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Exploring “Humane” Dimensions of Wildlife

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Peer-Reviewed Articles

Exploring “Humane” Dimensions of Wildlife

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The field of wildlife management has been on a collision course with human nature for some time, documented by the growing and important body of human dimensions of wildlife research. As the evolution of this field continues, a new dimension of “humane” considerations in wildlife management should be investigated. An exploratory online study of opinions about management decisions with 351 British Columbians of various wildlife engagement levels was conducted. Many participants were not willing to accept trading-off individual animals to protect populations, or killing other species to protect an endangered species, expressing both conservation and animal welfare rationales. Participants’ wildlife engagement level and utilitarian or protectionist values influenced how they perceived the acceptability of invasive monitoring and population reduction techniques. The application of animal welfare science to conservation can improve the humaneness of practices and in turn, will help managers communicate with the public and generate support for their programs.

Keywords animal welfare, humane, intervention, invasiveness, lethal control

Introduction

The field of human dimensions of wildlife has evolved over the past 30 years from studies of hunter satisfaction and recreation use enquires to a dynamic discourse between natural and social sciences. The focus is now on human values and behaviors regarding wildlife and the environment (Manfredo, 1989; Manfredo, Decker, & Duda, 1998). Human dimensions of wildlife parallels the science of animal welfare, which assesses quality of life issues related to animal suffering in use and management, and addresses ethical challenges raised by evolving social values. For example, public concerns about animal welfare are

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widespread in agriculture and animal research (Crettaz von Roten, 2009; Eurobarometer, 2007). Although often thought of as conceptually and politically distinct (Soulé, 1985), animal welfare and conservation share the goal of reducing harm to wildlife in the face of a common struggle: exponential human population growth and resource use (Fraser, 2010).

Human dimensions research has documented the recent shift from utilitarian values (which endorse human use and manipulation of wildlife) to a protection orientation (which endorses human protection and appreciation of wildlife) (Zinn, Manfredo, & Barro, 2002). Value orientations toward wildlife have been reframed in recent research to reflect the rise of a mutualism value orientation over one of domination (Manfredo, Teel, & Henry, 2009; Teel & Manfredo, 2009). The domination wildlife value orientation extends the utilitarian orientation to reflect an explicit hierarchy in which humans have mastery over wildlife. People holding this value orientation are more likely to be accepting of asserting total control over wildlife, including those actions that may result in the death of animals.

In contrast, the mutualism wildlife value orientation extends the protectionist orientation to reflect an egalitarian ideology in which the welfare of all beings is emphasized. People holding this value orientation are less likely to be accepting of actions that result in harm to wildlife, and may in fact view wildlife in anthropomorphic terms (Manfredo et al., 2009; Teel & Manfredo, 2009). The shift to a mutualism wildlife value orientation suggests that the role that “humane” dimensions play in wildlife management should also be investigated. “Humane” has been defined as the ethic of animal welfare, which seeks to promote animal health, prevent suffering, and allow animals to live in ways that suit their natural adaptations (Fraser, 2008).

Animal welfare value orientations also include protectionist and utilitarian values, and the interplay between conservation and welfare values may inform wildlife management decision-making. For example, across three studies of conservation values, those holding protectionist orientations were less willing to accept destroying an animal than were those with utilitarian orientations (Zinn, Manfredo, Vaske, & Wittmann, 1998). Additional knowledge about animal welfare could inform this process, as knowing how many animals would be killed, what methods would be used, and understanding the humaneness of alternatives (e.g., relocation) could influence public attitudes toward lethal interventions. Although it may not be possible to change value orientations shaped by broader conditions of society (Manfredo, Teel, & Bright, 2003), animal welfare considerations of management programs could influence attitudes on specific issues. This may be useful in guiding policy, program implementation, and public education.

We conducted an exploratory online survey of a wide cross-section of stakeholders about wildlife management in British Columbia (BC), Canada. Three wildlife management scenarios were used to prompt discussions about the “humane” dimension of such practices to explore demographic influences on decision-making. Based on past studies (Dougherty, Fulton, & Anderson, 2003; Heberlein & Ericsson, 2005; Koval & Mertig, 2004; Zinn & Pierce, 2002), we predicted that female and urban participants would be less likely to accept invasive or lethal interventions, while those with utilitarian values or a high level of experience with wildlife would be more likely to accept invasive or lethal practices.

Methods

Design

The Wildlife Values Survey was made available through the online engagement tool “YourViews,” which was designed as a platform for surveys that elicit attitudes about ethical issues in science and technology (Ahmad et al., 2006). All YourViews surveys

require a password-protected user profile to limit participation to once per survey; participants were not able to revisit or change their answers. The platform can implement several survey designs; one such approach provides a means of arriving at a social decision using “reason-based” questions (Danielson, 2011). Questions using this design are called “N-reasons”—“N” to indicate that reasons may express a social *norm*.

