ANIMAL SENTIENCE
AN INTERDISCIPLINARY JOURNAL ON ANIMAL FEELING

Mazza, Valeria, PhD and Carere, Claudio (2024) Wildlife conservation and adaptation to humans. *Animal Sentience* 34(9)
DOI: 10.51291/2377-7478.1849
Date of submission: 2024-08-19
Date of acceptance: 2024-08-19

Wildlife conservation and adaptation to humans

Commentary on **Owens et al.** on *Wildlife Personality*

Valeria Mazza & Claudio Carere
Department of Ecological and Biological Sciences, University of Tuscia

Abstract: For many animal species, the ability to adapt to coexistence with the human species and to the environmental changes that humans cause is a biological imperative. This adaptive capacity varies not only between species, but within species. Studying individual differences in animals' behavioral, cognitive and physiological adaptability is important for integrating ethology and conservation. Findings about animal cognitive capacities, including learning, need to be applied in conservation—but humans need to be educated about ethology, coexistence and conservation too.

Valeria Mazza is a lecturer at the University of Tuscia, Italy. Her research focuses on the role of between-individual variation in behaviour and cognition in coping with the challenges of current human-induced environmental change. **Website**

Claudio Carere is Professor of Animal Behavior at the University of Tuscia, Italy. He teaches animal behavior and evolution and conducts research on collective behavior and animal personality in many animal species, including invertebrates, in relation to animal welfare, human-wildlife conflicts, and conservation. **Website**

1. Introduction. The individuality of animals is crucial for conservation as well as for welfare. Many excellent reviews advocate integrating the two (e.g., Berger-Tal et al., 2016; Berger-Tal & Saltz, 2016; Greggor et al., 2014, 2016; Smith et al., 2013; Sadoul et al. 2021), but the number of studies actually doing so is still few. The target article by Owens and colleagues (2024) provides theoretical insights and practical case studies, offering a valuable model for future research.

Conservation efforts aim to mitigate the damage humans do to animal habitats and populations. With the rapid expansion of the human population, few places on Earth remain untouched by human presence or its consequences (e.g., Carter et al., 2012; Procko et al., 2023). The ability to coexist with humans, tolerate their disturbances, and adapt to the environmental changes they cause is becoming essential for more and more species. There are between-species differences in adaptability to human presence (e.g., Ducatez et al., 2020), but there is also significant within-species variation in individuals' ability to tolerate human proximity and disturbances, or even to survive in habitats permanently altered by humans (e.g., Allan et al., 2020; Vincze et al., 2016). The study of individual differences in the capacity to adjust to human disturbances and "Human-Induced Rapid Environmental Change" (HIREC) (Sih et al., 2011) is hence becoming increasingly important for bridging the gap between ethology and conservation.

2. Small Non-Commensal Mammals. Rodents are usually not reckoned among the taxa most affected by human encroachment. However, small mammals, which constitute over 60% of wild land mammal species (e.g., Greenspoon et al., 2023), play a crucial role in terrestrial trophic dynamics. Most rodents are neither commensal nor synanthropic, meaning they have little incentive to live near humans. Consequently, when their habitats are destroyed or converted into human settlements, these small mammals may face local extinction (e.g., Deacon & Mac Nally, 1998; Delibes-Mateos et al., 2011). The findings of studies of within-species differences in behavior and cognition among small mammals that do manage to cope with human-altered environments could be useful for targeted conservation measures.

Several species of urban-dwelling mice and voles in central Europe show significant behavioral differences compared to their counterparts in more natural settings. Urban individuals tend to be bolder and more flexible; this suggests that adapting to human-altered environments requires enhanced behavioral flexibility and a greater propensity for risk-taking (e.g., Dammhahn et al., 2020; Mazza et al., 2020). This is further supported by evidence that urban small mammals are better at innovative problem-solving, both in captivity (e.g., Mazza & Guenther, 2021) and in the wild (Mazza et al., unpublished).

Focusing on the innovators within populations—or the "eccentrics," as they are dubbed by Stringham et al. (2024)—is essential for understanding the potential of species and populations for adapting to environmental change. Risk-taking in these small mammals appears to be limited to familiar risks, however, as they show consistently high levels of neophobia, comparable to that of conspecifics in natural and even protected areas (e.g., Mazza et al., 2021).

