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Bears or butterflies? How should zoos make value-driven decisions about their collections?[1]

Clare Palmer, TJ Kasperbauer & Peter Sandøe

Introduction

Zoos are ethically contested institutions, not only in terms of their existence, but also with respect to their aims, policies, and practices. Many of these aims, policies, and practices are underpinned by commitments to defensible and widely shared values including animal welfare and species conservation. However, as we will argue, these values may be in tension, forcing choices between fulfilling some aims at the expense of others, or requiring trade-offs where each aim can be only partially met.

Such tensions are particularly salient with respect to the variety of species in zoo collections. Obviously, zoos have limited space; even in combination, zoos can only keep a tiny fraction of existing species, and keeping one species essentially means excluding others. So what should drive the mix of species kept, given the aims and values that zoological associations claim to endorse? And how should zoos respond to tensions and conflicts between these values in terms of their collections?

We begin this chapter by exploring key aims endorsed by three major zoo associations. Then we discuss the values underlying these aims, including animal welfare and competing understandings of conservation. We consider why these values are important, and the dilemmas and difficulties they pose for decision-making about the composition of zoo collections. In concluding, we make some tentative suggestions about future directions for zoo collections.

The Aims Expressed by Zoo Associations

In considering zoos' aims, we draw on mission statements and other policies adopted by three major zoo associations: World Association of Zoos and Aquariums (WAZA), Association of Zoos and Aquariums (AZA; primarily a US-centered organization), and European Association of Zoos and Aquaria (EAZA). We assume that in joining these associations, individual zoos endorse these statements and policies (we will not discuss zoos operating outside these associations; and our primary focus is on zoos, not aquariums).

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The most prominent shared aim is to promote conservation to protect animal species, populations, and habitats. WAZA's (2015a, 16) strategy document (see also Barongi, this volume), for instance, defines successful conservation as "securing populations of species in natural habitats for the long term." Animals kept in zoos should "play a conservation role that benefits wild counterparts" (WAZA 2015a, 17), in particular by linking zoo exhibits with fundraising for specific *in situ* projects involving the same species (for instance, through the "One Plan" approach; see, e.g., Traylor-Holzer, Leus, and Byers, this volume). By 2008, WAZA members collectively contributed over $350 million each year to *in situ* conservation (Gussett and Dick 2011; WAZA 2015a). Zoos may also keep animals for reintroduction, or to serve as an "assurance population," for reintroduction "when conditions are ripe" (AZA 2014a). Zoos also train staff and wildlife veterinarians, while conservation-relevant zoo research may contribute to protecting species in the wild. Alongside *direct* contributions to field conservation, zoos also pursue *indirect* conservation work, in particular public engagement and environmental education aimed at changing knowledge, attitudes, and behavior with respect to conservation (WAZA 2015a; AZA 2014b).

A clearly separate aim concerns animal welfare. The AZA highlights animal welfare in its mission statement: "The AZA provides its members with the services, high standards, best practices and program co-ordination to be leaders in animal welfare, public engagement and the conservation of species" (AZA 2014b). *Caring for Wildlife* (WAZA 2015b) is a wide-ranging policy statement on the significance of animal welfare, and WAZA notes on its website (n.d.) "The goal of the World Association of Zoos and Aquariums is to guide, encourage and support the zoos… of the world in animal care and welfare, environmental education and global conservation." While EAZA does not explicitly mention animal welfare in its mission statement, its 2009 Code of Ethics requires members to "promote the interests…of animal welfare"; and animal welfare is emphasized in most of EAZA's official guidelines and position statements.

It's not clear exactly how promoting animal welfare fits with conservation, however. Animal welfare in EAZA, WAZA, and AZA's statements appears to require independent promotion, rather than being just a side-constraint on the pursuit of conservation; this is certainly how some leading interpreters see it (e.g., Maple and Perdue 2013). However, zoo animal welfare is not usually understood as a goal in the same sense as conservation. Animals are not kept in zoos just to promote animal welfare. For instance WAZA (2015a, 59) describes conservation as zoos' core *purpose,* and positive welfare as their core *activity*. What these welfare commitments do establish, though, is that when animals are kept in zoos, it's important that their welfare is good—for the animals themselves, for visitors to appreciate, and sometimes as an inspiration for animal welfare initiatives in other areas (see Maple and Segura, this volume).

