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Wildlife conservation:
The importance of individual personality traits and sentience

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Abstract: Individual differences in personality types within the same species have been studied much less than differences between species and populations. Personality differences are related to risk-taking and exploration, which in turn correlate with individuals' daily responses, decisions, and fitness. Bold and shy personality types can have different advantages and disadvantages under different social or environmental pressures. Analyzing personality differences has helped clarify how elk habituate to a well-populated area and how management strategies can be adapted to them. For wolves newly repatriated to Colorado, individual personality factors are likely to prove important for adapting to their new homes as well as to the needs of the people cohabiting them. Animal and human factors need to be investigated jointly for the long-term success of conservation initiatives.

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1. Introduction

The study of individual personalities in wildlife is becoming recognized as an important tool in conservation research, adding to a better understanding of how individual behavior varies with environmental conditions and social contexts (Blumstein & Fernández-Juricic, 2010; Dingemanse et al., 2010; Fudali & Pietrzak, 2024). Personality is usually defined as individual differences in behavior that are consistent across contexts and time (MacKinlay & Shaw, 2022; Réale et al., 2007; Smith & Blumstein, 2008). The research concerns the way animals handle novel situations, space, risks, and interactions with other individuals (Hunter et al., 2022) and how these factors influence population dynamics (Anthony & Blumstein, 2000; Merrick & Koprowski, 2017; Sih et al., 2012).

Within-species differences in wildlife personality (Sloan Wilson et al., 1994) have been found to influence interactions in ecosystems and across species (Gosling, 2001; Esattore et al., 2024) in domains such as evolution, conservation (Blumstein & Fernández-Juricic, 2010), predator/prey dynamics (Réale & Festa-Bianchet, 2003), food acquisition, social interactions, habitat use (Hunter et al., 2022), fitness (Smith & Blumstein, 2008), migration (Found, & St. Clair, 2016), foraging (Toscano et al., 2016), movement patterns (Speigel et al., 2017), species reintroduction (Myers, 2016), reciprocity in relationships (Found, 2017), as well as longevity and the survival of reintroduced individuals (Bremmer-Harrison et al., 2004, Hertel et al., 2019).

This research concerns wildlife in their natural habitats as well as urban animals. Climate change, wildfires, and urban expansion, along with industrial development, contribute to habitat loss and fragmentation. Human encroachment on natural habitats results in a greater prevalence of wildlife in urban areas, hence increased human-wildlife interaction (Hodgson et al., 2020). To understand this interaction, individual personality (Adolphs & Xu, 2024) has to be taken into account, together with animals' strategies for adapting to dynamic urban and natural areas and a changing climate (Bombieri et al., 2021; Brooks et al., 2020; Robertson, 2018; Wat, 2019).

According to the principle of "compassionate conservation" (Bekoff, 2024a; Ferraro et al., 2023), wild animals have intrinsic value: "individuals matter." The well-being of individual animals depends on the success of conservation efforts; hence understanding their individual personalities is an important component of wildlife research.

2. Individual Wildlife Personalities and Animal Sentience

Studying wildlife personality in the framework of compassionate conservation must be grounded in the understanding that animals are individual sentient beings, with subjective experiences and emotions that govern complex behaviors. These behaviors include the way they respond to environmental conditions and the nature of their social relationships with one another as well as with human beings (Bradshaw, 2017; Ferraro et al., 2023). For sustainable success, the goals of conservation must be aligned with the intrinsic value of individual wildlife (Fudali & Pietrzak, 2024); otherwise they can lead to unethical management practices and needless invasive research (Wallach et al., 2018).

Despite the wealth of knowledge about animal emotions and cognitive capacities, many conservation practices persistently ignore animal sentience (Bekoff & Pierce, 2017). In a review of 190 studies of wildlife conservation and management strategies, Edelblutte et al. (2023) identified three underlying assumptions:

"[1] animal behaviors are rigid and homogeneous;

[2] wildlife exhibit idealized wild behavior and prefer pristine habitats; and

[3] human–wildlife relationships are of marginal or secondary importance relative to nonhuman interactions."