Recruitment

The recruitment strategy was designed to explore and compare the attitudes of BC residents who have an interest in wildlife issues. Recruitment was done in two waves so that two separate sets of responses could be generated for the same N-reason questions. The first wave (June 2010) targeted individuals with high levels of wildlife engagement, either as a paid professional (e.g., biologist, guide outfitter) or as a volunteer enthusiast (e.g., hunter, naturalist). Wave 1 recruitment included emails to available membership lists and directories of wildlife organizations, relevant professional groups and government departments. Further snowball recruitment was encouraged through email invitations to register on YourViews to other BC wildlife professionals and enthusiasts. Wave 2 (July 2010) targeted the general public with an interest in wildlife, but who generally had low engagement. Recruitment involved email solicitations in volunteer and membership e-newsletters of non-profit wildlife and animal welfare organizations and direct emails to participants of previous surveys.

Relevant stakeholders were approached first as they typically are familiar with the management scenarios and are often asked by government to provide input on management issues. Given the exploratory nature of this research and the lack of publicly available lists of BC wildlife professionals or enthusiasts, results may not be generalized beyond the samples. Our intent was to characterize a range of attitudes about wildlife welfare and to inform future surveys of these groups.

Questions

“N-reason” questioning asks participants to consider a scenario followed by a question, to which they respond by voting Yes/Neutral/No. In addition to their vote, participants must provide a reason or select an existing reason created by a previous respondent. As each reason was displayed by sequence authored (from most recent to earliest), all but the first participant had the option of selecting an existing reason. Each reason was also displayed with an updated percentage of its popularity among respondents. Participants had the option of splitting their vote among multiple reasons. Thus, analysis required quantitative summaries of voting tallies and qualitative assessment of each reason.

The first N-reason question had participants consider trading off individual animals to save their population. This scenario asked whether to cull individual bighorn sheep with a temporary, but infectious, eye disease that caused blindness, to protect others in the same population. Participants were told the disease was not fatal, but could cause deaths from affected animals falling from cliffs and could rapidly spread throughout the isolated population. Respondents indicated their level of agreement with the tradeoff to sacrifice individuals to save the population and their reason.

This concept was expanded in the second scenario as participants were asked whether they believed that interventions to protect one species justified the killing of another. The five part N-reason question (on separate Web pages) proposed management dilemmas between an endangered species and other species. The fate of the endangered Vancouver Island marmot would be affected by proposing changes to the number and species of

predators or game animals culled. Finally, to investigate perceptions on invasive management techniques, participants rated the level of acceptable harm to black bears. Using a five-point scale of “acceptability” plus an open comment box, participants rated harm caused by specific population monitoring and population reduction methods, which differed by degree of invasiveness.

Demographic Characteristics

Demographic information collected included: gender, age, urban/rural residency, wildlife experience level, wildlife interests, and organizational memberships. Wildlife engagement (“high” or “low”) was assigned to participants based on professional and volunteer activities, roles, and duration of activity (high = minimum three years for paid professionals or five years participation as a volunteer enthusiast). Wildlife use value orientation was assigned based on answers to wildlife activities and organizational support. Utilitarian individuals hunted or trapped and supported hunting and/or land preservation organizations, but did not support animal rights organizations. Neutral use individuals did not hunt or trap, and did not support animal welfare or animal rights organizations. Protectionist individuals did not hunt or trap but supported animal welfare and/or animal rights organizations.

Analysis

Proportional votes per reason were calculated so that each participant had only one vote, although it might have been split over many reasons. Inductive content analysis (Elo & Kyngäs, 2008) was used to identify themes in reasons during multiple iterations of text analysis. Quotes presented in results were selected as the best examples of the voting choice or as otherwise indicated. Means and standard errors of acceptability scores were calculated by demographic group, and *t*-tests or ANOVAs were conducted for group comparisons. Gender, residency, wildlife engagement, and wildlife use value orientation were independent variables used to assess the variation in the dependent variable acceptability. The Spearman rank-order correlation coefficients by each group pairing were also calculated.

Results

Participants

A total of 351 participants provided demographic information (Table 1) and answered the first question, while 341 completed the entire survey. Wave recruitment groupings were used to compare responses in N-reasons questions between Wave 1 and Wave 2. All responses, however, were pooled for comparisons about the ratings of management technique acceptability. With the exception of 16 participants, all were current residents of BC. We tested for differences between BC and non-BC residents’ mean acceptability scores by independent samples *t*-test and found only one significant difference ($p < .05$), as non-BC residents differed from BC residents only in responses to sterilization with no non-BC residents supporting sterilization.

