

Managing Invasive Alien Species on Islands: Ethical Considerations of Killing for Conservation Purposes

Introduction

An invasive alien species is commonly defined as any non-native living organism, often introduced by humans, in a region where it was not originally present (Global Invasive Species Database, 2023). The main characteristic of these species is their ability to adapt to different environmental conditions and to exploit large ecological niches. In areas where an exotic species is introduced, the absence of natural enemies (predators, parasites, diseases, competitors) facilitates its rapid growth. They out-compete native species for resources, causing significant ecosystem disturbance and a severe threat to biodiversity (Courchamp et al., 2003). Islands are particularly vulnerable to invasive alien animal species (IAS) due to their unique ecosystems, isolation, and high levels of endemism (Myers et al., 2000; Spatz et al., 2017). Some of the most destructive species on islands that exert intense pressure on native and endemic species are predatory mammals such as rats (*Rattus sps.*), cats (*Felis catus*) and mongooses (*Urva sps.*) (Lowe et al., 2007; Soubeyran et al., 2008).

The best way to manage IAS that threaten endangered native species is often debated within the scientific community. Elimination of IAS is often favoured by scientists because it offers the best chance of restoring native biodiversity (Genovesi, 2008). However, in some cases, complete eradication of an invasive species may prove difficult or impossible: targeted lethal control of these species may be an alternative to reduce predation pressure on native species and allow them to recover (DIISE, 2018).

While it is widely accepted that some form of control is necessary, the central question is whether we should attempt to eradicate these animals once they are established outside their natural range. Indeed, this approach raises crucial ethical questions about animal welfare, respect for the intrinsic value of every living thing, and unintended consequences for the ecosystem.

This essay examines the ethical issues involved in eliminating invasive alien animal species from islands, using the case study of the Indian mongoose (*Urva auropunctata*) to illustrate the ethical dilemmas and complexities involved.

The value of a living being

From an ethical perspective, the deliberate killing of animals raises important moral questions about respecting the intrinsic value of every living being (Santiago-Avila et al., 2018). Animal rights activists argue that every individual, native or exotic, has the right to live and thrive and that our moral duty is to respect these rights (animal ethics movement). We may question our right to eliminate one species in favour of another. The notion that some species are more valuable than others based on their invasiveness may suggest an anthropocentric bias, whether from a social (seen as a pest by the population) or economic perspective (not profitable or causing damage). While IAS may not hold the same level of protection as other species, this should not diminish the intrinsic value of the individuals (biocentrist view). Furthermore, the same species are sometimes threatened or have a different status in their natural range, which can change their value depending on the context (e.g. feral cat vs domestic cat, see Campbell et al., 2011).

The need to eliminate in order to conserve

Conservation of biodiversity is a moral imperative because of the unique role of each species in the balance and stability of ecosystems (ecocentrist view). When IAS threaten endangered populations or native species, humans may have a moral and legal responsibility to act to preserve the ecosystem. Indeed, since humans are often the main cause of the introduction of these invasive species, whether intentional or accidental, they are responsible for them. This raises the ethical question of whether we have a moral duty to rectify human errors and repair the damage caused by these human-introduced invasive alien species.

Russell et al. (2016) argue that lethal control of invasive predators is justified when it reverses the negative impacts of these human-introduced species on native species and ecosystems or when predation threatens the survival of entire populations or species. In their view, there is sufficient evidence of the benefits of lethal control, with several successful eradication projects having conserved or restored populations of threatened species (Russell, 2016; Jones et al., 2016). Indeed, there is ample evidence from around the world that invasive alien species have had catastrophic effects on biodiversity, particularly on island fauna with high rates of endemism (Courchamp et al., 2003).