The failure to take into account animals' emotional and mental capacities, individuality, learning, decision-making, sociality, and relationships with humans leads to significant biases in scientific research (Biro & Dingemanse, 2009). This becomes particularly apparent in the impact on animals of traumatic events such as culling or relocation, which can induce enduring psychophysiological changes in their brain and behavior. Demonstrating the depth of their emotional experiences and capacity for suffering, African elephants (Bradshaw et al., 2005), as well as other species such as orcas (Marino et al., 2020) and bears (Narayan et al, 2018), exhibit symptoms reminiscent of human PTSD, including hyper-aggression, asocial behavior, and depression. These emotional states affect their behavioral responses to humans and other species.

The success of translocation projects can also be influenced by variations in individual personalities and behavior. For example, the initial translocations of kangaroo rats failed because the conservation efforts did not consider the social bonds and emotional connections among individual rats (Greggor et al., 2016). Animal behaviors are not homogeneous; rather, they reflect the array of individual behavioral variations that are shaped by distinct experiences and emotional responses of each animal. Edelblutte et al. (2023) stress the intrinsic value of individuals and advocate recognizing wild animals as active participants in wildlife management and conservation practices. They define agency as "the ability of animals to actively influence conservation and management outcomes through their adaptative, context-specific, and complex behaviors that are predicted on their sentience, individuality, lived experiences, cognition, sociality, and cultures in ways that shape and reshape shared human-wildlife cultures, spaces and histories."

3. Personality Traits

Wildlife personality, or temperament, has several different categories: primarily shyness-boldness, exploration-avoidance, and activity (Carter et al., 2013; Gosling, 2001; Merrick & Koprowski, 2017; Réale et al., 2007; Sloan Wilson et al., 1994). We will focus on the shy/bold (S/B) dimension, one of the first and most thoroughly studied measures of animal personality so far (Cabrera et al., 2021). S/B is correlated with specific behaviors (Found & St. Clair, 2016}. Bold individuals are more exploratory, take more risks, and show more assertive or dynamic behaviors, whereas shy individuals explore less, take fewer risks, and display more sociability. Understanding where individuals fall on this dimension can provide insights into their behavior and the choices they make in their environment.

S/B is measured by individuals' response to novel environments, objects or sounds, their acceptance of predation risk, their flight response and vigilance, and their movement within an ecosystem (Stamps, 2007; Bombieri et al., 2021). In elk (*Cervus Canadensis),* boldness is correlated with suspending migration and maintaining year-round residency, greater behavioral flexibility, and rapid habituation to human presence (Found & St. Clair, 2017). In brown bears (*Ursus arctos),* boldness is correlated with increased daytime activity in open areas, less avoidance of people, longer travel distances, and variability in movement patterns and foraging (Hertel et al., 2019; Hertel et al., 2021). Across species, boldness can also be associated with faster growth, greater dispersal distances, and increased reproductive success, but with shorter male life spans (Cote et al., 2010; Smith & Blumstein, 2008). Finally, boldness has been found to influence prey selection and individual hunting behavior in predator-prey interactions (McGhee et al., 2013; Pruit et al., 2012; Sweeney et al., 2013).

On the other end of the B/S spectrum are the opposite traits. Shy elk keep migrating rather than adopting year-round residency in locations where habituation occurs between elk and humans.

In brown bears, shyness is linked to less variability in movement patterns and foraging as well as increased nocturnal activity to avoid human areas (Bombieri et al., 2021). Across species, shy individuals have reduced reproductive success but tend to have increased life spans as well as greater sensitivity to predation, resulting in lower risks of predation (Réale & Festa-Bianchet, 2003; Toscano et al., 2016). They also prefer fewer open habitats during the daytime (Bonnot, 2015), their dispersal distances are smaller (Cote et al., 2010), and their flight distances are greater (Found & St. Clair, 2018; Réale et al., 2007; Shih et al., 2004), with a decreased likelihood of engaging in human-wildlife interactions. Shy personalities are also less flexible and innovative in responding to changing human stimuli, along with reduced problem-solving ability in urban areas (Brooks et al., 2020; Robertson, 2018; Wat, 2019).

