation efforts, further embed already intractable conflict, and perpetuate harm to human- and non-human animals alike (Bar-Tal et al. 2007; Dickman 2010; Balint et al. 2011; Doucey 2011; Peterson et al. 2013; Madden & McQuinn 2014, 2015; van Eeden et al. 2019). In an era of mounting ecological and social instability (Carpenter et al. 2019; Folke et al. 2021), it is critical that we establish academic frameworks and tools to assess and negotiate arising conflicts towards just, equitable conservation solutions that benefit our collective well-being and the maintenance of our shared biosphere (Dickman 2010; Redpath et al. 2013; Madden & McQuinn 2014; Folke et al. 2021). Recognizing the potential risks and opportunities presented by conservation conflicts, I applied conflict transformation theory (Lederach 1996), a Conservation Conflict Transformation (CCT) lens (Madden & McQuinn 2014), and methodological tools deriving from diverse social and ecological traditions to analyze three conservation conflicts in Canada. The overarching goal of this dissertation was to provide insight into these conflicts and what tools (e.g., social survey instruments), concepts (e.g., the levels-of-conflict model), theories (e.g., conflict transformation theory), and lenses (e.g., CCT) might best help conservation scholars and practitioners better understand and (eventually) transform conservation conflicts. I accomplished this objective by analyzing three case studies of disparate manifestations of conservation conflict; I outline the contribution of each of these case studies below.

I answered three main questions in this dissertation:

- 1. How can a CCT approach inform assessment of Canadian environmental-decision making processes as they attempt to embrace multiple forms of knowledge and many interested parties?**

My second chapter (completed in collaboration with a wonderful team of co-authors across disciplines and positionalities) analyzed the deep roots of conflict that emerges between knowledge types (and institutions) in the context of environmental decision-making policy in Canada. This first chapter, initiated in part as a response to lessons learned during my M.Sc. research experiences (Eckert et al.

2018b, 2018a) in service to the Haíłzaqv (Heiltsuk), Kitasoo/Xai'xais, Wuikinuxv, and Nuxalk Nations, was both informed by and informed this dissertation's conflict transformation approach. It was through my qualitative research endeavors analyzing the relationship between Indigenous knowledge and federal Environmental Assessment (EA) processes and policies in Canada that I was invited into analyzing the deep-rooted and (often invisible) barriers preventing knowledge interweaving opportunities and harmonized relationships in the context of environmental decision-making. This chapter drew upon scholarly interpretation of the relationship between Indigenous knowledge and federal EA processes and policies in Canada towards identifying obstacles and ways forward at the interface of these disparate and complex systems. By identifying and analyzing deeper-rooted dimensions of barriers to harmonized EA processes, we identified that, while some superficial obstacles to interweaving Indigenous knowledge and EA processes may yet be overcome via legislative revisions, deeply-embedded and intersecting power-imbances, historic harms, distrust, and epistemological differences halt reconciliatory progress, limit including multiple knowledge forms in EA processes, and may foment conflict in the context of environmental decision-making processes in Canada (Ch.2; Eckert et al. 2020).

Through this chapter and in retrospect as emergent themes caused me to explore conflict theory literatures, I identified that operationalizing a CCT lens in the context of environmental decision-making provides the tools (e.g., the levels-of-conflict model; Madden & McQuinn 2014) and conceptual framework to see beyond the presenting disputes (e.g., conflict over language regarding the inclusion of Indigenous knowledge in EA processes) to their deep, often-hidden dimensions (e.g., unreconciled epistemological clashes, unresolved colonial harms that have resulted in deep-seated distrust, etc.). These deep-roots of conflict and the barriers they present must be attended to should enduring, effective EA processes and healthier relationships between Indigenous and colonial governments be built (Lederach 1996; Doucey 2011; Madden & McQuinn 2015; Adams 2021). While we did not yet have the tools to articulate so at the time of completing and publishing Chapter 2, our results indicate that a CCT approach can inform future policy decisions and conflicts that emerge during and due to EA processes, especially as Canada aims to bridge Indigenous and Western knowledges. CCT provides tools to allow parties involved in EAs to assess factors contributing to their conflict (the levels-of-conflict model) and provides potential intervention strategies to begin the work of conflict transformation (e.g., through use of the conflict intervention triangle, capacity building workshops, and deliberative relationship-building and power-sharing strategies, among others). However, as we identified in Ch.2, these practices and relationship transformations must also occur at broader systemic and institutional scales should enduring solutions be achieved in the long-term.

What existing bodies of scholarship and social science-derived instruments and conceptual models might be mobilized within a CCT framework? Might some of these other models and supporting scholarship contribute repeatable methodologies to the CCT literature?

My second chapter (again completed in collaboration with an exceptional team of scholars and practitioners) probed a local case study to provide practical, applicable information regarding a conflict of concern, and to examine the utility of selected social science instruments (e.g., environmental identity scale, social identity affiliation score) and concepts (definition, e.g., value-attitude-behavior model, intergroup conflict dimensions) for understanding the anatomy of conflict (as required by a CCT approach; Madden & McQuinn 2014). While engaging in a comprehensive review of all potentially useful social science-derived methodologies was beyond the scope or intention of this dissertation, we were interested in applying social science instruments most relevant to local conflict to better understand it. In this chapter, we mobilized theories about identity constructs and conflict, and instruments measuring environmental (Clayton 2003) and social identity (Tajfel & Turner 1986; van Eeden et al. 2019), to understand the role these psychological attributes might play in intergroup conflict regarding salmon management in the Salish Sea bioregion. These tools, combined with the use of the levels-of-conflict model (deriving from a CCT lens; Madden & McQuinn 2014) and the value-attitude-behavior model (Vaske 1999) allowed deep insight into on-going disputes between recreational fishers and conservation-supporters. Our approach aligns with Madden and McQuinn's (2014) calls to operationalize conflict assessments and approaches that analyze conflicts beyond their presenting disputes (e.g., conflict over Chinook salmon harvesting restrictions) and take holistic account of deeper social conflicts that underlie them (e.g., identity-based conflicts). Our research also provided insight into the role identities play in conservation conflicts; the intensity of affiliation of both angler and conservation-supporter participants revealed one potential dimension of the deeper social roots of conflict.

Ultimately, in this chapter we provided both practical local suggestions to respond to on-going conflict and broader mobilizable tools to assess other intergroup conservation conflicts through a CCT lens. We suggest that fisheries managers in BC focus their energy and limited resources in responding to disputes not through stakeholder engagement strategies that focus on negotiating management details, but instead on externally-facilitated, multi-day capacity building workshops between stakeholders, and social-cohesion exercises focused not on superficial conflicts but instead on mutual humanization and relationship-building across identities (Madden & McQuinn 2014). When attending to conservation conflicts, researchers and practitioners must first acutely understand the depth and breadth of the conflict at hand before proposing context-based, sustainable solutions (Madden & McQuinn 2014; Lederach 2015). Acknowledging the relationships among human values, beliefs, attitudes, and behaviors, and

examining dimensions of beliefs through pre-existing self-identity measurement instruments, provides a promising way for researchers to analyze conflicts prior to developing interventions. Under the processes and principles of CCT, we suspect that these tools will assist scientists and practitioners in a world increasingly in need of approaches to transform conflict towards solutions.

2. How can a CCT approach inform studies of human-wildlife conflict? Can CCT processes be aligned with ecological research assessing human-wildlife conflict to examine these conflicts more holistically?

My third chapter (completed in partnership with a team of ecologists, geographers, and social and interdisciplinary scientists) leveraged conflict transformation theory and a CCT lens to inspect human-wildlife conflict in the qRD. While other scholarship has probed psychological and social drivers of human-wildlife conflicts (e.g., see Zajac et al. 2012; Lischka 2018; Lischka et al. 2019), few (but see Wilkinson et al. 2021) have concurrently inspected the social and ecological drivers of human-wildlife conflict. In this study, a CCT lens framed our data collection, analyses, and interpretation, and motivated us to overcome the barriers associated with concurrently examining social and ecological data. A CCT approach also guided us in looking beyond the proximate drivers of conflict (e.g., attractant management and presence, bear presence, land cover, etc.) to their roots (e.g., risk perception) to understand the anatomy of human-black bear conflict prior to proposing solutions. This approach also informed our management suggestions; because we identified risk perceptions as a key predictor of bear-human conflict – and because changing risk-perception requires relationship- and trust-building – CCT interventions are likely to reduce conflict between people and black bears in the qRD. Our research: 1) indicated that social-ecological models best explained conflict probability between bears and people, supporting the need for holistic approaches for assessing human-wildlife interactions and 2) revealed that social variables (participant risk perception and household garbage, which both had a positive influence on conflict probability) were more important than ecological predictors in explaining conflict variation and 3) provided methodologies and an analytical framework that other scientists and practitioners might mobilize to simultaneously assess immediate and underlying, ecological and social, drivers of human-wildlife conflict.

Ultimately, this chapter contributes tools that may assist researchers and practitioners in focusing limited resources on attending to human-wildlife conflict and demonstrates the utility of applying a CCT lens to human-wildlife conflict research, namely by showcasing the value of assessing diverse predictors of conflict in social-ecological systems. Equipped with the insight we provide, managers and policymakers can begin leveraging educational and jurisdictional resources to transform the relationship between people

and black bears, focusing on psychological drivers (i.e., risk perception) of conflict outcomes and CCT processes that attend to them (Madden and McQuinn 2014). Beyond our research, CCT will likely serve as a useful tool to reduce conflict between people and wildlife where deep-rooted psychological drivers are identified as a primary cause of conflict (which is often reported as the case, see Dickman 2010), owing to the abundance of relational pathways CCT proposes to transform these ‘invisible’ attributes of conflict (e.g., relationship- and capacity-building approaches, community workshops, conflict intervention triangle approach, etc.)

Deep Roots of Conflict and Barriers to Overcoming Them

A common theme that arose across these otherwise disparate case studies (and arises in the CCT literature more broadly) was that presenting conflicts had only been acknowledged or addressed for their superficial characteristics. Elsewhere in the conflict transformation literature, scholars have identified that conflict resolution or management approaches (e.g., stakeholder engagement sessions) that only attend to presenting disputes where deeper roots of conflict are present can actually exacerbate conflict (Lederach 1996, 2015; Rothman 1997a; Väyrynen 1999). These deeper roots emerged in our case studies and across conflict types in the form of unresolved past conflicts, violent recent histories, emergent distrust, opposed identities and beliefs, psychological risk perception, and more. Based on our research, none of these deeper roots of conflict had been adequately acknowledged or attended to by legislators, decision-makers, or managers. For instance, in Ch.2 we observed that Canadian federal EA processes were attempting to reconcile Indigenous and Western knowledges and harmonize decision-making processes with Indigenous Nations through superficial policy modifications that did not directly acknowledge nor provide resources or infrastructure to attend to deep conflict (which presented in the form of epistemological clashes, distrust, unresolved and violent recent histories and collectively damaged relationships). In Ch.3, we observed that the Department of Fisheries and Oceans Canada has responded to conflict between anglers and conservation-supporters and associated distrust in authorities through stakeholder engagement workshops that focus attention on the details of local salmon management decisions. These stakeholder engagement workshops, while laudable in their efforts, have not attended to the strained relationships, distrust, or the deep-roots of identity-based conflict that our research revealed underlies conflict. Finally, in the context of human-black bear conflict in the qRD (Ch.4), conflict mitigation efforts have been focused on removing problem bears (either through relocation or euthanization) or changing human behavior through education (e.g., about how to manage attractants) rather than attending to intersecting social and ecological dimensions of conflict and deep-rooted psychological attributes that in part predict conflict outcomes.

The complexities and associated deep roots of conflict that our research revealed suggest that achieving enduring conservation solutions will require conflict transformation approaches in these case studies and beyond - but these approaches face barriers to their implementation. While the fields of conservation scholarship and practice have in recent decades moved towards more collaborative, socially-focused approaches (Madden & McQuinn 2014; Bennett et al. 2017; Bennett & Roth 2019), most prescribed conflict measures and resources are still predominately focused on physical and spatial conservation measures, economic and technical solutions to conservation problems, and legislative action to protect ecosystems and species (Nyhus et al. 2005; Madden & McQuinn 2014, 2015; Bennett et al. 2017; Catalano et al. 2019; Hawlena 2022; Harris et al. 2023). This status quo may lead practitioners and authorities to ignore conflict, direct limited conservation resources towards these conventional solution pathways, and may also limit awareness or acceptance of conflict transformation approaches (e.g., neutral mediation, capacity- and relationship-building workshops, redistribution of power, creation of just decision-making processes, etc.) as valid alternative approaches (Madden & McQuinn 2014). Furthermore, where conservation conflicts arise and cannot be ignored, authorities typically lack the capacity to employ comprehensive conflict analysis and transformation approaches, are unaware that such approaches exist, or wish to avoid the messy reality of conservation, opting for solutions perceived as expeditious (Coleman 2006; Manolis et al. 2009; Madden & McQuinn 2014). These solutions fit within the broader status quo of neoliberal, Western conservation science and cultural approaches, where reductionistic thinking and expedient decisions often prevail over slower processes that hold space for complexity, and negotiations regarding conservation policy are predominately transactional and often hierarchical (Chalmers 1985; Madden & McQuinn 2014; Stewart 2019; Abu et al. 2020; Apostolopoulou et al. 2021). In this context, conflict transformation processes (requiring vulnerability, trust, relationship-building, time, and ample resources) may face resistance because they are perceived as too slow relative to urgent ecological challenges, or only tangentially related to the conflict at hand (DeCaro & Stokes 2008; Madden & McQuinn 2014).

Ways Forward

Despite the barriers to implementing conflict transformation processes and principles, the results presented in this dissertation support a growing body of CCT literature that prescribes a new way forward should we wish to leverage conflicts towards enduring conservation outcomes. Conservation scholars and practitioners must focus limited energy and resources on assessing the deep-roots and anatomy of conflict, and then devising transformative processes and deep interventions in iterative, context-dependent fashions (Figure 5.1). While CCT approaches must indeed be built depending on local contexts and complexities, I offer broad guidelines based on my dissertation results and the supporting literature.

Fundamentally, conflict transformation approaches are oriented towards creating conditions that reconcile negative relationships and sustain dialogue and interactions in the long term; this means recognizing relationships and responsibilities to all parties engaged in conflict as central to building solutions. These approaches, already developed and operationalized in other contexts (Lederach 1996, 2015; Madden & McQuinn 2014, 2015), focus on mutual humanization and the destruction of “us” versus “them” mentalities that arise as a natural consequence of protracted, intractable conflict and human biology (Coleman 2006; Tucker et al. 2018; Bail et al. 2018; Fitzduff 2021). These processes must also include clear goals and participatory frameworks, trained professionals and conscious third-party mediators, willingness from all those invested in conflict to engage in good-faith discussions, and means to balance power where it is inequitably distributed (Madden & McQuinn 2014; Lederach 2015). While further enabling CCT approaches in response to conflict will require time, resources, advocacy, and paradigm shifts in our approach to conservation action, doing so may offer enduring solutions and the establishment of relationships and structures to respond to inevitable future conservation conflicts before they become deeply-embedded and destructive.

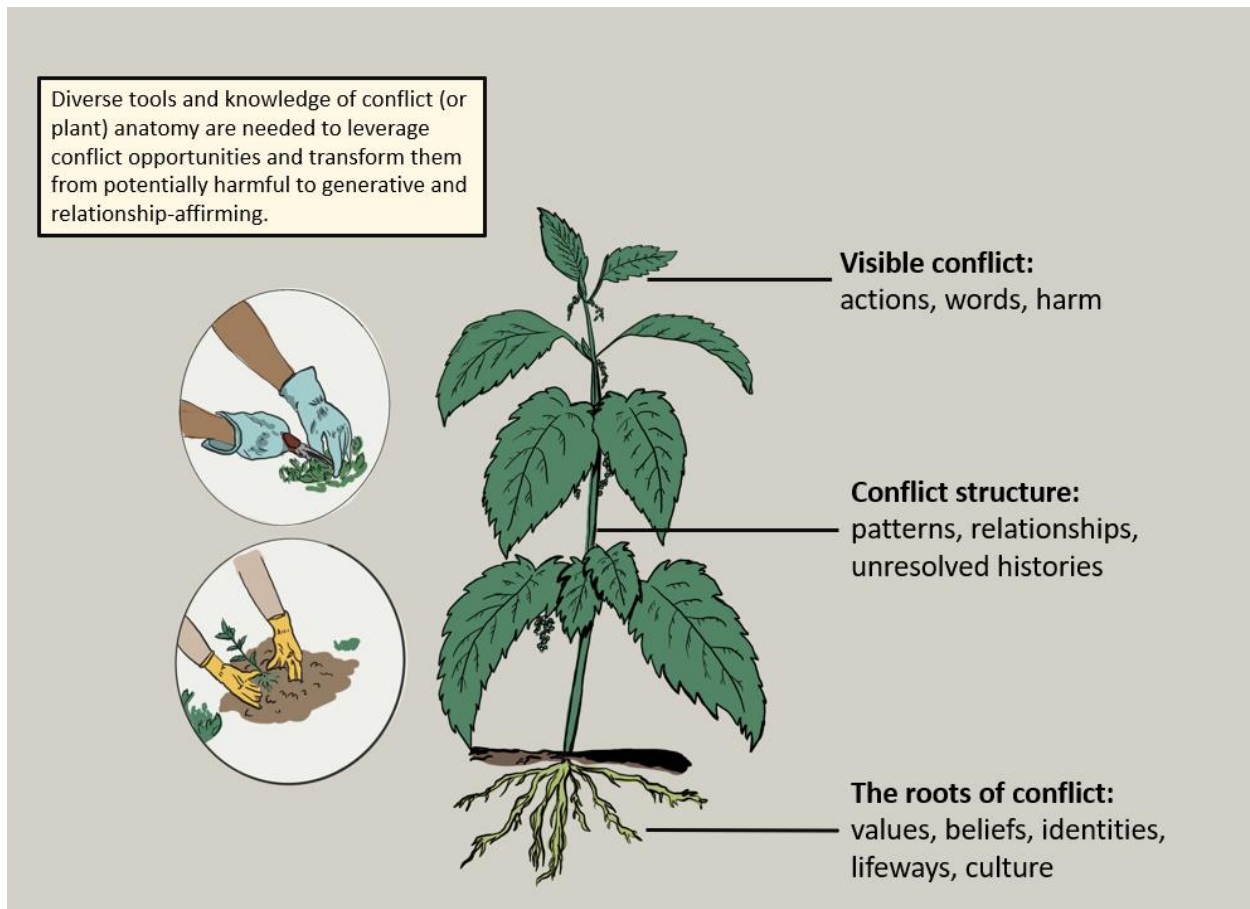


Figure 5.1. A New Conflict Metaphor. I offer a visual metaphor for imagining conservation conflict and transformative approaches, moving beyond typically used visuals (like the iceberg we leverage in Ch.2) and using stinging nettle (*Urtica dioica*) in order to indicate that conflicts are diverse, present opportunity in addition to risk, require care and knowledge to handle, and in most cases, require our action. In this figure, visible or presenting conflict is represented by stinging nettles leaves, whose formic acid (like conflicts' destructive aspects) can result in harm. These stinging leaves are upheld and supported by the plant's stem (conflict structure, patterns, and relationships) and the plant itself is fed and fundamentally held in place by roots (the values, beliefs, identifies, cultures, and systemic framework that embed conflict). While stinging nettle and conflicts can cause harm, when properly understood for their anatomy they can be harvested (or transformed) in myriad ways for human benefit. For instance, stinging nettle leaves can be clipped carefully with appropriate protective tools (to make healing salves or delicious teas, for instance) or harvested at the root (to deter their regrowth if not desired, or to use in various medicines). Conflict too can be attended to through customized CCT processes outlined in this Conclusion and lead to better relationships, conservation policy, and more resilient social-ecological systems.

Contributions to Conservation Conflict Transformation

Conservation conflict transformation (CCT) is yet a nascent lens and set of processes and principles, albeit with great promise for analyzing and transforming intractable conservation conflicts and reframing how scholars and practitioners orient themselves towards conflicts and relationship-building. While CCT is regularly and successfully used by a subset of conservation practitioners (e.g., see the [Center for Conservation Peacebuilding](#)), it remains minimally applied as both a lens through which to interpret conservation conflicts and a suite of tools through which to overcome it. In this dissertation and through three case studies, I advanced CCT in concept and potential utility – especially in the academic and research context – via:

- i) expanding its application to novel case studies and conflict contexts (i.e., by applying a CCT lens to a case study of direct human-wildlife conflict⁶, by retroactively consider the use of CCT in environmental-decision making processes).
- ii) identifying fruitful connections with and contributions from other disciplines and associated methodologies (i.e., by examining and supporting the utility of conceptual models of human behavior (Homer & Kahle 1988; Jerry J. Vaske 1999), intergroup conflict (Tajfel et al. 1971), and methodologies to measure environmental- and social-identities (Tajfel & Turner 1986; Clayton 2003) as key concepts and tools to operationalize CCT processes and understand conflict anatomy).
- iii) contributing conceptual insight by summarizing lessons learned across case studies (i.e., by suggesting structural relationships between the levels-of-conflict model and values-attitude-behavior model, Figure 3.1; by producing new visual metaphors/concepts for understanding CCT and approaches, Figure 5.1).

Ultimately, my research brings a more deeply interdisciplinary lens and approach to bear on CCT processes and principles (i.e., by retroactively incorporating political science and theories of environmental assessment, decision-making, and diverging epistemologies into an assessment of political conflicts, by reproducibly mobilizing methods from environmental sociology and psychology to empirically analyze conflict anatomy, and by including wildlife as stakeholders in conflict and incorporating ecological data into assessments of conflict). It is my hope that this dissertation provides repeatable methodological processes and tools that can be operationalized to assess the anatomy of conservation conflicts, and provides examples of how CCT can be leveraged to address complex conflicts requiring interdisciplinary approaches.

Limitations

⁶ Rather than cases of human-human conflict over wildlife management (e.g., Madden and McQuinn 2014).

In this dissertation, a CCT lens proved immensely useful towards better understanding and proposing context-specific, potentially enduring, novel solutions across three case studies of conservation conflict in Canada. However, there were several limitations associated with this approach and my dissertation.

Because this dissertation proceeded iteratively, Ch.2 is limited in directly applying CCT principles because I began my research process with limited exposure to the conflict transformation or CCT literature. It is a privilege to engage in unfolding, applied research that evolves in response to emergent themes; analyzing Canadian EAs and their relationship to Indigenous knowledge fundamentally influenced the direction of this dissertation by naturally exposing me to the deep roots underlying conflicts emerging as a result of environmental-decision making processes, ultimately leading me to conflict transformation theory. However, I recognize in retrospect that my analysis in Ch.2 would have benefitted from more direct settling within the realms of conflict transformation theory and CCT approaches. For instance, in the context of environmental justice movements in Latin America, conflict transformation and decolonial approaches have been mobilized to address conflicts resulting from top-down, colonial environmental decision-making processes via “strengthening the capacity of vulnerable actors to transform environmental conflicts through impacting three different types of hegemonic power: structural, cultural and actor-networks (Rodriguez and Interius; 2018, p.92).” Mobilizing conflict transformation literature and frameworks towards dissecting Canadian EAs may have resulted in clearer identification of some aspects of the anatomy of conflict and emergent barriers we described, particularly via supporting our understanding systemic power imbalances. It also could have informed our suggestions for conflict transformation and mitigation, as described elsewhere in this Conclusion.

In Chs. 3 and 4, I focused research efforts and limited resources on issues most pertinent to better understanding drivers of conflict (and associated anatomy of conflict), but could not comprehensively include all potential drivers of conflict in my data collection or analyses. For example, our analyses of conflict in Ch.3 may have benefitted from understanding how survey participants defined their social identities (e.g., how participants defined ‘conservation’, what qualified individuals as ‘anglers’) and how these likely diverse definitions correlated with other identities, beliefs, and opinions. It also would have been informative to know how members of different identity groups perceived each other (e.g., how conservation-supporters perceived members of out groups, like anglers), to better understand if stakeholder conflict had reached a level of further intractable “us” versus “them” mentalities. Similarly, our Ch.4 analyses may have benefitted from data regarding a larger suite of ecological and social predictors of human-bear conflict, such as survey participant wildlife value orientations (Fulton et al. 1996; Manfredi 2008) or perceived benefits of bears (Zajac et al. 2012b; Lischka et al. 2019), and ecological data regarding black bear demographics or local natural food production (Merkle et al. 2013;

Lewis et al. 2015). Recognizing our resource limitations, colleagues and I leveraged insight from the existing relevant literature in both chapters to select and collect data regarding those aspects of conflict we expected to be most important for predicting and dissecting conflict in both case studies.

Understanding the intersecting and entwined social and ecological dimensions of conflict across case studies required a deeply interdisciplinary approach; while this interdisciplinary approach is vital to understanding and responding to conflict (Redpath et al. 2013), it also presented challenges and imposed limitations. These challenges are recognized elsewhere where interdisciplinary approaches are required, and emerge owing to differences in terms, methodologies, theories, understandings, languages, and more across mobilized disciplines (Daniel et al. 2022; Campbell 2005). My focus on integrating a broad suite of methodologies deriving from diverse academic traditions (e.g., environmental psychology, political science, conflict transformation, ecology, geography) limited how deeply I could delve into any given body of theory or methodology, and required a tremendous amount of self-training and communication across disciplinary cultures and diverging approaches (Daniel et al. 2022). That said, the broad and interwoven approach to studying conflicts and approaches to resolving them granted me multidisciplinary insight that I feel strengthened my dissertation and improved the practical applicability of my knowledge, allowing me to identify novel and fruitful disciplinary intersections (e.g., the relationship between the value-attitude-behavior and levels-of-conflict models, Ch.3).

Finally, the COVID-19 pandemic fundamentally shaped my doctoral journey, in ways known and unknown. Most obviously, the pandemic significantly limited potential opportunities for face-to-face, in-person meetings required to begin the processes of conflict transformation. Given these limitations, I suggest below that future research should build upon our work by partnering with CCT practitioners and policy-makers to identify processes of conflict transformation and assess their successes and challenges.

Future Research

Reflecting on limitations and lessons learned, I propose interdisciplinary research that continues to assess the anatomy and deep roots of conservation conflicts and supports enacting and measuring the efficacy of transformative solutions. Data regarding the efficacy of CCT processes and practices (i.e., those outlined in Madden & McQuinn 2014) may help overcome current barriers associated with a lack of political or institutional will to focus limited conservation resources on the deep roots of conservation conflicts. As I have acknowledged elsewhere in this dissertation, the work of conflict transformation begins with assessing presenting conflicts through a CCT lens to holistically understand their deeper roots; once these roots are understood, applied transformative approaches may begin. While I offer many suggestions in this dissertation meant to reorient scholars' and practitioners' understandings of conflict and specifically

provide intervention suggestions across case studies, this dissertation does not enact CCT approaches nor measure the efficacy of CCT interventions. Future conservation action and research should consider explicitly analyzing interventions where such conflict assessment has been completed. Beyond this doctoral dissertation and associated suggestions for future research, it is my intention that I engage in the applied work of CCT, recognizing my responsibility to mobilize my results towards meaningful policy and relationship changes. This applied CCT work may take the shape of policy briefs for relevant authorities (at DFO, and in the qRD), continued relationship building across my communities of work and practice, youth engagement workshops in the qRD, presentation of key results to groups engaged in conflict, and training in CT and CCT approaches (e.g., offered via the Center for Conservation Peacebuilding, etc.).

Furthermore, other-than-Western approaches to conservation (e.g., Indigenous and decolonial approaches) are critical to consider equitably and pluralistically in the context of conservation conflicts and their transformation. This is especially the pertinent as Indigenous and non-Indigenous governments the world over reassert their inherent ecosystem management rights and make environmental decisions. My postdoctoral research fellowship (under the supervision of Dr. Andrea Reid) will be explicitly oriented towards more deeply understanding, augmenting, and applying CCT principles guided by an *Etuaptmumk* (Two-Eyed Seeing) approach (Marshall & Bartlett 2009; Reid et al. 2021).

Conclusion

When I began this work in 2016, I did so with a fuzzy understanding of a problem – that despite widely available scientific data outlining best approaches to manage shared and perturbed ecosystems (Peterson et al. 2013; Madden & McQuinn 2014; Carpenter et al. 2019) – conservation policies and interventions often fall short of their goals of protecting ecosystems and biodiversity. Indeed, I was driven to the conflict transformation literature by my (evidently not unique) observation that, despite laudable conservation successes (Simberloff et al. 2011; Sodhi et al. 2011), conservation policies proposed or enacted are often met with, and halted by, intense, messy, intractable conflict at local and global scales (Peterson et al. 2013; Madden & McQuinn 2014; Bennett et al. 2017; Carpenter et al. 2019; Bennett & Roth 2019). I complete this doctoral dissertation with a clearer idea of the problem at hand, a deep appreciation for the complex manifestations of conflict and opportunities they provide, offering humble suggestions towards solutions, and with many remaining questions. In some ways – good ways – I complete it feeling as if the work is just beginning.

Bibliography

Abbass K, Qasim MZ, Song H, Murshed M, Mahmood H, Younis I. 2022. A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research* 29:42539–42559.