N-Reasons: Intraspecies Tradeoffs—Population Versus Individual

Participants were asked to consider the killing of individual wild animals to save others within the same population. The majority of participants from both waves (69% and 71%,

Table 1
Participant demographic characteristics

	Wave 1 June 2010 (<i>n</i> = 116) Recruitment target high engagement	Wave 2 July 2010 (<i>n</i> = 235) Recruitment target low engagement	Overall June-July 2010 (<i>n</i> = 351) Waves combined
Wildlife engagement	High = 77% Low = 23%	High = 10% Low = 90%	High = 32% Low = 68%
Wildlife use value	Utilitarian = 35% Neutral use = 30% Protectionist = 35%	Utilitarian = 2% Neutral use = 16% Protectionist = 82%	Utilitarian = 13% Neutral use = 20% Protectionist = 67%
Gender	Female = 39% Male = 61%	Female = 83% Male = 15% No answer = 2%	Female = 68% Male = 30% No answer = 2%
Residency	Rural = 41% Urban = 59%	Rural = 27% Urban = 73%	Rural = 32% Urban = 68%
Age	19–29 = 8% 30–39 = 16% 40–49 = 17% 50–59 = 31% 60–above = 28%	19–29 = 18% 30–39 = 26% 40–49 = 18% 50–59 = 24% 60–above = 12% No answer = 2%	19–29 = 14% 30–39 = 22% 40–49 = 18% 50–59 = 27% 60–above = 17% No answer = 2%

respectively) voted No to culling any individuals (Table 2). Yes voting participants within Wave 1 (13%), the mostly “high engagement” group, tended to agree with this reason:

. . . the culling of the infected would likely be in the best interest of the overall herds health. . . . In reality, the answer is not a simple yes or no but one that should be carefully thought out. . . . Unfortunately today with current financial and manpower constrains within governmental wildlife management agencies I suspect the cheapest route would be taken rather than the appropriate one.

Wave 2 participants who voted Yes (4%) indicated that “It is better to cull a few than to lose them all.” Wave 1 participants who voted Neutral (18%) asked for more information about the scenario. Wave 2 Neutral voters (25%) also asked for more information about the disease and species, with almost one-quarter supporting this popular Neutral reason: “I agree with those who said there is not enough information provided to properly answer the question, but I don’t generally have a problem with the concept of ‘intervention’ where the risk is very high and there is a very high degree of ‘certainty’ that the ‘cure’ will be efficacious.”

Most Wave 1 participants that supported No reasons highlighted that the disease is natural and that nature should be left to take its course so a healthier population would result. One No reason in Wave 1 (3 votes) disagreed with this majority: “I think that the diseased sheep should be removed and treated, not killed.” In Wave 2, 60% of No voters

Table 2

Number of N-Reasons created and percent of Yes/Neutral/No votes by recruitment wave (majority high or low wildlife engagement) on proposed lethal control management strategies

N-Reason questions	Wave	% Yes votes and # reasons	% neutral votes and # reasons	% No votes and # reasons
Q1) An isolated bighorn sheep population is being monitored closely because it is experiencing an outbreak of a natural eye disease that is spreading gradually throughout the population. So far the few individuals with the disease are easy to identify as their eye infection quickly causes temporary blindness. Although the disease is not fatal, some of the sheep are dying from falling off the cliffs. If left alone, the disease could affect all individuals in this population. Should the affected individuals be culled?	1 (<i>n</i> = 116) Reasons = 19 2 (<i>n</i> = 235) Reasons = 30	13% 4 4%	18% 5 25%	69% 10 71%
Q2a) There is a proposal to cull wolves and cougars, up to ten individuals in total, in an effort to reduce predators during the initial re-establishment of the marmot population. Would this be acceptable?	1 (<i>n</i> = 115) Reasons = 20 2 (<i>n</i> = 233) Reasons = 31	25% 8 4%	26% 1 3%	49% 11 93%
Q2b) An alternative proposal recommends the culling of up to ten golden eagles to control marmot predators during their initial re-establishment. Would this be acceptable?	1 (<i>n</i> = 115) Reasons = 15 2 (<i>n</i> = 233) Reasons = 27	33% 6 2%	1% 1 3%	66% 8 95%
Q2c) Initial estimates of the impact of predators were too low. To address this, a new proposal has been made to cull over one hundred individual predators, wolves and cougars, in order to achieve low predator levels until viable re-establishment of the marmots is achieved. Would this be acceptable?	1 (<i>n</i> = 115) Reasons = 17 2 (<i>n</i> = 233) Reasons = 31	27% 7 1%	3% 1 6%	70% 9 93%

Q2d) An alternative strategy to address the under-estimation of predator impacts would be to increase the annual hunting quota of elk by 30%, which would result in several hundred game animals being killed. By reducing the elk population, fewer prey animals will be available for predators which could result in a decrease in the number of predators. This strategy assumes that the threat of wolf and cougar predation to marmots will also decline. Would this be acceptable?	1 (n = 111) Reasons = 16 2 (n = 230) Reasons = 32	3% 1 2% 3	1% 1 7% 5	96% 14 91% 25
Q2e) Local wildlife managers decided to implement a strategy that culls wolves and cougars, up to ten individuals in total. This program has been in place for one year and marmot re-establishment results are promising. However, a permanent annual cull of up to ten predators has been proposed in order to sustain low predator levels indefinitely. Would this be acceptable?	1 (n = 111) Reasons = 14 2 (n = 230) Reasons = 29	25% 8 1% 1	1% 1 3% 3	74% 5 96% 25

opposed the cull as they felt nature should be left alone to run its course. One third of these No voters suggested that intervention may be required if the species was endangered, or if the isolated population harboured unique genetic diversity. Almost 40% of all No votes in Wave 2, however, recommended some form of medical treatment or isolation for the affected sheep or management to prevent falls. Those opposed to the cull in Wave 2 believed there were alternatives and offered these two main rationales:

There are better, more humane ways, of intervening. Why not try to cure the illness instead of killing the animal?