4. Personality in Captive Populations

4.1 Captive Populations. Research on individual personality in wildlife has focused primarily on captive populations (MacKinlay & Shaw, 2022; Myers, 2016; Parsons et al., 2022; Pruitt et al., 2012; Sweeney et al., 2013) to be able to observe the same animals more easily while controlling or isolating specific variables (Archard & Braithwaite, 2010; Parsons et al., 2022). The behavior of individuals in temporary captive environments has been compared with their behavior once they are back in their natural environments (Boon et al., 2008; Dingemanse et al., 2003). Personality assessments in captivity were found to be accurate predictors of behavior in natural environments.

Studying captive populations has limitations. Being taken into captivity causes significant stressors such as trapping injuries, weight loss, disease, and reproductive depression (Teixeira et al., 2007). Captivity also impedes normal movement, induces frustration, and leads to stereotypic behavioral patterns as surrogates for natural behavior patterns. These stereotypies are an indication of the malfunction of various brain regions and also alter the central nervous system (Mason & Rushen, 2008). Conducting experiments in captive settings also requires modifications to simulate conditions encountered in the wild that may not reflect real life situations accurately (Bekoff, 2013).

4.2 Stress and Bias. Invasive techniques used to capture sentient beings can have profound psychophysiological effects. For example, the effects of capture and collar deployment were shown to cause a significant elevation in stress hormones within the first 24 hours post-capture in kangaroos (*Macropus genus*) (Herbert et al., 2020) and kangaroo rats (*Dipodomys stephensi*) (Baker, 2014). The stressors associated with trapping can also change behavior patterns and movement. These changes have been observed to last from two days in the case of the Alpine ibex (*Capra ibex*) to as long as 36 days in black bears (*Ursus americanus*) (Brivio et al., 2017; Cattet et al., 2008;). Such changes could have significant impacts on reproduction and long-term survival (Brogi et al., 2019; Proulx et al., 2020) and the physiological and behavioral outcomes of offspring (Wassink et al., 2020). Recognizing the potential ramifications of stress from capture is not only vital for the ethical treatment of animals but also for obtaining accurate and meaningful research outcomes (Bekoff, 2023; Wallach, 2018).

Research results may also be influenced by the unique personalities of the wildlife being studied. Individuals who are bolder, more inquisitive, and less risk-averse (Archard & Braithwaite, 2010; Biro & Dingemanse, 2009; Carter et al., 2012) are the ones who are most likely to be trapped. This bias was first noticed by Wilson et al. (1993) who found that bold pumpkinseed sunfish (*Lepomis gibbosus*) were captured more frequently than shy pumpkinseed sunfish, and some shy fish could never be captured. This effect has since been observed in many other species. When studying the Namibian rock agama (*Agama planiceps*), Carter et al. (2011) too found that bold individuals were much easier to trap than shy individuals, hence shy personalities are consistently underrepresented. Methods for assessing personality in the field are accordingly needed, otherwise random sampling of captive populations is not truly random. Statistical analyses will only be reliable if such biases are minimized or their impact is measured and taken into account.