Abu R, Reed MG, Jardine TD. 2020. Using two-eyed seeing to bridge Western science and Indigenous knowledge systems and understand long-term change in the Saskatchewan River Delta, Canada. *International Journal of Water Resources Development* 36:757–776. Routledge.

Adams E. 2021. Can scientists and knowledge keepers sit comfortably together? An Indigenous physician's reflections on a decade of participatory research into First Nations nutrition, environment and health. *Canadian Journal of Public Health* 112:3–7.

Affolderbach J. 2011. Environmental Bargains: Power Struggles and Decision Making over British Columbia's and Tasmania's Old-Growth Forests. *Economic Geography* 87:181–206. Routledge.

Agrawal A. 2002. Indigenous knowledge and the politics of classification. *International Social Science Journal*, 54(173): 287–297. DOI: 10.1111/1468-2451.00382

Ainsworth GB, Redpath SM, Wilson M, Wernham C, Young JC. 2020. Integrating scientific and local knowledge to address conservation conflicts: Towards a practical framework based on lessons learned from a Scottish case study. *Environmental Science & Policy* 107:46–55.

Anderson MJ. 2017. *Permutational Multivariate Analysis of Variance (PERMANOVA)*. Pages 1–15 Wiley StatsRef: Statistics Reference Online. John Wiley & Sons, Ltd. Available from <https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118445112.stat07841> (accessed March 5, 2023).

Apostolopoulou E, Chatzimentor A, Maestre-Andrés S, Requena-i-Mora M, Pizarro A, Bormpoudakis D. 2021. Reviewing 15 years of research on neoliberal conservation: Towards a decolonial, interdisciplinary, intersectional and community-engaged research agenda. *Geoforum* 124:236–256.

Arlinghaus R, Tillner R, Bork M. 2015. Explaining participation rates in recreational fishing across industrialised countries. *Fisheries Management and Ecology* 22:45–55.

Aslan CE, Pinsky ML, Ryan ME, Souther S, Terrell KA. 2014. Cultivating Creativity in Conservation Science. *Conservation Biology* 28:345–353.

Assembly of First Nations Quebec-Labrador. 2019. Comments on Bill C-69, an act to enact the Impact Assessment Act and the Canadian Energy Regulator Act, to amend the Navigation Protection Act and to make consequential amendments to other acts: submission to the Standing Committee of Energy, the Environment and Natural Resources. The Great Circle of Our First Nations, Wendake, Quebec.

Atlas WI et al. 2021. Indigenous Systems of Management for Culturally and Ecologically Resilient Pacific Salmon (*Oncorhynchus* spp.) Fisheries. *BioScience* 71:186–204.

Bacon JM. 2020. Dangerous pipelines, dangerous people: colonial ecological violence and media framing of threat in the dakota access pipeline conflict. *Environmental Sociology* 6:143–153. Routledge.

Bail CA, Argyle LP, Brown TW, Bumpus JP, Chen H, Hunzaker MBF, Lee J, Mann M, Merhout F, Volfovsky A. 2018. Exposure to opposing views on social media can increase political polarization. *Proceedings of the National Academy of Sciences* 115:9216–9221. *Proceedings of the National Academy of Sciences*.

- Baker JM, Westman CN. 2018. Extracting knowledge: Social science, environmental impact assessment, and Indigenous consultation in the oil sands of Alberta, Canada. *The Extractive Industries and Society* 5:144–153.
- Baker JM, and Westman CN. 2018. Extracting knowledge: social science, environmental impact assessment, and Indigenous consultation in the oil sands of Alberta, Canada. *The Extractive Industries and Society*, 5(1): 144–153. DOI: 10.1016/j.exis.2017.12.008
- Balint P, Stewart, Desai, Walters. 2011. *Wicked Environmental Problems: Managing Uncertainty and Conflict*. Available from <https://link.springer.com/book/10.5822/978-1-61091-047-7> (accessed July 14, 2022).
- Ban NC, Frid A, Reid M, Edgar B, Shaw D, and Siwallace P. 2018. Incorporate Indigenous perspectives for impactful research and effective management. *Nature Ecology & Evolution*, 2(11): 1680–1683. PMID: 30349090 DOI: 10.1038/s41559-018-0706-0
- Barrett MA, Telesco DJ, Barrett SE, Widness KM, Leone EH. 2014. Testing Bear-Resistant Trash Cans in Residential Areas of Florida. *Southeastern Naturalist* 13:26–39. Eagle Hill Institute.
- Bar-Tal D, Halperin E, De Rivera J. 2007. Collective Emotions in Conflict Situations: Societal Implications. *Journal of Social Issues* 63:441–460.
- Baruch-Mordo S, Breck SW, Wilson KR, Theobald DM. 2008. Spatiotemporal Distribution of Black Bear–Human Conflicts in Colorado, USA. *Journal of Wildlife Management* 72:1853–1862. The Wildlife Society.
- Baxter B, Hamilton S. 2017. Southern British Columbia Chinook Salmon (*Oncorhynchus tshawytscha*) Conservation Units, Sites & Status. Fisheries and Oceans Canada. Available from <https://open.canada.ca/data/en/dataset/e05fedf1-4b55-42dc-9b84-4b5d00caa407> (accessed July 17, 2022).
- Baynham-Herd Z, Redpath S, Bunnefeld N, Molony T, Keane A. 2018. Conservation conflicts: Behavioural threats, frames, and intervention recommendations. *Biological Conservation* 222:180–188.
- Bebbington A, Williams M. 2008. Water and Mining Conflicts in Peru. *Mountain Research and Development* 28:190–195. International Mountain Society.
- Beck JM, Elliott KC, Booher CR, Renn KA, Montgomery RA. 2021. The application of reflexivity for conservation science. *Biological Conservation* 262:109322.
- Beckmann JP, Berger J. 2003. Rapid ecological and behavioural changes in carnivores: the responses of black bears (*Ursus americanus*) to altered food. *Journal of Zoology* 261:207–212. Cambridge University Press.
- Bennett JT. 2020, February 18. Using Conservation Conflict Transformation as a Framework to Address Social Conflict Over Wildlife in a Swedish County. Available from <https://gupea.ub.gu.se/handle/2077/63390> (accessed May 26, 2022).
- Bennett NJ et al. 2017. Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation* 205:93–108.
- Bennett NJ et al. 2021. Advancing Social Equity in and Through Marine Conservation. *Frontiers in Marine Science* 8. Available from <https://www.frontiersin.org/articles/10.3389/fmars.2021.711538> (accessed July 29, 2023).
- Bennett NJ, Roth R. 2019. Realizing the transformative potential of conservation through the social sciences, arts and humanities. *Biological Conservation* 229:A6–A8.

- Benson J. 2000. *Environmental Ethics: An Introduction with Readings*. Psychology Press.
- Bercovitch J. 1986. International conflict resolution: theory and practice. *International Affairs* 63:99–100.
- Berkes F. 2004. Rethinking Community-Based Conservation. *Conservation Biology* 18:621–630.
- Berkes F. 2007. Community-based conservation in a globalized world. *Proceedings of the National Academy of Sciences* 104:15188–15193. *Proceedings of the National Academy of Sciences*.
- Berkes F. 2012. *Sacred ecology: Traditional ecological knowledge and management systems*. Routledge, London.
- Berkes F, Turner NJK. 2014. Learning and the Evolution of Conservation Practice for Social Ecological System Resilience Knowledge. *Conservation Learning Practice* 34:479–494.
- Bhattacharyya J, Larson BMH. 2014. The Need for Indigenous Voices in Discourse about Introduced Species: Insights from a Controversy over Wild Horses. *Environmental Values* 23:663–684.
- Bloomfield D. 1995. Towards complementarity in conflict management: Resolution and settlement in Northern Ireland. *Journal of Peace Research* 32:151–164. Sage Publications 6 Bonhill Street, London EC2A 4PU, UK.
- Bolster C. 2017. Powell River area sees spike in bear conflicts. Available from <http://www.prpeak.com/news/powell-river-area-sees-spike-in-bear-conflicts-1.20911124>.
- Bommel V, Klees J. 2019. Planning for coexistence : assessing predictors of human-carnivore conflict on Southern Vancouver Island. University of British Columbia.
- Booth AL, and Skelton NW. 2011a. Industry and government perspectives on First Nations' participation in the British Columbia environmental assessment process. *Environmental Impact Assessment Review*, 31(3): 216–225. DOI: 10.1016/j.eiar.2010.11.002
- Booth AL, and Skelton NW. 2011b. Improving First Nations' participation in environmental assessment processes: recommendations from the field. *Impact Assessment and Project Appraisal*, 29(1): 49–58. DOI: 10.3152/146155111X12913679730395
- Bopp L, Resplandy L, Orr JC, Doney SC, Dunne JP, Gehlen M, et al. 2013. Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models. *Biogeosciences*, 10(10): 6225–6245. DOI: 10.5194/bg-10-6225-2013
- Borrows J. 2005. Indigenous legal traditions in Canada contemporary and comparative perspectives on the rights of Indigenous peoples. *Washington University Journal of Law & Policy*, 19: 155.
- Bruce AS, and Hume E. 2015. The Squamish nation assessment process: getting to consent. Unpublished manuscript.
- Botes J. 2003. Conflict transformation: a debate over semantics or a crucial shift in the theory and practice of peace and conflict studies? *International Journal of Peace Studies* 8:1–27.
- Boyce P, Bhattacharyya J, Linklater W. 2022. The need for formal reflexivity in conservation science. *Conservation Biology* 36:e13840.
- Brewer NT, Chapman GB, Gibbons FX, Gerrard M, McCaul KD, Weinstein ND. 2007. Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology* 26:136–145. American Psychological Association, US.

- Brooks M E, Kristensen K, Benthem K J ,van, Magnusson A, Berg C W, Nielsen A, Skaug H J, Mächler M, Bolker B M. 2017. glmmTMB Balances Speed and Flexibility Among Packages for Zero-inflated Generalized Linear Mixed Modeling. *The R Journal* 9:378.
- Bruskotter JT, Vucetich JA, Dietsch A, Slagle KM, Brooks JS, Nelson MP. 2019. Conservationists' moral obligations toward wildlife: Values and identity promote conservation conflict. *Biological Conservation* 240:108296.
- Bruskotter JT, Wilson RS. 2014. Determining Where the Wild Things will be: Using Psychological Theory to Find Tolerance for Large Carnivores. *Conservation Letters* 7:158–165.
- Burton AC, Neilson E, Moreira D, Ladle A, Steenweg R, Fisher JT, Bayne E, Boutin S. 2015. REVIEW: Wildlife camera trapping: a review and recommendations for linking surveys to ecological processes. *Journal of Applied Ecology* 52:675–685.
- Butler CF, and Menzies CR. 2007. Traditional ecological knowledge and Indigenous tourism. In *Tourism and Indigenous peoples*. Edited by CF Butler and CR Menzies. Routledge, London, UK. pp. 33–45.
- Cade BS. 2015. Model averaging and muddled multimodel inferences. *Ecology* 96:2370–2382.
- Campbell JM. 2012. The effect of education in reducing bear attractants on cottage properties: Manitoba's "Bear Smart" program. *Forest Policy and Economics* 19:56–65.
- Canadian Charter of Rights and Freedoms. 1982. s 8, Part 1 of the Constitution Act, 1982, being Schedule B to the Canada Act 1982 (UK), 1982, c 11.
- Canadian Environmental Assessment Agency. 2017. Building common ground: a new vision for impact assessment in Canada. Canadian Environmental Assessment Agency, Ottawa, Ontario.
- Carrier Sekani Tribal Council. 2007. First nations perspectives on the BC environmental assessment process for discussion purposes [online]: Available from <http://www.carriersekani.ca/images/docs/lup/EAO%20Critique%20-%20CSTC.pdf>.
- Cardinale B. 2012. Impacts of Biodiversity Loss. *Science* 336:552–553. American Association for the Advancement of Science.
- Carini RM, Weber JD. 2017. Female anglers in a predominantly male sport: Portrayals in five popular fishing-related magazines. *International Review for the Sociology of Sport* 52:45–60. SAGE Publications Ltd.
- Carpenter SR, Folke C, Scheffer M, Westley FR. 2019a. Dancing on the volcano: social exploration in times of discontent. *Ecology and Society* 24. Available from <https://www.ecologyandsociety.org/vol24/iss1/art23/> (accessed June 8, 2019).
- Carranza DM, Varas-Belemmi K, De Veer D, Iglesias-Müller C, Coral-Santacruz D, Méndez FA, Torres-Lagos E, Squeo FA, Gaymer CF. 2020. Socio-environmental conflicts: An underestimated threat to biodiversity conservation in Chile. *Environmental Science & Policy* 110:46–59.
- Carter NH et al. 2019. Integrated spatial analysis for human-wildlife coexistence in the American West. *Environmental Research Letters* DOI: 10.1088/1748-9326/ab60e1. Available from <http://iopscience.iop.org/10.1088/1748-9326/ab60e1> (accessed January 20, 2020).
- Carter NH, Brown DG, Etter DR, Visser LG. 2010. American black bear habitat selection in northern Lower Peninsula, Michigan, USA, using discrete-choice modeling. *Ursus* 21:57–71. International Association for Bear Research and Management.

- Carvalho SW, Block LG, Sivaramakrishnan S, Manchanda RV, Mitakakis C. 2008. Risk perception and risk avoidance: The role of cultural identity and personal relevance. *International Journal of Research in Marketing* 25:319–326.
- Catalano AS, Lyons-White J, Mills MM, Knight AT. 2019. Learning from published project failures in conservation. *Biological Conservation* 238:108223.
- Cashmore M, William R, Morgan R, Cobb D, and Bond A. 2004. The interminable issue of effectiveness: substantive purposes, outcomes and research challenges in the advancement of environmental impact assessment theory. *Impact Assessment and Project Appraisal*, 22(4): 295–310. DOI: 10.3152/147154604781765860
- Chalifour L et al. 2022. Identifying a pathway towards recovery for depleted wild Pacific salmon populations in a large watershed under multiple stressors. *Journal of Applied Ecology* 59:2212–2226.
- Chalmers AF. 1985. *What Is This Thing Called Science: An Assessment of the Nature and Status of Science and Its Methods* 2 edition. Univ of Queensland Pr, St. Lucia, Qld.
- Chang K-C, Hwung H-H, Chuang C-T. 2012. An exploration of stakeholder conflict over the Taiwanese marine protected area. *Ocean & Coastal Management* 55:36–41.
- Chapron G, Epstein Y, López-Bao JV. 2019. A rights revolution for nature. *Science* 363:1392–1393.
- Chapron G, López-Bao JV. 2020. The place of nature in conservation conflicts. *Conservation Biology* 34:795–802.
- Charmaz K. 2006. *Constructing grounded theory*. Sage, London, UK.
- Charmaz K, and Belgrave L. 2012. Qualitative interviewing and grounded theory analysis. In *The SAGE handbook of interview research: the complexity of the craft*. Edited by JF Gubrium, JA Holstein, AB Marvasti, and KD McKinney. SAGE Publications, Inc., Thousand Oaks, California. pp. 347–366.
- Clayton S. 2003. *Environmental Identity: A Conceptual and an Operational Definition*. Pages 45–65 *Identity and the natural environment: The psychological significance of nature*. MIT Press, Cambridge, MA, US.
- Clayton S, Opatow S, editors. 2003. *Identity and the Natural Environment: The Psychological Significance of Nature*. MIT Press, Cambridge, MA, USA.
- Cleary M, Joshi O, Fairbanks WS. 2021. Mapping and modeling the components of human tolerance for black bears in eastern Oklahoma. *Journal of Environmental Management* 288:112378.
- Coleman PT. 2006. Intractable Conflict. Pages 533–559 *The Handbook of Conflict Resolution: Theory and practice*. Available from https://scholar-google-com.ezproxy.library.uvic.ca/scholar_lookup?title=Intractable%20Conflict&author=Peter%20Coleman&publication_year=2006 (accessed July 3, 2023).
- Cook TC, James K, Bearzi M. 2015. Angler perceptions of California sea lion (*Zalophus californianus*) depredation and marine policy in Southern California. *Marine Policy* 51:573–583.
- Cortina JM. 1993. What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology* 78:98–104. American Psychological Association, US.
- Coser LA. 1956. *Functions of Social Conflict*. Routledge, New York.

- COSEWIC. 2020. COSEWIC assessment and status report on the Chinook Salmon *Oncorhynchus tshawytscha*, Designatable Units in Southern British Columbia (Part Two - Designatable Units with High Levels of Artificial Releases in the Last 12 Years), in Canada. Page 203. featured articles xxxv. Available from <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/chinook-salmon-2020.html> (accessed November 26, 2022).
- Costantino CA, Merchant CS. 1996. How to design conflict management systems. *Alternatives to the High Cost of Litigation* 14:48–49.
- Council NR, Studies D on E and L, Sciences B on L, Health C on KCA for C and. 2014. *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*. National Academies Press.
- Couture F, Oldford G, Christensen V, Barrett-Lennard L, Walters C. 2022. Requirements and availability of prey for northeastern pacific southern resident killer whales. *PLOS ONE* 17:e0270523. Public Library of Science.
- Crawford SS. 2018. The Canadian Crown’s duty to consult Indigenous nations’ knowledge systems in federal environmental assessments. *The International Indigenous Policy Journal*, 9(3) [online]: Available from <https://ir.lib.uwo.ca/iipj/vol9/iss3/4>. DOI: 10.18584/iipj.2018.9.3.4
- Delgamuukw v British Columbia. 1997. 3 SCR 1010.
- Cronon W. 1995. *The Trouble with Wilderness; or, Getting Back to the Wrong Nature*. Norton & Co., New York. Available from https://www.williamcronon.net/writing/Trouble_with_Wilderness_Main.html (accessed June 23, 2023).
- Cusack JJ et al. 2021. Measuring the intensity of conflicts in conservation. *Conservation Letters* 14:e12783.
- Davis H, Weir RD, Hamilton AN, Deal JA. 2006. Influence of phenology on site selection by female American black bears in coastal British Columbia. *Ursus* 17:41–51.
- DeCaro D, Stokes M. 2008. Social-Psychological Principles of Community-Based Conservation and Conservancy Motivation: Attaining Goals within an Autonomy-Supportive Environment. *Conservation Biology* 22:1443–1451.
- Decker DJ, Evensen DTN, Siemer WF, Leong KM, Riley SJ, Wild MA, Castle KT, Higgins CL. 2010. Understanding Risk Perceptions to Enhance Communication about Human-Wildlife Interactions and the Impacts of Zoonotic Disease. *ILAR Journal* 51:255–261.
- Denning KR, Hodges SD. 2022. When Polarization Triggers Out-Group “Counter-Projection” Across the Political Divide. *Personality and Social Psychology Bulletin* 48:638–656. SAGE Publications Inc.
- Department of Fisheries and Oceans. 2019. 2022 management measures to protect Southern Resident killer whales. Available from <https://www.pac.dfo-mpo.gc.ca/fm-gp/mammals-mammiferes/whales-baleines/srkw-measures-mesures-ers-eng.html> (accessed July 4, 2022).
- Dickman AJ. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation* 13:458–466.
- Dietsch A, Slagle K, Baruch-Mordo S, Breck S, Ciarniello L. 2017. Education is not a panacea for reducing human–black bear conflicts. *USDA Wildlife Services - Staff Publications*. Available from https://digitalcommons.unl.edu/icwdm_usdanwrc/2013.

- Dion KL. 1973. Cohesiveness as a determinant of ingroup-outgroup bias. *Journal of Personality and Social Psychology* 28:163–171. American Psychological Association, US.
- Doucey M. 2011. Understanding the root causes of conflicts: Why it matters for international crisis. *International Affairs* 20:1–8.
- Dougherty ML. 2011. The Global Gold Mining Industry, Junior Firms, and Civil Society Resistance in Guatemala. *Bulletin of Latin American Research* 30:403–418.
- Douglas LR, Veríssimo D. 2013. Flagships or Battleships: Deconstructing the Relationship between Social Conflict and Conservation Flagship Species. *Environment and Society* 4:98–116.
- Drew JA. 2005. Use of traditional ecological knowledge in marine conservation. *Conservation Biology*, 19(4): 1286–1293. DOI: 10.1111/j.1523-1739.2005.00158.x
- Eckert LE, Ban NC, Frid A, McGreer M. 2018a. Diving back in time: extending historical baselines for yelloweye rockfish with Indigenous knowledge. *Aquatic Conservation: Marine and Freshwater Ecosystems* 28:158–166. Wiley Online Library.
- Eckert LE, Ban NC, Tallio S-C, Turner N. 2018b. Linking marine conservation and Indigenous cultural revitalization: First Nations free themselves from externally imposed social-ecological traps. *Ecology and Society* 23. Resilience Alliance Inc. Available from <https://www.jstor.org/stable/26796892> (accessed June 17, 2023).
- Eckert LE, Claxton N, Ban NC, Owens C. 2020. Indigenous knowledge and federal environmental assessments in Canada: applying past lessons to the 2019 impact assessment act. *FACETS*. Available from <https://www.facetsjournal.com/doi/full/10.1139/facets-2019-0039> (accessed August 31, 2022).
- Eichler L and Baumeister D. 2018. Hunting for Justice: An Indigenous Critique of the North American Model of Wildlife Conservation. *Environment and Society* 9:75–90. Berghahn Journals.
- Elfström M, Zedrosser A, Støen O-G, Swenson JE. 2014. Ultimate and proximate mechanisms underlying the occurrence of bears close to human settlements: review and management implications. *Mammal Review* 44:5–18.
- Elliott JK. 2019, June 21. Why critics fear Bill C-69 will be a ‘pipeline killer’. *Global News* [online]: Available from <https://globalnews.ca/news/5416659/what-is-bill-c69-pipelines/>.
- Ellis SC. 2005. Meaningful consideration? A review of traditional knowledge in environmental decision making. *Arctic*, 58(1): 66–77.
- Endter-Wada J, Blahna D, Krannich R, Brunson M. 1998. A Framework for Understanding Social Science Contributions to Ecosystem Management. *Ecological Applications* 8:891–904.
- EnviroNics Research Group. 2008. Final report: 2008 national benchmark survey. Prepared for Indian Residential Schools Resolution Canada and the Truth and Reconciliation Commission, Ottawa, Ontario.
- Fink CF. 1968. Some conceptual difficulties in the theory of social conflict. *Journal of Conflict Resolution* 12:412–460.
- Fisheries and Oceans Canada. 2009, March 12. Integrated Fisheries Management Plans | Pacific Region. Available from <https://www.pac.dfo-mpo.gc.ca/fm-gp/ifmp-eng.html> (accessed July 4, 2022).

- Fisheries and Oceans Canada. 2018. Amended Recovery Strategy for the Northern and Southern Resident Killer Whales (*Orcinus orca*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa.
- Fisheries and Oceans Canada. 2019. Survey of Recreational Fishing in Canada, 2015. Government of Canada. Available from <https://www.dfo-mpo.gc.ca/stats/rec/can/2015/index-eng.html> (accessed July 12, 2022).
- Fisheries and Oceans Canada. 2021. What we heard: Overview of Government of Canada consultations on proposed Southern Resident Killer Whale recovery measures for 2019. Available from <https://www.pac.dfo-mpo.gc.ca/consultation/fm-gp/srkw-eprs/overview-apercu-eng.html>.
- Fitzduff M. 2021. *Our Brains at War: The Neuroscience of Conflict and Peacebuilding*. Oxford Academic.
- Fletcher M-S, Hamilton R, Dressler W, Palmer L. 2021. Indigenous knowledge and the shackles of wilderness. *Proceedings of the National Academy of Sciences* 118:e2022218118. *Proceedings of the National Academy of Sciences*.
- Folke C et al. 2021. Our future in the Anthropocene biosphere. *Ambio* 50:834–869.
- Ford JK. 1998. Dietary specialization in two sympatric populations of killer whales (*Orcinus orca*) in coastal British Columbia and adjacent waters. *Can. J. Zool* 76:1456–1471.
- Forester B. 2023. Injunctions justify RCMP spending near \$50M on resource standoffs, B.C. Mounie Says. CBC News. Available from <https://datawrapper.dwcdn.net/1BjpN/4/> (accessed June 29, 2023).
- Frank B, Glikman JA, Marchini S, editors. 2019. *Human-Wildlife Interactions: Turning Conflict into Coexistence*. Cambridge University Press, Cambridge, United Kingdom ; New York, NY.
- Freedman D, Pisani R, Purves R. 2007. *Statistics: Fourth International Student Edition*. W.W. Norton & Company.
- Fulmer AM, Godoy AS, Neff P. 2008. Indigenous Rights, Resistance, and the Law: Lessons from a Guatemalan Mine. *Latin American Politics and Society* 50:91–121. Cambridge University Press.
- Fulton DC, Manfredo MJ, Lipscomb J. 1996. Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife* 1:24–47. Routledge.
- Garnett ST et al. 2018. A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability* 1:369–374. Nature Publishing Group.
- Gatersleben B, Murtagh N, Abrahamse W. 2014. Values, identity and pro-environmental behaviour. *Contemporary Social Science* 9:374–392.
- Ghermandi A, Sinclair M. 2019. Passive crowdsourcing of social media in environmental research: A systematic map. *Global Environmental Change*:36–47.
- Gifford R, Nilsson A. 2014. Personal and social factors that influence pro-environmental concern and behaviour: a review. *International Journal of Psychology: Journal International De Psychologie* 49:141–157.
- Gissibl B. 2016. *The Nature of German Imperialism: Conservation and the Politics of Wildlife in Colonial East Africa*. Berghahn Books. Available from <https://www.europenowjournal.org/2017/01/04/the-nature-of-german-imperialism-conservation-and-the-politics-of-wildlife-in-colonial-east-africa/> (accessed June 23, 2023).

- Glikman JA, Frank B, Bogardus M, Meysohn S, Sandström C, Zimmermann A, Madden F. 2022. Evolving Our Understanding and Practice in Addressing Social Conflict and Stakeholder Engagement Around Conservation Translocations. *Frontiers in Conservation Science* 3. Available from <https://www.frontiersin.org/articles/10.3389/fcosc.2022.783709> (accessed June 29, 2023).
- Gore ML, Siemer WF, Shanahan JE, Schuefele D, Decker DJ. 2005. Effects on risk perception of media coverage of a black bear-related human fatality. *Wildlife Society Bulletin* 33:507–516.
- Green AR, Murphy A, Collison BR, Sánchez-Nivicela M, Anderson H, Morano JL, Williams TD, Wilkinson CE. 2022. A response to Cafaro, Hansson & Götmark (2022): Shifting the narrative from overpopulation to overconsumption. *Biological Conservation* 273:109698. Elsevier.
- Greenleaf S, Matthews S, Wright R, Beecham J, Leithead H. 2009. Food habits of American black bears as a metric for direct management of human–bear conflict in Yosemite Valley, Yosemite National Park, California. *Ursus* 20:94–101.
- Grip K, Blomqvist S. 2018. Establishing marine protected areas in Sweden: Internal resistance versus global influence. *Ambio* 47:1–14.
- Grip K, Blomqvist S. 2020. Marine nature conservation and conflicts with fisheries. *Ambio* 49:1328–1340.
- Gustafson A, Ballew MT, Goldberg MH, Cutler MJ, Rosenthal SA, Leiserowitz A. 2020. Personal Stories Can Shift Climate Change Beliefs and Risk Perceptions: The Mediating Role of Emotion. *Communication Reports* 33:121–135. Routledge.
- Hagani JS, Kross SM, Clark M, Wynn-Grant R, Blair M. 2021. Mapping and modeling human-black bear interactions in the Catskills region of New York using resource selection probability functions. *PLOS ONE* 16:e0257716. Public Library of Science.
- Hanson MB et al. 2021. Endangered predators and endangered prey: Seasonal diet of Southern Resident killer whales. *PLOS ONE* 16:e0247031. Public Library of Science.
- Harding LE, Bourbonnais M, Cook AT, Spribille T, Wagner V, Darimont C. 2020. No statistical support for wolf control and maternal penning as conservation measures for endangered mountain caribou. *Biodiversity and Conservation* 29:3051–3060.
- Harris NC, Wilkinson CE, Fleury G, Nhleko ZN. 2023. Responsibility, equity, justice, and inclusion in dynamic human–wildlife interactions. *Frontiers in Ecology and the Environment* n/a. Available from <https://onlinelibrary.wiley.com/doi/abs/10.1002/fee.2603> (accessed July 5, 2023).
- Hartter J, Goldman A. 2011. Local responses to a forest park in western Uganda: alternate narratives on fortress conservation. *Oryx* 45:60–68. Cambridge University Press.
- Hawlena H. 2022. Coexistence research requires more interdisciplinary communication. *Ecology and Evolution* 12:e8914.
- Hayden D, Deng F. 2013. The Science of Goal Setting A Practitioner’s Guide to Goal Setting in the Social Marketing of Conservation. *Social Marketing Quarterly* 19:13–25.
- Hayman B, Harvey RG, Mazotti FJ, Israel GD, Woodward AR. 2014. Who Complains About Alligators? Cognitive and Situational Factors Influence Behavior Toward Wildlife. *Human Dimensions of Wildlife* 19:481–497.