If the herd is being monitored closely and the disease is “spreading gradually” then the individual animals should (according to the statement) be easily identified and therefore able to be treated without need of more drastic intervention like culling.

N-Reasons: Interspecies Tradeoffs—Killing Animals of One Species to Protect Another

To understand tradeoffs between the culling of different species, a five-part series of N-reasons questions was used. First, participants were asked to consider culling up to 10 predators (wolves and cougars) to protect endangered Vancouver Island marmots (Table 2). Only half of Wave 1 participants voted No, while 93% of Wave 2 participants opposed the cull. One quarter of votes from Wave 1 participants supported the cull and emphasized that due to the critical status of the marmots, healthy predator populations could be reduced if predation was a driving cause of marmot mortality. The most popular Yes reason suggested that it may not be the most publically acceptable action:

If wolf predation is a primary risk to this marmot species going extinct then culling wolf [sic] in a science based manner is acceptable. Although this may not be “publicly popular”; it is effective and ethical. . . . The ethical question is do you ignore the predation issue that is not publicly popular and allow a species to become extinct for evermore.

In Wave 2, the few Yes supporters (4%) suggested culling was necessary to restore balance as the marmots are the priority, with the most popular Yes reason being: “We made this mess by reducing the marmot population and threw the natural balance off, therefore, we have to try to restore that balance . . .”

Just over one-quarter of Wave 1 participants voted for the one Neutral reason, which suggested a cull was not sustainable if other measures to preserve the marmot population for the long-term were not undertaken:

The real issue is habitat loss. A predator cull, or predator exclusion may be necessary in the short term to re-establish the decimated marmot population but in the long-term habitat restoration and prevention of further logging close to VI marmot habitat is the only way to make a wild population of VI marmots truly self-sustaining. I have no ethical problem with a predator cull. . . . but feel that such a cull would be unethical in the absence of a clear plan to protect habitat . . .

Wave 2 Neutral participants (3%) emphasized the role of human interference: “One would have to consider the effects of culling the predators in order to keep the marmot alive. Could some predators be relocated? What should happen if fish were endangered? Would we start culling humans or should we just try to keep humans away from fish . . .?”

Almost half of Wave 1 participants opposed the predator cull. The most common issues raised were that a cull would be temporary, not address habitat loss, unfairly punish predators, and ignored alternatives (e.g., fences, colony stewards). Some suggested that we do not fully understand, nor can we control, the interactions between species or the consequences of a cull. A few suggested that efforts to save the marmots were a waste of resources and unnecessary: “We need a new paradigm for management of endangered species. Species go extinct, that is natural; causes of extinction (= human activities) need to be addressed. . . . In this case, culling predators seems too short term and unlikely to succeed.”

Most Wave 2 participants voted No; a majority suggested the cull may create another imbalance: “Killing the wolves and cougars may just create another imbalance. Continue to captive breed and re-introduce until the population stabilizes.”

Habitat issues and continuing captive breeding programs were emphasized in many Wave 2 No reasons. Yet some participants felt it was just wrong to cull because it was human interference that caused the original endangerment:

Simply because we shouldn’t kill one species at the expense of another, especially when it is the humans who have caused the problem in the first place. Only efforts that do not harm other species should be made, and focus should be on habitat reconstruction and human exclusion.

The second marmot question proposed an alternative predator cull, to instead kill up to 10 golden eagles (a protected but not endangered species). One-third of Wave 1 participants voted Yes, and although they recognized that habitat loss needed to be addressed, most believed the healthy eagle population would sustain the cull and that tough decisions have to be made:

Clearly habitat loss is the overarching issue, however at this point without predator reduction we run the risk of having these marmots only in zoos. At this point we need to ask ourselves the question: Is it better to have marmots with predator reduction even as a long-term solution or to have no wild marmots at all?

Two-thirds of Wave 1 participants voted No to the culling of golden eagles, most citing ecosystem tampering and the need for long-term habitat restoration:

This is a classic case of trying to correct an environmental problem by creating a new one. These predators are not new to the ecosystem and are not the cause of the decline in numbers—why should they now have to pay the price? And do we really think that killing more animals is a sustainable solution . . .?

The majority of votes in Wave 2 (95%) were for No responses. Opponents were concerned about ecosystem imbalance and lack of habitat, and supported solutions like captive breeding and non-lethal protection measures: “Killing/culling the eagles may well create

imbalances in other species. Continue to breed and re-introduce marmots till population stabilizes.”