5. Personality in Wild Populations

5.1 Wild Populations. Although studying wild populations in their habitat can be challenging (e.g., because of the logistics and time required to find and monitor individuals) (Archard & Braithwaite, 2010), the benefits are considerable. Field research helps connect theoretical research with the practical needs of wildlife management (Bell et al., 2009; Caro & Sherman, 2013; Dingemanse & Wright, 2020). Understanding the effectiveness of wildlife corridors in mitigating the deadly effects of road barriers while promoting safe movement and migration relies on the research and monitoring of individuals in their natural habitats (Soanes et al., 2024). Studying the responses of individual coyotes in urban neighborhoods using non-lethal aversive conditioning is essential to reducing unhealthy human-wildlife conflict and can only be accomplished through research on wild populations (Breck et al., 2016). Studying adaptations to climate change is one of the most current and pressing issues today, and it too is most effectively conducted on wild populations (Greggor et al., 2016).

5.2 Techniques for Studying Wild Populations. Personality analysis in wild populations should minimize not only sample bias but invasive research (Hertel et al., 2019). There are links between personality traits, dispersal and hunting strategies in large carnivores such as brown bears and wolves (Bump et al., 2022; Cote et al., 2010; Spiegel et al. 2017). The advances in GPS technology can also be used to track smaller species with sensors such as thermometers and accelerometers. These provide a detailed level of accuracy and the statistical means to analyze fine movement, diurnality, and habitat selection ([Internet of Animals](#)). Noninvasive research techniques also include biotelemetry which is being used to assess the personalities of Atlantic Cod (*Gadus morhua)* and Lemon Sharks (*Negaprion brevirostris)* in aquatic ecosystems (Finger et al., 2016; Villegas-Ríos et al., 2017).

Camera traps have also been used for analyzing the personalities of coyotes (*Canis latrans*) in urban areas. Collecting hair samples can provide information about the links between personality and diet in elk (Ogden, 2012; Brooks et al., 2020). Biologging data is being used to detect individual variation in the predictability of movement, foraging behaviors, and individual parental specialization in brown bears (Hertel et al., 2020; Hertel et al., 2023), and automated facial recognition software has already been successfully applied to identifying individual bears without physically tagging them (Clapham et al., 2020).

6. Personality and Species Reintroductions

Species reintroductions (also called repatriations) are frequently used to strengthen animal populations as well as to counter the threat of animal extinctions (de Azevedo & Young, 2021). Reintroductions involve countless complexities; their success is determined by survival rates that lead to stable growth and viable populations of the threatened species (Colas et al., 2015). Understanding how animals respond to the stress of a new and unfamiliar environment or how they navigate predation risks in a new habitat is crucial in assessing the long-term success of reintroduction programs.

Research conducted by Bremner-Harrison et al. (2004) shows how personalities affect survival rates in captive-bred swift foxes (*Vulpes velox*). Bold individuals, identified through their reactions to novel stimuli after leaving the den, exhibited behaviors consistent with less fear. However, these bolder individuals also have lower survival rates six months after reintroduction compared to shy individuals. These findings also confirm that shy and risk-averse animals who explore their environment with greater caution are less prone to predation. Bolder or more assertive

individuals may reproduce and repopulate new areas more successfully than shy individuals, but their vulnerability to predation counters their suitability for reintroduction.

It is important, however, to avoid generalizations about the most suitable personality type for reintroduction without careful prior research and analysis. Exceptions such as Blanding's turtles (*Emydoidea blandingii*) and Blue-fronted parrots (*Amazona aestiva*) can go against generalizations. In the reintroduction of zoo-hatched Blanding's turtles, researchers found that survival was correlated with exploratory behavior and not boldness (Allard et al., 2019). In contrast, the reintroduction of Blue-fronted parrots revealed no differences in survival between bold and shy individuals. Shy individuals were recommended for release first as they showed a greater capacity to establish lasting social relationships, thus enabling reintroduced individuals to learn from experienced individuals in the environment (Lopes et al., 2017).