- Hervieux D, Hebblewhite M, Stepnisky D, Bacon M, Boutin S. 2014. Managing wolves (*Canis lupus*) to recover threatened woodland caribou (*Rangifer tarandus caribou*) in Alberta. *Canadian Journal of Zoology* 92:1029–1037. NRC Research Press.
- Hicks T. 2001. Another Look at Identity-Based Conflict: The Roots of Conflict: The Roots of Conflict in the Psychology of Consciousness. *Negotiation Journal* 17:35–45.
- Hilborn R, Cox SP, Gulland FMP, Hankin DG, Hobbs NT, Schindler DE, Trites AW. 2012. The Effects of Salmon Fisheries on Southern Resident Killer Whales. Final Report of the Independent Science Panel. NOAA Fisheries.
- Hilson G, Yakovleva N. 2007. Strained relations: A critical analysis of the mining conflict in Prestea, Ghana. *Political Geography* 26:98–119.
- Hogg MA, Turner JC. 1987. Intergroup behaviour, self-stereotyping and the salience of social categories. *British Journal of Social Psychology* 26:325–340.
- Homer PM, Kahle LR. 1988. A structural equation test of the value-attitude-behavior hierarchy. *Journal of Personality and Social Psychology* 54:638–646. American Psychological Association, US.
- Houston MJ, Bruskotter JT, Fan D. 2010. Attitudes Toward Wolves in the United States and Canada: A Content Analysis of the Print News Media, 1999–2008. *Human Dimensions of Wildlife* 15:389–403.
- Humprecht E, Hellmueller L, Lischka J. 2020. Hostile Emotions in News Comments: A Cross-National Analysis of Facebook Discussions. *Social Media + Society* 6. Available from <https://journals-sagepub-com.ezproxy.library.uvic.ca/doi/full/10.1177/2056305120912481> (accessed July 18, 2022).
- Huntington HP. 2000. Using traditional ecological knowledge in science: methods and applications. *Ecological Applications*, 10(5): 1270–1274. DOI: 10.1890/1051-0761(2000)010[1270:UTEKIS]2.0.CO;2
- Indigenous and Northern Affairs Canada, Tla’amin Nation, Ministry of Aboriginal Relations and Reconciliation. 2016. Tla’amin Final Agreement: Tla’amin Lands.
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). 2019. Global assessment report on biodiversity and ecosystem services of the intergovernmental science - policy platform on biodiversity and ecosystem services. IPBES Secretariat, Bonn, Germany.
- Janssens I, de Bisthoven LJ, Rochette A-J, Kakai RG, Akpona JDT, Dahdouh-Guebas F, Hugé J. 2022. Conservation conflict following a management shift in Pendjari National Park (Benin). *Biological Conservation* 272:109598.
- Jerry J. Vaske MPD. 1999. A Value-Attitude-Behavior Model Predicting Wildland Preservation Voting Intentions. *Society & Natural Resources* 12:523–537. Routledge.
- Johannes RE. 1978. Traditional marine conservation methods in Oceania and their demise. *Annual Review of Ecology and Systematics*, 9(1978): 349–364. DOI: 10.1146/annurev.es.09.110178.002025
- Johannes RE. 1998. Government-supported, village-based management of marine resources in Vanuatu. *Ocean & Coastal Management*, 40: 165–186. DOI: 10.1016/S0964-5691(98)00046-5
- JWN staff. 2019, June 24. Passing bill C-69 signals a bleak future for new major pipeline projects: CEPA [online]: Available from <https://www.jwnenergy.com/article/2019/6/passing-bill-c-69-signalsbleak-future-new-major-pipeline-projects-cepa/>.

- Johns D. 2019. *Conservation Politics: The Last Anti-Colonial Battle*. Cambridge University Press.
- Johnson HE, Lewis DL, Lischka SA, Breck SW. 2018. Assessing ecological and social outcomes of a bear-proofing experiment. *The Journal of Wildlife Management* 82:1102–1114.
- Johnson RJ, McCaul KD, Klein WMP. 2002. Risk involvement and risk perception among adolescents and young adults. *Journal of Behavioral Medicine* 25:67–82.
- Jolly H, Satterfield T, Kandlikar M, Tr S. 2022. Indigenous insights on human–wildlife coexistence in southern India. *Conservation Biology* 36:e13981.
- Kahn LS. 1988. *Peacemaking: a systems approach to conflict management*. University Press of America.
- Kansky R, Knight AT. 2014. Key factors driving attitudes towards large mammals in conflict with humans. *Biological Conservation* 179:93–105.
- Kashwan P. 2017. *Colonialism and the Transformation of Hinterlands*. Page (Kashwan P, editor). Oxford University Press. Available from <https://doi.org/10.1093/acprof:oso/9780190637385.003.0003> (accessed June 23, 2023).
- Keep Canada Fishing. 2019. *Killer Whales: Anglers are Not the Enemy*. Available from <http://www.keepcanadafishing.com/killer-whales-and-anglers/>.
- Kirchhoff D, Gardner HL, and Tsuji LJS. 2013. The Canadian environmental assessment act, 2012 and associated policy: implications for aboriginal peoples. *International Indigenous Policy Journal*, 4(3). DOI: 10.18584/iipj.2013.4.3.1
- Klees van Bommel J, Badry M, Ford AT, Golumbia T, Burton AC. 2020. Predicting human-carnivore conflict at the urban-wildland interface. *Global Ecology and Conservation* 24:e01322.
- Kluckhohn FR, and Strodtbeck FL. 1961. *Variations in value orientations*. Row, Peterson, Oxford, UK.
- Krippendorff K. 2018. *Content analysis: an introduction to its methodology*. Sage Publications.
- Latour B. 1998. From the world of science to the world of research? *Science*, 280(5361): 208–209. DOI: 10.1126/science.280.5361.208
- Lacy RC. 2017. Evaluating anthropogenic threats to endangered killer whales to inform effective recovery plans. *Sci Rep* 7:1–12.
- Latour B. 1999. *Pandora’s hope: essays on the reality of science studies*. Harvard University Press, Cambridge, Massachusetts.
- Laird K. 2018. Fishing ban a ‘devastating blow’ for Sooke. *Sooke News Mirror*. Available from <https://www.sookenewsmirror.com/news/fishing-ban-a-devastating-blow-for-sooke/>.
- Lederach JP. 1996. *Preparing for Peace: Conflict Transformation Across Cultures*. Syracuse University Press, Syracuse. Available from <https://www.beyondintractability.org/artsum/lederach-preparing> (accessed January 20, 2020).
- Lederach JP. 2015. *The Little Book of Conflict Transformation: Clear articulation of the guiding principles by a pioneer in the field*. Simon and Schuster.
- LeFlore EG, Fuller TK, Tomeletso M, Dimbindo TC, Stein AB. 2020. Human dimensions of human–lion conflict: a pre- and post-assessment of a lion conservation programme in the Okavango Delta, Botswana. *Environmental Conservation* 47:182–189. Cambridge University Press.

- LeFlore EG, Fuller TK, Tomeletso M, Stein AB. 2019. Livestock depredation by large carnivores in northern Botswana. *Global Ecology and Conservation* 18:e00592.
- Leong KM, Emmerson DP, Byron R (Rudi). 2011. The New Governance Era: Implications for Collaborative Conservation and Adaptive Management in Department of the Interior Agencies. *Human Dimensions of Wildlife* 16:236–243. Routledge.
- Leopold A. 1949. *A Sand County Almanac: With Essays on Conservation from Round River*. Random House. Available from <https://www.amazon.ca/Sand-County-Almanac-Essays-Conservation/dp/0345345053> (accessed June 26, 2023).
- Lewis DL, Baruch-Mordo S, Wilson KR, Breck SW, Mao JS, Broderick J. 2015. Foraging ecology of black bears in urban environments: guidance for human-bear conflict mitigation. *Ecosphere* 6:art141.
- Liboiron M. 2021. *Pollution Is Colonialism*. Duke University Press, Durham, NC.
- Linnell JDC. 2010. Confronting the costs and conflicts associated with biodiversity: Confronting the costs and conflicts associated with biodiversity. *Animal Conservation* 13:429–431.
- Lischka SA. 2018. A conceptual model for the integration of social and ecological information to understand human-wildlife interactions. *Biological Conservation* 225:80–87.
- Lischka SA, Teel TL, Johnson HE, Crooks KR. 2019. Understanding and managing human tolerance for a large carnivore in a residential system. *Biological Conservation* 238:108189.
- Lischka SA, Teel TL, Johnson HE, Reed SE, Breck S, Don Carlos A, Crooks KR. 2018a. A conceptual model for the integration of social and ecological information to understand human-wildlife interactions. *Biological Conservation* 225:80–87.
- Lischka SA, Teel TL, Johnson HE, Reed SE, Breck S, Don Carlos A, Crooks KR. 2018b. A conceptual model for the integration of social and ecological information to understand human-wildlife interactions. *Biological Conservation* 225:80–87.
- Litterer JA. 1966. Conflict in Organization: A Re-Examination. *The Academy of Management Journal* 9:178–186.
- Luce MF, Kahn BE. 1999. Avoidance or Vigilance? The Psychology of False-Positive Test Results. *Journal of Consumer Research* 26:242–259.
- Lüders A, Jonas E, Fritsche I, Agroskin D. 2016. Between the Lines of Us and Them: Identity Threat, Anxious Uncertainty, and Reactive In-Group Affirmation: How Can Antisocial Outcomes be Prevented? Pages 33–53 in McKeown S, Haji R, Ferguson N, editors. *Understanding Peace and Conflict Through Social Identity Theory: Contemporary Global Perspectives*. Springer International Publishing, Cham. Available from https://doi.org/10.1007/978-3-319-29869-6_3 (accessed July 13, 2022).
- Lute ML, Bump A, Gore ML. 2014. Identity-Driven Differences in Stakeholder Concerns about Hunting Wolves. *PLOS ONE* 9:e114460. Public Library of Science.
- Lyons AL, Gaines WL, Servheen C. 2003. Black bear resource selection in the northeast Cascades, Washington. *Biological Conservation* 113:55–62.
- MacDonald DW, Willis KJ. (n.d.). *Key topics in conservation biology*. Wiley-Blackwell, New York.
- Madden F. 2004. Creating Coexistence between Humans and Wildlife: Global Perspectives on Local Efforts to Address Human–Wildlife Conflict. *Human Dimensions of Wildlife* 9:247–257. Routledge.

Madden F, McQuinn B. 2014. Conservation's blind spot: The case for conflict transformation in wildlife conservation. *Biological Conservation* 178:97–106.

Madden F, McQuinn B. 2015. Conservation conflict transformation: The missing link in conservation. Pages 257–270 *Conflicts in Conservation: Navigating Towards Solutions*.

Madden F, McQuinn B. 2017. *Conservation Conflict Transformation: Addressing the Missing Link in Wildlife Conservation. Understanding Conflicts about Wildlife: A Biosocial Approach*. Berghahn Books.

Maiese M. 2003. *Justice Conflicts. Page Beyond Intractability*. Conflict Information Consortium, University of Colorado, Boulder. Available from <https://www.beyondintractability.org/essay/justice-conflicts> (accessed June 23, 2023).

Manfredo MJ. 2008. Values, Ideology, and Value Orientations. in *Who Cares About Wildlife?* 141–166. Springer US.

Manfredo MJ, Dayer AA. 2004. Concepts for Exploring the Social Aspects of Human–Wildlife Conflict in a Global Context. *Human Dimensions of Wildlife* 9:1–20.

Manfredo MJ, Teel TL, Dietsch AM. 2016. Implications of human value shift and persistence for biodiversity conservation: Value Shift and Conservation. *Conservation Biology* 30:287–296.

Manfredo MJ, Teel TL, Don Carlos AW, Sullivan L, Bright AD, Dietsch AM, Bruskotter J, Fulton D. 2020. The changing sociocultural context of wildlife conservation. *Conservation Biology* 34:1549–1559.

Manfredo MJ, Teel TL, Gavin MC, Fulton D. 2014. Considerations in Representing Human Individuals in Social-Ecological Models. Pages 137–158 in Manfredo MJ, Vaske JJ, Rechkemmer A, Duke EA, editors. *Understanding Society and Natural Resources: Forging New Strands of Integration Across the Social Sciences*. Springer Netherlands, Dordrecht. Available from https://doi.org/10.1007/978-94-017-8959-2_7 (accessed January 20, 2020).

Manfredo MJ, Vaske JJ, Teel TL. 2003. The Potential for Conflict Index: A Graphic Approach to Practical Significance of Human Dimensions Research. *Human Dimensions of Wildlife* 8:219–228.

Manning F. 2013. *Peace on the Water: Advancing the Full Implementation of Mi'kmaq, Wolastoqiyik and Peskotomuhkati Rights-Based Fisheries*. 4th report, 44th Parliament, 1st session, Report of the Standing Senate Committee on Fisheries and Oceans. Government of Canada, Ottawa. Available from <https://sencanada.ca/en/info-page/parl-44-1/pofo-peace-on-the-water-advancing-the-full-implementation-of-mi-kmaq-wolastoqiyik-and-peskotomuhkati-rights-based-fisheries/> (accessed August 7, 2022).

Manolis JC, Chan KM, Finkelstein ME, Stephens S, Nelson CR, Grant JB, Dombeck MP. 2009. Leadership: a New Frontier in Conservation Science. *Conservation Biology* 23:879–886.

Manuel A, and Derrickson RMGC. 2015. *Unsettling Canada: a national wake-up call*. Between The Lines, Toronto, Ontario, Canada.

Marshall A, Bartlett C. 2009. Co-learning re: “Talking and Walking Together” of Indigenous and Mainstream Sciences.

Mason T, Keane A, Redpath SM, Bunnefeld N. 2018. The changing environment of conservation conflict: Geese and farming in Scotland. *Journal of Applied Ecology* 55:651–662.

McCreary TA, and Milligan RA. 2013. Pipelines, permits, and protests: Carrier Sekani encounters with the Enbridge Northern Gateway Project. *Cultural Geographies*, 21(1): 115–129. DOI: 10.1177/1474474013482807

- McFadden-Hiller JE, Jr DEB, Belant JL. 2016. Spatial Distribution of Black Bear Incident Reports in Michigan. *PLOS ONE* 11:e0154474. Public Library of Science.
- McGregor D. 2004. *Coming Full Circle: Indigenous Knowledge, Environment, and Our Future*. The American Indian Quarterly 28:385–410. University of Nebraska Press.
- McGuire SA, Ehlinger T. 2018. Analysis of social-ecological dynamics driving conflict in linked surface-groundwater systems. *Ecology and Society* 23. Available from <http://www.ecologyandsociety.org/vol23/iss4/art19/> (accessed January 20, 2020).
- McKenzie-Mohr D. 2000. Fostering sustainable behavior through community-based social marketing. *The American psychologist* 55:531–7.
- McMichael C. 2020. Human mobility, climate change, and health: unpacking the connections. *The Lancet Planetary Health* 4:e217–e218. Elsevier.
- Menell PS. 1991. The Limitations of Legal Institutions for Addressing Environmental Risks. *Journal of Economic Perspectives* 5:93–113.
- Menzies AK, Bowles E, Ford AT, Popp JN, Khan JS, McGregor D. 2021. Caring For The Land: Indigenous Practices, Community Values, Changes Over Time, and Building Values-Based Environmental Initiatives.
- Menzies CR, Butler CF. 2007. Returning to Selective Fishing through Indigenous Fisheries Knowledge: The Example of K'moda, Gitxaala Territory. *The American Indian Quarterly* 31:441–464.
- Merkle JA, Robinson HS, Krausman PR, Alaback P. 2013. Food availability and foraging near human developments by black bears. *Journal of Mammalogy* 94:378–385.
- Miall H. 2004. Conflict Transformation: A Multi-Dimensional Task. Pages 67–89 in Austin A, Fischer M, Ropers N, editors. *Transforming Ethnopolitical Conflict*. VS Verlag für Sozialwissenschaften, Wiesbaden. Available from http://link.springer.com/10.1007/978-3-663-05642-3_4 (accessed January 20, 2020).
- Microsoft Corporation. 2018. Microsoft Excel. Available from <https://www.researchgate.net/deref/https%3A%2F%2Foffice.microsoft.com%2Fexcel>.
- Milfont TL, Duckitt J, Wagner C. 2010. A Cross-Cultural Test of the Value–Attitude–Behavior Hierarchy. *Journal of Applied Social Psychology* 40:2791–2813.
- Minnes S, Gaspard V, Loring PA, Baulch H, Breen S-P. 2020. Transforming conflict over natural resources: a socio-ecological systems analysis of agricultural drainage. *FACETS* 5:864–886. Canadian Science Publishing.
- Morishima GS, Henry KA. 2000. The History and Status of Pacific Northwest Chinook and Coho Salmon Ocean Fisheries and Prospects for Sustainability. *Page Sustainable Fisheries Management*. CRC Press.
- Murray CC, Wong J, Singh GG, Mach M, Lerner J, Ranieri B, et al. 2018. The insignificance of thresholds in environmental impact assessment: an illustrative case study in Canada. *Environmental Management*, 61: 1062–1071. DOI: 10.1007/s00267-018-1025-6
- Nadasdy P. 1999. The politics of TEK: Power and the “Integration” of Knowledge. *Artic Anthropology*, 36(1): 1–18.
- Naess A. 1973. The shallow and the deep, long-range ecology movement. A summary. *Inquiry* 16:95–100.

National Research Council. 2005. *Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects*. The National Academies Press, Washington, D.C.

Nguyen VM, Young N, Hinch SG, Cooke SJ. 2016. Getting past the blame game: Convergence and divergence in perceived threats to salmon resources among anglers and indigenous fishers in Canada's lower Fraser River. *Ambio* 45:591–601.

NVivo qualitative data analysis Software. 2012. QSR International Pty Ltd. Vers.12.

Nyhus PJ. 2016. Human–Wildlife Conflict and Coexistence. *Annual Review of Environment and Resources* 41:143–171.

Nyhus PJ, Osofsky SA, Ferraro P, Madden F, Fischer H. 2005. Bearing the costs of human–wildlife conflict: the challenges of compensation schemes. Pages 107–121 in Rabinowitz A, Woodroffe R, Thirgood S, editors. *People and Wildlife, Conflict or Co-existence?* Cambridge University Press, Cambridge. Available from <https://www.cambridge.org/core/books/people-and-wildlife-conflict-or-coexistence/bearing-the-costs-of-humanwildlife-conflict-the-challenges-of-compensation-schemes/BAD82B1F38EFF966924856417CF2CA22> (accessed July 5, 2023).

Oelschlaeger M. 1993. *The Idea of Wilderness: From Prehistory to the Age of Ecology* Revised ed. edition. Yale University Press, New Haven.

O'Faircheallaigh C. 2007. Environmental agreements, EIA follow-up and aboriginal participation in environmental management: the Canadian experience. *Environmental Impact Assessment Review*, 27(4): 319–342. DOI: 10.1016/j.eiar.2006.12.002

O'Faircheallaigh C. 2017. Shaping projects, shaping impacts: community-controlled impact assessments and negotiated agreements. *Third World Quarterly*, 38(5): 1181–1197. DOI: 10.1080/01436597.2017.1279539

Olsen DG. 1999. *Constructivist Principles of Learning and Teaching Methods*. Education 120:347–347. Project Innovation Austin LLC.

Omofonmwan SI, Odi LO. 2009. Oil Exploitation and Conflict in the Niger-Delta Region of Nigeria. *Journal of Human Ecology* 26:25–30. Routledge.

Osborne R. 1999. A Historical ecology of Salish Sea 'resident' killer whales (*Orcinus orca*): with implications for management.

Owen B. 2019. For Coast Salish communities, the race to save southern resident orcas is personal. *National Observer*. Available from <https://www.nationalobserver.com/2019/09/17/features/coast-salish-communities-race-save-southern-resident-orcas-personal>.

Oyserman D, Elmore K, Smith G. 2012. Self, self-concept, and identity. *Page Handbook of self and identity* 2nd ed 69–104. The Guilford Press.

Oz M, Zheng P, Chen GM. 2018. Twitter versus Facebook: Comparing incivility, impoliteness, and deliberative attributes. *New Media & Society* 20:3400–3419.

Özkaynak B et al. 2012. Mining conflicts around the world: Common grounds from an Environmental Justice perspective. Available from <https://repub.eur.nl/pub/38559/> (accessed June 24, 2023).

Paci C, Tobin A, and Robb P. 2002. Reconsidering the Canadian environmental impact assessment act: a place for traditional environmental knowledge. *Environmental Impact Assessment Review*, 22(2): 111–127. DOI: 10.1016/S0195-9255(01)00095-6

- Pearl MA. 2018. Human Rights, Indigenous Peoples, and the Global Climate Crisis. *Wake Forest Law Review* 53:713–738.
- Peek L, Guikema S. 2021. Interdisciplinary Theory, Methods, and Approaches for Hazards and Disaster Research: An Introduction to the Special Issue. *Risk Analysis* 41:1047–1058.
- Peterson MN, Birckhead JL, Leong K, Peterson MJ, Peterson TR. 2010a. Rearticulating the myth of human–wildlife conflict. *Conservation Letters* 3:74–82.
- Peterson MN, Birckhead JL, Leong K, Peterson MJ, Peterson TR. 2010b. Rearticulating the myth of human–wildlife conflict. *Conservation Letters* 3:74–82.
- Peterson MN, Peterson MJ, Peterson TR, Leong K. 2013. Why transforming biodiversity conservation conflict is essential and how to begin. *Pacific Conservation Biology* 19:94–103. CSIRO PUBLISHING.
- Pooley S et al. 2017. An interdisciplinary review of current and future approaches to improving human–predator relations: Improving Human–Predator Relations. *Conservation Biology* 31:513–523.
- Postmes T, Haslam SA, Jans L. 2013. A single-item measure of social identification: reliability, validity, and utility. *The British Journal of Social Psychology* 52:597–617.
- Prior M. 2013. Media and Political Polarization. *Annual Review of Political Science* 16:101–127.
- Province of British Columbia. 2023. BC Address Geocoder - Province of British Columbia. Province of British Columbia. Available from <https://www2.gov.bc.ca/gov/content/data/geographic-data-services/location-services/geocoder> (accessed May 29, 2023).
- qathet Regional District | Welcome to qRD. (n.d.). Available from <https://www.qathet.ca/> (accessed June 30, 2023).
- R Core Team. 2023. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. Available from <https://www.R-project.org>.
- Rai ND, Devy MS, Ganesh T, Ganesan R, Setty SR, Hiremath AJ, Khaling S, Rajan PD. 2021. Beyond fortress conservation: The long-term integration of natural and social science research for an inclusive conservation practice in India. *Biological Conservation* 254:108888.
- Rakotonarivo OS et al. 2021. The role of incentive-based instruments and social equity in conservation conflict interventions. *ECOLOGY AND SOCIETY* 26:8.
- Rathwell KJ, Armitage D, Berkes F. 2015. Bridging knowledge systems to enhance governance of environmental commons: A typology of settings 9:851. Ubiquity Press.
- Redpath SM et al. 2013. Understanding and managing conservation conflicts. *Trends in Ecology & Evolution* 28:100–109.
- Redpath SM, Bhatia S, Young J. 2015a. Tilting at wildlife: reconsidering human–wildlife conflict. *Oryx* 49:222–225.
- Redpath SM, Gutiérrez RJ, Wood KA, Young JC. 2015b. *Conflicts in Conservation*. Cambridge University Press.
- Reid AJ, Eckert LE, Lane J-F, Young N, Hinch SG, Darimont CT, Cooke SJ, Ban NC, Marshall A. 2021. “Two-Eyed Seeing”: An Indigenous framework to transform fisheries research and management. *Fish and Fisheries* 22:243–261.

- Rickson RE, Burdge RJ, Hundloe T, and McDonald GT. 1990. Institutional constraints to adoption of social impact assessment as a decision-making and planning tool. *Environmental Impact Assessment Review*, 10(1): 233–243. DOI: 10.1016/0195-9255(90)90022-R
- Riddel D. 2005. Evolving Approaches to Conservation: Integral Ecology and Canada's Great Bear Rainforest. *World Futures* 61:63–78. Routledge.
- Ripple WJ et al. 2014. Status and Ecological Effects of the World's Largest Carnivores. *Science* 343:1241484. American Association for the Advancement of Science.
- Robinson S, Carlson D. 2021. A just alternative to litigation: applying restorative justice to climate-related loss and damage. *Third World Quarterly* 42:1384–1395. Routledge.
- Ross PS. 2006. Fireproof killer whales (*Orcinus orca*): flame-retardant chemicals and the conservation imperative in the charismatic icon of British Columbia, Canada. *Can. J. Fish. Aquat. Sci* 63:224–234.
- Rosser A. 2006. The political economy of the resource curse: a literature survey. Institute of Development Studies Working Paper, Brighton, UK.
- Rothman. 1997a. Action Evaluation and Conflict Resolution Training: Theory, Method and Case Study. *International Negotiation* 2:451–470.
- Roue M, and Nakashima D. 2002. Knowledge and foresight: the predictive capacity of traditional knowledge applied to environmental assessment. *International Social Science Journal*, 54(173): 337–347. DOI: 10.1111/1468-2451.00386
- Sabatier E, Huveneers C. 2018. Changes in Media Portrayal of Human-wildlife Conflict During Successive Fatal Shark Bites. *Conservation and Society* 16:338–350.
- Sallenave J. 1994. Giving traditional ecological knowledge its rightful place in environmental impact assessment. *Northern Perspectives*, 22(1): 1–7.
- Sandbrook C. 2015. What is conservation? *Oryx* 49:565–566. Cambridge University Press.
- Sandlos J, and Keeling A. 2016. Aboriginal communities, traditional knowledge, and the environmental legacies of extractive development in Canada. *Extractive Industries and Society*, 3(2): 278–287. DOI: 10.1016/j.exis.2015.06.005
- Satterfield T. 2007. *Anatomy of a Conflict: Identity, Knowledge, and Emotion in Old-Growth Forests*. UBC Press.
- Scheffer M, Carpenter S, Foley JA, Folke C, and Walker B. 2001. Catastrophic shifts in ecosystems. *Nature*, 413(6856): 591–596. PMID: 11595939 DOI: 10.1038/35098000
- Schakner Z, Purdy C, Blumstein DT. 2019. Contrasting attitudes and perceptions of California sea lions by recreational anglers and the media. *Marine Policy* 109:103710.
- Schelling T. 1980. *The Strategy of Conflict*. Harvard University Press, Cambridge. Available from <https://www.hup.harvard.edu/catalog.php?isbn=9780674840317> (accessed January 20, 2020).
- Schleicher J, Peres CA, Amano T, Lactayo W, Leader-Williams N. 2017. Conservation performance of different conservation governance regimes in the Peruvian Amazon. *Scientific Reports* 7:11318.
- Schroeder SA, Fulton DC, Currie L, Goeman T. 2006. He Said, She Said: Gender and Angling Specialization, Motivations, Ethics, and Behaviors. *Human Dimensions of Wildlife* 11:301–315. Routledge.

- Serrouya R, Seip DR, Hervieux D, McLellan BN, McNay RS, Steenweg R, Heard DC, Hebblewhite M, Gillingham M, Boutin S. 2019. Saving endangered species using adaptive management. *Proceedings of the National Academy of Sciences* 116:6181–6186. *Proceedings of the National Academy of Sciences*.
- Service CN, Adams MS, Artelle KA, Paquet P, Grant LV, and Darimont CT. 2014. Indigenous knowledge and science unite to reveal spatial and temporal dimensions of distributional shift in wildlife of conservation concern. *PLoS ONE*, 9(7): e101595. PMID: 25054635 DOI: 10.1371/journal.pone.0101595
- Shiple, G. P., & Williams, D. H. 2019. Limitations of the Western scientific worldview for the study of metaphysically inclusive peoples. *Open Journal of Philosophy*, 9(03), 295-317.
- Simberloff D, Genovesi P, Pyšek P, Campbell K. 2011. Recognizing Conservation Success. *Science* 332:419–419. American Association for the Advancement of Science.
- Slagle K, Zajac R, Bruskotter J, Wilson R, Prange S. 2013. Building tolerance for bears: A communications experiment. *The Journal of Wildlife Management* 77:863–869.
- Slovic P. 1987. Perception of Risk. *Science* 236:280–285.
- Smith CG. 1966. A comparative analysis of some conditions and consequences of intra-organizational conflict. *Administrative Science Quarterly*:504–529.
- Smith MJ. 1998. *Ecologism: Towards Ecological Citizenship*. U of Minnesota Press.
- Sodhi NS, Butler R, Laurance WF, Gibson L. 2011. Conservation successes at micro-, meso- and macroscales. *Trends in Ecology & Evolution* 26:585–594.
- Soulé ME. 1985. *What Is Conservation Biology?* *BioScience* 35:727–734. [American Institute of Biological Sciences, Oxford University Press].
- Stevenson MG. 1996. Indigenous knowledge in environmental assessment. *Artic*, 49(3): 278–291.
- Trosper RL. 2003. Resilience in pre-contact Pacific Northwest social ecological systems. *Conservation Ecology*, 7(3): 6.
- Spiegel SJ. 2020. Visual Storytelling and Socioenvironmental Change: Images, Photographic Encounters, and Knowledge Construction in Resource Frontiers. *Annals of the American Association of Geographers* 110:120–144. Taylor & Francis.
- St John FAV, Steadman J, Austen G, Redpath SM. 2019. Value diversity and conservation conflict: Lessons from the management of red grouse and hen harriers in England. *People and Nature* 1:6–17.
- Stamieszkin K, Wielgus J, Gerber LR. 2009. Management of a marine protected area for sustainability and conflict resolution: Lessons from Loreto Bay National Park (Baja California Sur, Mexico). *Ocean & Coastal Management* 52:449–458.
- Statistics Canada. 2017. Census Profile, 2016 Census - Powell River. Available from <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=POPC&Code1=0673&Geo2=PR&Code2=47&Data=Count&SearchText=Powell%20River&SearchType=Begins&SearchPR=01&B1=All> (accessed January 21, 2020).
- Statistics Canada. 2022. Profile table, Census Profile, 2021 Census of Population, Victoria, City, British Columbia. Available from <https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E> (accessed July 28, 2023).