Many No voters in Wave 2 thought the approach was short-sighted and some believed forsaking one species over another was not right: “Removing a territorial predator opens up the territory for another one. We can’t keep killing off species to protect other species. This is not sustainable.”

The third marmot question proposed increasing the cull of wolves and cougar from 10 to over 100. Yes and No votes again differed by wave, with Wave 1 resulting in over one-quarter of participants voting Yes, and only a few votes for one Neutral reason. These participants who voted in favor of culling over 100 predators felt the predator populations would recover and are not at risk like the marmots:

The goal is to save marmots, a species which occurs in only one spot in the world. Wolves, cougars and golden eagles as species are not at risk. . . . If we’re to deviate from science, I would suggest it would be prudent to examine the ethics and morality of allowing a species to disappear from the wild versus the ethics and morality of reducing populations of other species which are abundant

For Wave 2, only one Yes reason explained that healthy predator populations can sustain the cull and Neutral respondents asked for more information on the predator species status.

The majority of Wave 1 No voters (70%) explained their opposition to the increased cull in relation to the skewing of ecosystem dynamics with potentially unknown and far reaching consequences. Some also expressed this concern: “Where do we stop once we start the killing? When new predators move in to fill the void do we kill them too. . . . Still doesn’t guarantee the marmot re-introduction will be successful. It may still fail . . .”

A majority of Wave 2 respondents (93%) opposed an increased predator cull, as it did not address habitat loss, but they believed captive breeding and monitoring should continue. Overall, they indicated that culling does not fix problems, but creates new ones. Many Wave 2 participants expressed a moral concern that it is just not acceptable to cull predators when human actions caused the marmot decline:

The only intervention by humans that is ethically justified is restoring a wrong we have been responsible for. So, if the marmots are endangered because humans have caused habitat destruction, captive breeding to increase populations is an ethical solution. Causing further destruction to wildlife through culling predators to correct a wrong we have committed only makes our involvement more shameful.

The fourth marmot question proposed increasing hunting pressure on elk, which are also depredated by cougars and wolves. Generally both recruitment waves opposed this management option. In both waves, participants that voted Yes supported increased hunting of elk to restore a balance and Neutral reason supporters felt the idea was too convoluted to be predictable and could go either way.

Although the majority of Wave 1 participants supported No reasons (96%), there were two distinct groups: those that previously supported predator culls and those that opposed them. The former did not support primary prey reduction theory in principle and opposed

increasing elk hunting because high predation would continue as expressed by this popular reason: “This does not address the issue of high predation. Although reducing the elk population may reduce the wolf population it also poses increased risk that other species will be targeted or that the wolf in the area will simply change their hunting patterns and prey.”

The latter group in Wave 1 however, did not support increased hunting of elk, some because they felt the theory was misguided, but most because habitat loss was still unresolved and human interference continued to negatively impact others species, as explained in this reason: “The real cause, habitat destruction is still not being addressed. I echo others that ask,, why should one species suffer for another? WE are the problem not wolves or bears or eagles. Cull humans.”

The majority of votes in Wave 2 (91%) opposed increasing the elk hunt because it would again be too much human intervention or as was expressed in one reason: “This is the same interventionist management-by-death game with more dominoes and more assumptions.” The most popular Wave 2 reason opposed the increased elk hunt because one species was still being killed to protect another and they preferred non-lethal solutions:

The strategy is still to kill (whether through intentional culling or increased game-hunting) one species to protect another. If the intent is to increase the marmot population, then breed the marmots. . . . Unfortunately, while us humans usually have the best intentions, it seems we get sucked into a vicious cycle of species management. . . . at what point do we just let nature run its course? We should not be contributing to the decrease of animal populations through intentional killing.

The final marmot question extended the cull of ten animals (wolves and cougars) from a one-time to a permanent annual cull. Although the majority of both Wave 1 and 2 participants opposed the cull extension, the waves differed by vote percentages, 74% versus 96%, respectively. In Wave 1, one-quarter of votes supported Yes reasons but only 1% supported the one Neutral reason. The most popular Yes reason in Wave 1 explained: “Clearly there should be a long term management plan but until such a time that habitat can be restored you do what has to be done.”

The majority of Wave 1 participants opposed the extension, most selecting this No reason:

The problem here is habitat loss. . . . Ongoing culls of predators would perhaps allow marmot survival, though not in a truly viable and self-sustaining manner, without properly sustainable management of the surrounding habitat. This is not a useful outcome at all—it creates an ongoing cost, both financial and ethical, associated with the permanent cull. . . . The solution here is long term habitat protection, period.

The majority of Wave 2 opposition to the extension was because it would mean there would be a permanent intervention to balance the ecosystem, potentially creating more imbalance to other species, when it should be left to stabilize with the addition of captive bred marmots, as the most popular reason explains: “This assumes the local wildlife officials understand the balance/imbalance of ALL population levels. Continue to breed and re-introduce marmots and leave the other healthy populations alone.”

