

Veterinarians and Taxonomic Chauvinism: The Dilemma of Parasite Conservation

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Abstract

Preservation of biodiversity is one of the fundamental objectives of conservation. Animal conservation programs, however, tend to be dominated by charismatic vertebrate species. Many parasites are highly specialized, having evolved to depend on a single species and may be rarer and hence more endangered than their specific hosts. The phenomenon of coextinction, in which there is the loss of affiliated species such as parasites, needs consideration if conservation is not to fall victim to taxonomic chauvinism. Broad-spectrum antiparasitic drugs when used in free-living wildlife can have an effect on nontargeted species and the wider ecosystem. It is also recognized that parasites may have a role to play in the normal functioning of a host's immune system when the two have coevolved over an extended period of time. Although the concept of parasite conservation is in itself controversial, this is further complicated when deciding to which areas of conservation medicine it should apply. © 2009 Published by Elsevier Inc.

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Although the *Oxford English Dictionary* defines conservation very broadly, as “the protection of the natural environment,” conservation is generally taken to mean the preservation of biodiversity, itself defined as “the existence of a large number of different kinds of animals and plants that make a balanced environment.”¹ Preservation of biodiversity is also one of the three basic objectives in the World Conservation Strategy of the International Union for the Conservation of Nature (IUCN).² It is, however, well recognized that animal conservation programs, zoological research, public interest, and veterinary input tend to be dominated by charismatic vertebrate species.³

In comparison with birds, where the conservation status of all 9990 recognized species has been assessed, less than 0.5% of the more than 1 million currently described invertebrates have been evaluated.⁴ Most authorities believe that the true number of invertebrate species is more likely to be 6 to 10 million,⁵ whereas

some have estimated that this may actually be as high as 80 million.⁶

A distinctive aspect of parasitism is that the host is caused some damage by the parasite (see Perez, this issue). Because this is commonly assessed in the context of health and economic impact in humans and domesticated animals, parasites are usually considered to be pests (see Introduction by Cooper, this issue). It has been highlighted that this runs the real

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risk of confusing a large number of organisms' particular way of life with a perceived negative status.⁷

Coextinction Risks

A seminal paper by Koh and coworkers⁸ estimated, that of the 12,200 species of plants and animals that were listed at that stage as threatened or endangered, at least a further 6300 affiliate species should also have been classified as "coendangered." This study attempted an initial quantification of the phenomenon of coextinction⁹: the loss of an "affiliate" species, such as a parasite, when its host becomes extinct. Entomologists have long recognized that specialized parasitoids, such as members of the Hymenoptera, are rarer than their specific hosts. Likewise, many parasites of vertebrates are highly specialized, having evolved to depend on a single species, or having a complex life cycle. It stands to reason that these parasites will be at least as endangered as their hosts, if not more so.

Good examples of host specificity are whale lice, parasitic crustaceans of the Cyamidae family, found on cetaceans. The majority of whale species have a species-specific louse. In sperm whales (*Physeter catodon*), the relationship is even more unusual, being sex specific. The louse *Cyamus catodontis* lives exclusively on the skin of the males, whereas *Neocyamus physteris* is found only on females and young whales.¹⁰ Although they cause minor superficial skin damage, they predominantly feed on algae that settle on the whales' skin. Their distinctive clusters, in association with barnacles, have been used by biologists as identifiers for individual whales.¹¹ Aside from identification, parasites can elucidate population history and movement, such as in studies of the Galápagos hawk (*Buteo galapagoensis*).¹²

The concept of parasite conservation is by no means new (see Perez, this issue).¹³⁻¹⁵ Although veterinarians are most commonly involved with charismatic vertebrate species, ignoring the possibly highly endangered nature of some parasites themselves, through taxonomic chauvinism, risks rendering the whole concept of conservation meaningless. It has already been recognized that antiparasitic drugs such as ivermectin, when used by veterinarians in free-living wildlife and in domestic stock in areas of biodiversity conservation priority, can have adverse effects on nontargeted species such as dung beetles (Scarabaeoidea) and the wider ecosystem.¹⁶⁻¹⁸ At the same time, it is increasingly clear that parasites may have a role to play in the normal functioning of a host's immune system when they have coevolved over an extended period of time. Numerous studies demonstrate an association between

increased rates of atopy and asthma in populations when there are low numbers of some parasites, such as intestinal helminths.¹⁹⁻²¹