Action does not mean elimination

Some scientists accept that while humanity has a moral obligation to help restore threatened ecosystems, killing animals to repair the damage caused by humans is not necessarily the most ethical or effective solution (Wallach et al., 2015). Indeed, Wallach et al. point out that the costs to the individuals killed are apparent, while the benefits to the target populations and ecosystems may be uncertain. For them, as for others, it is difficult to prove that the removal of a particular IAS will promote the development of endemic wildlife, given the many causes of their decline, most of which are due to humans rather than predators (deforestation, habitat fragmentation, pollution, global warming).

Because we need to act but not kill, they suggest a more compassionate approach to conservation, focusing on non-lethal methods of controlling IAS populations, such as sterilisation, relocation, or habitat modification. These approaches are more ethical and may be more acceptable to society. However, even if sterilised, releasing an IAS in an environment where it can only survive by hunting would still cause damage to the native fauna.

Unexpected consequences

Furthermore, eradication and lethal control can have unanticipated consequences for the ecosystem. Eliminating an invasive species can sometimes lead to the proliferation of other exotic species, harm non-target species, or cause additional ecological disturbances that can lead to a new imbalance or even the disappearance of native species (Zavaleta, 2001). In addition, potential adverse effects on non-target species must be considered, such as native predators or scavengers that may be unintentionally killed or injured by lethal methods.

Informed elimination

Ethical management of IAS therefore requires a holistic perspective that considers the needs of different species and assesses the potential consequences of our actions. Conservation ethics encourages thinking about long-term consequences and avoiding simplistic approaches that fail to consider the complex interactions between species and ecosystems. Eliminating a species to protect others should only be done after thoroughly examining all the impacts and ethical implications. It is recommended that priority be given to methods that cause the least damage to native species and ecosystems. In addition, it is essential to implement monitoring and research to assess the impact of lethal approaches and improve them over time, as Simberloff (2013) recommends. Social acceptance of these measures is critical to their success, as potential conflicts between stakeholders can undermine the implementation of lethal control (Crowley et al., 2017).

The case of the small Indian mongoose in Martinique

The case of the small Indian mongoose (*Urva auropunctata*) provides an interesting case study for understanding the ethical dilemmas involved in IAS elimination.

Initially voluntarily introduced to islands by humans to control rat and snake populations, the mongoose spread rapidly and began to threaten native species (Nellis, 1982; Lorvelec et al., 2004; Hays & Conant, 2007; Barun et al., 2011).

This case highlights the importance of ethical decision-making when deliberately introducing alien species into new habitats. Although some introductions may appear beneficial in the short term as part of biological control, they can have unexpected and harmful consequences for the ecosystem. In the case of the mongoose, the introduction was intended to solve a specific problem but ended up causing severe damage to local biodiversity. Indeed, the small Indian mongoose is now considered to be one of the 100 species considered by the International Union for Conservation of Nature to be the most invasive in the world and a dangerous predator of the native biodiversity on islands (Lowe et al., 2007; Hays & Conant, 2007; Global Invasive Species Database, 2011).

The mongoose was introduced to the Caribbean islands in the late 1800s and has since threatened many native species, from endemic-ground nesting birds to small reptiles, as well as pre-and post-emergence stages of sea turtles (Nellis & Small, 1983; Lorvelec et al., 2004; Leighton et al., 2008).

Mongoose eradication is a logical solution to protect local biodiversity. Successful eradication attempts have been observed on some islands, such as the island of Fajou in Guadeloupe, where it effectively reduced the mongoose population and thus limited their negative impact on prey species (Lorvelec et al., 2004). Targeted control approaches offer an alternative where eradication is not feasible due to the size of islands or the density of individuals. By targeting areas where the mongoose poses the greatest threat to native species, it is possible to limit its predatory impact (Barun, 2011). This is the case in Guadeloupe and Martinique, where annual regulatory campaigns are carried out to limit the impact of mongoose predation on specific sea turtle nesting sites (Grelot-Valade, 2023 – Internship report).