Overall, respondents believed that a permanent cull would cause more harm than good.

Acceptability of Wildlife Management Techniques

Participants were asked to score the level of acceptable harm on a scale of 1 (not acceptable) to 5 (completely acceptable). The least invasive monitoring practice, remote observations with motion-activated cameras was highly acceptable (average 4.4–4.8) across all demographic groups (Table 3). The acceptability of onsite field surveys to observe bears was also highly acceptable. The collection of DNA from hair removed by barbed wire, a non-invasive monitoring technique, was generally acceptable across participants, with “high engagement” participants rating it as more acceptable than their counterparts. Trapping, sedation and radio-collaring bears for monitoring was moderately acceptable among participant groups (average 3.0–4.0). Trapping, sedation and surgical implantation of a monitoring device was the least acceptable monitoring technique overall (average 2.1–2.9). Women, “low engagement” participants, and those with protectionist values were significantly less supportive of invasive monitoring techniques than their counterparts.

Participants were then asked, if all costs were equal, to indicate the acceptability of three population reduction methods based on harm to the bears. Overall, the option of trapping, sedation and relocation was moderately acceptability (average 2.3–3.4) among groups. Here, women, “low engagement” participants, and those with “protectionist” values were statistically more supportive of this option than their counterparts. Trapping, sedation, and sterilization was less acceptable than relocation as a population reduction method across all groups, but only significantly different between men and women.

Culling was the least acceptable option for population reduction and statistically significant for women, urban residents, “low engagement” participants and those with “neutral use” or “protectionist” values. “High engagement” and “utilitarian” participants believed culling to be more acceptable than relocation and sterilization; seven participants also suggested that increased hunting quotas could resolve the problem. However, three of their counterparts suggested there be a strict condition for any culling along these lines:

Culling would be acceptable if it is carried out by professional biologists and NOT hunters, as hunters often shoot what they see and don't discriminate between male, female, young or old. They also tend to shoot the biggest, healthiest ones, which goes against natural population control.

Assessing differences within demographic groups, Spearman rank-order correlation coefficients were calculated to determine how each ranked the acceptability of management techniques relative to their counterparts. The strength of concerns between women and men differed among invasive techniques, but women and men had a similar sequence of rating harms and thus the relative importance of concerns was significant ($r_s = .85$) (Table 3). Agreement in ranking sequence was also high overall for urban and rural participants ($r_s = .96$) and between those with “neutral” and “protectionist” values ($r_s = .97$). However, the greatest differences in both strength of concerns and relative importance of acceptability were seen between “low” and “high” engagement participants and those with “utilitarian” and “protectionist” values.

Table 3

Mean score and standard error of acceptable harm to bears on scale 1 to 5 (1 = Not acceptable; 2 = Slightly acceptable; 3 = Somewhat acceptable; 4 = Mostly acceptable; 5 = Completely acceptable) and Spearman rank-order correlation coefficient for demographic groups

	Gender		Residency			Wildlife engagement			Wildlife use value		
	Female <i>n</i> = 238	Male <i>n</i> = 107	Urban <i>n</i> = 238	Rural <i>n</i> = 112	Low <i>n</i> = 238	High <i>n</i> = 112	Utilitarian <i>n</i> = 46	Neutral <i>n</i> = 70	Protectionist <i>n</i> = 234		
Management activity											
Non-invasive monitoring techniques											
a) Remote observations with motion-activated cameras to photograph bears	4.7 ± .05	4.6 ± .09	4.8** ± .04	4.5** ± .10	4.7 ± .05	4.7 ± .08	4.4* ± .18	4.7* ± .09	4.7* ± .05		
b) Individuals conduct field surveys on site and visually search for the bears	4.1 ± .08	4.2 ± .11	4.2 ± .07	4.0 ± .13	4.1 ± .08	4.2 ± .11	4.1 ± .19	4.2 ± .14	4.1 ± .07		
c) Barbed wire is wrapped around natural rubbing trees; hair removed when bears rub and hair DNA tested to identify individuals	3.9** ± .10	4.3** ± .11	4.0 ± .09	4.0 ± .14	3.7** ± .10	4.6** ± .08	4.7** ± .10	4.0** ± .15	3.8** ± .10		
Invasive monitoring techniques											
d) Trap and sedate bears to radio-collar them; monitor signals emitted; radio-collars programmed to fall off a few months later	3.0** ± .09	3.7** ± .13	3.2 ± .09	3.2 ± .14	3.0** ± .09	3.6** ± .12	4.0** ± .17	3.3** ± 1.6	3.0** ± .09		
e) Trap, drug and surgically implant abdominal tracking devices into bears; implants emit monitoring signals for > 1 year	2.1** ± .10	2.9** ± .15	2.3 ± .10	2.5 ± .15	2.1** ± .10	2.8** ± .15	3.3** ± .24	2.4** ± .18	2.1** ± .10		