So what implications do these differing aims have for the composition of zoo collections? Direct conservation goals alone might suggest focusing on threatened species of ongoing ecological significance, where populations may persist with assistance, and where there is some likelihood of successful reintroduction. While conservation education *may* focus on those same species, these species might not appeal to visitors, and so may not be ideal for public engagement. And in terms of animal welfare, some species may flourish better in a zoo environment than others; but these species are not necessarily those with high conservation value, *or* attractiveness to visitors (Dubois and Fraser 2013). So, given the relative independence of these aims, zoos may face conflicts or trade-offs in terms of what's kept in their collections.

Some of these tensions are acknowledged in the mission statements or ethical codes of zoological associations. WAZA (2005, 61) is explicit: "In practice there could be a conflict of interest between the conservation of a species or population and the welfare of an individual animal." But little assistance about how to tackle such conflicts is offered, other than to say that doing so may involve "weighing competing values" and that "these considerations are complex and often dependent on context." Similar value weighing is proposed in WAZA (2015b). The WAZA Code of Ethics (2005) comments: "Any actions taken in relation to an individual animal, e.g. euthanasia or contraception, must be undertaken with this higher ideal of species survival in mind, but the welfare of the individual animal should not be compromised." This gives little guidance as to how zoos might go about "balancing values," if indeed that is what they should be doing; if euthanasia or contraception are seen as incompatible with welfare, this statement may instead suggest that weighing species conservation at the cost of animal welfare is not, after all, permissible.

Zoo mission and strategy statements don't go into much detail about how to understand the values underpinning zoos' aims. We therefore now turn to the wider literature in conservation, environmental, and animal ethics to help spell out what might be meant by "conservation" and "animal welfare" values.

Values Underlying Conservation and Animal Welfare

Conservation value can refer to conserving a number of different things, singly or in combination: individuals, populations, species, ecosystems or more abstract qualities such as "wildness" or "place." Recently – although this is not undisputed - it has been proposed that larger, more encompassing entities such as ecosystems should have conservation priority (see Norton, this volume). Certainly, inasmuch as zoos' conservation goals are tied to either original or potential future habitats of the species they support, a key concern is maintaining the health of (and potentially restoring or even creating) these ecosystems (WAZA 2005, 11). Ecosystems may provide both consumptive values (such as food sources) and non-consumptive values including places and landscapes that people value for cultural, historical, and aesthetic reasons. On some (admittedly contested) ethical views, it's also argued that we have direct moral responsibilities to

ecosystems, independent of their instrumental value (e.g., Johnson 1992). So, there are many value-based reasons for supporting zoos' ecosystemic goals.

Zoo conservation may also be committed to the value of species themselves or at least to the value of *some* species. Species can be highly valued for intrinsic qualities such as charisma (for instance, polar bears) or beauty; or their apparent similarity to human beings, as in the case of gorillas (dePinho et al. 2014; Russow 1981). Philosophers such as Johnson (1992) and Staples and Cafaro (2012) argue that we have direct duties to species as well as ecosystems. These values persist even if species have no remaining natural habitat, as in the case of Pere David's Deer; or when reintroduction seems unlikely, as with members of amphibian species being kept in zoos to avoid extinction from chytid fungus in the wild (see Mendelson, this volume).

Another distinct value is that of good animal welfare. Welfare is typically understood in one of three ways: in terms of animals' positive and negative subjective *experiences*, and/or the satisfaction or frustration of their *preferences*, and/or their ability to perform *natural behaviors* (Appleby and Sandøe 2002). In the animal welfare literature there's significant disagreement between those who think that only animals' subjective experiences are relevant to welfare and those who maintain that being able to perform natural behaviors makes an independent contribution to welfare. Concern for both the subjective states of animals and animals' ability to perform natural behavior appears in zoo association documents, and both seem important to animal welfare in zoos. Many animals held in zoo collections are sentient, that is, able to undergo subjective experiences of pain and pleasure, and to be in other positive, or aversive, experiential states. WAZA (2005) commits zoos to avoid both causing and allowing suffering (i.e., strong and/or protracted episodes of pain or other aversive states) in animals under their care, and emphasizes the importance of allowing zoo animals to perform natural behaviors. However, it's not clear whether performing natural behaviors here is regarded as independently important, or important only in terms of the resulting experiences of the animals concerned. This may matter when promoting natural behavior conflicts with preventing suffering – for example, when deciding whether male animals should be allowed to fight, or when fostering "wild behaviors", potentially stressful to captive animals, prior to reintroductions (WAZA 2015a, 60; see Greene, this volume).