Both shy and bold personality traits are crucial for healthy populations and involve important tradeoffs. In European mink (*Mustela lutreola*) reintroductions in 2012 and 2013 (Haage et al., 2017), captive mink personalities were analyzed for boldness, sociability, and exploration by testing individual reactions to potentially risky novel stimuli using: (1) a mirror in the enclosure to assess reactions to other mink in a home range, (2) a novel-environment test, and (3) a mirror placed in the novel environment to test for reactions to other mink from outside a home range. Survival was positively correlated with boldness in both years of study. However, exploration had a negative effect on survival in the first year of the study and a positive effect in the second year, suggesting that there is a more complex relationship among boldness, exploration, and survival. Both bold and shy individuals may be needed for stable populations, but in a reintroduced species, the optimal ratio may differ across species and across environmental conditions (de Azevedo & Young, 2021).

6.1 Captive Breeding Programs. Species reintroductions are conservation efforts that often depend on successful captive breeding programs facilitated by zoos, aquariums, or other collections (Moloney et al., 2023). Captivity and husbandry can introduce strong selective pressures on heritable traits such as personality and temperament, resulting in contemporary evolution within breeding programs designed for conservation (Ashley et al., 2003; McDougall et al., 2006; Stockwell et al., 2003). The inadvertent selective pressures in captivity can be quite different from those of natural selection in native habitats. Examples of these differences include a release from predation pressure, more frequent disturbance by humans, medical treatment with less need to rely on the immune system, and less requisite time for foraging (Archard & Braithwaite, 2010). A caretaker's unconscious favoring of particular individuals with certain personality types, receptivity to handling, ability to cope with stress, and lack of aggression can also exert artificial selection in as few as ten generations (Marliave et al., 1993). These changes can dramatically reduce the potential for survival and fitness in natural ecosystems.

There also are other concerns. Domestication is generally defined as being synonymous with genetic adaptation to an artificial environment under the influence of human selection (Schulte-Hostedde & Mastromonaco, 2015). Inadvertent domestication is a significant concern in captive zoo populations in which multiple generations of a species are in captivity and can experience genetic changes in breeding populations used for conservation and reintroduction (McDougall et al., 2006). Species management plans with systematic collection and preservation of genetic material, as well as strategic breeding of individuals who demonstrate a specific genotype, are essential practices in maintaining the genetic diversity that leads to successfully reintroduced populations.

7. Personality and Human-Wildlife Interactions: Real World Applications

7.1 Urban coyotes. Aversive conditioning (AC) such as loud noises, lights, paint ball guns or dogs are used in areas of more frequent human-wildlife interactions, including the potential habituation of wildlife to humans (Found & St. Clair, 2018; Sampson & Van Patter, 2020). AC. also called humane hazing, is defined as "deliberate negative conditioning that employs the immediate

use of deterrents or negative stimulus to move an animal out of an area, away from a person, or discourage an undesirable behavior or activity" (Bonnell & Breck, 2017, p. 147). AC is recognized as a valuable tool that utilizes the theory of associative learning (Lind, 2018) to create strategies for wildlife management (Evans Ogden, 2021). Also, AC is generally well-accepted by the public as a non-lethal strategy (Homstol et al., 2024; Lajeunesse et al., 2023). In large urban areas such as Denver, Colorado, coyotes have become increasingly habituated to humans with increased attacks on pets and negative encounters with the general public. Researchers hypothesize that coyotes can view the public as a neutral stimulus, thereby increasing habituation. The support and active involvement of the public are valuable and effective aspects of AC. They have consequences with appropriate timing and can be done by anyone with proper training. This can change a coyote's perception of humans, increasing their aversion and decreasing negative interactions toward people, and consequently eliminating the use of lethal measures.