Small mammals are most cautious when faced with unpredictable risks and disturbances (Mazza et al., unpublished). Protecting and maintaining the full spectrum of behavioral and cognitive variation within a population in response to environmental change hence requires strategies that:

> (a) minimize perceived risks for shy individuals (e.g., relocating them to safer areas or encouraging the use of new structures like nest boxes);
>
> (b) provide gradual habituation for disturbance-sensitive individuals to help them tolerate close proximity to humans (and their pets); and
>
> (c) consider individual learning trajectories, particularly for non-innovators, who may need guidance from bolder demonstrators to shift from familiar resources to those available in modified environments.

3. Are Monk Seals Adapting Their Personality? Studying personality in relation to human disturbance and human-wildlife conflicts can provide valuable insights into the adaptive significance of specific personality traits and the role of humans as agents of selection (e.g., Campbell-Staton et al., 2021). The Mediterranean monk seal (*Monachus monachus*) is an iconic species, but its personality in response to these pressures remains largely understudied. With an estimated global population of fewer than 1,000 individuals, the monk seal is the most endangered mammal in Europe (e.g., Karamanlidis, 2024). Throughout the first half of the 20th century, hunting and deliberate persecution drove them to the brink of extinction (e.g., Karamanlidis et al., 2016). Once common on open shores, monk seals were forced into marine caves for hauling out, resting, and pupping, making direct observation of individuals exceedingly rare (e.g., Karamanlidis, 2024).

Conservation efforts over the past 35 years have helped slow the species' decline (e.g., Karamanlidis, 2024). Listed as "Critically Endangered" globally on the IUCN Red List in 2008, the species was reclassified as "Vulnerable" in the Mediterranean in 2023 (e.g., Karamanlidis, 2024). Despite their continued vulnerability, monk seals have been observed more frequently on Mediterranean open shores and even near human activities, suggesting a slight but promising improvement (e.g.,

Adamantopoulou et al., 2023). Past persecution and hunting pressures may have selected for the most risk-averse individuals, whereas the current environment—reduced hunting but increased human presence—may be favoring more tolerant, less-sensitive phenotypes. Research is needed to explore this potential shift. Personality has been studied in other pinniped species (e.g., DeRango et al., 2019); future research should focus on this aspect in monk seals and other iconic marine species (e.g., Mather & Carere, 2016). Understanding selection pressures on personality during the Anthropocene will not only enhance our knowledge but also improve targeted conservation strategies.

4. Personality and Human Disturbance. Owens et al. highlight the three non-social dimensions of behavioral variation most likely to influence successful reintroductions and other conservation efforts. In animals' tolerance to humans and their ability to coexist in the restricted spaces left by human expansion, sociability and aggressiveness (Réale et al., 2007) become key foci of personality research. Historically, these have received less attention in personality studies, possibly because it is hard to measure interactions between individuals or because of a belief that they are less relevant for solitary species. But even solitary animals engage in social interactions with conspecifics, such as during contests for resources or mates, or in mating itself. They also interact with heterospecifics, for example, in predation or competition for resources (e.g., Camacho-Cervantes & Ojanguren, 2024; Schirmer et al., 2020). Hence, personality studies aimed at informing conservation efforts should not neglect these social dimensions, challenging as they may be to study. They can provide valuable insights into how individuals navigate the challenges of within- and between-species coexistence.

Attention should also be paid to the costs animals incur when adapting to living near humans. Urban birds, such as seagulls and storks, who forage in landfills, may suffer long-term negative effects, such as human-driven malnutrition, with a direct impact on their health and survival (e.g., Adami et al., 2024; Houston et al., 2007; Plaza & Lambertucci, 2018; Suárez-Rodríguez & Macías Garcia, 2014). Similarly, stress levels may remain elevated in animals coping with urban noise or human presence in protected areas (e.g., Barber et al., 2009; Szott et al., 2019; Chiatante & Carere, 2024). Human presence and resulting changes in predator communities may also lead to a decoupling of commonly associated traits related to coping styles, such as low aggressiveness, physiological stress responses, and enhanced behavioral plasticity (e.g., Sadoul et al., 2021). Future studies should explore this complex dynamic from multiple perspectives to better understand and mitigate these effects.