Other issues also require clarification. First, some animals kept in zoo collections – particularly invertebrates – may not have a welfare, at least in the sense of having subjective experiences or preferences. It still makes sense to talk about them performing "natural behaviors", but there's a question whether this *matters* in animals lacking sentience.

Second, concern about zoo animal experience has, historically, focused more on avoiding negative welfare (such as suffering) than providing *positive* welfare – in terms of feelings of pleasure, satisfaction, or excitement (Maple and Perdue, 2013) or the opportunity to exercise natural

behaviors. The recent emphasis on enriched environments in zoos indicates increasing concern for positive welfare, as does the new emphasis on animal "wellness" (see Maple and Segura, this volume; WAZA 2015b); but there's still a question about how significant positive welfare actually is in practice for zoos.

Third, while a focus on animal welfare centers on the ongoing *quality* of animals' lives, it can be argued that it doesn't necessarily have implications for the *length* of their lives, and therefore for painless culling of healthy but "surplus" animals. This view, though, is controversial; Kasperbauer and Sandøe (2016) defend the view that painless culling may be a welfare issue.

This brief overview of the values that underlie concern for conservation and animal welfare indicates tensions between different conservation values, between different ideas of animal welfare, and, in addition, potential conflicts between conservation values and animal welfare values. This may give rise to complex and contested situations, especially when thinking about a value-driven species composition for zoo collections. We'll now return to this discussion of zoo collections more directly, drawing on debates about the possible future of conservation and on recent empirical studies of conservation and animal welfare.

Composition of collections of zoos in light of their different aims

Zoo collections and direct conservation value

Zoos are limited in terms of space and resources; not all species of conservation value can be conserved. So, zoos must operate tactically by using their collections to best serve their own conservation goals. But these will vary, depending on what conservation values are prioritized.
Strategic decisions of this sort are being taken by zoos and zoo associations, for instance as part of IUCN Population Management Strategies. The AZA's Regional Collection Plan Handbook (2012) outlines the criteria Taxon Advisory Groups should use when making recommendations for which species should be managed by groups of zoos. First among these criteria are "conservation status" and "extinction risk in the wild." Do zoo collections currently manifest this priority?

Leader-Williams et al. (2007) found that the numbers of threatened species held by zoos increased from 103 in 1993 to 230 in 2003 (mostly non-mammalian species). However, recent studies of current zoo collections have questioned whether these increases are sufficient to meet conservation goals. Conde et al. (2013, 3), for instance, compared the species held in zoos with those listed on the IUCN Red List as vulnerable, endangered, or critically threatened (together called "threatened") and concluded that with a few exceptions "most collections are not distinguishable from what would be expected if the species were selected at random." Martin et al. (2014) compared bird and mammal species held in zoos to the most closely related species not

held in zoos, and found that (*inter alia*) zoo species tended to be less, rather than more, threatened with extinction. These and other studies suggest that given zoos' own commitments, there's room for a greater focus on threatened species in practice.

An earlier study by Conde et al. (2011) raises another issue about the fit between conservation and the composition of zoo collections: the classes of species held in zoos. While one-fifth to one-quarter of IUCN threatened and near-threatened mammal species are represented in zoos, only 6.2% of globally threatened amphibian species are represented (Dawson et al. 2015), even though 41% of amphibian species are listed by the IUCN as threatened or extinct in the wild. Taking only conservation value into account, amphibians – and reptiles – seem good choices for zoo collections (as suggested, for instance, by the Amphibian Ark project – see Mendelson, this volume). In addition to being threatened, many of them require little space, while still contributing as much to conservation research and personnel training as larger species.
Keulartz (2015) recently argued:

> "the most effective strategy to combat the problem of limited space is without any doubt a shift away from the large charismatic mammals towards smaller species, particularly amphibians, invertebrates and some species of fish, which occupy less space, are relatively inexpensive to keep, have a high birth rate and are easy to reintroduce."