- Steffen W et al. 2018. Trajectories of the Earth System in the Anthropocene. *Proceedings of the National Academy of Sciences* 115:8252–8259.
- Steinitz C et al. 2005. Alternative Futures for the Region of Loreto, Baja California Sur, Mexico. Harvard University's Graduate School of Design/Universidad Autónoma de Baja California Sur/University of Arizona/cibnor/San Diego State University/Scripps Institute of Oceanography/Municipality of Loreto,. (accessed June 25, 2023).
- Stephens L et al. 2019. Archaeological assessment reveals Earth's early transformation through land use. *Science* 365:897–902. American Association for the Advancement of Science.
- Stewart GT. 2019. *Mātauranga Māori: a philosophy from Aotearoa*. Auckland University of Technology, Auckland, Aotearoa, New Zealand.
- Stoett P. 2022. Plastic pollution: A global challenge in need of multi-level justice-centered solutions. *One Earth* 5:593–596.
- Sugiura N. 1978. Further analysis of the data by Akaike's information criterion and the finite corrections. *Communications in Statistics - Theory and Methods* 7:13–26. Taylor & Francis.
- Tajfel H, Billig MG, Bundy RP, Flament C. 1971. Social categorization and intergroup behaviour. *European Journal of Social Psychology* 1:149–178.
- Tajfel H, Turner JC. 1986. The social identity theory of intergroup behavior. Pages 7–24 *Psychology of intergroup relationships*, 2nd edition. Nelson-Hall.
- Teffer AK, Bass AL, Miller KM, Patterson DA, Juanes F, Hinch SG. 2018. Infections, fisheries capture, temperature, and host responses: multistressor influences on survival and behaviour of adult Chinook salmon. *The Ocean Tracking Network: Advancing aquatic research and management* 01:2069–2083. NRC Research Press.
- Teo, T. 2019. Academic subjectivity, idols, and the vicissitudes of virtues in science: Epistemic modesty versus epistemic grandiosity. *Psychological studies of science and technology*, 31-48.
- Thirgood S, Redpath SM. 2008. Hen harriers and red grouse: science, politics and human–wildlife conflict. *Journal of Applied Ecology* 45:1550–1554.
- Thirgood S, Woodroffe R, Rabinowitz A. 2005a. The impact of human–wildlife conflict on human lives and livelihoods. *People and Wildlife, Conflict or Co-existence?* DOI: 10.1017/CBO9780511614774.003.
- Thirgood S, Woodroffe R, Rabinowitz A. 2005b, August. The impact of human–wildlife conflict on human lives and livelihoods. Available from /core/books/people-and-wildlife-conflict-or-coexistence/impact-of-humanwildlife-conflict-on-human-lives-and-livelihoods/8FB022F54119A86265B503E6A52F724B (accessed January 20, 2020).
- Tla'amin Nation. 2014. Community. Available from <https://www.tlaamination.com/community/> (accessed January 21, 2020).
- Trettin L, Musham C. 2000. Is Trust a Realistic Goal of Environmental Risk Communication? - Lillian Trettin, Catherine Musham, 2000. *Environment and Behavior* 32:410–417.
- Treves A, Karanth KU. 2003a. Human-Carnivore Conflict and Perspectives on Carnivore Management Worldwide. *Conservation Biology* 17:1491–1499.
- Treves A, Karanth KU. 2003b. Human-Carnivore Conflict and Perspectives on Carnivore Management Worldwide. *Conservation Biology* 17:1491–1499.

Trosper R. 2003. Resilience in Pre-contact Pacific Northwest Social Ecological Systems. *Conservation Ecology* 7. The Resilience Alliance. Available from <https://www.ecologyandsociety.org/vol7/iss3/art6/> (accessed June 23, 2023).

Tsilhqot'in Nation v. British Columbia. 2014. 2 SCR 257.

Tsleil-Waututh Nation et al. v. Attorney General of Canada et al. 2018. FCA 153.

Tsuji LJS, McCarthy DD, Whitelaw GS, and McEachren J. 2011. Getting back to basics: the victor diamond mine environmental assessment scoping process and the issue of family-based traditional lands versus registered traplines. *Impact Assessment and Project Appraisal*, 29(1):37–47. DOI: 10.3152/146155111X12913679730755

Tucker JA, Guess A, Barbera P, Vaccari C, Siegel A, Sanovich S, Stukal D, Nyhan B. 2018, March 19. Social Media, Political Polarization, and Political Disinformation: A Review of the Scientific Literature. Rochester, NY. Available from <https://papers.ssrn.com/abstract=3144139> (accessed July 14, 2022).

Turner NJ, Ignace MB, Ignace R. 2000. Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia. *Ecological Applications* 10:1275–1287.

Turner NJ, and Berkes F. 2006. Coming to understanding: developing conservation through incremental learning in the Pacific Northwest. *Human Ecology*, 34: 495–513. DOI: 10.1007/s10745-006-9042-0

Turner NJ, and Spalding PR. 2013. “We might go back to this”; drawing on the past to meet the future in northwestern North American indigenous communities. *Ecology and Society*, 18(4): 29. DOI: 10.5751/ES-05981-180429

Udofia A, Noble B, and Poelzer G. 2015. Community engagement in environmental assessment for resource development: benefits, enduring concerns, opportunities for improvement. *The Northern Review*, 39(2015): 98–110.

Udofia A, Noble B, and Poelzer G. 2017. Meaningful and efficient? Enduring challenges to aboriginal participation in environmental assessment. *Environmental Impact Assessment Review*, 65: 164–174. DOI: 10.1016/j.eiar.2016.04.008

UN General Assembly. 2 October 2007. United Nations Declaration on the Rights of Indigenous Peoples: resolution/adopted by the General Assembly, A/RES/61/295 [online]: Available from <https://www.refworld.org/docid/471355a82.html>.

Urki L. 2011. The Defence of Community in the Anti-Mining Movement of Guatemala. *Journal of Agrarian Change* 11:556–580.

Usher PJ. 2000. Traditional ecological knowledge in environmental assessment and management. *Arctic*, 53(2): 183–193.

van Eeden LM, Newsome TM, Crowther MS, Dickman CR, Bruskotter J. 2019. Social identity shapes support for management of wildlife and pests. *Biological Conservation* 231:167–173.

Vanclieaf D. 2014. Extraction and empowerment: the application of traditional knowledge within the development of the NWT BHP Ekati diamond mine. *Laurier Undergraduate Journal of the Arts*, 1(1): 59–70.

- Vaske JJ, Beaman J, Barreto H, Shelby LB. 2010. An Extension and Further Validation of the Potential for Conflict Index. *Leisure Sciences* 32:240–254. Routledge.
- Väyrynen R. 1991. Summary of To Settle or to Transform? Perspectives on the Resolution of National and International Conflicts. Page New Directions in Conflict Theory: Conflict Resolution and Conflict Transformation. Sage Publications, London. Available from <https://www.beyondintractability.org/artsum/vayrynen-settle> (accessed January 20, 2020).
- Väyrynen R. 1999. From Conflict Resolution to Conflict Transformation: A Critical Review. Page The New Agenda for Peace Research, 1st edition. Routledge. Available from <https://www-taylorfrancis-com.ezproxy.library.uvic.ca/chapters/edit/10.4324/9780429441745-10/conflict-resolution-conflict-transformation-critical-review-raimo-v%C3%A4yrynen> (accessed July 2, 2023).
- Vidler N, and Elhaimer E. 2016. Indigenous traditional knowledge in Canadian federal environmental assessment. Submission to the Expert Review Panel.
- Watts R. 2019. Sport fishers stage floating protest over chinook salmon fishing ban. *Times Colonist*.
- Weisgarber M, Multi-skilled Journalist CNV, Contact F|. 2022, January 31. Controversial B.C. wolf cull approved for another 5 years. Available from <https://bc.ctvnews.ca/controversial-b-c-wolf-cull-approved-for-another-5-years-1.5762380> (accessed June 25, 2023).
- Westwood AR, Olszynski M, Fox CH, Ford AT, Jacob AL, Moore JW, et al. 2019. The role of science in contemporary Canadian environmental decision making: the example of environmental assessment. *University of British Columbia Law Review*, 52: 243.
- White PCL, Ward AI, White PCL, Ward AI. 2010. Interdisciplinary approaches for the management of existing and emerging human–wildlife conflicts. *Wildlife Research* 37:623–629. CSIRO PUBLISHING.
- White RM, Schmook B, Calmé S, Giordano AJ, Hausser Y, Kimmel L, Lecuyer L, Lucherini M, Méndez-Medina C, Peña-Mondragón JL. 2023. Facilitating biodiversity conservation through partnerships to achieve transformative outcomes. *Conservation Biology* 37:e14057.
- Whitelaw GS, McCarthy DD, and Tsuji LJ. 2009. The victor diamond mine environmental assessment process: a critical First Nation perspective. *Impact Assessment and Project Appraisal*, 27(3): 205–215. DOI: 10.3152/146155109X465931
- Whittaker D, Vaske JJ, Manfredo MJ. 2006. Specificity and the Cognitive Hierarchy: Value Orientations and the Acceptability of Urban Wildlife Management Actions. *Society & Natural Resources* 19:515–530. Routledge.
- Wiles A, McEwen J, and Sadar MH. 1999. Use of traditional ecological knowledge in environmental assessment of uranium mining in the Athabasca Saskatchewan. *Impact Assessment and Project Appraisal*, 17(2): 107–114. DOI: 10.3152/147154699781767864
- Wilbur RC, Lischka SA, Young JR, Johnson HE. 2018. Experience, attitudes, and demographic factors influence the probability of reporting human–black bear interactions. *Wildlife Society Bulletin* 42:22–31.
- Wilkinson CE, Brashares JS, Bett AC, Kelly M. 2021. Examining Drivers of Divergence in Recorded and Perceived Human-Carnivore Conflict Hotspots by Integrating Participatory and Ecological Data. *Frontiers in Conservation Science* 2. Available from <https://www.frontiersin.org/articles/10.3389/fcosc.2021.681769> (accessed June 17, 2023).

- Wilson J. 1998. *Talk and Log: Wilderness Politics in British Columbia*. University of British Columbia Press. Available from <https://press.uchicago.edu/ucp/books/book/distributed/T/bo70069628.html> (accessed June 25, 2023).
- Wolfe P. 2006. Settler colonialism and the elimination of the native. *Journal of Genocide Research* 8:387–409. Routledge.
- Woodroffe R, Frank LG, Lindsey PA, ole Ranah SMK, Romañach S. 2007. Livestock husbandry as a tool for carnivore conservation in Africa’s community rangelands: a case–control study. *Biodiversity and Conservation* 16:1245–1260.
- Woodroffe R, Thirgood S, Rabinowitz A, editors. 2005. *People and Wildlife, Conflict or Co-existence?* Cambridge University Press, Cambridge. Available from <https://www.cambridge.org/core/books/people-and-wildlife-conflict-or-coexistence/43EC425AE7C4D530AE23DF75E3CF2639> (accessed June 1, 2023).
- Wynn-Grant R, Ginsberg J, Lackey C, Sterling E, Beckmann J. 2018. Risky business: Modeling mortality risk near the urban-wildland interface for a large carnivore. *Global Ecology and Conservation* 16:e00443.
- Young J, Marzano M, White RM, McCracken DI, Redpath SM, Carss DN, Quine CP, Watt AD. 2010. The emergence of biodiversity conflicts from biodiversity impacts: characteristics and management strategies. *Biodiversity and Conservation* 19:3973–3990.
- Zajac RM, Bruskotter JT, Wilson RS, Prange S. 2012a. Learning to live with black bears: A psychological model of acceptance. *The Journal of Wildlife Management* 76:1331–1340.
- Zajac RM, Bruskotter JT, Wilson RS, Prange S. 2012b. Learning to live with black bears: A psychological model of acceptance. *The Journal of Wildlife Management* 76:1331–1340.
- Zeitsoff T. 2017. *How Social Media Is Changing Conflict*. *Journal of Conflict Resolution* 61:1970–1991. SAGE Publications Inc.

Appendix A: Ch.2 Supplementary Material

A.1. Literature Review and Analysis Methods

The purpose of our analysis was to systematically investigate scholarly publications regarding the relationship between Indigenous knowledge and federal Environmental Assessment processes in Canada. To synthesize the peer-reviewed literature, we selected papers if they contained the keywords: “Indigenous knowledge” or “Traditional ecological knowledge” or “Aboriginal knowledge” or “Aboriginal wisdom” or “Indigenous wisdom” or “Indigenous Law”, and “Environmental Assessment” and “Canada” and were published in a peer-reviewed journal between 1973-2018.

We used qualitative content analysis (Krippendorff 2013, 2018). We considered each peer-reviewed paper a sampling unit. For each paper, we used an emergent coding process supported by constructivist grounded theory (Mills & Francis 2006) to identify categories and themes from our selected texts, rather than establishing them *a priori* (Charmaz 2006, 2012). Coding of emergent themes was conducted in NVivo QSR qualitative analysis software, and additional analytical details to describe the papers were recorded in Microsoft Excel. To support reproducibility, we produced a code book

Codebook

Annotation and Recording: Coders should highlight relevant paper content and record notes in the margins of each paper, as well as coding them in QSR NVivo software, so excerpts and examples that inform their coding decisions may later be identified and/or verified. Coders must also maintain careful notes about all papers in the relevant Microsoft Excel coding spreadsheet and should enter numerical results of coding there. After coding each manuscript, denote a subjective confidence level for regarding the accuracy of codes assigned for each paper (i.e. low, medium, or high confidence in to that paper).

Section A: The relationship between Indigenous knowledge and Environmental Assessment

This section seeks to analyze original authors' perspective on the relationship between Indigenous knowledge and Canadian Environmental Assessment processes. This section of coding aims to understand the implicit and explicit opinions that authors convey throughout their papers. Papers coded about the state of the relationship will clearly advance an argument and construct support for this argument and will likely (but not necessarily) articulate recommendations for improving this relationship. A paper may include both implicit and explicit commentary on the relationship between Indigenous knowledge and Canadian Environmental Assessment.

The following questions are asked of each manuscript to support coding in a systematic manner. Coders should answer each question in the relevant Excel Spreadsheet in binary terms (0 = no, 1 = yes), and code relevant sentences and paragraphs in NVivo with the appropriate label (e.g. "A1").

A1 Does the paper indicate that the author(s) find the relationship between Indigenous knowledge and Canadian Environmental Assessment adequate and positive, either implicitly or explicitly?

- 0 No
- 1 Yes
- 97 Can't tell

A1.1 Does the paper explicitly indicate that the relationship between Indigenous knowledge and Environmental Assessment in Canada is adequate and positive?

- 0 No
- 1 Yes
- 97 Can't tell

A1.2 Does the paper implicitly indicate that the relationship between Indigenous knowledge and Environmental Assessment in Canada is positive and adequate?

- 0 No
- 1 Yes
- 97 Can't tell

A1.3 Does the paper explicitly indicate that the relationship between Indigenous knowledge and Environmental Assessment in Canada is in some way flawed or inadequate?

- 0 No
- 1 Yes
- 97 Can't tell

A1.4 Does the paper implicitly indicate that the relationship between Indigenous knowledge and Environmental Assessment in Canada is in some way flawed or inadequate?

- 0 No
- 1 Yes
- 97 Can't tell

Section B: “Obstacles”

If the paper indicated explicitly or implicitly that the relationship between Indigenous knowledge and Environmental Assessment in Canada is inadequate or otherwise requires improvement, coders should answer the following questions. If the paper was coded “0” in both A1.3 and A1.4 the coder should skip section B.

B1 Does the author explicitly indicate obstacles that prevent a positive and effective relationship between Indigenous knowledge and Environmental Assessment in Canada? If so, what are these obstacles?

- 0 No
- 1 Yes
- 97 Can't tell

B1.1 Does the author explicitly indicate obstacles that prevent a positive and effective relationship between Indigenous knowledge and Environmental Assessment in Canada?

- 0 No
- 1 Yes
- 97 Can't tell

B1.2 What is/are the obstacle(s) that the author(s) identify?

Coders should annotate identified explicit obstacles appropriate, coding them in QSR NVivo.

Section C: Suggestions for Ways Forward

In this section, the coder asks if the author(s) explicitly or implicitly identifies ways forward in repairing or improving the relationship between Indigenous knowledge and Canadian Environmental Assessment. Coders should complete this section regardless of the results of Section A. Questions C1, C1.1, and C1.2 should be coded in a binary fashion, where 0=No and

1=Yes. Question C2.1 should be coded via annotation and QSR NVivo software in order to aid in generating overall themes and categories.

C1 Does the paper identify ways forward in repairing or improving the relationship between Indigenous knowledge and Canadian Environmental Assessment either explicitly or implicitly?

- 0 No
- 1 Yes
- 97 Can't tell

C1.1 Does the paper identify ways forward in repairing or improving the relationship between Indigenous knowledge and Canadian Environmental Assessment implicitly?

- 0 No
- 1 Yes
- 97 Can't tell

C1.2 Does the paper identify ways forward in repairing or improving the relationship between Indigenous knowledge and Canadian Environmental Assessment explicitly?

- 0 No
- 1 Yes
- 97 Can't tell

C2 If the coder responded with a "1" (Yes) to either question C1.1 or C1.2, what suggestions or ways forward towards improving the relationship between Indigenous knowledge and Canadian Environmental Assessment does the paper suggest?

Section D: Authors' Use of Supporting Evidence

This section indicates what details (e.g. specific logic, examples, etc.) the authors used, if any, to support their positions regarding the relationship between Indigenous knowledge and Environmental Assessment in Canada. The coder should skip this section if all codes for Section A were "0". D1.1 should be coded using in-paper annotations and QSR NVivo software.

D1 To support their explicit or implicit position on the relationship between Indigenous knowledge and Environmental Assessment in Canada, did the author provide supporting evidence?

- 0 No
- 1 Yes
- 97 Can't tell
- 98 Section A coded 0

D1.1 What form of support did the author(s) utilize to support their argument. (Do not code this question if the answer to D was 0, 97, or 98).

A.2. Code Book: *Review of the Impact Assessment Act (p.1-100 of Bill C-69)*

The purpose of our analysis of the *Impact Assessment Act* was to systematically investigate whether Canada's newly-approved legislation overcomes obstacles that emerged in our literature review in meaningful and actionable ways. To accomplish this goal, we qualitatively analyzed the legislation using key search terms (Section A) and information that emerged during our literature review. To support reproducibility, we created this code book to guide systematic reading and coding of the *Impact Assessment Act*.

Annotation and Recording: Coders should highlight relevant paper content and record notes in the margins of each paper (or via electronic annotations), as well as coding them in QSR NVivo software, so excerpts and examples that inform their coding decisions may later be identified and/or verified. Coders must also maintain detailed notes about coding and interpretation in a companion spreadsheet. Coders should use key search terms (Section A) to code subset of the *Act* that relate to Indigenous knowledge and peoples, and obstacles as defined in our literature review. These codes should not only be considered in the context of our literature review, but also in the context of the *Act* as a whole.

Section A: Search Terms

Indigenous knowledge

Traditional knowledge

Traditional ecological knowledge

Community knowledge

Aboriginal knowledge

Indigenous wisdom

Indigenous law

Indigenous

Aboriginal

First Nations

Culture

Cultural

Colonization

Historical

Section B: Interpreting Language

While our search terms were useful to identify relevant sections of the *Act* that consider Indigenous knowledge and peoples, it was also necessary to read the entire *Impact Assessment Act*. This allowed for a full consideration of legislative context, and to consider obstacles

addressed in the Act's language. While interpreting Act language and coded search terms, we identified obstacles according to these guidelines:

Obstacles were categorized as **addressed** if:

- Act language identified or directly alluded to the obstacle and provided an explicit solution or solution-oriented language (see Example 1)

Obstacles were categorized as **not addressed** if:

- Act language identified or directly alluded to the obstacle without providing explicit solution-oriented language (see Example 2)
- Act language sets forth policy that is at odds with overcoming identified obstacles (see Example 3)
- Act language did not identify or allude to the obstacle (e.g. language regarding the obstacle was absent)

Example 1: Obstacle is addressed

Obstacle: Historical extraction of Indigenous knowledge

Legislation Language:

“(1) Any Indigenous knowledge that is provided to the Minister, the Agency, a committee referred to in section 92, 93 or 95 or a review panel under this Act in confidence is confidential and must not knowingly be, or be permitted to be, disclosed without written consent.

Exception (2): Despite subsection (1), the Indigenous knowledge referred to in that subsection may be disclosed if:

- (a) it is publicly available;
- (b) the disclosure is necessary for the purposes of procedural fairness and natural justice or for use in legal proceedings; or
- (c) the disclosure is authorized in the prescribed circumstances.

Consultation (2.1) Before disclosing Indigenous knowledge under paragraph 2(b) for the purposes of procedural fairness and natural justice, the Minister, the Agency, the committee or the review panel, as the case may be, must consult the person or entity who provided the Indigenous knowledge and the person or entity to whom it is proposed to be disclosed about the scope of the proposed disclosure and potential conditions under subsection (3).”

(Impact Assessment Act, Part 1, S.119 (1-2))

Interpretation:

The Act recognizes that many Indigenous peoples of Canada are concerned that their knowledge, shared in the context of Impact Assessments, may be taken out of context, misused, or otherwise

extracted by colonial governments. Thus, the Act generates actionable solutions; Indigenous knowledge included in Impact Assessments will be confidential, unless certain explicitly-identified exceptions are deemed necessary. Where Indigenous knowledge is considered important to make public, consultation will occur with the relevant Nation prior to the dissemination of Indigenous knowledge.

Result: Obstacle is actionably addressed

Example 2: Obstacle is not addressed

Obstacle: Underlying political power structures

Legislation Language:

“Whereas the Government of Canada is committed, in the course of exercising its powers and performing its duties and functions in relation to impact, regional and strategic assessments, to ensuring respect for the rights of the Indigenous peoples of Canada recognized and affirmed by section 35 of the Constitution Act, 1982, and to fostering reconciliation and working in partnership with them;

Whereas the Government of Canada is committed to implementing the United Nations Declaration on the Rights of Indigenous Peoples;”

(Impact Assessment Act, Ch.28, Part 1, Preamble)

“Membership (3) The membership of the council must include at least
(a) one person recommended by an Indigenous governing body or other entity that represents the interests of First Nations;
(b) one person recommended by an Indigenous governing body or other entity that represents the interests of the Inuit; and
(c) one person recommended by an Indigenous governing body or other entity that represents the interests of the Métis.”

(Impact Assessment Act, Part 1, S.116(2))

“Substitution

Minister’s power 31 (1) Subject to sections 32 and 33, if the Minister is of the opinion that a process for assessing the effects of designated projects that is followed by a jurisdiction referred to in any of paragraphs (c) to (g) of the definition jurisdiction in section 2, that has powers, duties or functions in relation to an assessment of the effects of a designated project would be an appropriate substitute, the Minister may, on request of the jurisdiction and before the expiry of the time limit referred to in subsection 18(1), or any extension of that time limit, approve the substitution of that process for the impact assessment.”

(Impact Assessment Act, Part 1, S. 31 (1))

Interpretation:

The Act language addresses the existence of power imbalances implicitly and seeks to set its preamble intention as aligned with Section 35 and the obligations of Canada to UNDRIP. However, actionable legislation language that seems to overcome the power imbalance is sparse in the Act. While the Act does legislate representation on advisory councils of Indigenous peoples, and allows for the potential for substitution of Impact Assessment processes with those led by other governing jurisdictions (e.g. Indigenous Nations), these steps fall short of actionably addressing power imbalances due to the overriding context of the Act. In short, while the Minister still retains full decision-making authority in the context of Impact Assessment outcomes, and in deciding what governments may lead substitution processes, political power structures and assumed colonial authority remain an obstacle to meaningfully engaging IK in the Impact Assessment process

Result: Obstacle is not actionably addressed

Example 3: Legislation is at odds with overcoming obstacle

Obstacle: Limited and mandated timelines

Legislation Language:

“Final report submitted to Minister (2) After taking into account any comments received from the public, the Agency must, subject to subsection (5), finalize the report with respect to the impact assessment of the designated project and submit it to the Minister no later than 300 days after the day on which the notice referred to in subsection 19(4) is posted on the Internet site.”

(Impact Assessment Act, Part 1, S.28 (1))

Interpretation:

Throughout our literature review, mandated and limited timelines arose as a key obstacle in appropriately integrating IK in Impact Assessments, as it limits opportunity for full engagement and two-way dialogue, and creates logistical challenges for First Nations with geographical or temporal constraints.

Whereas the Act does afford opportunities for the Minister to suspend timelines, the legislation defining strict timelines for public and Indigenous participation in Impact Assessments fails to overcome the identified obstacles created in the past by mandated timelines.