5. Linking Individuality, Sentience, and Conservation. Owens et al. emphasize the importance of applying knowledge about animal personality as well as sentience to conservation scenarios. However, Briffa (2024) cautions against conflating these two concepts, and Adolphs & Xu (2024) suggest that a new discipline of animal psychology may be needed to bridge the gap. We agree that such a bridge is necessary, but we believe that this field of research already exists in the study of between-individual variation in cognition (e.g., Carere & Locurto, 2011; Sih & Del Giudice, 2012; Lucon-Xiccato et al., 2024). This research offers the conceptual and methodological tools required to distinguish between mental processes, individuality, and sentience without confusion. Leveraging our understanding of individuality and sentience for conservation purposes can be enhanced by considering between-individual variation in animal cognition. This is not to imply that only cognitively sophisticated animals are sentient (in line with Briffa, 2024), but rather that most taxa possess measurable cognitive processes. These cognitive processes shape how individuals interact with both abiotic and social environments, thereby creating unique individual experiences (e.g., Duckworth, 2009).

Explicit consideration of animal cognition will also benefit conservation efforts, particularly for iconic species whose mental processes can be partly explained. Humans are more likely to extend rights and protection to species perceived as particularly "intelligent" (e.g., Carere & Mather, 2019;

Mather & Carere, 2016; Rogers & Kaplan, 2005). Thus, efforts to integrate personality and sentience into conservation are incomplete without a comprehensive understanding of animal cognitive processes. In other words, to promote the conservation of individuals and their well-being effectively, we must consider not only who or what they are and how they feel, but also how and what they think, regardless of how we perceive their cognitive "proficiency."

6. What About Humans? In considering the potential for species and individuals to coexist, biologists often focus on how other species avoid conflicts with humans. There have been attempts to use animal cognition, particularly learning, to train "nuisance" animals to avoid human-populated areas (e.g., Owens et al., 2024) or to keep away from garbage bins (e.g., Klump et al., 2022; Stringham et al., 2024). The aim is to teach wild animals how to behave safely around humans in the long term. This suggests another important question, however: Shouldn't we also be advocating similar efforts to educate humans on how to behave around other animals?

Although this may sound like an uphill battle, especially given the challenges humans face in achieving peaceful coexistence within their own species, we believe that conservation efforts would benefit greatly from a complementary, bilateral approach: Teaching both humans and animals how to live in close proximity with minimal conflict could enhance the effectiveness of conservation actions, reintroductions, and humane management practices. We hope that in the future, human education will become a central focus in conservation and pedagogy. If more humans were informed and engaged in conservation efforts—promoting or at least not hindering these initiatives—scientists would find it much easier to implement and sustain them.

Acknowledgments: *During manuscript preparation VM was supported by the National Biodiversity Future Center—NBFC, a project funded by the European Union "NextGenerationEU" (National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.4—Call for tender No. 3138 of 16 December 2021, rectified by Decree n.3175 of 18 December 2021 of Italian Ministry of University and Research funded by the European Union—Next Generation EU. Project code CN_00000033, Concession Decree No. 1034 of 17 June 2022 adopted by the Italian Ministry of University and Research, CUP J83C22000860007) granted to the group of CC. CC was also supported by the PRIN project PL-ASTICI (20223EETLW) 'Phenotypic plasticity in a rapidly changing world: an ontogenetic perspective for improving aquaculture and conservation practices of the European lobster'. We thank Marzia Verduci and Valeria Marasco for feedback on an early draft.*

References

Adamantopoulou, S., Karamanlidis, A. A., Dendrinos, P., & Gimenez, O. (2023). Citizen science indicates significant range recovery and defines new conservation priorities for Earth's most endangered pinniped in Greece. Animal Conservation, 26(1), 115–125.

Adami, M. A., Bertellotti, M., Agüero, M. L., Frixione, M. G., & D'Amico, V. L. (2024). Assessing the impact of urban landfills as feeding sites on physiological parameters of a generalist seabird species. Marine Pollution Bulletin, 202, 116327.

Adolphs, R., & Xu, Y. (2024). PRECOMMENTARY: Animal personality needs animal sentience. Animal Sentience, 34(2).

Allan, A. T. L., Bailey, A. L., & Hill, R. A. (2020). Habituation is not neutral or equal: Individual differences in tolerance suggest an overlooked personality trait. Science Advances, 6(28), eaaz0870.

Barber, J. R., Crooks, K. R., & Fristrup, K. M. (2010). The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology & Evolution, 25(3), 180-189.