While these factors may not apply to all species, holding more small-bodied, non-mammal species may help zoos to protect endangered species (without, as we discuss below, negatively impacting on visitor responses).

The issue Keulartz raises about reintroduction is, however, complicated. Reintroductions from captive populations have not, to date, been very successful. Zoos have played a direct role in the recovery and reintroduction of 13 animal species (though this number is contested in both directions; Balmford et al. 2011; Conde et al. 2011a; Conde et al. 2011b; Hoffmann et al. 2010). Multiple studies have found that reintroductions with captive-bred populations are less successful than reintroductions with relocated wild populations. For instance, Jule, Leaver, and Lea (2008) surveyed reintroductions of 46 carnivore species and found that 48.5% of the reintroduced populations sourced from the wild, and only 19% of the populations sourced from captivity, survived 6-18 months after release.

A further inhibiting factor for zoos' captive breeding programs is that many populations of threatened species in captivity are small, and distributed between zoos (Conde et al. 2013). To ensure sufficient genetic diversity in breeding programs, zoos therefore need to exchange either animals or gametes. Zoos are, of course, tackling such difficulties, for instance with collaborations

supported by Regional Collection Plans, but moving animals for breeding faces many hurdles (WAZA 2015a, 54). However, a more cost-effective strategy may be for different zoos to hold smaller numbers of species in their collections, but to increase the number of individual animals in each species, which may also have welfare benefits (Maple and Purdue 2013, 150).

The likely impact of climate change on ecological systems also raises concerns about the possible success of species reintroductions and the purpose of keeping assurance populations. Those species that flourish in such changing systems are unlikely to be currently threatened or endangered. For many currently endangered species, changing climate is likely to increase threats and diminish the likelihood of successful reintroduction into the foreseeable future - at least, into their current native habitats (Sandler 2013).

This doesn't mean that efforts aimed at reintroductions should be abandoned. But it does suggest that when species are being kept for reintroduction, or as assurance populations, it's important to consider the resilience of these species to climate change, climate predictions for their native habitats, and the possibility of potential introductions to non-native locations in the future. If wild reintroduction is a goal, but successful reintroduction anywhere in a realistic, climate-changed future looks unlikely, this should count against the inclusion of a species in a zoo's collection (though some species could be still be important for conservation-oriented research; Minteer and Collins 2013). If, on the other hand, the purpose is just considered to be conservation of certain species, even when their natural habitats are gone, zoos may still have an important role to play.
As noted above, some species are valued independently of their wild habitat on the basis of their beauty, or charisma – which might contribute to what the AZA calls "exhibit value." However, given zoos' own conservation goals, exhibit value does not by itself seem a sufficiently compelling reason for keeping animals in spaces that could be occupied by those of more direct conservation value. But "exhibit value" may matter when it comes to *indirect* conservation, to which we will now turn.

Indirect Conservation: Education and Fundraising

Alongside direct conservation, zoos' collections attract visitors, generate resources for field conservation, and are used for conservation education (see Barongi, this volume). Without an income stream from visitors, most zoos can't carry out direct conservation, and of course, conservation education requires visitors. Zoo collections must thus attract visitors.

If species best for direct conservation were also best for visitor preference and conservation education, zoos' collection decisions would (in these respects) be relatively simple. And in fact, such decisions may be fairly simple, at least in terms of what can be gleaned from current research. After reviewing the literature, we could find little evidence of significant negative impacts on visitor numbers or conservation education when zoos *did* primarily select species ideal

for direct conservation. On the contrary, there's evidence that people are particularly interested in seeing rare and endangered animals (Whitworth, 2012).

It's widely believed, however, that charismatic mammals, and species with large body sizes, are needed to attract visitors. This view may have affected the current composition of zoo collections. Frynta et al. (2010, 2013) found that people's ranking of an animal's beauty, as well as its body size, were good predictors of whether that species would be found in zoos – implying that zoos take these factors into account when forming their collections, and that animals of this kind are well represented in zoos.