AC is increasingly recommended by wildlife managers because of its potential for agreeable outcomes not involving lethal control. There is, however, limited research on its effectiveness, its short and long-term effects (Bonnell and Breck, 2017; Swan et al., 2017; Lajeunesse et al., 2023), and the role of personality in AC (Kloppers et al., 2005; Blackwell et al., 2016; Homstol et al., 2024). However preferable AC is as a strategy in place of lethal management, it also imposes stress and potential trauma (Beckmann et al., 2004; Kidd-Weaver et al., 2022). There is also concern that AC is frequently initiated after undesirable behavior has already been established, especially when it is perceived to be problematic for human safety, and immediate results are expected. These variables can prompt impulsive responses that are poorly planned, provide only limited, short-term solutions, and ignore underlying issues, ultimately resulting in unsuccessful outcomes. Considering coyotes, for example, in a study conducted by Breck et al. (2016) researchers instructed community scientists to shout, use noisemakers and make themselves look big towards coyotes in areas that had already experienced coyote activity. Results showed that these reactive, non-lethal measures had no significant effect on coyote behavior and the authors emphasize that non-lethal hazing should be used as a preventive as opposed to a reactive measure. Likewise, in 2018, Colorado Parks and Wildlife (CPW) noticed a significant increase in the frequency of interactions between mountain goats and visitors leading to habituation and disease outbreak in the goats (Clay, 2019). CPW responded with reactionary hazing techniques and press releases to reduce human-wildlife interactions. By 2020, CPW invited Denver Mountain Parks and the Denver Zoo to collaborate on a solution since the reactionary hazing techniques had been ineffective (J. Harrington, personal communication, 2021; Krajewski, 2020).

For AC to be effective, a comprehensive study of the underlying causes of undesirable behaviors is needed (Bonnell and Breck, 2017; Sampson & Van Patter, 2020; Snijders et al., 2021; Swan et al., 2017). Bold individuals are most frequently the animals who encounter people as they are more willing to move into novel environments, are less risk-averse, and have shorter flight zones, whereas shy individuals are more risk-averse, avoid human areas, and encounter people less often (Blackwell et al., 2016; Found & St. Clair, 2017; Found & St. Clair, 2018; Honda et al., 2018; Modlmeier et al., 2014). Bold animals may thus exhibit less susceptibility to specific hazing/AC techniques, while shy individuals can retain a greater long-term influence from AC (Darrow & Shivik, 2009, Found & St. Clair, 2019, Homstol et al. 2024). Boldness may also exhibit temporal variations; for example, coyotes' boldness may increase during the pup-rearing season relative to the breeding season (Farr et al., 2023; Lajeunesse et al., 2023).

7.2 Elk Habituation. Found & St. Clair (2019) studied elk personality-dependent responses to AC in Jasper, Alberta, Canada, where the elk had strongly habituated to humans and their community. The purpose of the study was to determine whether knowledge of individual personality types could increase the efficacy of AC as a management strategy. Town-dwelling elk have bolder

personalities, are less likely to migrate, and are more likely to become involved in human-wildlife conflict, thereby posing a significant wildlife management concern (Found & St. Clair, 2016; Kloppers et al., 2005). In Jasper, elk of different personality types were compared before, during, and after AC, which consisted of high-speed foot chases of targeted individuals for a 10-minute duration with the goal that these chases would mimic the "energetic consequence of being pursued". Unexpectedly, bold elk demonstrated a more rapid response to foot chases with their average flight distance increasing up to five times more than shy elk; however, they also returned more quickly to their lower average flight distance than shy elk once the AC treatment was complete. One year after the AC treatment, shy elk retained half of their conditioned increase in wariness, while bold elk lost all their conditioned wariness.

The researchers go on to discuss the variables that have inadvertently favored bold, habituated elk, such as a human landscape with no hunting and very little predation, ample forage, and interspecies dynamics that favor individuals who outcompete and physically dominate shyer elk. Since high-quality forage and an absence of predation or hunting within town limits are variables that cannot be changed. Management recommendations focus on increasing the cost of being close to humans through AC that is specific, immediate, initially intense, consistent, evolutionarily relevant, and unpredictable in space and time. The strategies recommended include targeting individual animals for short-term chases, identifying bold versus shy animals, using isolation to increase the evolutionary cost of being targeted, and determining an appropriate frequency that maintains wariness. The goal is for AC to replace a landscape of fear, thereby reducing for elk the experience of refugia that are found in a human landscape. Found & St. Clair created a study that bridged the gap between theory and the practical necessities of wildlife conservation. This type of research is rare and difficult to find in the literature. Researchers and management practitioners have noted that their respective fields are crucial and complementary to one another. Greggor et al. (2016) discuss how animal behavior can be used as a powerful management tool serving shared conservation goals, current and future.