Berger-Tal, O., Blumstein, D. T., Carroll, S., Fisher, R. N., Mesnick, S. L., Owen, M. A., Saltz, D., Claire, C. C., & Swaisgood, R. R. (2016). A systematic survey of the integration of animal behavior into conservation. Conservation Biology, 30(4), 744–753.

Berger-Tal, O., & Saltz, D. (2016). Conservation behavior: Applying behavioral ecology to wildlife conservation and management (Vol. 21). Cambridge University Press.

Briffa, M. (2024). Animal personality and sentience as distinct concepts. *Animal Sentience*, 34(4).

Camacho-Cervantes, M., & Ojanguren, A. F. (2024). Within-population variation in an invasive fish' sociability when associating with conspecifics or heterospecifics. Ecology and Evolution, 14(8), e70118.

Campbell-Staton, S. C., Arnold, B. J., Gonçalves, D., Granli, P., Poole, J., Long, R. A., & Pringle, R. M. (2021). Ivory poaching and the rapid evolution of tusklessness in African elephants. Science, 374(6566), 483–487.

Carere, C., & Locurto, C. (2011). Interaction between animal personality and animal cognition. Current Zoology, 57(4), 491–498.

Carere, C., & Mather, J. (Eds.). (2019). The Welfare of Invertebrate Animals (Vol. 18). Springer International Publishing.

Carter, N. H., Shrestha, B. K., Karki, J. B., Pradhan, N. M. B., & Liu, J. (2012). Coexistence between wildlife and humans at fine spatial scales. Proceedings of the National Academy of Sciences, 109(38), 15360–15365.

Chiatante, G. P., & Carere, C., (2024). Flight initiation distance in waterbirds of two coastal wetlands with different protection regimes. *Rendiconti Lincei Scienze Fisiche e Naturali* 36, 293-303.

Dammhahn, M., Mazza, V., Schirmer, A., Göttsche, C., & Eccard, J. A. (2020). Of city and village mice: Behavioural adjustments of striped field mice to urban environments. Scientific Reports, 10(1), 13056.

Deacon, J. N., & Mac Nally, R. (1998). Local extinction and nestedness of small-mammal faunas in fragmented forest of central Victoria, Australia. Pacific Conservation Biology, 4(2), 122.

Delibes-Mateos, M., Smith, A. T., Slobodchikoff, C. N., & Swenson, J. E. (2011). The paradox of keystone species persecuted as pests: A call for the conservation of abundant small mammals in their native range. Biological Conservation, 144(5), 1335–1346.

DeRango, E. J., Schwarz, J. F. L., Piedrahita, P., Páez-Rosas, D., Trillmich, F., & Krüger, O. (2019). Intraspecific variation in boldness and exploration shapes behavioral responses to stress in Galápagos sea lion pups. Behavioral Ecology and Sociobiology, 73(12), 166.

Ducatez, S., Sol, D., Sayol, F., & Lefebvre, L. (2020). Behavioural plasticity is associated with reduced extinction risk in birds. Nature Ecology & Evolution 4: 788-793

Duckworth, R. A. (2009). The role of behavior in evolution: A search for mechanism. Evolutionary Ecology, 23(4), 513–531.

Greenspoon, L., Krieger, E., Sender, R., Rosenberg, Y., Bar-On, Y. M., Moran, U., Antman, T., Meiri, S., Roll, U., Noor, E., & Milo, R. (2023). The global biomass of wild mammals. Proceedings of the National Academy of Sciences, 120(10), e2204892120.

Greggor, A. L., Berger-Tal, O., Blumstein, D. T., Angeloni, L., Bessa-Gomes, C., Blackwell, B. F., St Clair, C. C., Crooks, K., de Silva, S., Fernández-Juricic, E., Goldenberg, S. Z., Mesnick, S. L., Owen, M., Price, C. J., Saltz, D., Schell, C. J., Suarez, A. V., Swaisgood, R. R., Winchell, C. S., & Sutherland, W. J. (2016). Research Priorities from Animal Behaviour for Maximising Conservation Progress. Trends in Ecology & Evolution, 31(12), 953–964.

Greggor, A. L., Clayton, N. S., Phalan, B., & Thornton, A. (2014). Comparative cognition for conservationists. Trends in Ecology & Evolution, 29(9), 489–495.

Houston, D. C., Mee, A., & McGrady, M. (2007). Why do condors and vultures eat junk?: the implications for conservation. Journal of Raptor Research, 41(3), 235-238.