(Continued)

Table 3
(Continued)

	Gender		Residency		Wildlife engagement			Wildlife use value		
	Female <i>n</i> = 238	Male <i>n</i> = 107	Urban <i>n</i> = 238	Rural <i>n</i> = 112	Low <i>n</i> = 238	High <i>n</i> = 112	Utilitarian <i>n</i> = 46	Neutral <i>n</i> = 70	Protectionist <i>n</i> = 234	
Management activity										
Population reduction techniques										
f) Trap, drug, and relocate enough bears to another area to balance population	3.3** ± .09	2.9** ± .15	3.3 ± .09	3.0 ± .14	3.4** ± .09	2.7** ± .14	2.3** ± .19	2.9** ± .17	3.4** ± .09	
g) Trap, drug, and sterilize enough bears so population rates will drop	2.6* ± .10	2.3* ± .14	2.5 ± .10	2.5 ± .14	2.5 ± .10	2.5 ± .14	2.0 ± .20	2.6 ± .18	2.6 ± .10	
h) Cull enough bears to balance the population	1.7** ± .09	2.7** ± .16	1.9** ± .09	2.3** ± .16	1.6** ± .08	2.8** ± .16	3.8** ± .21	2.4** ± .19	1.5** ± .08	
Spearman rank-order correlation coefficient	<i>r_s</i> = .85*		<i>r_s</i> = .96*		<i>r_s</i> = .70		U-N <i>r_s</i> = .73*	N-P <i>r_s</i> = .97*	U-P <i>r_s</i> = .64	

* $p < .05$; ** $p < .01$.
($r_s = .72$ for $p < .05$, $n = 8$ two-tailed test).

Discussion

Wildlife management decisions in North America have traditionally been made by government experts, with limited input from the stakeholders that directly benefit from policies. As government agencies seek input from a greater diversity of stakeholders, the rise of public participation in environmental policy development (Reed, 2008) has translated into similar opportunities in wildlife management (Enck & Brown, 1996; Meuser, Harshaw, & Mooers, 2009).

The goal of this research was to connect wildlife managers to both quantitative and qualitative opinions of diverse BC stakeholders. Using this mixed-methods platform, we were able to ask participants not only if they supported or opposed decisions, but why, while they considered responses of other participants, which would not be possible in mail surveys. This led to more informative responses, as votes alone could be similar across different stakeholder groups, but the reasons behind the votes may differ vastly. This level of inquiry parallels more qualitative assessments of surveying diverse stakeholder groups (Tindall, 2001).

A Note on Survey Methods

Recency was used to display newly authored reasons. Concerns for primacy effects are minimal however, as past N-Reasons research tested the reliability of three groups answering the same question and found the groups came to the same social choice despite facing different sets of reasons (Danielson, 2010). Also, if recency was an issue, the first reasons observed (most recent authored) would have been selected most often by participants, which did not occur. We do not believe that displayed popularity scores deterred participants from reading all reasons or creating new ones, as new reasons were authored regularly throughout both waves.

Although the interactive online tool used was not a traditional survey sampling a known population, it was effective at comparing perspectives of wildlife professionals and enthusiasts with those of the general public, identifying issues, strength and relative importance of concerns, and differences in attitudes toward management practices. Strategic online engagement can target various groups of stakeholders to inform decisions or other participatory processes, and serve as one of many tools for wildlife managers who are under pressure to do more with less.

Intraspecies Tradeoffs

When asked to make tradeoffs to sacrifice individuals to save a population, most participants opposed a cull. Wave 1 participants opposed a cull because they felt nature should be left to run its course, leaving a stronger population. Although some Wave 2 participants discussed leaving nature alone, 40% believed the animals should be treated or isolated during the temporary outbreak to protect themselves and others. If we had only asked participants to vote Yes/Neutral/No without explaining their choice, we may have assumed the waves selected No for the same reason. Many participants in Wave 2 (mostly general public) did not want a cull, instead supporting interventions to provide humane care to the animals. This sentiment was almost non-existent in the wave of mostly wildlife professionals and enthusiasts. Whether or not this management alternative would be too impractical or costly, this difference should be noted.

Interspecies Tradeoffs

The proposed culling of predators to protect endangered animals met with mixed responses in Wave 1 (mostly wildlife professionals and enthusiasts), which debated when interventions to protect one species might justify the killing of another. Those that supported culling believed healthy predator populations were sustainable, and that such measures were warranted to protect endangered species. There was more support for a one-time small intervention (ten animals) than for a one-time large intervention (100 animals), or an extended intervention (ten animals annually). Changing predator species from cougars and wolves (hunted species) to golden eagles (protected species) negatively affected support levels in Wave 1.