However, it has been difficult to establish what visitors' preferences actually are regarding the physical features of zoo animals. Balmford (2000), for instance, failed to find any connection between body size and popularity among zoo visitors, looking both at his own data and that of 4 other studies. More recently, Whitworth (2012) found that small animals were actually more popular than large animals in UK zoos. He did, however, find a weak positive correlation ($r = .268$) between the popularity of animals held at a zoo and the number of visitors. This suggests that the type of animals held by zoos do matter somewhat for zoo attendance, but that body size is not a strong factor influencing which animals people want to see. While further research is needed, this at least in principle suggests that keeping animals with smaller body sizes would not reduce (and might increase) the number of zoo visitors (a view perhaps reinforced by Ivanyi, this volume).

On the other hand there's some evidence that mammals are the most popular animals kept in zoos. Moss and Esson (2010), for instance, studied visitors' interest in 40 zoo species at Chester Zoo in the UK, spanning mammals, birds, reptiles, amphibians, fish, and invertebrates, measuring both the number of visitors at each exhibit and the amount of time visitors spent at the exhibit ("holding power"). Mammals were significantly more popular than all other groups on both measures. It's not clear what implications this finding might have (assuming it could be confirmed in other studies). It might mean that while mammals are most popular with visitors, other taxonomic groups would be visited more, if fewer mammals were available. Or it might suggest that zoos should keep some "flagship" mammals for attracting visitors and as a gateway to conservation education, but that they could in addition increase collections of smaller, more threatened individuals from other taxonomic groups. Another strategy might be to increase conservation value among mammal holdings by seeking less popular but threatened mammal species. Smith et al. (2012), for instance, identify 183 candidate species that receive very few conservation resources, but nonetheless possess aesthetically appealing features (e.g., large, forward facing eyes) for visitors.

In terms of conservation education, we don't know much about what's specifically learned from species composition in zoos. Studies have tended to focus on the *way* zoos present information;

for instance, whether there's a human interpreter at exhibits, and the effects of signage (Routman et al. 2010) and on overall knowledge gained, for instance about biodiversity (Moss, Jensen and Gussett 2015). It may be that once people have entered the zoo, information presentation is more important than species composition.

Although more research is needed here, education and fundraising considerations don't appear to winnow out or expand the species suggested by direct conservation values alone. So, there may not be much tension between achieving the aims of direct and indirect conservation in terms of zoo species composition. However, animal welfare concerns generate more potential for value conflict.

Animal welfare

One potential consequence of pursuing good animal welfare is in narrowing the species thought suitable for zoos, since some species can't easily achieve good welfare in captivity (e.g., forest duikers and cheetahs; Mason, 2010). But zoos may approach this problem in different ways, depending on how they prioritize the value of animal welfare. Four alternatives are:

a) Absolute conservation value, no welfare side constraint: When conservation values and the value of good animal welfare are likely to come into conflict, conservation values should always take priority, even if this means causing or allowing animal suffering, frustration, or restriction on natural behavior.
b) Conservation value primary, absolute welfare side constraint: Conservation value is the priority for zoos, but it should not be pursued in cases where doing so would lead to poor animal welfare (so, for example, species that do not thrive in captivity should not be kept). Depending on what understanding of animal welfare is adopted, such side constraints will be more or less severe.
c) Conservation value and animal welfare commensurable, with weighing of values: Values must be weighed to bring about the best overall consequences in terms of both values. So, zoos should not sacrifice good animal welfare for a small gain in conservation value. But for a large gain in conservation value – for instance, saving a key species with a strong likelihood of successful captive breeding and reintroduction – sacrificing a good deal of animal welfare is ethically permissible, if alternatives aren't available.
d) Animal welfare as absolute or primary: Here welfare would have priority over any conflicting conservation values. This is more likely to be adopted in a sanctuary than a zoo.

A zoo that accepted (a) would not appear to be taking animal welfare as seriously as zoo association commitments require. WAZA (2015b) seems to support (c), recommending that zoos

"Evaluate whether the animal welfare implications of management interventions are outweighed by their conservation benefits." But WAZA (2005) seems to propose a version of (b) when values conflict, since "the welfare of the individual animal should not be compromised." However, depending on what's meant by "welfare compromise", this may not amount to a very strong side-constraint. The species selection criteria outlined in the AZA Regional Collection Plan Handbook, for instance, while emphasizing conservation, only says of welfare that member institutions need to consider whether they have sufficient expertise "to meet the species' basic biological needs (i.e., nutritional, medical, social, etc.) as related to maintaining and propagating them in AZA member institutions." This doesn't, for instance, mention *positive* welfare, although this does appear in other more recent documents (e.g., WAZA 2015b).