Result: Obstacle is not actionably addressed

A.3. Obstacles identified by scholars

Obstacles Identified by Scholars			
Obstacle Type	Identified Component of Obstacle	References	Frequency
Historical	Historical Colonization	O'Faircheallaigh 2007; Baker and Westman 2018; Hoogeveen 2016; Udofia, Noble and Poelzer 2017; Ellis 2005; McCreary and Milligan 2014; Booth and Skelton 2011; Usher 2000; Paci, Tobin, and Robb 2002; Wiles, McEwen, and Sadar 1999; Tsuji et al. 2011	11
Historical	Historical Extraction of Knowledge	Sandlos and Keeling 2015; O'Faircheallaigh 2007; Baker and Westman 2018; Hoogeveen 2016; Stevenson 1996; Ellis 2005; Paci, Tobin, Robb 2002; Usher 2000	8
Historical	Histories of Failed E.A.s	Sandlos and Keeling 2015; O'Faircheallaigh 2007; Tsuji et al. 2011; Baker and Westman 2018; Stevenson 1996; Udofia, Noble and Poelzer 2017; Booth and Skelton 2011; Whitelaw, McCarthy, and Tsuji 2009	8
Epistemological	Inability of Canadian Policy to incorporate IK (i.e. framework deficiency)	Sandlos and Keeling 2015; Baker and Westman 2018; Roue and Nakashima 2002; Hoogeveen 2016; Stevenson 1996; McCreary and Milligan 2014; Booth and Skelton 2011; Paci, Tobin, Robb 2002; O'Faircheallaigh 2007; Tsuji et al. 2011; Ellis 2005; Paci, Tobin, and Robb 2002; Sallenave 1994; Usher 2000; Wiles, McEwan, and Sader 1999; Whitelaw, McCarthy, and Tsuji 2009	16
Epistemological	Perceived Hierarchies of Knowledge	Sandlos and Keeling 2015; Baker and Westman 2018; Roue and Nakashima 2002; Vanclief 2014; Sallenave 1994; Hoogeveen	13

		2016; Stevenson 1996; Ellis 2005; McCreary and Milligan 2014; Paci, Tobin, Robb 2002; O'Faircheallaigh 2007; Booth and Skelton 2011; Usher 2000	
Epistemological	Knowledge Incompatibility	Baker and Westman 2018; Sandlos and Keeling 2015; Vanclief 2014; Tsuji et al. 2011; Hoogeveen 2016; Stevenson 1996; Sallenave 1994; McCreary and Milligan 2014; Ellis 2005; Usher 2000; Paci, Tobin, Robb 2002; O'Faircheallaigh 2007; Booth and Skelton 2011; Roue and Nakashima 2002, Wiles, McEwan, and Sader 1999	15
Political	Imbalance of Decision-Making Power	Baker and Westman 2018; Sandlos and Keeling 2015; Vanclief 2014; Tsuji et al. 2011; Hoogeveen 2016; Stevenson 1996; Sallenave 1994; McCreary and Milligan 2014; Ellis 2005; Usher 2000; Paci, Tobin, Robb 2002; O'Faircheallaigh 2007; Booth and Skelton 2011; Roue and Nakashima 2002, Wiles, McEwan, and Sader 1999	8
Political	Externally-Driven Nature of EA Process and Focus on Approval	Sandlos and Keeling 2015; Vanclief 2014; Udofia et al. 2015; O'Faircheallaigh 2007; Baker and Westman 2018; Udofia, Noble, and Poelzer 2017; Hoogeveen 2016; Stevenson 1996; Paci, Tobin, and Robb 2002	9
Political	Underlying Political Power Structures	Vanclief 2014; O'Faircheallaigh 2007; Baker and Westman 2018; Stevenson 1996; Sallenave 1994; Ellis 2005; McCreary and Milligan 2014; Wiles, McEwan, and Sader 1999; Paci, Tobin, Robb 2002; Udofia et al. 2017	10
Legal	EA Assumptions that are not Responsive to Canadian Case Law	O'Faircheallaigh 2007; Booth and Skelton 2011; Baker and Westman 2018; Paci, Tobin, Robb 2002; Udofia, Noble, and Poelzer 2017	5

Legal	Inconsistencies between Canadian and Indigenous Law	O'Faircheallaigh 2007; Booth and Skelton 2011; McCreary and Milligan 2014	3
Legal	Unresolved Treaty and Title Rights	O'Faircheallaigh 2007; Booth and Skelton 2011; McCreary and Milligan 2014; Paci, Tobin, Robb 2002; Wiles, McEwan, and Sader 1999	5
Procedural	Colonial and Capitalistic Design of EA Process	Ellis 2005; Sandlos and Keeling 2015; Vanclief 2014; O'Faircheallaigh 2007; Baker and Westman 2018; Tsuji et al. 2012; Booth and Skelton 2011; Udofia, Noble, and Poelzer 2015; Udofia, Noble, and Poelzer 2017; Usher 2000; Wiles, McEwan, and Sader 1999; Paci, Tobin, and Robb 2002	12
Procedural	Failures to Define or Engage in Best Practices	Sandlos and Keeling 2015; O'Faircheallaigh 2007; Baker and Westman 2018; Tsuji et al. 2012; Sallenave 1994; Booth and Skelton 2011; Gardner, Kirchoff, Tsuji 2015; Udofia, Noble, and Poelzer 2015; Udofia, Noble, and Poelzer 2017; Usher 2000; Whitelaw, McCarthy, and Tsuji 2012; Wiles, McEwan, and Sader 1999	12
Procedural	Mandated and Limited Timelines	Baker and Westman 2018; O'Faircheallaigh 2007; Sallenave 1994; Gardner, Kirchoff, Tsuji 2015; Vanclief 2014; Udofia, Noble, and Poelzer 2015; Udofia, Noble, and Poelzer 2017	7
Resource Limitation	Training Limitations	Booth and Skelton 2011; Vanclief 2014; Gardner, Kirchoff, Tsuji 2015; Udofia, Noble, and Poelzer 2015; Stevenson 1996	5
Resource Limitation	Financial Limitations	O'Faircheallaigh 2007; Udofia, Noble, and Poelzer 2015; Sallenave 1994; Booth and Skelton 2011; Gardner, Kirchoff, Tsuji 2015;	11

		Udofia, Noble, and Poelzer 2017; Vanclief 2014; Usher 2000; McCreary and Milligan 2014; Whitelaw, McCarthy, and Tsuji 2012; Ellis 2005	
Resource Limitation	General Capacity Limitations	O'Faircheallaigh 2007; Booth and Skelton 2011; Gardner, Kirchhoff, Tsuji 2015; Udofia, Noble, and Poelzer 2017; Udofia, Noble, and Poelzer 2015; Vanclief 2014	6

For examples of obstacle details and example quotations, see :

<https://www.facetsjournal.com/doi/full/10.1139/facets-2019-0039#supplementary-materials>

Appendix A.4. Suggestions forward identified by scholars

Suggestion Category	References	Frequency
Best Practices Defined	Sandlos and Keeling 2016; Udofia, Noble and Poelzer 2015; O'Faircheallaigh 2007; Baker and Westman 2018; Tsuji et al. 2011; Sallenave 1994; Stevenson 1996; Booth and Skelton 2011; Gardner, Kirchhoff, Tsuji 2015; Ellis 2005; Usher 2000; Whitelaw, McCarthy, and Tsuji 2012; Wiles, McEwan, and Sader 1999; Udofia, Noble and Poelzer 2016	14
Epistemological Suggestions	Sandlos and Keeling 2016; O'Faircheallaigh 2007; Baker and Westman 2018; Sallenave 1994; Stevenson 1996; Booth and Skelton 2011; Paci, Tobin, Robb 2002; Usher 2000; Wiles, McEwan, and Sader 1999	9
Procedural Changes	O'Faircheallaigh 2007; Baker and Westman 2018; Tsuji et al. 2011; Stevenson 1996; Booth and Skelton 2011; Gardner, Kirchhoff, Tsuji 2015; Udofia, Noble and Poelzer 2016; Paci, Tobin, Robb 2002; Usher 2000; Whitelaw, McCarthy, and Tsuji 2012; Wiles, McEwan, and Sader 1999, Vanclieaf 2014	12
Power Shifts	O'Faircheallaigh 2007; Baker and Westman 2018; Sallenave 1994; Booth and Skelton 2011; Ellis 2005; Paci, Tobin, Robb 2002; Wiles, McEwan, and Sader 1999; Stevenson 1996	8

For examples of obstacle details and example quotations, see

<https://www.facetsjournal.com/doi/full/10.1139/facets-2019-0039#supplementary-materials>

Appendix B: Ch.3 Supplementary Material

B.1. Supplementary Material 1: List of Coast Salish-speaking Tribes and Nations

Here, we include a list of many (but not all) Coast Salish-speaking Tribes and Nations.

Chehalis
Chimakum
Cowichan
 Skwxwu7mesh
 Semiahmoo
 Penelakut
 Lyackson
 Lamalcha
Cowlitz Tribe
Duwamish
Esquimalt
Halalt
Homalco
Klallam
K'omoks (Comox)
Klahoose
Lamalcha (Hwlitsum)
Lummi (Lhaq'temish)
Lyackson
Muckleshoot
Musqueam (xwməθkwəyəm)
Nisqually
Nooksack (Noxws'áʔaq)
Penelakut
Pentlatch
Puyallup
New Westminster Indian Band
Qualicum
Quileute
Saanich (WSÁNEĆ)
MÁLEXEŁ - Malahat First Nation
BOKÉCEN – Pauquachin
SṪÁ,UTW – Tsawout
WJOŁEŁP – Tsartlip
WŚÍKEM – Tseycum First Nation
Samish
Sawhewamish (S'əhiw'abš)
Scia'new First Nation (Beecher Bay)
Semiahmoo (SEMYOME)
Shishalh (Sechelt)
Shoalwater Bay Tribe
Siletz
Skagits
Lower Skagit (Whidbey Island Skagits)

Upper Skagit
Skokomish (Twana)
Sliammon (Tla'amin)
Snaw-naw-as
Snohomish (Sduhubš)
Snokomish
Snoqualmie (Sduqwalbixw)
Snuneymuxw (Nanaimo)
Songhees (Lekwungen)
Squamish (Sk̓wx̓wú7mesh Úxwumixw)
Squaxin
Stillaguamish
Stó:lō
Aitchelitz
Chawathil
Cheam
Kwantlen
Kwikwetlem
Katzie
Leq' a: mel
Matsqui
Popkum
Salish
Seabird Island
Skawahlook (Tait)
Shxw'ow'hamel
Skway (Shxwhá:y)
Skowkale
Skwah
Soowahlie
Sts'Ailes
Sumas
Tzeachten
Yakwekwioose
Stz'uminus First Nation
Sui'a̓xbixw
Suquamish (Suqwabš)
Swinomish
Tsawwassen
Tseil-Waututh
T'Sou-ke Nation
Tulalip (dxwlilap)
Twana
Xacuabš

Resources

University of British Columbia. 2018. Research Guides: First Nations Languages of British Columbia: Getting Started. Available from <https://guides.library.ubc.ca/c.php?g=307246&p=2049664> (accessed March 5, 2023).

Kennedy, D. and Bouchard, R. 2019. Coast Salish. In *The Canadian Encyclopedia*. Available from <https://www.thecanadianencyclopedia.ca/en/article/coastal-salish> (accessed March 5, 2023).

First Nations - Land Rights and Environmentalism in British Columbia. Available from http://www.firstnations.de/development/coast_salish.htm (accessed March 5, 2023).

Native-Land.ca. 2023. Available from <https://native-land.ca/#> (accessed March 5, 2023).

Province of British Columbia. Indigenous Language & Culture. Available from <https://www2.gov.bc.ca/gov/content/governments/indigenous-people/supporting-communities/culture-language> (accessed March 5, 2023).

B.2. SRKW-Salmon Survey

Lauren Eckert, PhD Candidate, The University of Victoria
Phone: 360-809-0842
Email: laureneckertresearch@gmail.com

Supervised by Dr. Chris Darimont, University of Victoria

The purpose of this study is to better understand how British Columbians value, use, and wish to manage wildlife - with questions focusing on Southern Resident Killer Whales and Chinook Salmon. The questions included in this survey will allow researchers to draw broad-scale conclusions about beliefs towards wildlife in the province and better understand BC residents' priorities in this context, which can be used to inform future studies and provincial wildlife and fisheries management decisions. This survey is not being conducted by any of the existing provincial or federal government institutions. This survey should take approximately 15 minutes to complete.

PLEASE READ BEFORE COMPLETING THIS SURVEY:

The information you provide in this survey will be kept strictly confidential. By completing this survey, the participant acknowledges that their anonymous data may be used in future academic publications. Any published materials will not refer to the individual nor individual data, but rather consider broad-scale themes.

Your data will be stored anonymously with, and analyzed by, the principal researcher (Lauren Eckert). By completing this survey, you acknowledge and consent to your data being stored and used in this manner and in the manner thoroughly explained in the [Implied Consent Form](#). Participants may withdraw their data / involvement in this research project at any time by contacting Lauren Eckert at laureneckertresearch@gmail.com and stating their desire to withdraw. In the case participants withdraw consent, their fully-anonymous data will not be able to be withdrawn because it has no personal identifiers (excluding paper-based survey submissions, which may be excluded).

Please see the "[Full Implied Consent Information Document](#)" for more information before completing this survey. By completing this survey, you acknowledge that you have fully read this document (see hyperlink) and consent to the research as explained within.

1. I have read the "[Full Implied Consent Information Document](#)" and am 18 years of age or over. My free and informed consent is implied in my completion of this survey.

Yes

Part I. Social Identity.

Below are statements that represent a variety of ways people identify themselves in relation to stakeholder groups.

1. Do you identify with any of the following stakeholder groups? If so, select those groups (you may select multiple groups). If not, select "other".

- Recreational fisher / Angler
- Conservationist / Conservation-supporter
- Commercial fisher
- Ecotourism operators
- Recreational fishing guide
- Other (please specify)

2. If you identified with more than one of the preceding stakeholder groups, is identifying with these multiple groups ever challenging (i.e. because there is tension between stakeholder groups)?

- Yes
- No
- I only identify with one stakeholder group in this context

3. If you identified with more than one of the stakeholder groups listed, which group do you feel you identify with most? Write your answer in the space provided.

4. Rate the intensity of your identification with the social group you selected in the preceding question (i.e. the identity group you associate with the most). Select one. I identify with this group...

- A great deal
- A lot
- A moderate amount
- A little
- Not at all

Please respond to the following questions, indicating how much you agree or disagree with each statement. Select one answer for each statement. Each statement corresponds to your feelings regarding the stakeholder group you identified yourself as being part of (i.e. the stakeholder group you identify with the most).

5. I identify with this stakeholder group.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

6. I feel committed to this stakeholder group.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

7. I am glad to be a member of this stakeholder group.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

8. Being a member of this stakeholder group is an important part of how I see myself.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

9. Have you ever criticized, been embarrassed by, or felt distant from your identified stakeholder group?

- Yes
- No

10. If you answered "yes" to the preceding question, please expand on why you have felt that way or criticized your group below:

Part 2. Environmental Identity

Below are statements that represent a variety of ways people feel about fish and wildlife and the natural environment. Please indicate the extent to which you disagree or agree with each statement. Select one answer for each statement.

1. I spend a lot of time in natural settings (woods, mountains, desert, lakes, ocean, plains, etc.).

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

2. Engaging in environmental behaviours is important to me (e.g. recycling, gardening, buying sustainable products, etc.).

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

3. I think of myself as a part of nature, not separate from it

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

4. If I had enough time or money, I would certainly devote some of it to working for environmental causes.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

5. When I am upset or stressed, I can feel better by spending some time outdoors "communing/connecting with nature".

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

6. Living near wildlife is important to me; I would not want to live in a city all the time.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

7. I have a lot in common with environmentalists as a group.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

8. I believe that some of today's social problems could be cured by returning to a more rural lifestyle in which people live in harmony with the land.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

9. I feel that I have a lot in common with other species.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

10. I like to garden.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

11. Being a part of the ecosystem is an important part of who I am.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

12. I feel that I have roots to a particular geographical location that had a significant impact on my development.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

13. Behaving responsibly toward the earth -- living a sustainable lifestyle -- is part of my moral code.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

14. Learning about the natural world should be an important part of every child's upbringing.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

15. In general, being part of the natural world is an important part of my self image.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

16. I would rather live in a small room or house with a nice view than a bigger room or house with a view of other buildings.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

17. I really enjoy camping and hiking outdoors.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

18. Sometimes I feel like parts of nature -- certain trees, or storms, or mountains -- have a personality of their own.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

19. I would feel that an important part of my life was missing if I was not able to get out and enjoy nature from time to time.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

20. I take pride in the fact that I could survive outdoors on my own for a few days.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

21. I have never seen a work of art that is as beautiful as a work of nature, like a sunset or a mountain range.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

22. My own interests usually seem to coincide with the position advocated by environmentalists.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

23. I feel that I receive spiritual sustenance from experiences with nature.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

24. I keep mementos from the outdoors in my room, like shells or rocks or feathers.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

Part III. Demographic and Recreational Activity Information

We are also interested in learning about your recreation opportunities related to fish and wildlife in BC, and about information related to you, your work, and the communities in which you live. This information is collected to better understand large scale trends in the province, and will be kept completely confidential.

1. Have you ever participated in / do you participate in recreational (non-commercial) fishing?

- Yes
- No

2. If your answer to Question 1 was yes, what is the nature of recreational fishing you engage/d in? (Select as many responses as are appropriate)

- I am an operator of a recreational fishing company
- I am employed by a recreational fishing company
- I engage/d in fishing through a recreational fishing company
- I fish/ed recreationally alone or with a few other people
- Other (please specify)

3. Did you participate in recreational (non-commercial) fishing during the past 12 months (1 year)?

- Yes
- No

4. Have you ever taken any recreational trips for which fish or wildlife viewing was the primary purpose of the trip?

- Yes
- No

5. Did you take any recreational trips in the past 12 months (1 year) for which fish or wildlife viewing was the primary purpose of the trip?

- Yes
- No

The following demographic information will be used to help make general conclusions about those who participate in this interview. Your responses will remain completely anonymous and confidential.

6. Are you a...? (please select one).

- Woman
- Man
- Gender non binary
- I prefer not to say

7. What is your age?

8. How many people under 18 years of age are currently living in your household?

9. What is the highest education level you have completed:

- Less than high school diploma
- High school diploma or equivalent (for example, GED)
- 2-year associates degree or trade school
- 4-year college degree
- Advanced degree beyond 4-year college degree

10. What is your approximate annual household income before taxes?

- Less than \$10,000
- \$10,000 - \$29,999
- \$30,000 - \$49,999
- \$50,000 - \$69,999
- \$70,000 - \$89,999
- \$90,000 - \$109,999
- \$110,000 - \$129,999
- \$130,000 - \$149,999
- \$150,000 or more

11. Are you currently a resident of British Columbia?

- Yes
- No

12. About how long have you lived in BC? (Select one answer).

- Less than 1 year
- I am not a resident of BC currently
- Longer than one year (write in how long)

13. How would you describe the community in which you were raised? (Select one). If more than one area, check the place where you lived the longest.

- A farm or rural area
- Small town / village with less than 5,000 people
- Town with 5,000 to 9,999 people
- Town with 10,000 to 24,999
- Small city with 25,000 to 49,999 people
- City with 50,000 to 99,999 people
- City with 100,000 to 249,999 people
- Large city with 250,000 or more people

14. Would you consider the community in which you were raised a suburb of a larger city or metropolitan area? (Select one)

- Yes
- No

15. Are you...? (Check one or more categories to indicate what you consider yourself to be - responses are optional.)

- White
- Asian
- Black or African American
- Indigenous
- Spanish, Hispanic, or Latino
- Pacific Islander
- Other
- Would rather not say

16. What is your current postal code? (Postal code will not be made public in any way)

Part IV. Questions related to Southern Resident Killer Whales and Salmon in BC

Below are statements that represent a variety of ways people feel about Southern Resident Killer Whales, Chinook salmon, and management of both in British Columbia. Please indicate the extent to which you disagree or agree with each statement. Circle one number for each statement.

1. I believe Southern Resident Killer Whales are part of British Columbia's identity.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

2. I believe that Chinook salmon are part of British Columbia's identity.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

3. I feel that Southern Resident Killer Whales deserve to exist regardless of their benefit to humans.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

4. I believe Chinook salmon deserve to exist regardless of their benefit to humans.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

5. Chinook salmon are abundant in British Columbia and minimally impacted by human behaviour.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

6. Southern Resident Killer whales experience cyclical population changes and are not threatened due to human behaviour.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

7. I believe Southern Resident Killer Whales play a critical role in local ecosystems.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

8. The loss of Southern Resident killer whales from BC's waters would have a negative impact on me personally.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

9. The loss of Chinook salmon from BC's waters would have a negative impact on me personally.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

10. I believe that Southern Resident killer whales threaten the health and abundance of Chinook salmon.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

11. I would be strongly opposed to legislation that sought to protect Southern Resident Killer Whales if it reduced humans' ability to fish salmon.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

12. I would vote for, or otherwise support, legislation that sought to protect Southern Resident killer whales - even if it reduced humans' ability to harvest salmon.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

13. I believe the federal government (Department of Fisheries and Oceans Canada) is doing a good job managing Chinook salmon.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

14. I believe the core priority when managing Chinook salmon should be human harvesting / use of Chinook.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

15. I believe that Southern Resident Killer Whales, Chinook salmon, and other marine species are threatened by human behaviour.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

16. I believe the federal government (Department of Fisheries and Oceans Canada) is doing a good job managing Southern Resident Killer whales.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly Disagree

17. In which ways have you participated in public discussion regarding Southern Resident Killer Whale protection measures? Please select all that apply.

- Through social media (e.g. Twitter, Facebook, etc.)
- Through government feedback sessions or public consultations (e.g. those hosted by DFO)
- By attending local discussion forums not hosted by the province or federal government
- By engaging in public demonstrations (e.g. demonstrations, protests, etc.)
- By writing for local publications (e.g. opinion pieces, etc.)
- By supporting an organization that represents my positions (e.g. Conservation or Angler foundation or club)
- I have not publicly participated in the discussion
- Other (please specify)

18. Considering all of the ways you have participated in public conversations regarding Southern Resident Killer Whale protection measures (as answered in the previous question) how many times (approximately) have you engaged in this conversation?

- 0-3 times
- 4-6 times
- 6-10 times
- More than 10 times

19. **Please answer this final question regarding how you think Canada and BC should prioritize wildlife, fisheries, and marine management in BC.** From the following, select one answer that best matches your personal priorities.

- Sustaining the ability of humans to use natural resources should be the core priority of wildlife and marine management in BC (e.g. managing to conserve species most used by humans, such as salmon, deer, elk, etc.).
- Conservation of species should be the core priority of wildlife and marine management in BC, regardless of the species' benefits to humans (e.g. managing to conserve species should focus on species at risk even if those species aren't directly used by humans).
- Wildlife, fisheries, and marine management in BC should balance the needs of humans with conservation of species not directly useful to humans.
- Wildlife, fisheries, and marine management in BC should prioritize conserving species that provide direct economic opportunity in the province.

This final (optional) question is an opportunity to provide us with additional information or share information regarding anything we missed.

1. Do you have anything else you would like to share with researchers? If yes, please do so in the blank space provided:

B.3. Group Invite Email

Hello,

Are you someone who is interested in participating in research to better understand conflict regarding newly-established Southern Resident Killer Whale Protection measures? Do you consider yourself a stakeholder in on-going decisions regarding Chinook Salmon and Orca whales in British Columbia?

If yes, please consider participating in our research study seeking to understand current conflict surrounding Southern Resident Killer Whale and Chinook Salmon management measures enacted by the Department of Fisheries and Oceans Canada (DFO) in 2018 and 2019. This project is led by scientists at the University of Victoria, alongside partners at the University of British Columbia and collaborators at Raincoast Conservation Foundation and its goals are to understand the values, beliefs, and opinions of stakeholders involved in public conversations and conflict regarding salmon and killer whales in BC. Ultimately, our research seeks to better understand conflict surrounding Southern Resident Killer Whale protection measures so as to accurately represent on-going narratives surrounding these measures, engage a diverse array of stakeholders in an anonymous feedback opportunity, and suggest potential solutions to on-going conflict between stakeholders who care about the Salish sea and its inhabitants who support local biodiversity, culture, and economies. The survey will also include basic questions about sociodemographics (e.g., questions about your age, gender, number of people in household, etc.). All survey responses submitted through our online survey will be completely anonymous.

The survey ([hyperlink here](#)) will take approximately 8-15 minutes to complete, and participants will be entered into a drawing to receive one of three \$150 Amazon Gift Cards.

Thank you,



Lauren Eckert, Ph.D. Candidate
Supervised by: Chris Darimont
University of Victoria



B.4. Supplementary Methods

Survey Instrument

We developed a survey with 72 response items designed to assess self-concepts of social identity and environmental identity, as well as their sociodemographic information, engagement in public discourse, opinions, and beliefs (further details in Appendix B). We pre-tested and refined the survey for clarity with several individuals familiar with the study objectives. We instructed participants to self-select their *social identity* from a group of relevant identity options (i.e., angler, conservation-supporter, commercial fisher, ecotourism operator, fishing guide, or other), and participants could select all relevant identities and/or declare their own. If participants selected more than one identity, they were asked to select which identity is most important to them (i.e. their ‘salient identity’, Hogg & Turner, 1987; Tajfel & Turner, 1986) in this context. We then measured the intensity or importance of participants’ salient identity using a three-item Social Identity Affiliation measure (hereafter “Social Identity Affiliation” or **SIA**) (Postmes et al. 2013). Environmental identity was measured using the 24-item measure Environmental Identity Scale (**EID**; Clayton 2003); this scale assesses self-identification as it relates to the natural world. Across our sample, Cronbach’s alpha coefficients suggested good internal reliability for both our EID ($\alpha = 0.885$) and SIA ($\alpha = 0.903$) scales. Participants were also asked to provide sociodemographic (e.g., age, gender, income, etc.), information regarding their participation in public management discussions, and recreational information (e.g., fishing activity) through multiple choice and free-response questions. Participant beliefs and opinions were assessed by presenting participants with a list of statements regarding SRKW protection measures, DFO management strategies, and the value of salmon and SRKWs. Participants were asked to respond by selecting the best option from a seven-point Likert-style scale (i.e., ‘Strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree’). Finally, we provided participants an opportunity to respond to an optional open-ended question to provide additional details, and/or to self-identity interest in additional topics.

Data Collection

We targeted individuals who were 18 years or older, residents of British Columbia, and self-identified as a stakeholder in ongoing decisions regarding chinook salmon and SRKWs via non-random recruitment methods. We focused our survey distribution efforts on individuals associated with the angler and conservation communities. Survey data were collected between April 2020 and August 2021 via SurveyMonkey (an online, cloud-based survey software) hosted by the University of Victoria. We used

two methods to recruit survey participants, which varied in their approach and responses. We began by contacting public-facing organizations via email or phone call that represent participant populations of conservation-supporters (including *redacted for review process*, The David Suzuki Foundation, and others) and anglers in the region. In our introductory emails (or calls), we introduced our research and asked organizations to distribute our survey invitation electronically to their confidential mailing lists. While some organizations (especially those that represented conservation-supporters, including *redacted for review process*, an affiliate of several authors on this paper shared our survey invitations with their supporters via bulk email, others did not. Specifically, organizations representing anglers were hesitant. Given the apparent depth of conflict and mistrust surrounding management of SRKW and salmon in the region, and that we identified our *redacted for review process* affiliations in communications, the ultimate refusal to distribute our survey invite was perhaps unsurprising. Despite otherwise agreeable and productive follow-up discussions with organization representatives regarding this research and its utility, we realized the need to develop additional recruitment methods to collect data from more anglers.

Owing to the unbalanced response in our primary collection phase (Appendix B), we developed a second data collection phase. Our first phase of data collection, during which we solicited participation through email communication, occurred between April 16, 2020, and May 25, 2020 and resulted in 306 responses, 241 of which identified as conservation-supporters and 33 as anglers. Our second phase of data collection occurred between May 26, 2021, and June 11, 2021. We used Facebook advertising campaigns to distribute the same survey to our targeted respondents (anglers and conservation-supporters) via direct and purposive snowball-style sampling (Howarth et al. 2021; Schneider & Harknett 2022). Using the first author's (LEE's) public Facebook platform, we created and shared two paid advertisements tailored to our two target groups (Appendix 4). Our online survey remained open between these two concentrated data collection phases, and the final survey collector closed in September of 2021.

While approximately one year elapsed between these two data collection pulses, the sociopolitical environment and policies relevant to our survey questions and data collection experienced little change (see Introduction). Furthermore, because our research sought to identify stable and relatively unchanging (Homer & Kahle 1988; Fulton et al. 1996; Clayton 2003; Clayton & Opotow 2003; Manfredo et al. 2016) cognitive aspects of participants (such as self-identity), we did not expect the time that elapsed between survey responses to substantively alter participant responses.

We conducted checks on data completeness and quality to refine our data set. We excluded data from surveys that were not completed (i.e., surveys where not all required questions were answered; n =373)

and surveys in which participants responded “no” to our consent affirmation question (n = 1). We analyzed 727 complete surveys (Appendix B).

This research was conducted with approval from the Human Research Ethics Board of The University of British Columbia (H20-00359-A004). All participants were also offered an opportunity to enter to win one of three Amazon gift-cards (\$150 in value) in a raffle upon anonymous survey completion.

Survey Analysis

We analyzed 727 complete surveys when assessing responses of all participants, and 638 complete surveys when assessing differences between anglers (n = 255) and conservation-supporters (n = 383). When comparing anglers and conservation-supporters, we excluded those individuals who identified as both identities but did not provide a salient identity. We used several data analysis approaches, depending on data types. We compared responses to identity, environmental identity, sociodemographics and activities, beliefs, and opinions between anglers and conservation-supporters using Pearson’s Chi-squared, Wilcoxon Rank Sum, and student’s t-tests and permutational multivariate analysis of variance (PERMANOVA in R, Anderson 2017). We used the Kruskal-Wallis H test to determine the relationship between participant frequency of participation in public engagement and EID/SIA scores within each identity group. The PERMANOVA analyses were based on Gower distance resemblance matrices with 999 permutations and Type III sum of squares (Anderson 2001, 2008) using the *vegan* package (Oksanen J. et al. 2020) in R (R Core Team 2020, version 3.4.2) (Appendix B).

We were also interested in understanding consensus (or lack thereof) regarding management of SRKW and Chinook salmon within groups. We assessed intra- and inter-group variation in responses to SRKW and salmon management opinion and belief items using the Potential for Conflict Index (PCI₂, Manfredro et al. 2003, Vaske et al. 2010) via Microsoft Excel (D₁; Power=1; Vaske 2018; available <https://sites.warnercnr.colostate.edu/jerryv/calculating-pci2-excel/>). The PCI₂ assesses the consensus regarding a given management option within groups and across survey participants (Vaske, 2008). PCI₂ values can range from 0 (greatest consensus, least potential for conflict) to 1 (least consensus, greatest potential conflict).

Content analysis

We also analyzed participant responses to open-ended survey questions and respondents' comments on advertised Facebook posts using a qualitative, constructivist approach (Olsen 1999). Specifically, we identified themes that arose, including those that we otherwise might have missed in our survey questions. Open-ended responses were coded into coarse categories (e.g., management concerns, support of management plans, expressed distrust, etc.) and then into finer subcategories (e.g., concerns regarding pinniped populations, support for blanket ecosystem protections, distrust in the government or DFO, etc.). We then analyzed data using NVivo software (NVivo qualitative data analysis software; QSR International Pty Ltd. Version 14).

We were also interested in examining tonal differences between survey respondents and social media commenters. Accordingly, we coded the nature of the sentiment of comments derived from Facebook and our survey in NVivo. The sentiment of each comment or response was identified by coding the apparent tonality of each comment as a whole. Supported by previous research (Oz et al. 2018; Humprecht et al. 2020), we defined a 'hostile' sentiment as one that included an expression of anger or frustration (e.g., "Are people that stupid or are they smart people pulling a huge scam? Either way, they can take a hike."), offensive contempt (e.g., "how far is your head up your [expletive]?"), violence (e.g., "get your harpoon it's time to get stabby"), victimization ("We are now portrayed as evil harvesters, demonized and depicted as blood sport enthusiasts with no regard for Orca..."), distrust (e.g., "If Raincoast is in, I'm out. I will not participate in their propaganda"), or hate (e.g., "Send DFO management to prison."). We counted total occurrence of hostile sentiment (each comment or response was identified as "not hostile" or "hostile") across sources, and considered each commenter/participant one unit (i.e., if a Facebook commenter posted multiple hostile sentiments, we only counted this as a single hostile sentiment occurrence).