In the case of the mongoose, lethal control has been proven effective in reducing the negative impact on native fauna (Barun et al., 2011). There are several methods, such as poisoning or trapping. In

Martinique, rat traps have been used successfully for many years (ONF internal reports). These traps are designed not to kill the animal immediately, allowing non-target species to be released. However, they must be checked daily and placed in shaded areas to ensure the animal's welfare. It is important to recognise that these traps can potentially harm the animal's welfare due to the heat and stress that the mongoose may experience while in the trap. Furthermore, this trap implies that the human is killing the mongoose by shooting it (other possible methods are suffocation or breaking its neck). This raises another question about the human parameter and his ability as an individual to deal with the killing of another living being and the psychological impact this can have on the operator.

It is also possible to use lethal traps that kill the mongoose instantly. However, this approach also raises ethical considerations due to the capture of non-target species. These traps are not 100% mongoose specific and may inadvertently kill other species, including native or endemic species.

Finally, the social value of the species must also be considered. Despite its proven detrimental impact in Martinique, the mongoose has carved out a place for itself in society and is well known, particularly through the Creole language. Its name, "mangous" or "manglous", describes a shy, timid or wild person. It also populates the ontology of West Indian Creole proverbs that illustrate the perceived impact of its introduction on the local fauna: "Avan manglous, gouti té ka viv" ("Before the mongoose, the agouti lived", meaning that no one is indispensable). The mongoose's long history on the island and familiarity give it a special status in the eyes of the general public, who are not necessarily aware of its negative impact on biodiversity. Education and awareness of the damage caused by this species are also necessary to find ethical and sustainable solutions for management.

Conclusion

The ethics of invasive alien species' lethal control is complex and raises debates about the need to preserve biodiversity and respect the rights of all living beings. The management of IAS on islands requires a balanced approach, taking into account ethical, environmental and social dimensions.

Decisions on eradication or lethal control must be guided by respect for the intrinsic value of every living thing and a thorough understanding of the ecological consequences. Collaboration between scientists, environmental managers, local communities, and animal welfare activists is essential to determine whether such actions are justified and whether non-lethal methods are not possible. Furthermore, when lethal measures are invoked, they require rigorous and ongoing assessment of their necessity and effectiveness monitoring.

References

Barun, A., Hanson, C.C., Campbell, K.J., Simberloff, D., (2011). A review of small Indian mongoose management and eradications on islands. *Island Invasives: Eradication and Management*. 17–25.

Campbell, K.J., Harper, G., Algar, D., Hanson, C.C., Keitt, B.S., Robinson, S. (2011). Review of feral cat eradications on islands.

Courchamp, F., Chapuis, J. L., Pascal, M. (2003). Mammal invaders on islands: impact, control and control impact. *Biological Reviews of the Cambridge Philosophical Society*. 78(3), 347–383.

Crowley, S.L., Hinchliffe, S., McDonald, R.A., (2017). Conflict in invasive species management. *Front. Ecol. Environ.* 15, 133–141.