On approaches (b) and (c), zoos should consider whether they have sufficient capacity to provide good welfare for animals before acquiring them (see IUCN 2014). Research suggests that even among closely related species, some do much better than others in zoos. For instance, among raptors, kestrels seem to do better than sparrowhawks, especially in terms of mortality rates; and among psittacines, macaws do much less well in terms of feather-plucking and breeding success than lorikeets (Mason et al. 2010). Given zoos' welfare commitments, and the fact that zoos must make choices between species, these kinds of difference (taking into account any known environmental changes that could help improve welfare) should impact collection decisions.

However, welfare as a selection criterion might still lead to conflict with conservation values. A number of studies have suggested that endangered species are more likely to have poor welfare, as it may be harder to meet their needs. Martin et al. (2014) for instance, note that more threatened species existing only in the wild were larger, and occupied more land, than closely related species found in zoos; and that these features might make them harder to keep in captivity. Mason et al. (2015) hypothesized that anthropogenic changes to the wild—in terms of changing habitats, restrictions on ranging and dispersal, shifts in climate, new infectious diseases, pollutants, and changing social structures—pose similar challenges to animals as being taken into captivity. It's possible, then, that some species struggling from anthropogenic influences on their wild habitat may also struggle living in an anthropogenic captive environment, and for similar reasons. This conclusion may at least suggest caution about keeping some species endangered for anthropogenic reasons in zoos. Furthermore, since the world outside the zoo is likely to come under increasing anthropogenic influence, reintroductions from these species in the future are likely to be challenging.

To provide improved welfare, and meet conservation goals, some recent research suggests that zoos could expand the inclusion of indigenous and native animals in their collections (Maple and Perdue 2013). The Phoenix Zoo, for example, has been breeding and reintroducing into Arizona species native to the Southwest, including Chiricahua leopard frogs and desert pupfish (see Allard

and Wells, this volume). Such programs of breeding locally threatened fish, amphibians, reptiles, and invertebrates seem ideal for zoo collections: they focus on threatened species needing conservation; they are part of current and successful reintroduction programs; these species may take up less space than large mammals; and they may raise fewer welfare problems because they are already in an appropriate climate and need to travel less far to be reintroduced. Research suggests that visitors do want to see local animals. A recent study by Roe et al. (2014), for instance, found that 70% of visitors rated seeing endemic or local species as a high or very high priority, as opposed to fewer than half of zoo officials. One might hypothesize (as Roe et al. do) that exhibits of regional wildlife could help both in developing understanding of local species and suggesting how visitors might protect local environments.

Conclusions

This paper has explored how zoos committed to the values of conservation and animal welfare might strategically develop the composition of their collections. We suggested that:

- Zoos could hold a higher proportion of IUCN listed threatened species to better meet their commitment to conservation, although these species may pose particular welfare challenges in captivity.
- Zoos should consider expanding their collections to include less space intensive species, particularly amphibians, reptiles, invertebrates and some fish. These species may also raise fewer welfare concerns.
- Evidence suggests that holding more small and non-mammalian species would not discourage visitors, but there is also evidence that holding some charismatic mammals would attract visitors and promote zoos' conservation mission.
- Reintroductions from zoos have so far had limited success and climate change will make reintroductions even more difficult. This may weigh against assurance populations and suggest that species should be kept for reintroductions only where plausible in a climate-changed world.
- Where species cannot have good welfare in zoos, this should normally count against their inclusion in zoo collections. Animal welfare concerns should include both positive and negative welfare, but there is debate about the relative significance of positive welfare and whether to include opportunities for natural behavior as a consideration in its own right.
- Zoos should consider expanding their native and endemic collections – the Arizona-Sonora Desert Museum in Tucson (see Ivanyi and Colodner, this volume) is a good example of this.

So, to answer the question in our title: given their own value commitments, zoos may do best to expand their collections of less space-intensive, local, threatened, invertebrate populations, especially in cases where animals lack subjective welfare (such as butterflies) or their welfare needs are relatively easy to fulfill. But they could hold, in addition, a few charismatic "flagship" mammals, if they can thrive and have good positive welfare in captivity.

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