Citations

Anderson MJ. 2017. Permutational Multivariate Analysis of Variance (PERMANOVA). Pages 1–15 Wiley StatsRef: Statistics Reference Online. John Wiley & Sons, Ltd. Available from <https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118445112.stat07841> (accessed March 5, 2023).

Clayton S. 2003. Environmental Identity: A Conceptual and an Operational Definition. Pages 45–65 Identity and the natural environment: The psychological significance of nature. MIT Press, Cambridge, MA, US.

Clayton S, Opatow S, editors. 2003. Identity and the Natural Environment: The Psychological Significance of Nature. MIT Press, Cambridge, MA, USA.

Fulton DC, Manfredo MJ, Lipscomb J. 1996. Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife* 1:24–47. Routledge.

- Hogg MA, Turner JC. 1987. Intergroup behaviour, self-stereotyping and the salience of social categories. *British Journal of Social Psychology* 26:325–340.
- Homer PM, Kahle LR. 1988. A structural equation test of the value-attitude-behavior hierarchy. *Journal of Personality and Social Psychology* 54:638–646. American Psychological Association, US.
- Howarth A et al. 2021. COVID-19 restrictions and recreational fisheries in Ontario, Canada: Preliminary insights from an online angler survey. *Fisheries Research* 240:105961.
- Humprecht E, Hellmueller L, Lischka J. 2020. Hostile Emotions in News Comments: A Cross-National Analysis of Facebook Discussions. *Social Media + Society* 6. Available from <https://journals-sagepub-com.ezproxy.library.uvic.ca/doi/full/10.1177/2056305120912481> (accessed July 18, 2022).
- Likert R. 1932. A technique for the measurement of attitudes. *Journal of Applied Psychology* 39. Available from <http://psycnet.apa.org/psycinfo/1933-01885-001>.
- Manfredo MJ, Teel TL, Dietsch AM. 2016. Implications of human value shift and persistence for biodiversity conservation: Value Shift and Conservation. *Conservation Biology* 30:287–296.
- Olsen DG. 1999. *Constructivist Principles of Learning and Teaching Methods*. Education 120:347–347. Project Innovation Austin LLC.
- Oz M, Zheng P, Chen GM. 2018. Twitter versus Facebook: Comparing incivility, impoliteness, and deliberative attributes. *New Media & Society* 20:3400–3419.
- Postmes T, Haslam SA, Jans L. 2013. A single-item measure of social identification: reliability, validity, and utility. *The British Journal of Social Psychology* 52:597–617.
- Schneider D, Harknett K. 2022. What’s to Like? Facebook as a Tool for Survey Data Collection. *Sociological Methods & Research* 51:108–140. SAGE Publications Inc.
- Tajfel H, Turner JC. 1986. The social identity theory of intergroup behavior. Pages 7–24 *Psychology of intergroup relationships*, 2nd edition. Nelson-Hall.

B.5. Supplementary Figures and Tables

Term	Definition	Citations
<i>Values*</i>	<p>Abstract, enduring concepts of the desirable; developed early in life</p> <p>Single, stable concepts used to evaluate attitudes and behaviors</p> <p>Influence behaviors directly and indirectly through the construction of attitudes</p>	Rokeach 1973, Kahle 1983, Homer and Kahle 1988, Vaske and Donnelly 1999
<i>Value Orientations / Beliefs</i>	<p>Basic beliefs that flow from values and serve to strengthen and give meaning to fundamental values</p> <p>Often understood and measured on one or several conceptual continuums (e.g., wildlife value orientations)</p>	Fulton et al. 1996, Manfredro and Fulton 1997, Steel et al. 1994, Vaske and Donnelly 1999
<i>Attitudes and Norms</i>	<p>Mental states referring to some object</p> <p>Represent an individual's consistent tendency to respond favorably or unfavorably toward the object in question</p>	Eagly and Chaiken 1993, Vaske and Donnelly 1999
<i>Social identity</i>	An individual's sense of self as defined by group membership (a belief)	Tajfel and Turner 1986, Hogg 1987
<i>Environmental identity</i>	An individual's understanding of their connection to some part of the natural, non-human environment (a belief)	Clayton 2003, Clayton and Oppotaw 2003

* While other definitions and uses of "values" exist (i.e., philosophical, economic, etc.) we employ psychological definitions of value herein.

B.5. Table 1. Table depicting key definitions of terms.



B.5. Figure 1. The Salish Sea bioregion (our case study area) displaying 2022 area-based fisheries closures and SRKW critical habitat relevant to current Department of Fisheries and Oceans Canada SRKW management protection measures.

B.6. Targeted Facebook Advertisement Details

Angler-targeted ads

Location: British Columbia

Age: 18-65+

Schedule: May 26 – Jun 11, 2021

Bid strategy: Highest volume link clicks

Audience interests: Fishing, Fishing techniques, Recreational fishing, Recreational boat fishing, Salmon, Chinook salmon, Fishing line, Kayak Angler Magazine or Angler & Hunter and Job title: Fishing Guide

Conservation-supporter targeted ads

Location: British Columbia

Schedule: May 26 – June 11, 2021

Age: 18-65+

Bid strategy: Highest volume link clicks

Audience interests: wildlife conservation, Wildlife Conservation Society, Conservation movement, Conservation biology or Environmentalism and Field of study: Wildlife conservation

B.7. Summary of demographics, statistical analyses statistical differences

B.7.1. Summary of demographic information represented as percentage responses to our survey for: all respondents, angler respondents, and conservation-supporter respondents.

Item	% All respondents	% Angler respondents	% Conservation-supporter respondents
<i>Salient Stakeholder Identity</i>			
<i>Conservation-supporter</i>	52.47%		
<i>Angler</i>	34.75%		
<i>Multiple equally</i>	3.16%		
<i>Other</i>	2.61%		
<i>Commercial fisher</i>	2.06%		
<i>Scientist/Marine professional</i>	1.37%		
<i>Ecotourism</i>	1.65%		
<i>Citizen</i>	0.41%		
<i>Year Response</i>			
2020	39.42%	12.16%	58.64%
2021	60.58%	91.76%	38.74%
<i>Gender</i>			
<i>Man</i>	62.77%	89.41%	41.62%
<i>Woman</i>	33.93%	9.02%	54.45%
<i>Non-binary</i>	0.82%	0.00%	1.31%
<i>Did not say</i>	2.47%	1.57%	2.62%
<i>Income (annual household)</i>			
<i>Less than \$10,000</i>	1.92%	0.39%	3.14%
<i>\$10,000 - \$29,999</i>	8.10%	2.75%	12.83%
<i>\$30,000 - \$49,999</i>	13.74%	9.02%	17.02%
<i>\$50,000 - \$69,999</i>	12.50%	10.98%	14.14%
<i>\$70,000 - \$89,999</i>	14.29%	14.90%	14.92%
<i>\$90,000 - \$109,999</i>	14.15%	14.12%	13.09%
<i>\$110,000 - \$129,999</i>	10.30%	12.94%	7.85%
<i>\$130,000 - \$149,999</i>	6.04%	9.02%	3.93%
<i>\$150,000 or more</i>	18.96%	25.88%	13.09%
<i>Education</i>			
<i>Less than high school</i>	1.79%	3.53%	0.52%
<i>Highschool diploma</i>	13.6%	14.12%	11.52%
<i>2-year degree</i>	26.79%	38.82%	18.59%
<i>4-year degree</i>	28.02%	23.92%	32.46%
<i>Advanced degree</i>	29.81%	19.22%	36.91%
<i>Race</i>			
<i>White</i>	82.69%	83.14%	86.13%
<i>Did not say</i>	6.87%	5.49%	4.97%
<i>Multiple</i>	4.40%	6.27%	4.19%
<i>Indigenous</i>	1.65%	0.78%	1.57%

	<i>Other</i>	3.56%	1.96%	3.66%
<i>Town raised</i>				
	<i>A farm or rural area</i>	16.62%	16.86%	16.93%
	<i>Town with less than 5,000</i>	14.97%	12.55%	15.36%
	<i>Town with 5,000 – 9,999</i>	8.79%	11.76%	6.77%
	<i>Town with 10,000 – 24,999</i>	9.07%	9.41%	9.11%
	<i>City with 25,000 – 49,999</i>	11.40%	10.59%	12.50%
	<i>City with 50,000 – 99,999</i>	11.26%	15.69%	8.59%
	<i>City with 100,000 – 249,999</i>	7.55%	7.84%	7.55%
	<i>City with 250,000 +</i>	20.19%	15.29%	22.40%
<i>Fished</i>				
	<i>Yes</i>	81.73%	98.82%	32.03%
	<i>No</i>	18.27%	1.18%	67.45%
<i>Fished in the last year</i>				
	<i>Yes</i>	58.52%	92.16%	66.93%
	<i>No</i>	41.48%	7.84%	32.55%
<i>Rec. Trip</i>				
	<i>Yes</i>	78.85%	80.78%	75.52%
	<i>No</i>	21.15%	19.22%	23.96%
<i>Rec. Trip Last Year</i>				
	<i>Yes</i>	49.86%	59.22%	40.36%
	<i>No</i>	21.15%	40.78%	59.11%
<i>Freq. public engagement</i>				
	<i>No public engagement</i>	18.82%	32.94%	9.90%
	<i>1-3 times</i>	15.38%	16.86%	15.36%
	<i>4-10 times</i>	29.81%	27.06%	31.51%
	<i>More than 10 times</i>	35.85%	23.14%	42.71%
<i>Management priorities</i>				
	<i>Conservation as core priority</i>	62.09%	35.69%	82.29%
	<i>Human use / economics as core priority</i>	16.07%	32.16%	4.43%
	<i>Balanced priorities</i>	21.70%	32.16%	12.76%

B.7.2. Summary of statistical analyses results comparing responses between Angler and Conservation-supporters using a Pearson's Chi-Squared Test.

Item	Test-statistic	df	p-value
Year survey completed	$\chi^2 = 149.73$	1	< 0.001
Gender	$\chi^2 = 148.62$	3	< 0.001
Income	$\chi^2 = 56.121$	8	< 0.001
Education	$\chi^2 = 52.089$	5	< 0.001
Race	$\chi^2 = 5.509$	8	= 0.702
Town raised	$\chi^2 = 16.383$	7	= 0.022
Fish	$\chi^2 = 90.803$	1	< 0.001
Fished last year	$\chi^2 = 217.39$	1	< 0.001
Rec. trip	$\chi^2 = 1.830$	1	= 0.176
Rec trip last year	$\chi^2 = 20.545$	1	< 0.001
Frequency of public engagement	$\chi^2 = 60.614$	3	< 0.001
Management priorities	$\chi^2 = 156.27$	2	< 0.001

B.7.3. Summary of demographic responses for continuous data all participants, Anglers, and Conservation-supporters, and statistical analyses results (comparing Anglers and Conservation-supporters) using student's t-tests or Wilcoxon Rank Sum (Mann Whitney-U) tests.

Item	All respondents (mean)	Angler (mean)	Conservation-supporter (mean)	Test-statistic	df	p-value
Age	53.081	52.91	53.920	t = - 0.990	628	= 0.323
Years in BC	39.340	42.54	37.025	t = 3.388	592	< 0.001
Youth in Household	0.451	0.651	0.272	t = 5.415	632	< 0.001
EID score	6.015	5.694	6.246	W = 23954		< 0.001
SIA score	6.285	6.125	6.395	W = 42495		= 0.005

B.7.4. Wilcoxon Rank Sum (Mann-Whitney U) Test Results for Individual Likert Items

Item	Test Statistic	p-value
Chinook are abundant/minimally impacted by humans	W = 72371	< 0.001
I believe SRKW play a critical role in ecosystems	W = 22252	< 0.001
I believe SRKW threaten the health/abundance of Chinook	W = 70789	< 0.001
I believe that Chinook, SRKW, and other marine spp. are threatened by humans	W = 21633	< 0.001
SRKW experience cyclical changes and are not currently threatened	W = 81564	< 0.001
I believe that Chinook are an important part of BC's identity	W = 40403	< 0.001
I feel that Chinook deserve to exist regardless of benefits to humans	W = 33753	< 0.001
The loss of Chinook would have a negative impact on me personally	W = 46721	= 0.280
I believe that SRKW are an important part of BC's identity	W = 27466	< 0.001
I feel that SRKW deserve to exist regardless of benefits to humans	W = 28029	< 0.001
The loss of SRKW would have a negative impact on me personally	W = 18194	< 0.001
I believe DFO is doing a good job managing SRKW	W = 59536	< 0.001
I believe DFO is doing a good job managing Chinook	W = 41507	< 0.001
I believe harvest should be the core priority of management	W = 76797	< 0.001
I would oppose legislation to protect SRKWs if it limits fishing	W = 83348	< 0.001
I would support legislation to protect SRKWs, even that limits fishing	W = 13247	< 0.001
Chinook are abundant/minimally impacted by humans*	W = 63251	< 0.001
I believe SRKW play a critical role in ecosystems*	W = 35473	< 0.001
I believe SRKW threaten the health/abundance of Chinook*	W = 65053	< 0.001
I believe that Chinook, SRKW, and other marine spp. are threatened by humans*	W = 40774	< 0.001
SRKW experience cyclical changes and are not currently threatened*	W = 70468	< 0.001
I believe that Chinook are an important part of BC's identity*	W = 48197	= 0.411
I feel that Chinook deserve to exist regardless of benefits to humans*	W = 46921	< 0.001
The loss of Chinook would have a negative impact on me personally*	W = 49088	= 0.604
I believe that SRKW are an important part of BC's identity*	W = 43137	< 0.001
I feel that SRKW deserve to exist regardless of benefits to humans*	W = 46921	< 0.001
The loss of SRKW would have a negative impact on me personally*	W = 31952	< 0.001
I believe DFO is doing a good job managing SRKW*	W = 56193	< 0.001
I believe DFO is doing a good job managing Chinook*	W = 46931	= 0.176
I believe harvest should be the core priority of management*	W = 68206	< 0.001
I would oppose legislation to protect SRKWs if it limits fishing*	W = 80612	< 0.001
I would support legislation to protect SRKWs, even that limits fishing*	W = 19158	< 0.001

* Likert responses reduced to disagree (Strongly disagree, disagree, somewhat disagree), neutral, or agree (Somewhat agree, agree, strongly agree)

B.7.5. Permutational Analysis of Variance (PERMANOVA) Test Results

Permutation test for *adonis* (R package) under reduced model

Permutation: free

Number of permutations: 999

Variables included: both_groups, id_mean, eid_mean, gender, d_income, age_bin, d_education, srkw_id_2, chiook_id_2, srkw_exist_2, chinook_exist_2, chinook_abundant_2, srkw_cyclical_2, srkw_eco+2, srkw_loss_2, chinook_loss_2, srkw_threaten_2, opposed_leg_2, support_leg_2, dfo_chinook_2, harvest_priority_2, all_threatened_2, dfo_srwk_2, dfo_srwk_2, d_participated, d_times_participate, d_priorities

	Df	Sum of Squares	R ²	F	Pr (<F)
Model	1	1.1506	0.04753	31.688	0.001***
Residual	635	23.0580	0.95247		
Total	636	24.2086	1.00000		

*** Significance code

B.8. Certificate of Ethics Approval (HRE)



University of Victoria

**Certificate of Ethical
Approval for Harmonized
Minimal Risk Behavioural
Study**

University of Victoria
Human Research Ethics Board



Also reviewed and approved by:

- UBC Behavioural Research Ethics Board



Principal Investigator: Chris T. Darimont	Primary Appointment: University of Victoria, Faculty	Board of Record REB Number: BC20-0060 Board of Record: University of Victoria	UBC REB Number: H20-00359																														
Study Title: Conservation, conflict, and core beliefs: Examining deeply-rooted conflict and opportunities towards transformation in an Orca-Salmon-Human system																																	
Study Approved: March 3, 2020		Expiry Date: March 3, 2021																															
Research Team Members: Lauren E. Eckert, University of Victoria, Graduate student Paul Paquet, Raincoast Conservation Foundation Natalie Ban, University of Victoria, Faculty Misty McDuffee, Raincoast Conservation Foundation Dave Scott, UBC, Graduate student																																	
Sponsoring Agencies:		N/A																															
<table border="1"> <thead> <tr> <th>Document Name</th> <th>Version</th> <th>Date</th> </tr> </thead> <tbody> <tr> <td colspan="3">Protocol:</td> </tr> <tr> <td>Research Proposal Draft</td> <td>3 (final draft)</td> <td>January 31, 2020</td> </tr> <tr> <td colspan="3">Consent Forms:</td> </tr> <tr> <td>Implied Consent Form (Cover Letter)</td> <td>2 (revised)</td> <td>February 25, 2020</td> </tr> <tr> <td colspan="3">Advertisements:</td> </tr> <tr> <td>Recruitment Flyer</td> <td>3 (revised)</td> <td>February 26, 2020</td> </tr> <tr> <td>Recruitment Email</td> <td>2 (revised)</td> <td>February 25, 2020</td> </tr> <tr> <td colspan="3">Questionnaire, Questionnaire Cover Letter, Tests:</td> </tr> <tr> <td>Implied Consent Form (Cover Letter paper and web surveys)</td> <td>2 (revised)</td> <td>February 25, 2020</td> </tr> </tbody> </table>				Document Name	Version	Date	Protocol:			Research Proposal Draft	3 (final draft)	January 31, 2020	Consent Forms:			Implied Consent Form (Cover Letter)	2 (revised)	February 25, 2020	Advertisements:			Recruitment Flyer	3 (revised)	February 26, 2020	Recruitment Email	2 (revised)	February 25, 2020	Questionnaire, Questionnaire Cover Letter, Tests:			Implied Consent Form (Cover Letter paper and web surveys)	2 (revised)	February 25, 2020
Document Name	Version	Date																															
Protocol:																																	
Research Proposal Draft	3 (final draft)	January 31, 2020																															
Consent Forms:																																	
Implied Consent Form (Cover Letter)	2 (revised)	February 25, 2020																															
Advertisements:																																	
Recruitment Flyer	3 (revised)	February 26, 2020																															
Recruitment Email	2 (revised)	February 25, 2020																															
Questionnaire, Questionnaire Cover Letter, Tests:																																	
Implied Consent Form (Cover Letter paper and web surveys)	2 (revised)	February 25, 2020																															

Survey	2 (revised)	February 25, 2020
<u>Letter of Initial Contact:</u>		
Recruitment Email (to be distributed by 3rd party)	2 (revised)	February 25, 2020
<u>Other Documents:</u>		
PI and Chair Signatures	1	February 28, 2020
<u>Other:</u>		
None to display		
<p>This ethics approval applies to research ethics issues only and does not include provision for any administrative approvals required from individual institutions before research activities can commence.</p> <p>The Board of Record (as noted above) has reviewed and approved this study in accordance with the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2, 2014).</p> <p>The "Board of Record" is the Research Ethics Board delegated by the participating REBs involved in a harmonized study to facilitate the ethics review and approval process.</p>		
<p>The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.</p>		
<p>This study has been approved either by the Board of Record's full REB or by an authorized delegated reviewer.</p>		

REBC



**Management of Southern Resident Killer Whales and Chinook Salmon
in British Columbia**

You are invited to participate in a study entitled “Management of Southern Resident Killer Whales and Chinook Salmon in British Columbia” that is being conducted by Lauren Eckert.

Lauren Eckert is a Ph.D. Student in the department of Geography at the University of Victoria and you may contact her if you have further questions by emailing [REDACTED]

As a Ph.D. student, I am required to conduct research as part of the requirements for a Doctoral Degree in Geography. It is being conducted under the supervision of Dr. Chris Darimont. You may contact my supervisor at [REDACTED]

Purpose and Objectives

Attempts to manage and protect Chinook Salmon and Southern Resident Killer Whales in British Columbia has sparked substantial social conflict in recent years. Our research seeks to better understand conflict surrounding Southern Resident Killer Whale protection measures so as to accurately represent on-going narratives surrounding these measures, engage a diverse array of stakeholders in an anonymous feedback opportunity, and suggest potential solutions to on-going conflict between stakeholders who care about the Salish sea and its inhabitants who support local biodiversity, culture, and economies. In order to understand, repair, and ultimately transform conflict, it is critical to fully understand conflict between stakeholders prior to proposing solutions. We hope our research can contribute to comprehensive understanding of social conflict towards reparation.

Importance of this Research

We intend for our research to increase understanding regarding the drivers of current conflict in British Columbia, and that this understanding can contribute to future conflict resolution attempts.

Participants Selection

You are being asked to participate in this study because you are a stakeholder (recreational fisher, conservation-supporter, or both) invested in the protection and management of Chinook salmon and/or killer whales, over 18, and a resident of British Columbia.

What is involved

If you consent to voluntarily participate in this research, your participation will include the completion of an online or paper-based survey that should take approximately 15-25 minutes to complete. All collected data will remain anonymous, and will be analyzed for broad-scale (rather than individual) themes.

Inconvenience

Participation in this study may cause some inconvenience to you, namely in the amount of time spent on completing the survey.

Risks

There are minimum known or anticipated risks to you by participating in this research. Namely, if you are emotionally-invested in the management or protection of Chinook salmon or killer whales, completing this survey may result in an emotional response (however, not more so than already exists regarding opinions surrounding current management plans). Participants are welcome to contact Lauren Eckert if such unpleasant emotions arise if they wish to have their concerns heard.

Benefits

The potential benefits of your participation in this research include: opportunities for participants to anonymously provide opinions regarding current marine management plans in British Columbia, entry to win a \$150 Amazon Gift Card, the generation of research to help inform and potentially move towards remediating conflict in the province regarding marine management, and finally contribution to the state of knowledge in the province and beyond regarding stakeholder conflict surrounding wildlife management plans.

Compensation

As a way to compensate you for any inconvenience related to your participation, you will be entered into a drawing to win one of three \$150 Amazon Gift Cards once your survey is completed.

Voluntary Participation

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study, it will be impossible to remove your anonymous data from our database, as there will be no link between your name and contact information and your data. However, we will desist all research-oriented communications with you upon your confirmed withdrawal. You will still be eligible for compensation through our Amazon Gift Card drawing.

Anonymity

In terms of protecting your anonymity, your web-based survey results will remain completely anonymous, and your entry into our prize drawing will be completed through a separate prompted survey once you have completed and submitted your anonymous survey. If you are submitting your survey by mail, your responses will be stored under a coded (numerical) response rather than by your name, and your name will be stored separately so you may be entered for our prize award. Your submitted data will not be traceable to your name or contact information in either case.

Confidentiality

Your confidentiality and the confidentiality of the data will be protected by carefully storing the data on Lauren Eckert's personal, password protected computer, on a password protected back-up external memory, and on the University of Victoria network storage (also password protected). No stored data will include names or contact information linked with the provided data.

Dissemination of Results

It is anticipated that the results of this study will be shared with others in the following ways: broad results will be personally shared with those study participants who expressed interest in being updated on results, results will be shared at public forums of interested stakeholder groups, the principal

applicant and collaborators will submit results to a peer-review journal for publication and will act as a party of the participant applicant's dissertation, and the principal applicant may share results at academic conferences and through broader public outreach opportunities (e.g. media publications, social media, local talks, education programs, etc.)

Disposal of Data

Anonymous data from this study will not be disposed of and will be stored as described in the preceding "Confidentiality" section.

Contacts

Individuals that may be contacted regarding this study include the principal applicant (Lauren Eckert, the researcher) and the supervisor (Chris Darimont), and contact information is available for both at the beginning of page one of this document.

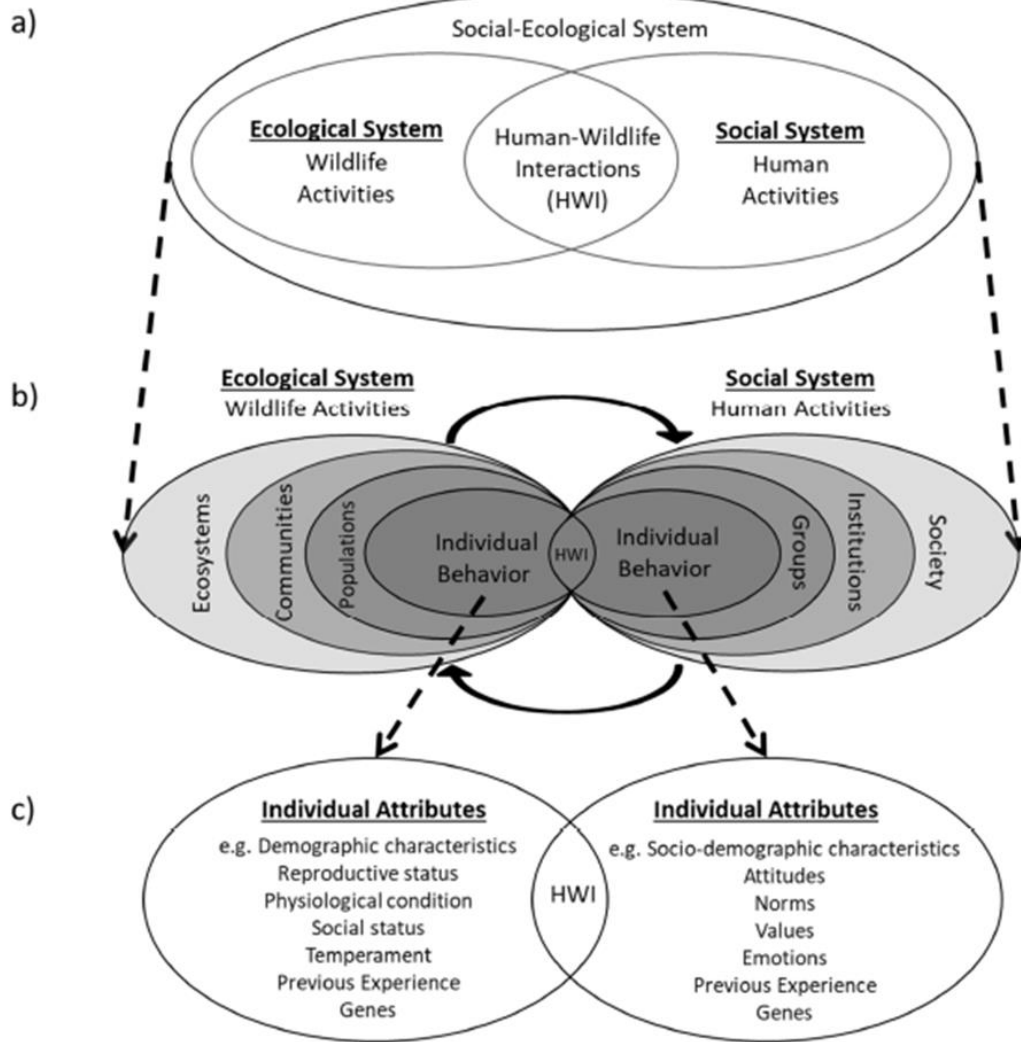
In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria [REDACTED]

By completing and submitting the questionnaire, **YOUR FREE AND INFORMED CONSENT IS IMPLIED** and indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

Please retain a copy of this letter for your reference.

Appendix C: Ch.4 Supplementary Material

FIGURES



560

Figure 1. SES model of Human-Wildlife Interactions. Selected concepts from this figure are defined in Table 1. Panel a) describes the overall SES model of HWIs, while panel b) describes external influences on individual behavior and panel c) describes individual attributes which also affect behavior. Curved arrows in b) indicate feedback among all levels of the social and ecological systems.

Conceptual model of human-wildlife interactions - 16

C.1. Figure 1 as seen in Lischka, S. A., Teel, T. L., Johnson, H. E., Reed, S. E., Breck, S., Carlos, A. D., & Crooks, K. R. (2018). A conceptual model for the integration of social and ecological information to understand human-wildlife interactions. *Biological Conservation*, 225, 80-87.

C.2. Invitation Flyers Camera Host (HRE Approved)

New Research Project in the qRD (or substitute with CRD)

As Summer rolls in again with promises of sunnier days, and many of us are increasingly working at home, we begin to witness the reemergence of our wild neighbors - with new cubs and hungry bellies.

With their re-emergence this Spring and foraging this Summer and Fall may also come concerns about conflict with black bears. In the last decade, reported conflict with black bears in Powell River and Lund (or Sooke / Metchosin) has been on the rise. These trends may reflect larger trends occurring across the province.

[black bear photo]

New research, set to begin [share approximate start date] in the Qathet Regional District (Powell River and Lund) (or insert Capital Regional District), seeks to answer questions about why and where conflict between humans and black bears occurs, and how we can turn conflict into coexistence. Lauren Eckert is a PhD student at the University of Victoria (supervised by Dr. Chris Darimont) who will be beginning a two year research project [subject to change due to COVID19], which will entail establishing camera traps to learn more about the abundance and whereabouts of local black bears, ~~and interviews~~ and surveys with community members to understand how people are impacted by black bears, their beliefs and opinions regarding black bears and their management, and their suggestions towards improved human-wildlife relationships in the region (among other questions).