Karamanlidis, A. (2024). Current status, biology, threats and conservation priorities of the vulnerable Mediterranean monk seal. Endangered Species Research, 53, 341–361.

Karamanlidis, A. A., Dendrinos, P., De Larrinoa, P. F., Gücü, A. C., Johnson, W. M., Kiraç, C. O., & Pires, R. (2016). The Mediterranean monk seal Monachus monachus: Status, biology, threats, and conservation priorities. Mammal Review, 46(2), 92–105.

Klump, B. C., Major, R. E., Farine, D. R., Martin, J. M., & Aplin, L. M. (2022). Is bin-opening in cockatoos leading to an innovation arms race with humans? Current Biology, 32(17), R910–R911.

Lucon-Xiccato, T., Carere, C., & Baracchi, D (2024) Intraspecific variation in invertebrate cognition: a review. *Behavioral Ecology and Sociobiology* 78, 1

Mather, J. A., & Carere, C. (2016). Cephalopods are best candidates for invertebrate consciousness. *Animal Sentience*, 9(2).

Mazza, V., Czyperreck, I., Eccard, J. A., & Dammhahn, M. (2021). Cross-context responses to novelty in rural and urban small mammals. Frontiers in Ecology and Evolution, 724.

Mazza, V., Dammhahn, M., Lösche, E., & Eccard, J. A. (2020). Small mammals in the big city: Behavioural adjustments of non-commensal rodents to urban environments. Global Change Biology, 15304, 6326–6337.

Mazza, V., & Guenther, A. (2021). City mice and country mice: Innovative problem solving in rural and urban noncommensal rodents. Animal Behaviour, 172, 197–210.

Owens, K. A., Bryja, G., & Bekoff, M. (2024). Wildlife conservation: The importance of individual personality traits and sentience. *Animal Sentience*, 34(1)

Plaza, P. I., & Lambertucci, S. A. (2018). More massive but potentially less healthy: black vultures feeding in rubbish dumps differed in clinical and biochemical parameters with wild feeding birds. PeerJ, 6, e4645.

Procko, M., Naidoo, R., LeMay, V., & Burton, A. C. (2023). Human presence and infrastructure impact wildlife nocturnality differently across an assemblage of mammalian species. PLoS ONE, 18(5), e0286131.

Rogers, L. J., & Kaplan, G. (2005). Think or be damned: The problematic case of higher cognition in animals and legislation for animal welfare. Animal L., 12, 151.

Sadoul B, Blumstein, D.T., Alfonso, S., & Geffroy, B. (2021) Human protection drives the emergence of a new coping style in animals. PLoS Biology 19(4): e3001186.

Schirmer, A., Hoffmann, J., Eccard, J. A., & Dammhahn, M. (2020). My niche: Individual spatial niche specialization affects within- and between-species interactions. Proceedings of the Royal Society B: Biological Sciences, 287(1918), 20192211.

Sih, A., Ferrari, M. C., & Harris, D. J. (2011). Evolution and behavioural responses to human-induced rapid environmental change. *Evolutionary Applications*, 4(2), 367-387.

Sih, A., & Del Giudice, M. (2012). Linking behavioural syndromes and cognition: A behavioural ecology perspective. Philosophical Transactions of the Royal Society B: Biological Sciences, 367(1603), 2762–2772.

Smith, B. R., Blumstein, D. T., in Carere, C., & Maestripieri, D. eds (2013). Animal personalities and conservation biology. Animal Personalities: Behavior, Physiology, and Evolution, 379–411.

Stringham, S. F., Rogers, L., & Bryant, A. (2024). Norms and variance fail to predict butterfly effects on social dynamics by idiosyncratic individuals. *Animal Sentience*, 34(3).

Suárez-Rodríguez, M., & Macías Garcia, C. (2014). There is no such a thing as a free cigarette; lining nests with discarded butts brings short-term benefits, but causes toxic damage. *Journal of Evolutionary Biology*, 27(12), 2719-2726.

Szott, I. D., Pretorius, Y., Ganswindt, A., & Koyama, N. F. (2019). Physiological stress response of African elephants to wildlife tourism in Madikwe Game Reserve, South Africa. Wildlife Research, 47(1), 34-43.

Vincze, E., Papp, S., Preiszner, B., Seress, G., Bókony, V., & Liker, A. (2016). Habituation to human disturbance is faster in urban than rural house sparrows. Behavioral Ecology, 27(5), 1304–1313.