- DIISE. (2018). *The Database of Island Invasive Species Eradications*, developed by Island Conservation, Coastal Conservation Action Laboratory UCSC, IUCN SSC Invasive Species Specialist Group, University of Auckland and Landcare Research New Zealand.
- Genovesi, P. (2008). Limits and Potentialities of Eradication as a Tool for Addressing Biological Invasions. In: Nentwig, W. (eds) *Biological Invasions. Ecological Studies*. 193, 385–400.
- Grelot, M. (2023). Regulation of the small Indian mongoose in Martinique: Assessing the effectiveness of two types of traps to optimise population management. 1-35.
- Global Invasive Species Database. (2023). Species profile: *Herpestes javanicus*. Downloaded from <http://www.iucngisd.org/gisd/speciesname/Herpestes+javanicus> on 01-07-2023.
- Hays, W. S. T., Conant, S. (2007). Biology and impacts of Pacific island invasive species. 1. A worldwide review of effects of the small Indian mongoose, *Herpestes javanicus*. *Pacific Science*. 61(1), 3–16.
- Jones, H. P., Holmes, N. D., Butchart, S. H. M., Tershy, B. R., Kappes, P. J., Corkery, I., Croll, D. A. (2016). Invasive mammal eradication on islands results in substantial conservation gains. *Proceedings of the National Academy of Sciences*. 113(15), 4033-4038.
- Leighton, P. A., Horrocks, J. A., Krueger, B. H., Beggs, J. A., Kramer, D. L. (2008). Predicting species interactions from edge responses: Mongoose predation on hawksbill sea turtle nests in fragmented beach habitat. *Proceedings of the Royal Society B: Biological Sciences*. 275(1633), 2465–2472.
- Lorvelec, O., Delloue, X., Pascal, M., Mege, S. (2004). Impacts des mammifères allochtones sur quelques espèces autochtones de l'Isle Fajou (Réserve Naturelle du Grand Cul-de-sac Marin, Guadeloupe), établis à l'issue d'une tentative d'éradication. *Revue D'Ecologie - La Terre et La Vie*. 59, 293-307.
- Lowe S., Browne M., Boudjelas S., De Poorter M., (2007). *100 of the World's Worst Invasive Alien Species A selection from the Global Invasive Species Database*. Invasive Species Specialist Group of the World Conservation Union (IUCN).
- Minteer, B.A., Collins, J.P. (2005). Ecological Ethics: Building a New Tool Kit for Ecologists and Biodiversity Managers. *Conservation Biology*. 19: 1803-1812.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., et al. (2000). Biodiversity hotspots for conservation priorities. *Nature*. 403(6772), 853–858.
- Nellis, D. W. (1982). Mongoose influence on the ecology of islands. *Transactions of the International Congress of Game Biologists*. 14, 311-314.
- Nellis, D. W., Small, V. (1983). Mongoose predation on sea turtle eggs and nests. *Biotropica*. 15(2), 159-160.
- Russell, J.C., Jones, H.P., Armstrong, D.P., Courchamp, F., Kappes, P.J., Seddon, P.J., Oppel, S., Rauzon, M.J., Cowan, P.E., Rocamora, G., Genovesi, P., Bonnaud, E., Keitt, B.S., Holmes, N.D., Tershy, B.R., (2016). Importance of lethal control of invasive predators for island conservation: Lethal Control of Invasive Predators. *Conserv. Biol.* 30, 670–672.
- Santiago-Ávila, F.J., Lynn, W.S., Treves, A. (2018). Inappropriate consideration of animal interests in predator management. *Large Carnivore Conservation and Management*.
- Simberloff, D., Martin, J. L., Genovesi, P., Maris, V., Wardle, D. A., Aronson, J., Courchamp, F., Galil, B., García-Berthou, E., Pascal, M., Pyšek, P., Sousa, R., Tabacchi, E., & Vilà, M. (2013). Impacts of biological invasions: what is what and the way forward. *Trends in ecology & evolution*. 28(1), 58–66.
- Soubeyran, Y. (2008). *Espèces exotiques envahissantes dans les collectivités françaises d'outre-mer (Etat des lieux et recommandations)*. Collection Planète Nature. Comité français de l'IUCN.
- Spatz, D.R., Zilliacus, K.M., Holmes, N.D., Butchart, S.H.M., Genovesi, P., Ceballos, G., Tershy, B.R., Croll, D.A., (2017). Globally threatened vertebrates on islands with invasive species. *Sci. Adv.* 3, e1603080.
- Wallach, A.D., Bekoff, M., Nelson, M.P., Ramp, D., (2015). Promoting predators and compassionate conservation: Predators and Compassionate Conservation. *Conserv. Biol.* 29, 1481–1484.
- Zavaleta, E., Hobbs, R., Mooney, H. (2001). Viewing invasive species removal in a whole-ecosystem context. *Trends in Ecology & Evolution*. 16. 454-459.