[photo of Lauren Eckert]

Lauren will mainly be interested in understanding how bears behave in human-dominated landscapes. She will be looking for opportunities to contact people with a variety of experiences with black bears to complete **online surveys**, and down-the-line to host wildlife camera traps on their properties.

[survey link here]

[photo of a wildlife camera]

If you are interested in learning more about this project, or engaging in surveys or having a wildlife camera trap placed on your property, contact Lauren at [REDACTED]

C.3. Survey Invitation Flyers

Opportunity to Participate in Research Regarding Black Bears in your region!

<https://www.surveymonkey.ca...> (survey link here)

All participants have a chance to win one of two \$100 Amazon Gift Cards!

Contact Lauren Eckert (PhD student, supervised by Chris Darimont):

- Do you have experiences with/opinions regarding local black bears that you would like to share?
- Are you over 18 years of age?
- Please consider participating in on-going research regarding human-black bear conflict towards coexistence!

 University of Victoria

WE WANT TO HEAR FROM YOU!

2021 BLACK BEAR SURVEY

We are inviting you to participate in our online survey regarding black bears in your area. Your responses will be anonymous and we would greatly appreciate your time!

Type this link into your web browser!

<https://www.surveymonkey.ca/r/QRDblackbears>

This research relies on your observations and expertise to understand human-black bear conflict towards promoting coexistence.



Or scan this code with your smart phone!

Your participation in this survey will be completely anonymous and should take 10-15 minutes to complete.



All participants will be entered to win one of two \$100 gift cards to local stores!

Lauren Eckert, PhD Candidate
Supervised by Dr. Chris Darimont

C.4. qRD Survey

A Study Conducted By:

Lauren Eckert, PhD Candidate, The University of Victoria

Email: [REDACTED]

Supervisor: Dr. Chris Darimont, University of Victoria

The purpose of this study is to learn more about black bears in Powell River and Lund (and surrounding areas) and their interactions with people. We are interested in learning about your relationships with local wildlife, past experiences, opinions regarding how black bears should be managed, thoughts on local human-wildlife conflict, sociodemographics, etc. The questions included in this survey will allow us to draw broad-scale conclusions about human-bear conflict in the region and suggest opportunities to resolve it, and data will be used to inform local management and mitigate conflict. This survey should take approximately 10-15 minutes to complete.

PLEASE READ BEFORE COMPLETING THIS SURVEY:

The information you provide in this survey will be kept strictly confidential. By completing this survey, the participant acknowledges that their anonymous data may be used in future academic publications. Any published materials will not refer to the individual nor individual data, but rather consider broad-scale themes.

Your data will be stored anonymously with, and analyzed by, the principal researcher (Lauren Eckert). By completing this survey, you acknowledge and consent to your data being stored and used in this manner and in the manner thoroughly explained in the cover letter (Implied Consent form) preceding this survey. Participants may withdraw their data/involvement in this research project at any time by contacting Lauren Eckert at laureneckertresearch@gmail.com and stating their desire to withdraw. In the case participants withdraw consent, their fully-anonymous data will not be able to be withdrawn because it has no personal identifiers (excluding paper-based survey submissions, which may be excluded).

Full Consent Form: <https://drive.google.com/file/d/1TtPwNEjN9GUcpcY1nsubskp0no2Ohr2/view?usp=sharing>

For all consent information, please see the "[Full Consent Information Document](#)" hyperlinked herein before completing this survey.

* 1. I have read the "full consent information document" and consent to all described therein.

I agree

Part I. Your Experiences with Black Bears

Below we ask that you tell us a bit about your experiences with black bears.

* 2. Have you ever seen a black bear where you live? Select one.

- Yes
 No

* 3. In the last 12 months, how many times did you see black bears where you live? Please select one.

- I have never seen a bear on my property.
 1-2 times
 3-4 times
 5-8 times
 More than 8 times

* 4. How many hours were you typically at home during the last 12 months? Please select one.

- I was at home most of the time.
 I am away from home 20-30 hours / week.
 I am away from home about 40-50 hours / week.
 I am rarely home (away 50+ hours/week).
 Other (please specify)

* 5. How long have you lived in your current home? Write your answer below.

* 6. What is your overall experience with bears during the past 5 years? Select one.

- Very positive
 Positive
 Neither negative nor positive
 Negative
 Very negative
 I have not had an experience with bears during the past 5 years.

7. If you had negative interactions with bears, when did the most recent occur?

- Within the last 12 months
- Between 12 months and 5 years ago
- 5 years ago or more
- I have not had a negative interaction with black bears.

8. If you had negative interactions with black bears, select the nature of your interaction(s).
Select all relevant answers.

- A black bear has caused damage to my property (e.g. broke into garbage, damaged fruit trees, bird feeders, etc.)
- A black bear has harassed or attacked my pets or livestock.
- I have been harassed or felt threatened by a black bear.
- I have been attacked by a black bear.
- I have not had a negative interaction with black bears.
- Other (please specify)

9. If you had positive interactions with bears, please select the nature of these experiences.
Select as many options as are relevant.

- I have seen black bears outside of town, and felt more connected to nature.
- I have seen black bears near my home, and felt more connected to nature.
- I have seen a black bear and felt excited, curious, or delighted to watch it.
- I have not had a positive interaction with bears in the last 5 years.
- Other (please specify)

* 10. Have you ever reported an interaction with a bear to the local Conservation Officer services while living in Powell River/Lund?

- Yes
- No

* 11. If you have reported an interaction with a bear to Conservation Officers, about how many times have you reported?

- 1 time
- 2-4 times
- 5-8 times
- More than 8 times
- I have never reported an interaction.

12. If you have reported an interaction with a bear to Conservation Officers, what was the nature of the interaction you reported? Please select all relevant answers.

- I sighted a bear on my / an adjoining property.
- A bear was damaging my property.
- A bear was harming my livestock or pets.
- A bear was being aggressive.
- I have not reported an interaction with a bear to Conservation Officers.
- Other (please specify)

13. If you have NEVER reported a problem with a bear to a Conservation Officer, or sometimes avoid reporting to an officer, why? Please select all of the appropriate answers.

- Because I have had no or non-serious interactions with bears (e.g. bears are rarely on my property)
- Because the bears that are on or near my property are not dangerous / do not threaten me.
- Because I do not trust the Conservation Officers to handle the problem.
- Because I think the Conservation Officer may kill the bear.
- Because I had a negative experience with Conservation Officers.
- Because I am confident I can handle the problem or interactions myself.
- I have never had a problem with a bear.
- I have no issues or hesitations reporting to a Conservation Officer.
- Other (please specify)

* 14. Do you take any measures to prevent negative interactions with bears at your home/property? Please select all that apply.

- I own a dog/livestock guardian dog.
- I have installed an electric fence around potential attractants (e.g. around livestock, gardens, fruit trees, etc.)
- I secure all of my attractants (e.g. garbage, garden, fruit trees, etc.)
- I usher bears off of my property using loud noises (e.g. my voice, air horns) when I see them.
- Other (please specify)

- None of the above

Part II. Questions related to Black Bears in Powell River / Lund

The following questions are explicitly about black bears in Powell River / Lund, your relationship to wildlife, and how black bear conflict is managed.

* 15. I am confident that the BC Conservation Officer service will manage black bears and human-black bear conflict in a way that is right for my community.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

* 16. I am familiar with local WildsafeBC education and outreach programs.

- Yes.
- Somewhat.
- No.

* 17. WildsafeBC provides locally valuable services towards preventing human-wildlife conflict.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I have not heard of WildSafeBC

Please select one answer for each statement below depending on how much you agree or disagree with it.

* 18. In general, do you think of black bears as good or bad?

- Extremely bad
- Moderately bad
- Slightly bad
- Neither
- Slightly good
- Moderately good
- Extremely good

* 19. In general, do you think of black bears as beneficial or harmful?

- Extremely harmful
- Moderately harmful
- Slightly harmful
- Neither
- Slightly beneficial
- Moderately beneficial
- Extremely beneficial

* 20. In general, do you think of black bears as a positive or negative presence?

- Extremely negative
- Moderately negative
- Slightly negative
- Neither
- Slightly positive
- Moderately positive
- Extremely positive

* 21. Black bears will be more of a problem for Powell River/Lund in the future.

- Strongly agree
- Agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Disagree
- Strongly disagree

* 22. I am not familiar with the risks posed by black bears.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I am not sure

* 23. I can prevent conflicts with black bears by making changes around my home.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I am not sure

* 24. Encounters with black bears are likely to result in serious injuries or human death.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I am not sure

* 25. I fear having an encounter with black bears.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I am not sure

* 26. All residents of Powell River/Lund (and surrounding areas) are equally exposed to conflicts with black bears

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I am not sure

* 27. I am vulnerbale to risks posed by black bears.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- I am not sure

* 28. Black bear populations in Powell River/Lund (the QRD) are... (Select one answer).

- Much too low
- Too low
- Slightly too low
- As they should be
- Slightly too high
- Too high
- Much too high

Part III. Sociodemographics

We are also interested in learning about information related to you, your work, and the communities in which you live. This information is collected to better understand large scale trends in the Province, and will be kept completely confidential.

* 29. Do you identify as a (select your response):

- Man
- Woman
- Gender non-binary
- I'd rather not say

* 30. What is your age? (Please write your answer in years).

* 31. How many people under 18 years of age are currently living in your household? Write your answer below.

* 32. What is your **current address**? (Responses to this question will be kept completely confidential, and are important for understanding where local bears are spending time. Your address will not be tied to any personal identifiers like your name or contact information).

* 33. What neighborhood do you live in?

- Wildwood
- Lund
- Westview
- Townsite
- Cranberry
- South of Town
- Tla'amin / Sliammon Nation Territory
- Other (please specify)

* 34. What is the highest education level you have completed? Select one of the following:

- Less than high school diploma
- High school diploma or equivalent (for example, GED)
- 2-year Associates degree or trade school
- 4-year College / University degree
- Advanced degree beyond 4-year college / University degree
- Prefer not to say

* 35. What is your approximate annual household income before taxes? Select one of the following. Please keep in mind that responses will be completely anonymous.

- Less than \$10,000
- \$10,000-\$29,999
- \$30,000-\$49,999
- \$50,000-\$69,999
- \$70,000-\$89,999
- \$90,000-\$109,999
- \$110,000-\$129,999
- \$130,000-\$149,999
- \$150,000 or more
- Prefer not to say

* 36. About how long have you lived in Powell River or Lund? Please select the answer below according to the number of years you have resided in the area. If less than one year, please select "0".

0 100

* 37. What is your current postal code? (Postal code information is important to understanding differences in bear conflict throughout neighborhoods in Powell River/Lund, and will not be shared publicly)

* 38. Were you raised in Powell River/Lund/Sliammon?

- Yes
- No

39. If no, how would you describe the community in which you were raised? (Select one). If more than one area, select the place where you lived the longest.

- A farm or rural area
- Small town/village with less than 5,000 people
- Town with 5,000 to 9,999 people
- Town with 10,000 to 24,999 people
- Small city with 25,000-49,999 people
- City with 50,000-99,999 people
- City with 100,000 to 249,999 people
- Large city with 250,000 or more people
- I was raised locally.

40. If you were not raised in Powell River/Lund/Sliammon, did you grow up in a suburb?

- Yes
- No
- I was raised locally.
- Other (please specify)

41. Are you...? (Select one or more categories to indicate what you consider yourself to be - responses are optional.)

- White
- Asian
- Black or African American
- Indigenous
- Spanish, Hispanic, or Latinx
- Pacific Islander
- Other
- Would rather not say

* 42. Please check all of the following statements that apply to you.

- I engage often in outdoor recreation (e.g. hiking, climbing, kayaking, etc.).
- I am a vegan/vegetarian.
- I am a wildlife professional.
- I hunt locally (for food).
- I hunt locally (for trophy or sport).
- I fish locally.
- I am a local farmer.
- None of the above apply to me.

Part IV. Open-Ended Questions

These are final, open-ended questions. Answers to these questions are optional, but we greatly appreciate any additional information or responses you would like to share. If you would rather respond to these questions via a phone call, please contact the researcher. Note that contacting the researcher will limit the anonymity of your data.

43. In your ideal world, what would the relationships between people and black bears in Powell River and Lund look like? How might we work towards that vision? Please write your answer below.

44. Is there anything you do to prevent conflict with bears that you would like to share here (e.g. electric fencing on property, attractant management, etc.)?

45. Is there anything else you would like to share about your experiences with black bears (or wildlife in general) in the region? If yes, please do so in the blank space provided:

46. Are there any important questions about black bears that we failed to ask in this survey? If yes, please explain in the blank space provided:

* 47. How did you find out about this survey? Select all that apply.

- Word of mouth
- Paper/mail invite
- Email
- Flyer
- Facebook
- Twitter
- Other Social Media
- Other (please specify)

C.5.

Table C.5.1. Social and Environmental variables for probability of self-reported conflict models.

Model set	Variable name	Type of variable	Value	Variable description and rationale
all	Self-reported conflict	Response	Binomial: 0: no reported conflict, 1: reported conflict	Our response variable indicates whether (1) or not (0) a survey participant indicated that they had experienced a negative interaction with a black bear in the last year (2021).
all	Individual	Random effect	Categorical (survey id number)	We introduced ‘individual’ as a random effect to account for unmeasured heterogeneity between survey participants.
Ecological	Distance to urban (Urban)	Fixed effect	Continuous numeric	Average distance to urban land cover cell within weighted buffer (using the Euclidean distance tool in ArcGIS Pro); standardized and centered (Klees van Bommel)
	Distance to forest patch (Forest patch)	Fixed effect	Continuous numeric	Average distance to <300 m2 contiguous forest land cover cell within weighted buffer (using the Euclidean distance tool in ArcGIS Pro); standardized and centered (Klees van Bommel)
	Distance to forest intact (Forest intact)	Fixed effect	Continuous numeric	Average distance to >300 m2 contiguous forest land cover cell within weighted buffer (using the Euclidean distance tool in ArcGIS Pro); standardized and centered (Klees van Bommel)
	Human density (HD)	Fixed effect	Continuous numeric	Average number of people per square kilometre within weighted buffer derived from the Gridded Population of the world; standardized and centered. (Klees van Bommel)
	Road density (RD)	Fixed effect	Continuous numeric	Total length of roads in buffer around point in km / area in km2 of buffer derived from the Digital Road Atlas;

				standardized and centered (Klees van Bommel)
	Bear detection	Fixed effect	Continuous numeric	Sum of total detection events at trail camera established on a private property within each grid.
Social	Household attractants	Fixed effect	Centered numeric (median)	Median of observations of attractant type at each household, collected April – November 2021
	Neighboring attractants	Fixed effect	Centered numeric (median)	Sum of median of observations of attractant type at each household surrounding the household of interest, extracted in a 150m km2 buffer and including all data about households collected within that buffer, proportionally extrapolated to unsampled areas within the buffer, collected April – November 2021
	Risk perception	Fixed effect	Continuous numeric	Prior research (Zajac et al, Lischka et al) supports that those with higher Risk perceptions (derived from a 7-item measure of likert-scale items) are less tolerant of black bears. We reasoned that those who perceived bears as a greater risk would be more likely to report conflict with them.
	Household garbage (square root transformed)	Fixed effect	Continuous numeric	Given that garbage has been found to be the main anthropogenic food source for black bears in other regions (Lewis et al. 2015), we substituted ‘Household garbage’ for ‘median attractants’ in a subset of our models.

Table C.5.2. Candidate Models

	Predictor Variables	K	AICc	ΔAICc	AICwt
Null model	1 + (1 Individual)	2	213.23	1.39	0.17
Ecological models	HD + (1 Individual)	3	212.80	0.97	0.21
	HD + RD + (1 Individual)	4	211.83	0.00	0.34
	Forest patch + Forest intact + Urban + (1 Individual)	5	217.88	6.05	0.02
	Forest patch + Forest intact + Urban + HD + (1 Individual)	6	218.06	6.23	0.02


	Forest patch + Forest intact + Urban + HD + RD + (1 Individual)	7	217.87	6.04	0.02
	HD + detection + (1 Individual)	4	214.66	2.82	0.08
	HD+ RD + detection + (1 Individual)	5	213.88	2.05	0.12
	Forest patch + Forest intact + Urban + detection + (1 Individual)	6	220.00	8.17	0.01
	Forest patch + Forest intact + Urban + HD + detection + (1 Individual)	7	220.17	8.33	0.01
	Forest patch + Forest intact + Urban + HD + RD + detection + (1 Individual)	8	220.03	8.20	0.01
Social models	Household attractants + (1 Individual)	2	213.23	5.36	0.02
	Household attractants + Risk perception + (1 Individual)	3	215.24	7.38	0.01
	Household attractants + Neighborhood attractants + (1 Individual)	4	211.89	4.02	0.05
	Household attractants + Risk perception + Household attractants*Risk perception + (1 Individual)	5	217.20	9.33	0.00
	Household attractants*Neighborhood attractants + Household attractants + Neighborhood attractants + (1 Individual)	5	213.49	5.62	0.02
	Household attractants + Risk perception + Household attractants*Risk perception + Neighborhood attractants + (1 Individual)	6	219.03	11.17	0.00
	Household attractants*Neighborhood attractants + Household attractants + Neighborhood attractants + Risk perception + (1 Individual)	6	215.18	7.32	0.01
	Household attractants*Neighborhood attractants + Household attractants*Risk perception + Household attractants + Neighborhood attractants + Risk perception + (1 Individual)	7	217.02	9.15	0.00
	Household garbage + (1 Individual)	3	211.96	4.10	0.0
	Household garbage + Risk perception + (1 Individual)	4	207.87	0.00	0.36
	Household garbage + Neighborhood attractants + (1 Individual)	4	213.77	5.91	0.02
	Household garbage + Risk perception + Household garbage*Risk perception + (1 Individual)	5	208.83	0.97	0.58
	Household garbage*Neighborhood attractants + Household garbage + Neighborhood attractants + (1 Individual)	5	215.87	8.00	0.01
	Household garbage + Risk perception + Household garbage*Risk perception + Neighborhood attractants + (1 Individual)	6	210.12	2.26	0.12
	Household garbage*Neighborhood attractants + Household garbage + Neighborhood attractants + Risk perception + (1 Individual)	6	211.26	3.39	0.07

	Household garbage*Neighborhood attractants + Household garbage*Risk perception + Household garbage + Neighborhood attractants + Risk perception + (1 Individual)	7	212.20	4.34	0.04
Social-ecological models	HD + Household garbage + Risk perception + (1 Individual)	5	207.29	0.00	0.23
	HD + Household garbage + Risk perception + Household garbage*Risk perception + (1 Individual)	6	208.12	0.41	0.16
	HD + RD + Household garbage + Risk perception + (1 Individual)	6	207.57	0.27	0.20
	HD + RD + Household garbage + Risk perception + Household garbage*Risk perception + (1 Individual)	7	209.04	1.75	0.10
	Household garbage + Risk perception + (1 Individual)	4	207.87	0.58	0.18
	Household garbage + Risk perception + Household garbage*Risk perception + (1 Individual)	5	208.83	1.54	0.11
	1 + (1 Individual)	2	213.23	5.93	0.01
	HD + (1 Individual)	3	212.80	5.51	0.01
	HD + RD + (1 Individual)	4	211.83	4.45	0.02
Universal model	Household garbage*Neighborhood attractants + Household garbage*Risk perception + Household garbage + Neighborhood attractants + Risk perception + HD + RD + detection + Forest patch + Forest intact + Urban + (1 Individual)	12	218.38	11.09	0.00

C.7. HRE Certificates of Approval



Certificate of Approval


PRINCIPAL INVESTIGATOR	Chris Darimont (Supervisor)	ETHICS PROTOCOL NUMBER	20-0076
		Expedited review - delegated	
PRINCIPAL APPLICANT	Lauren Eckert PhD student	ORIGINAL APPROVAL DATE	26-May-2020
UVIC DEPARTMENT	Geography	APPROVED ON	26-May-2020
		APPROVAL EXPIRY DATE	25-May-2021
<p>PROJECT TITLE Social-ecological drivers of human-wildlife conflict and coexistence: bear-human systems in coastal British Columbia</p> <p>RESEARCH TEAM MEMBERS None</p> <p>DECLARED PROJECT FUNDING Royal Canadian Geographical Society Scholarship, Alongside Wildlife Grant, National Geographic Society (Early Career Support),</p> <p>DOCUMENTS INCLUDED IN THIS APPROVAL ImpliedConsentFormGroup1_Eckert_5_25_20.doc - 25-May-2020 Bear Draft Survey Design_5_25_20.docx - 25-May-2020 Behavioral Observation Protocol and Script_5_25_20.docx - 25-May-2020 Draft Recruitment Script_Third Parties_5_25_20.docx - 25-May-2020 InvitationFlyer_5_25_20.pptx - 25-May-2020 Draft Outreach Article for Recruitment_5_25_20.docx - 25-May-2020 Draft E-Invitation 5_25_20.docx - 25-May-2020 Gmail - RE_Darimont and Eckert AUP (modified 5_2020).pdf - 25-May-2020 Updated AUP Progress_4_20_20.pdf - 20-Apr-2020 PartB_MOE_Eckert.docx - 20-Apr-2020 ProjectAgreement_Eckert_2_28_20.pdf - 20-Apr-2020 Gmail - Re_Application for Animal Testing.pdf - 02-Apr-2020</p>			
CONDITIONS OF APPROVAL			
<p>This Certificate of Approval is valid for the above term provided there is no change in the protocol.</p> <p>Modifications To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.</p> <p>Renewals Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.</p> <p>Project Closures When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.</p>			
Certification			
<p>This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.</p> <div style="text-align: center;">  <hr/> <p>Dr. Rachael Scarth Associate VP Research Operations</p> </div>			


Certificate Issued On: 26-May-2020

Certificate of Approval - Annual Renewal

PRINCIPAL INVESTIGATOR: Chris Darimont (Supervisor) PRINCIPAL APPLICANT: Lauren Eckert PhD student UVIC DEPARTMENT: Geography GEOG	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="font-size: small;">ETHICS PROTOCOL NUMBER</td> <td style="text-align: right;">20-0076</td> </tr> <tr> <td colspan="2" style="font-size: x-small;">Expedited review - delegated</td> </tr> <tr> <td style="font-size: small;">ORIGINAL APPROVAL DATE:</td> <td style="text-align: right;">28-May-2020</td> </tr> <tr> <td style="font-size: small;">APPROVED ON:</td> <td style="text-align: right;">10-May-2022</td> </tr> <tr> <td style="font-size: small;">APPROVAL EXPIRY DATE:</td> <td style="text-align: right;">25-May-2023</td> </tr> </table>	ETHICS PROTOCOL NUMBER	20-0076	Expedited review - delegated		ORIGINAL APPROVAL DATE:	28-May-2020	APPROVED ON:	10-May-2022	APPROVAL EXPIRY DATE:	25-May-2023
ETHICS PROTOCOL NUMBER	20-0076										
Expedited review - delegated											
ORIGINAL APPROVAL DATE:	28-May-2020										
APPROVED ON:	10-May-2022										
APPROVAL EXPIRY DATE:	25-May-2023										
PROJECT TITLE: Social-ecological drivers of human-wildlife conflict and coexistence: bear-human systems in coastal British Columbia											
RESEARCH TEAM MEMBERS: Jessica Maclean - Lab Manager, assisted in basic tasks, University of Victoria											
DECLARED PROJECT FUNDING: Royal Canadian Geographical Society Scholarship, National Geographic Society (Early Career Support).											
DOCUMENTS INCLUDED IN THIS APPROVAL: Gmail - Re_ Application for Animal Testing.pdf - 02-Apr-2020 ProjectAgreement_Eckert_2_28_20.pdf - 20-Apr-2020 PartB_MOE_Eckert.docx - 20-Apr-2020 Updated AUP Progress_4_20_20.pdf - 20-Apr-2020 Gmail - RE_ Darimont and Eckert AUP (modified 5_2020).pdf - 25-May-2020 Draft E-Invitation 5_25_20.docx - 25-May-2020 Draft Outreach Article for Recruitment_5_25_20.docx - 25-May-2020 InvitationFlyer_5_25_20.pptx - 25-May-2020 Draft Recruitment Script_ Third Parties_5_25_20.docx - 25-May-2020 Behavioral Observation Protocol and Script_5_25_20.docx - 25-May-2020 Bear Draft Survey Design_5_25_20.docx - 25-May-2020 ImpliedConsentFormGroup1_Eckert_5_25_20.doc - 25-May-2020 CameraHost_InvitationFlyer_7_21_20.jpg - 21-Jul-2020 ConsentFormQRD_CameraHosts_Eckert_7_21_20.doc - 21-Jul-2020 QRDFieldwork_SafetyProtocol_7_21_20.docx - 21-Jul-2020 OHSE_COVID-19 Safety Plan - Awareness_Training_Certificate of Completion.pdf - 21-Jul-2020 Gmail - Approval Notice - 2020-023(1)- ...pdf - 23-Jun-2021											
Conditions of approval											
This Certificate of Approval is valid for the above term provided there is no change in the protocol.											
Amendments To make changes to the approved research procedure in your study, please submit "Amendments" or "Annual renewal with amendments" form. You must receive research ethics approval before proceeding with your amended protocol.											
Renewals Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.											
Project Closures When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.											

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria's policies for research involving human participants.


 Dr. Sandra Gibbons
 Chair, Human Research Ethics Board


 Dr. Matthew Murphy
 Vice-chair, Human Research Ethics Board

C.8. Animal Ethics Communication of Approval



Animal Ethics Liaison

to Chris, me

Dec 3, 2020, 3:05 PM



Sent on behalf of the Chair, Animal Care Committee

Dear Dr. Darimont and Lauren Eckert,

We are pleased to inform you that your AUP application titled "**Defining Socioecological Predictors of Human-Wildlife Relationships: Human-bear coexistence and conflict in the Qateth Regional District**" has been approved and assigned protocol #2020-023. This protocol is valid effective December 3, 2020 and expires December 31, 2021.

Your approved protocol is attached and available on your [Connect Site](#).

Please note: two minor typos in section 14a of the AUP were corrected on behalf of the researchers ("lest", corrected to "left"; "check" corrected to "checked"); additionally, the HRE Approval # 20-076 was updated to the AUP.

One additional administrative comment: in the next iteration of the protocol, researchers may wish to consider the addition of a basic first aid kit to supplies mentioned in Section 17d.

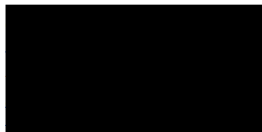
All the best with your study!

Many thanks,

Karin



Karin Johnston
Animal Ethics Liaison





Conflict and Coexistence in the Qathet Regional District: Understanding relationships between humans and black bears

You are invited to participate in a study entitled “Conflict and Coexistence in the Qathet Regional District: Understanding Social and Ecological predictors of outcomes between humans and black bears” that is being conducted by Lauren Eckert.

Lauren Eckert is a Ph.D. Student in the department of Geography at the University of Victoria and you may contact her if you have further questions by emailing [REDACTED]

As a Ph.D. student, I am required to conduct research as part of the requirements for a Doctoral Degree in Geography. It is being conducted under the supervision of Dr. Chris Darimont. You may contact my supervisor at [REDACTED]

Purpose and Objectives

The purpose of this research is to better understand the drivers of conflict between humans and black bears towards supporting coexistence opportunities and conflict resolution. This research strives to:

- 1) Create a tool to account for the complex social and ecological factors that result in human-wildlife conflict.
- 2) Use results of this research (e.g. information on what human and/or environmental characteristics lead to conflict, and where conflict is most likely to occur) to support local and provincial efforts to mitigate bear-human conflict towards coexistence.

Importance of this Research

Human-wildlife conflict is cited among the most critical threats facing modern wildlife management. Understanding which factors result in conflict in the qRD will identify where conflict is most likely to emerge or who is most likely to engage in conflict, and provide opportunities to better target community education surrounding wildlife (i.e. by matching education communication with individual values, or by identifying social-ecological locations where coexistence is most likely).

Participants Selection

You are being asked to participate in this study it is because the space surrounding your property was randomly selected during our early stages of spatial analysis. This spatial selection is based on the natural landscape surrounding your home and available data regarding conflict between black bears and humans has, or may, occur.

What is Involved

If you consent to voluntarily participate in this research, you consent to allow the principal researcher (Lauren Eckert) and her field assistant / volunteer (where applicable) to access your property to set up a camera trap (to capture images of wildlife, specifically black bears) and to check these camera traps regularly to ensure their functioning and check for animal (black bear) sign (e.g. hair or feces, etc.) near cameras (on a pre-determined schedule that you will be informed of ASAP). The principal researcher will use these images for research purposes and potentially for public outreach. All collected photos and data from your property will remain confidential, and we will strive to ensure the photos do not include any distinguishing features that would reveal that cameras were placed on your property (e.g. we will not share publicly any photos that include distinguishable structures, and will immediately delete any photos of persons or pets captured incidentally on wildlife cameras). Finally, you consent to follow all relevant COVID-19 safety protocols as they apply to this research (namely, social distancing from researchers and avoiding disturbing camera traps).