The vast majority (90%) of Wave 2 (mostly the general public) consistently voted to oppose to culling predators to protect endangered species, no matter the number, predator species, or duration. Opposition in both survey waves cited various reasons for not supporting culling: habitat loss; imbalance of ecosystem; unknown consequences of changes; and the sense that the culls were only a temporary solution. Alternatives like captive breeding and non-lethal predator deterrents were supported. Wave 2 participants frequently raised moral concerns and indicated that culling was not appropriate because predators were not at fault, and it was unfair to kill to protect other species. This underscores the importance of reflecting on ethical issues in the social acceptability of management practices, independent of biological capacities, especially when interventions to protect one population propose the killing of other animals.

Wildlife Management Techniques

We predicted that female and urban participants would be less supportive of invasive or lethal interventions, while those with utilitarian values or a high level of experience with wildlife would be more supportive. Our findings agree with these predictions with the exception that urban or rural residency did not appear to influence acceptability of invasive practices, but only those that were lethal. The invasiveness of some management techniques may go too far in the minds of some wildlife stakeholders, often placing managers in the middle of a debate between conservation and animal welfare.

The acceptability of wildlife management techniques questions sought to identify a threshold for the acceptability of practices, and how the perception of certain techniques differed among demographic groups. Most participants believed non-invasive monitoring techniques such as remote cameras and field observations were highly acceptable. Non-invasive hair removal for DNA testing is well-established in wildlife management and was mostly acceptable to all demographic groups. Yet there is an obvious opportunity for public education to inform “low engagement” participants and those with “protectionist” values about the benefits and low impact of this practice, as they indicated that it was less acceptable than their counterparts.

Public education could also be used to explain the effects of relocation. Although relocation was generally acceptable, “high engagement” individuals and those with “utilitarian” values were less supportive; the low success rate and negative impacts on relocated animals were discussed by these participants who were familiar with the practice. However, the general public is often unaware that relocation can be inhumane and ineffective for some species (Massei, Quay, Gurney, & Cowan, 2010) and communicating this in management recommendations is important. Radio-collaring was generally acceptable to all, whereas monitoring with implants was only slightly acceptable. As the

least acceptable monitoring technique, practicality and invasiveness of implants were concerns.

In terms of population reduction, surgical sterilization was only slightly acceptable across groups. Although not common, it is often suggested by the public as an alternative to culling (Lauber & Knuth, 2007). However, participants believed that the technique takes too long to be effective, it is expensive, there are unknown behavioral consequences, and that it is highly invasive. Vaccination sterilization programs may have received different support, but were not proposed as techniques in this survey, as they are currently used very rarely in BC. Relocation was more acceptable than surgical sterilization for all participants. The humaneness of these interventions should be outlined when fully considering such options and presented as criteria for the public to consider.

Culling acceptability varied strongly across demographic groups. As traditional wildlife surveys are often gender-biased toward men (Jacobson, Brown, & Scheufele, 2007), women’s attitudes toward culling could be under-represented without broader public consultation. However, differences in the acceptability of management practices were greatest between those with different levels of wildlife engagement and among those with different values on wildlife use, as they varied in strength and relative importance of concern. Wildlife policy and practices are generally developed by “highly engaged” biologists and managers with stakeholder input from “utilitarian” groups like hunting organizations. Consequently, there is a mismatch between public perception and acceptability of practices and actual practices that needs to be addressed with broader public consultation, and inclusion of “humane” dimensions to reduce the impact of an impending collision between human nature and wildlife management.

Fostering “Humane” Dimensions Research

Based on the survey responses, there are generally two reasons people oppose invasive and lethal wildlife management strategies. The first is the perceived necessity for managing or killing wild animals. If for population management, nuisance or disease control, sport, trophy, fur, or sustenance, support or opposition will reflect attitudes based on individuals’ wildlife use and animal welfare values. These are enduring values unlikely to change with an assessment of the humaneness of practices.

Context is the second consideration: the method, duration, number of animals and degree of harm experienced (Kirkwood, Sainsbury, & Bennett, 1994), could benefit from “humane” dimensions research. Exploring the “humane” dimensions of wildlife management (i.e., management that explicitly promotes animal health and prevents suffering, and seeks solutions that permit animals to exist in environments that suit their natural adaptations) has the potential to improve the welfare of conservation practices (Walker, Mellish, & Weary, 2010) while maintaining their scientific integrity (Darimont, Reimchen, Bryan, & Paquet, 2008). Although more such research is needed to show how reducing animal suffering and invasive practices can positively impact management efforts, the acceptance of animal welfare science by conservation managers and practitioners is also required.

Understanding animal welfare value positions and addressing concerns of humaneness within the management context may influence attitudes toward conservation practices, and help managers better communicate with the public and generate support for their programs. Although generating public support may be one benefit of including welfare considerations in wildlife management, another goal of wildlife managers should be to reduce potential harm and suffering of individual wild animals to improve research (e.g., more reliable data

if animals are not injured or impaired when tagged for monitoring). Lethal control and invasive techniques will continue to be used to serve broad conservation goals and may always cause public debate, but ensuring the humane treatment of wildlife as defined by animal welfare science is an important dimension to add to the dynamic field of human dimensions of wildlife.

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