8. Implications for Further Research: Colorado's New Wolves

The findings on personality differences in wildlife research reviewed here can also be applied to the recent repatriation of wolves (*Canis lupus*) to Colorado in December 2023 (Bekoff, 2024b,c). Conservation requires a multidisciplinary approach (Dick et al., 2016). In a series of webinars ([1], [2]) Sue Sternberg, a dog behavior specialist, has suggested that a domestic dog's behavior, choices, and success in the home cannot be fully understood without understanding three factors: (1) the dog's own individual temperament, (2) the dynamics of the dog's domestic environment, and (3) the personalities and ability of the dog's human family.

These three factors have counterparts in the field of wildlife conservation. In the reintroduction of wolves into Colorado, they take the form of (1) the individual personalities of the wolves recently released, (2) the dynamics of the wolf habitat in Colorado, and (3) the beliefs, values, and perceptions of the people of Colorado. Here we focus on the 1st factor, wolf personality, because it is the most relevant to this target article, but all three factors are important in conservation protocols for wolves and other animals.

The potential of studying the personalities of the individual wolves released in Colorado has been documented by multiple studies. Bump et al. (2022) used GPS data sets to analyze individual specialization in diets among wolves in Voyageurs National Park. They found that individual wolves specializing in hunting beavers had an indirect yet substantial role in ecosystem services. In a separate study, Cassidy et al. (2023) used GPS collars and aerial data to uncover the detrimental effect of human-caused mortality of individual wolves in pack-on-pack persistence and reproduction. These data showed that the human-caused mortality of individuals is disguised and unrecognized when only population-level numbers are studied. In analyzing the potential for personality traits to fluctuate over time and life experiences, Barry et al. (2020) studied wolf dispersal from natal

territories into new territories. They found that boldness increased as individuals dispersed into new territories as singles or pairs. This indicated their need to take increased risks by using human roads and housing areas while exploring unfamiliar terrain. This behavior was in stark contrast to consistent avoidance of human areas in their natal territories, demonstrating that dispersal necessitated a shift in the boldness and risk-taking personality traits.

These examples highlight the importance of considering individual personalities and sentience, which strongly influence behavior and decision-making in wolf research. Further studies will enhance our understanding of how individual personality-types influence Colorado's ecosystems, including hunting strategies, human-livestock interactions in ranching communities, and risk-taking behaviors associated with dispersal and the use of human areas. These areas of research are crucial for managing Colorado's new wolf populations and supporting wildlife managers. By applying the findings of Hertel et al. (2020, 2021, 2023), wildlife managers can analyze individual variations to predict movement patterns, habitat preferences, and parental specialization among Colorado wolves. Further studies could build on Baker's (2014) research to examine the short- and long-term implications of reintroductions. This includes identifying personality types and corresponding behavioral trends, as well as measuring cortisol levels throughout the reintroduction process. Such data would provide wildlife managers with insights into how personality types affect coping mechanisms during reintroduction, ultimately influencing long-term survival.

9. Where to from here?

This review has highlighted the importance of considering individual wildlife personality in research and conservation efforts. Individual animals are sentient beings with feelings that influence how they respond to social and environmental pressures, with effects on human, animal, and plant life. Traits such as shyness and boldness are linked to risk-taking and adaptation, which are essential for survival, including human-wildlife interactions and co-existence. More research and more collaborative efforts between researchers studying animal behavior and wildlife management are needed to extend and apply this knowledge effectively. As we increase our understanding of animal individuality and sentience, we can promote a more informed and compassionate approach to conservation.

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