Inconvenience

Participation in this study may cause some inconvenience to you, namely because the researcher and potentially one assistant/volunteer will visit your property on a pre-determined schedule to check camera traps. We will also ask participants not to manipulate established camera traps during the duration of the study.

Risks

There are minimum known or anticipated risks to you by participating in this research. Namely, having a camera trap on your property may result in a limitation to your privacy during the study (e.g. because the research will be on your property for short periods of time and images of you or your pets may be incidentally captured). However, the researcher will identify exactly where the camera will be placed on the property and when researchers will be checking the camera to minimize any encroachment on your privacy. We will also immediately delete any images captured of you (or other people) and your pets.

Benefits

The potential benefits of your participation in this research include: opportunities for participants to learn more about the local wildlife and behavior of said wildlife in their backyard, access photos from their property, entry to win a \$100 Amazon Gift Card, the generation of research to help inform and potentially move towards mitigating conflict between humans and black-bears in the Province, and finally contribution to the state of knowledge regarding human-wildlife conflict and opportunities towards coexistence.

Compensation

As a way to compensate you for any inconvenience related to your participation, you will be entered into a drawing to win one of two \$100 Amazon Gift Cards.

Voluntary Participation

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study, the researcher and her assistant/volunteer (if applicable) will come to your property to remove the camera trap, and destroy any images associated with it after its removal if you so choose. Data from this camera trap will not be included in the study if you indicate that said data should be withdrawn. If you withdraw participation after data from the property has been analyzed or published, we will be unable to remove data from the camera trap on your property, but we will not use any images from your property in outreach. In no scenario will the participant be able to keep the wildlife camera – if the

participant withdraws from the project the camera will be removed from their property as quickly as is feasible. However, even if you withdraw from this study you will still be eligible for compensation through our Amazon Gift Card drawing.

On-going Consent

To make sure that you continue to consent to participate in this research, I will approach you again before removing camera traps or establishing camera traps in future seasons (e.g. in 2021). By consenting to participation in this research, you consent for data from this study to be used over the next several years (anonymously and to determine large scale trends) in analysis, publications, and outreach. In the future, the researcher (Lauren Eckert) may use the anonymous data for additional summary research on human-wildlife conflict.

Anonymity

Because we will need to contact you directly and seek your signed consent in participation in this study, your participation in this study will not be anonymous to researchers. However, all data regarding the camera on your property and surroundings will be stored anonymously (no names, addresses, or identifiable data will be connected to data derived from your property).

Confidentiality

Your confidentiality and the confidentiality of the data will be protected by carefully storing the data on Lauren Eckert's personal, password protected computer, on a password protected back-up external memory, and on the University of Victoria network storage (also password protected). No stored data will include names or contact information linked with the provided data, nor identifiable addresses or individually distinguishing characteristics.

Dissemination of Results

It is anticipated that the results of this study will be shared with others in the following ways: broad results will be personally shared with those study participants who expressed interest in being updated on results, results will be shared at public forums of interested stakeholder groups and the community, the principal applicant and collaborators will submit results to a peer-review journal for publication and will act as a party of the participant applicant's dissertation, and the principal applicant may share results at academic conferences and through broader public outreach opportunities (e.g. media publications, social media, local talks, education programs, etc.). This data will also be used in Lauren Eckert's doctoral dissertation. If images taken on your property (i.e. of black bears) are included in outreach or dissemination, any identifying data (i.e. geospatial data) will be removed or jittered. Finally, no photos will be shared that have any distinguishing characteristics (e.g. structures, pets, people, addresses, etc.).

Disposal of Data

Anonymous data from this study will not be disposed of and will be stored as described in the preceding "Confidentiality" section.

Contacts

Individuals that may be contacted regarding this study include the principal applicant (Lauren Eckert, the researcher) and the supervisor (Chris Darimont), and contact information is available for both at the beginning of page one of this document.

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria [REDACTED]
[REDACTED]

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this research project.

Name of Participant _____
Signature _____
Date

Visually Recorded Images/Data Participant or parent/guardian to provide initials, *only if you consent*:

- Photos may be taken of my property for: Analysis _____ Dissemination* _____

*We will not use any photos for dissemination that include identifying features on your property

Future Use of Data *PLEASE SELECT STATEMENT*:

I consent to the use of my data in future research: _____ (Participant to provide initials)

I **do not** consent to the use of my data in future research: _____ (Participant to provide initials)

I consent to be contacted in the event my data is requested for future research: _____
(Participant to provide initials)

A copy of this consent will be left with you, and a copy will be taken by the researcher.

C.10: Coefficient Estimates and Predictions, all top social-ecological models

Figure 1. (a,b) Parameter coefficients and (a) 95% and (b) 90% CIs for fixed effects of top model from our top model set including human density, household garbage, and risk perception. Red dots represent the magnitude of effect on probability of conflict, and red lines span 95% CI (a) or 90% CI (b). Probability of reported conflict as function of (c) human density, (d) household garbage, and (e) risk perception. Curves represent predictions from the model within our top models that contained all fixed effects within our top model set, with shaded regions represent model-averaged 95% prediction confidence.

Human density + Household garbage sum + Risk perception + individual

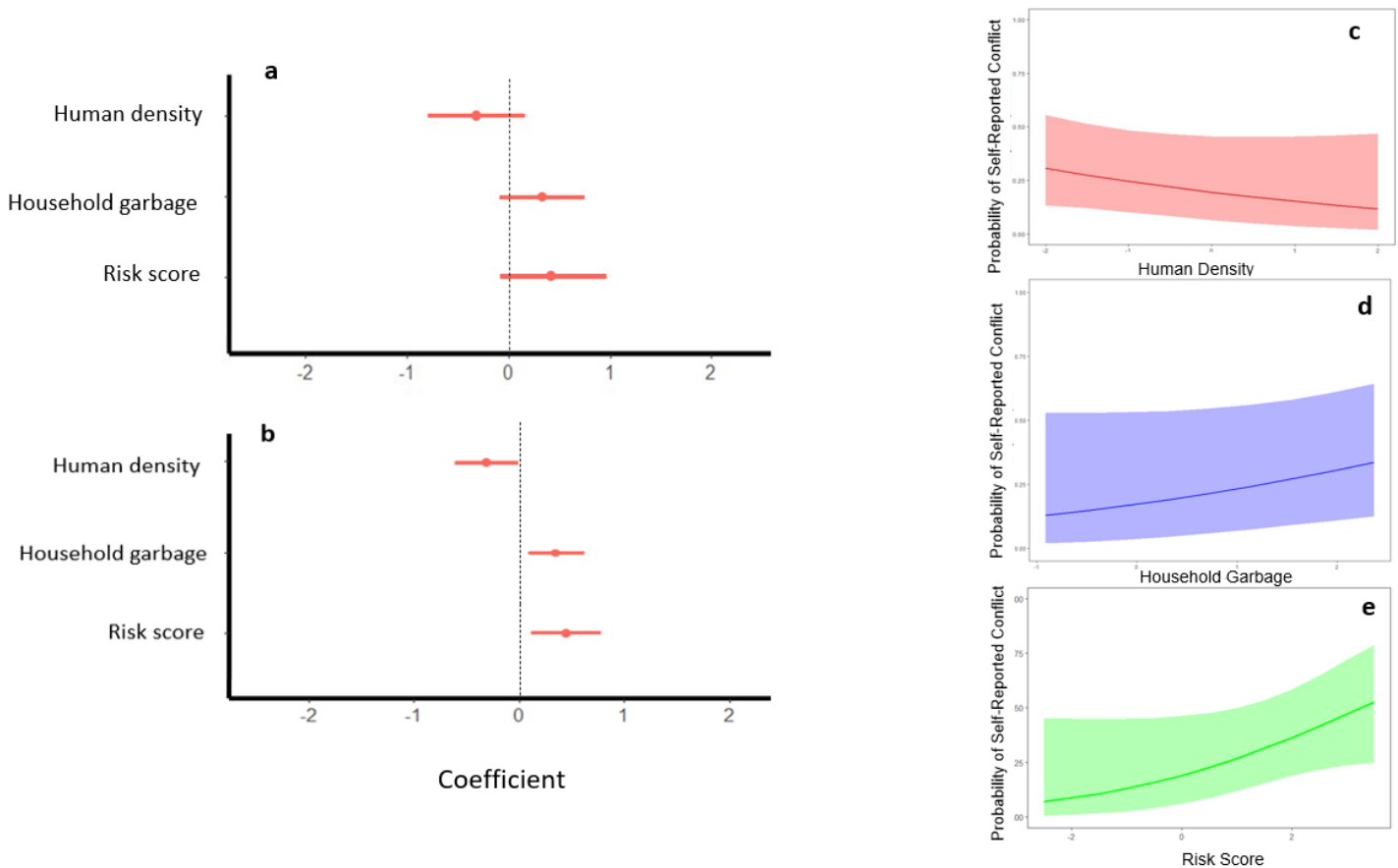


Figure 2. (a,b) Parameter coefficients and (a) 95% and (b) 90% CIs for fixed effects of top model from our top model set including human density, household garbage, risk perception, and an interaction term between risk score and household garbage. Red dots represent the magnitude of effect on probability of conflict, and red lines span 95% CI (a) or 90% CI (b). Probability of reported conflict as function of (c) human density, (d) household garbage, (e) risk perception, and (f) the interaction between household garbage and risk. Curves represent predictions from the model within our top models that contained all fixed effects within our top model set, with shaded regions represent model-averaged 95% prediction confidence.

Human density + Household garbage*Risk perception + Household garbage sum + Risk perception + individual

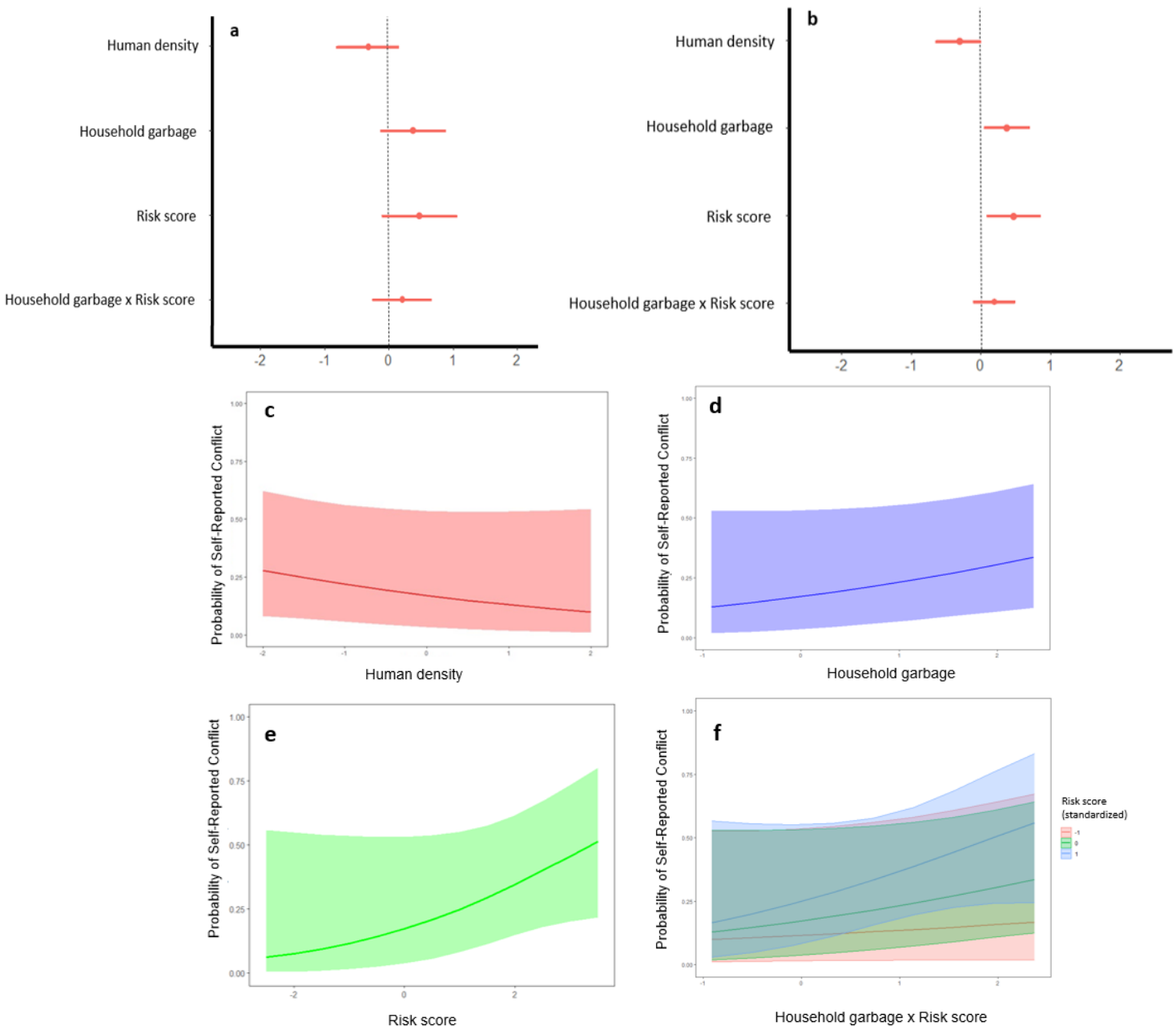


Figure 3. (a,b) Parameter coefficients and (a) 95% and (b) 90% CIs for fixed effects of top model from our top model set including household garbage and risk perception. Red dots represent the magnitude of effect on probability of conflict, and red lines span 95% CI (a) or 90% CI (b). Calculated RVI is presented for fixed effects. Probability of reported conflict as function of (c) household garbage and (d) risk perception. Curves represent predictions from the model within our top models that contained all fixed effects within our top model set, with shaded regions represent model-averaged 95% prediction confidence.

Household garbage sum + Risk perception + individual

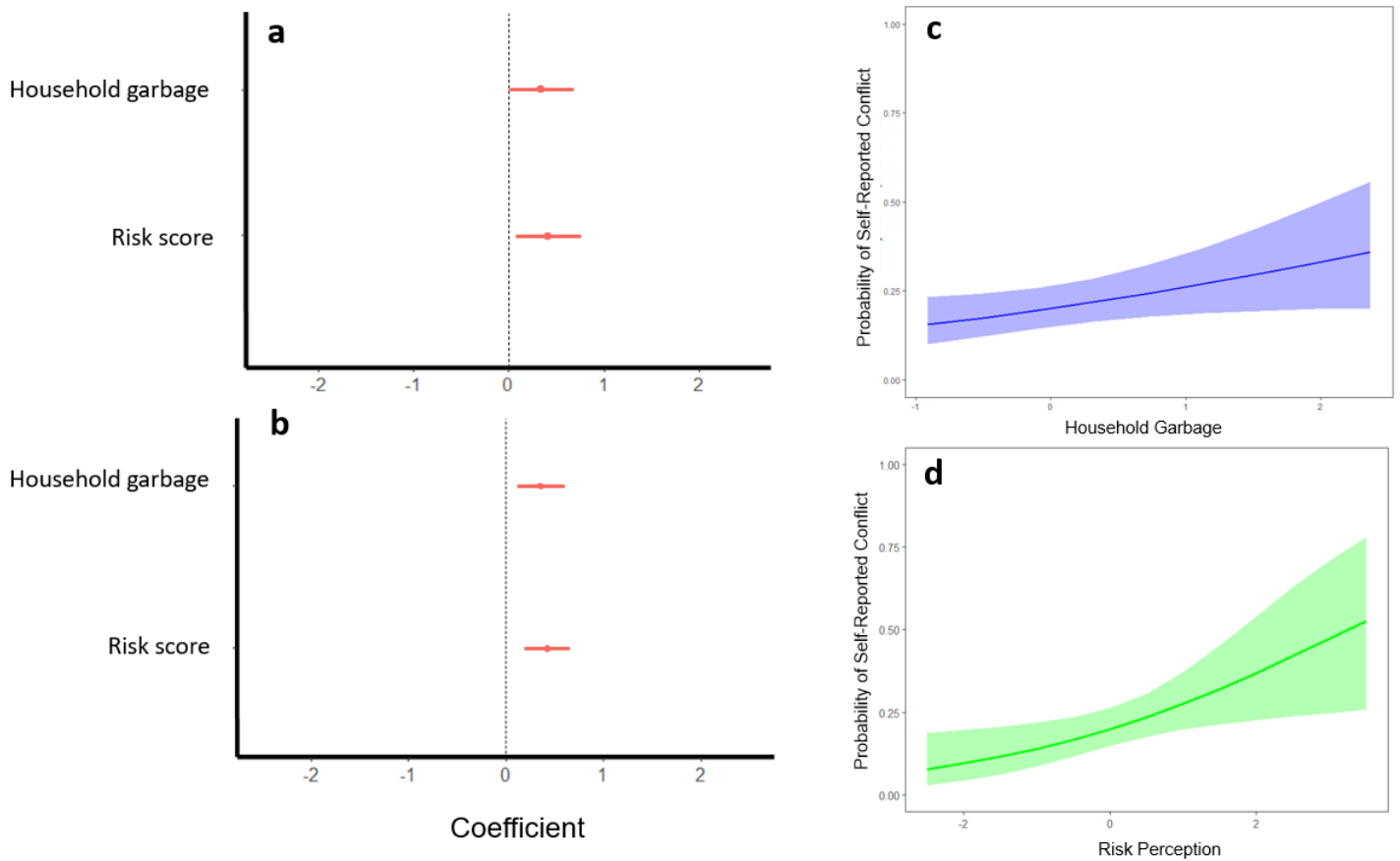


Figure 4. (a,b) Parameter coefficients and (a) 95% and (b) 90% CIs for fixed effects of top model from our top model set including household garbage, risk perception, and an interaction term between the two. Red dots represent the magnitude of effect on probability of conflict, and red lines span 95% CI (a) or 90% CI (b). Probability of reported conflict as function of (c) household garbage, (d) risk perception, and (e) the interaction term between household garbage and risk score. Curves represent predictions from the model within our top models that contained all fixed effects within our top model set, with shaded regions represent model-averaged 95% prediction confidence.

*Household garbage***Risk perception* + *Household garbage sum* + *Risk perception* + *individual*

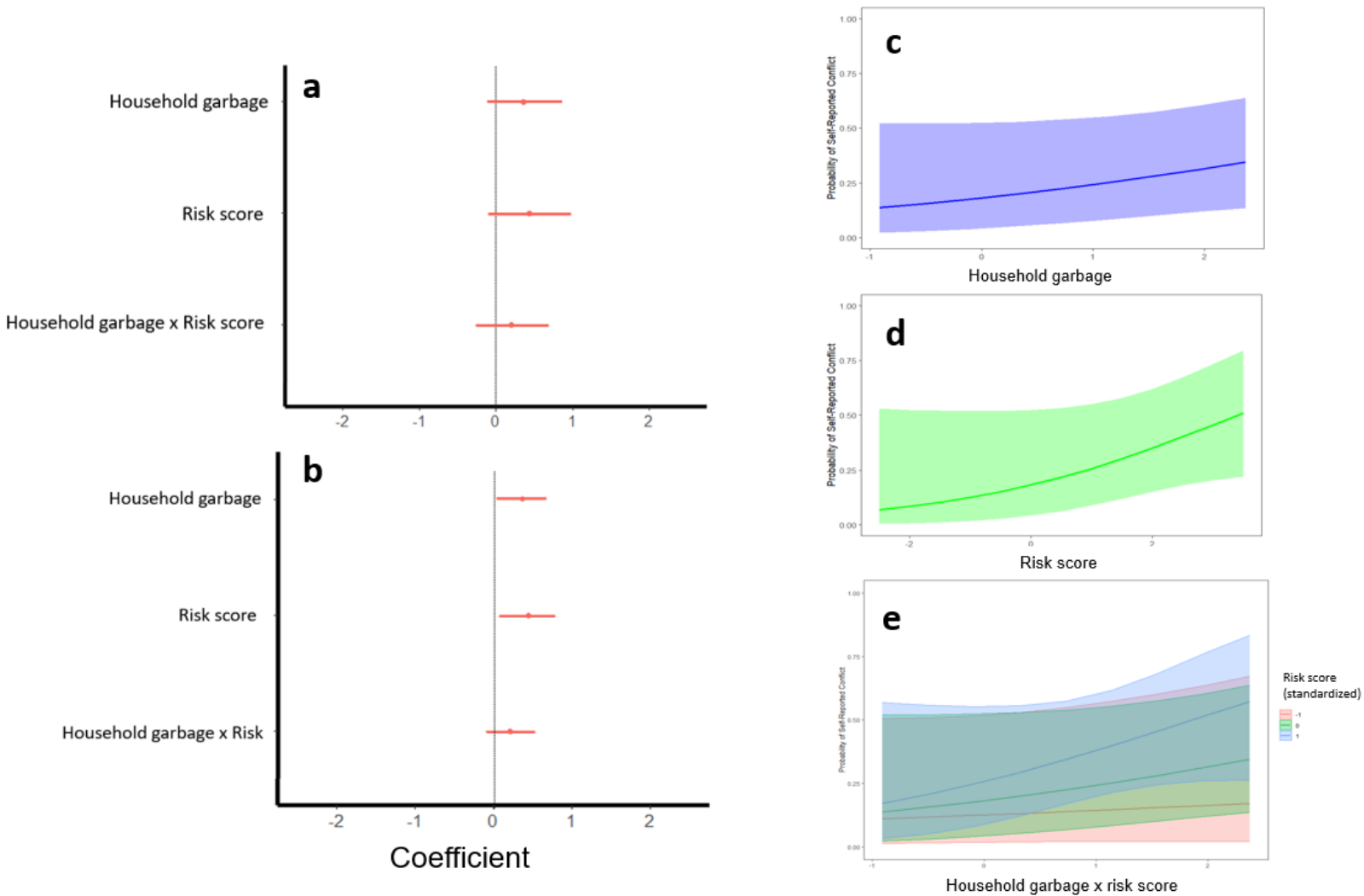
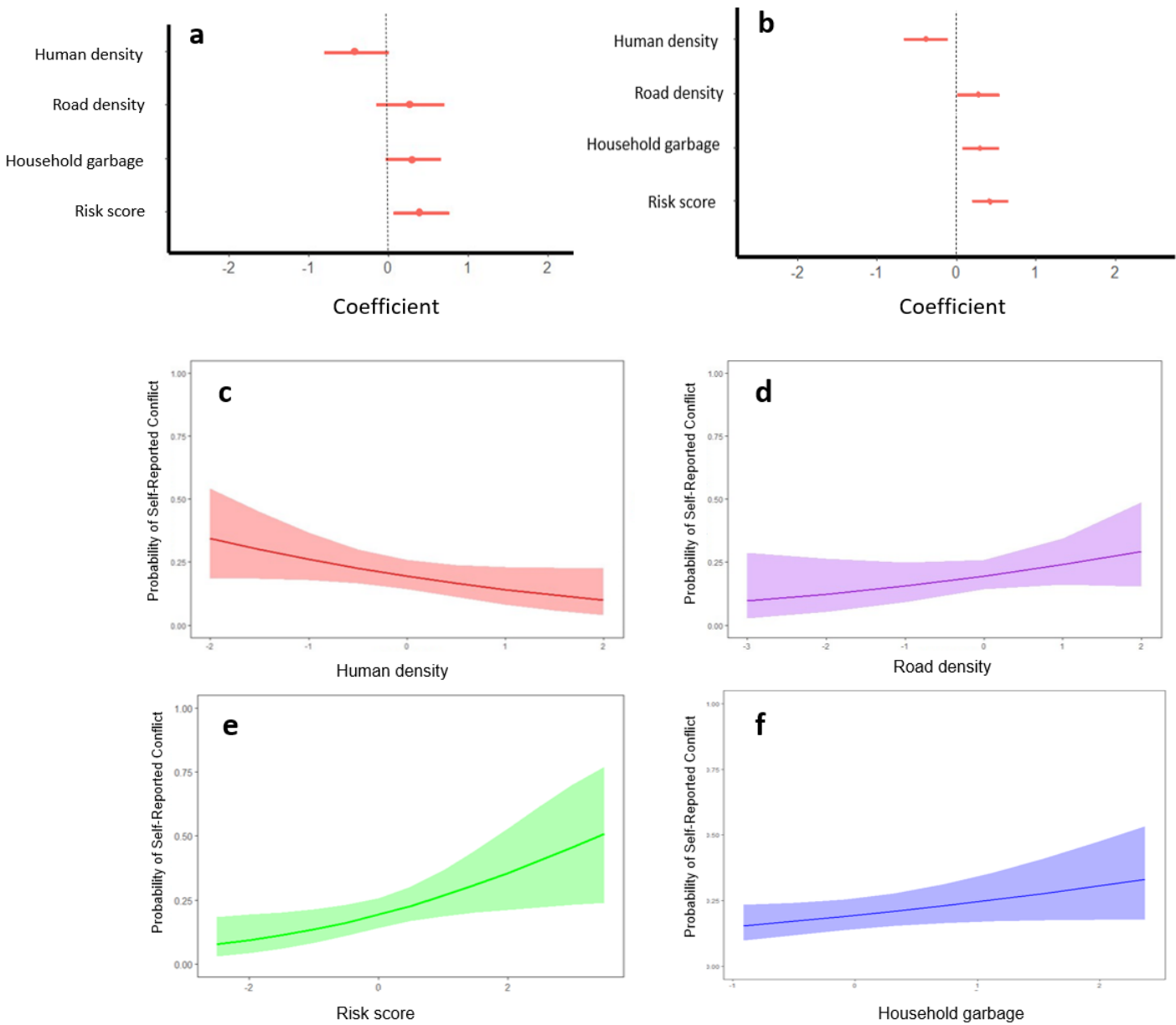


Figure 5. (a,b) Parameter coefficients and (a) 95% and (b) 90% CIs for fixed effects of top model from our top model set including human density, road density, household garbage, and risk perception. Red dots represent the magnitude of effect on probability of conflict, and red lines span 95% CI (a) or 90% CI (b). Probability of reported conflict as function of (c) human density, (d) road density, (e) household garbage and (f) risk perception. Curves represent predictions from the model within our top models that contained all fixed effects within our top model set, with shaded regions represent model-averaged 95% prediction confidence.

Human density + Road density + Household garbage sum + Risk perception + individual



C.11: Summary of Survey Responses

Survey Item	Percentage Response
Have you seen a black bear where you live?	
<i>Yes</i>	98%
<i>No</i>	2%
Have you ever reported a negative interaction with a bear to BCCOS?	
<i>Yes</i>	78.2%
<i>No</i>	21.8%
I am confident BCCOS will manage black bears and conflict in a way that is right for my community.	
<i>Strongly agree</i>	8.42%
<i>Agree</i>	34.7%
<i>Neither agree nor disagree</i>	36.6%
<i>Disagree</i>	14.4%
<i>Strongly disagree</i>	5.94%
In general, do you think of black bears as good or bad?	
<i>Extremely good</i>	36%
<i>Moderately good</i>	18%
<i>Slightly good</i>	6%
<i>Neither</i>	36%
<i>Slightly bad</i>	2%
<i>Moderately bad</i>	2%
<i>Extremely bad</i>	0%
In general, do you think of black bears as beneficial or harmful?	
<i>Extremely beneficial</i>	35%
<i>Moderately beneficial</i>	17%
<i>Slightly beneficial</i>	8%
<i>Neither</i>	30%
<i>Slightly harmful</i>	5%
<i>Moderately harmful</i>	3%
<i>Extremely harmful</i>	0%
In general, do you think of black bears as negative or positive?	
<i>Extremely positive</i>	35%
<i>Moderately positive</i>	25%
<i>Slightly positive</i>	9%
<i>Neither</i>	18%
<i>Slightly negative</i>	8%
<i>Moderately negative</i>	3%
<i>Extremely negative</i>	2%

Black bear populations in Powell River/Lund are:	
<i>Much too high</i>	3%
<i>Too high</i>	8%
<i>Slightly too high</i>	12%
<i>As they should be</i>	65%
<i>Slightly too low</i>	7%
<i>Too low</i>	4%
<i>Much too low</i>	1%
Number of Children in household:	median = 0 mean = 0.41 0-4 (range)
Income	
<i>Less than \$10,000</i>	0%
<i>\$10,000-\$29,999</i>	11%
<i>\$30,000-\$49,999</i>	21%
<i>\$50,000-\$69,999</i>	15%
<i>\$70,000-\$89,999</i>	12%
<i>\$90,000-\$109,999</i>	14%
<i>\$110,000-\$129,999</i>	5%
<i>\$130,000-\$149,999</i>	2%
<i>\$150,000 or more</i>	8%
<i>Prefer not to say</i>	11%
Years in Powell River/Lund	median = 23 mean = 27.3 0-80 (range)
Education	
<i>Less than high school</i>	3%
<i>High school or equivalent</i>	23%
<i>2-year degree</i>	33%
<i>4-year degree</i>	20%
<i>Advanced degree</i>	17%
<i>Did not say</i>	4%
Race (participants could select multiple)	
<i>White</i>	94%
<i>Indigenous</i>	1%
<i>Spanish, Hispanic, or Latinx</i>	0.05%
<i>Did not say</i>	6%

n = 202 survey respondents