There is a poorly recorded history of parasite coextinctions. This is less likely due to its being a rare occurrence, than that it has simply not been recognized when it has occurred.⁸ Until recently, the most commonly cited example of parasite coextinction was that of the extinct passenger pigeon (*Ectopistes migratorius*) and its parasitic bird lice, *Columbicola extinctus* and *Campanulotes defectus*. Recently, however, *Columbicola extinctus* was rediscovered on the band-tailed pigeon (*Patagioenas fasciata*),²² and *Campanulotes defectus* was found to be a probable case of misidentification of the existing *Campanulotes flavus*.²³ However, there is still the possibility that other unrecognized coextinctions occurred on the passenger pigeon.

A more recent and relevant example is the extinction of *Colpocephalum californici*, a louse species that is specific to the endangered California condor (*Gymnogyps californianus*). Its extinction was probably caused by antiparasitic treatment of the birds when these were taken into captivity to establish a breeding program. Several other avian Mallophaga louse species reportedly became extinct with their hosts, such as *Rallicola extinctus*, a parasite of the extinct New Zealand wattlebird, the huia (*Heteralocha acutirostris*)²⁴; none is listed as extinct by the IUCN. Despite this, few parasitic species have been assessed or had their conservation status classified by the IUCN. A notable exception is the pygmy hog louse (*Hematopinus oliveri*), which is listed as Critically Endangered (CR), the same conservation status given to its host, the pygmy hog (*Porcula salvania*).

The Veterinarian and Parasite Conservation

Although the concept of parasite conservation is in itself controversial, it is further complicated when deciding which areas of veterinary and conservation work apply. It is obvious that in many instances the application of parasite conservation within ex-situ zoological collection-based programs is unlikely to be viable. Although zoos play a role in the protection of biodiversity, they often cannot replicate the complete natural ecosystem, with its myriad interactions that act as checks and balances in the free-living host/parasite relationship. It may also be no easier or less controversial in in-situ conservation programs. A possible black-footed ferret (*Mustela nigripes*) species-specific *Neotrichodectus*-biting louse may have become extinct because of intensive veterinary intervention

and treatments of the last small population of its host, as well as ectoparasiticide treatment of the host ferrets' local prairie dog (*Cynomys leucurus*) prey population in an attempt to decrease the risk of sylvatic plague (*Yersinia pestis*) transmission by fleas.¹⁴ Ironically, at the same time, a decision was taken not to eradicate intestinal *Eimeria* parasitism. The authors reported that it was unclear whether this *Eimeria* sp. was a unique host-specific species or not. The decision appears to have been made to encourage the development of natural immunity and to help prepare the immunological response of ferrets destined for release. This was despite the fact that *Eimeria* spp. infection can prove fatal in captive ferrets. This in some way highlights the difficult job veterinarians may face in balancing ethical, conservation, and vertebrate welfare considerations when involved with endangered vertebrate conservation programs, while facing differing criticism from relevant stakeholders.

In many captive situations, the artificial environment and small populations are unlikely to lead to normal host/parasite relationships. The difficulty lies in deciding which forms of in-situ conservation work and what level of parasite consideration should be applicable. Currently, even large sub-Saharan African national parks have relatively intensive interventional management programs that include such procedures as the vaccination of rare species for anthrax²⁵ and rabies.^{26,27} Combined with factors such as the loss of natural migration routes, it may be argued by some that even these are unnatural environments and therefore parasite conservation is not feasible. This will remain a topic for discussion and debate between conservationists. In the meantime, veterinarians working in the field may consider the use of targeted antiparasitics for specific infestations, rather than continue the trend of broad-spectrum ecto- and endectocides such as the macrocyclic lactones. They should also deliberate, on a case-by-case basis, as to whether treatment of low-impact parasites such as Mallophaga-biting lice is actually needed.²⁸

Conclusion

It seems wise to contemplate Koh et al⁸: "Species coextinction is a manifestation of the interconnectedness of organisms in complex ecosystems. The loss of species through coextinction represents the loss of irreplaceable evolutionary and coevolutionary history."

May veterinarians keep this in consideration as we go about our daily work trying to balance animal welfare, conservation, and ethics in the practical setting of clinical work, with the ultimate aim of pro-

tecting the sometimes fragile remnants of our remarkable animal kingdom.

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