

Critically Evaluating the Consequences of a Single Species Conservation Approach



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Introduction

It is claimed that Earth is currently in the midst of its sixth mass extinction Briggs, Ceballos et al. & Laurance et al. [1-3], to date the IUCN Red List classifies 25,062 species of vertebrates, invertebrates, plants, fungi and protists as being threatened, with classification's ranging from near threatened to extinct in the wild IUCN Red List, Hoffman et al. [4,5] It is estimated that current extinction rates are 100 – 1000 times higher their pre-human background rates [6,7] but exact figures are often frequently disputed [8,9]. However, there is great effort to try to reduce and mitigate this rate of extinction by saving at risk species and habitats through wildlife conservation.

There are many different approaches and attitudes towards conservation, and what is thought to be in best efforts for the preservation of wildlife. Some conservationists may seek a utilitarian conservation ethic to harness market demand and engage communities to protect species by embracing the sustainable use of individual animals, such as those sought out through trophy hunting [8-12]. The polar opposite view on wildlife conservation is the preservationist ethic, which seeks to save every individual animal, conserving whole species and their habitats, even when the two goals may run counter to one another [13,14], preservationist conservation techniques could include; protecting habitats by law, designating them as SSSI, National Park or implementing Biodiversity Action Plans (BAPs), hoping to protect and increase the productivity of eco-systems, and preservation the genetic diversity of a species.

An additional practice is the single species approach to conservation; this idea focuses upon conserving just one species

and is the primary object within an eco-system management. Many single species approach to conservation focus on charismatic and endangered species, often referred to as 'flagship species'. Sometimes these flagships species can also be attributed and associated to wider environmental issues or importance to local culture such as the polar bear (*Ursus maritimus*) to climate change or African elephant (*Loxodonta*) to illegal wildlife trade, poaching and the conservation of African landscapes [15]. A large majority of these charismatic flagship species that are protected are vertebrates, particularly birds and mammals [5,16,17]. Schlegel and Rupf [18] conducted a study among school children to view their studies towards different types of indigenous species. The survey shows a heterogeneous pattern, whereby butterflies, birds and mammals are, higher appreciated than reptiles, insects and amphibians. Walpole and Leader- Williams [19] also argue that these flagship species are chosen and the focus of many conservation management plans due to their social-economic role rather than an ecological one, holding a more aesthetic value than ecological one, with people more willing to donate money towards saving tigers from extinction, opposed a rare species of sea slug. These flagship species may distract from wider ecosystem conservation priorities [17,20]. Often single species protection is both time consuming and costly, and it could also be considered as treating a symptom to wider environmental issues onset by anthropogenic influence.

There are many positive success stories to the single species conservation approach, for example, the Florida panther (*Puma concolor coryi*) dwindled to near extinction with just ~30 individuals left in the wild, primarily due to habitat fragmentation.

The closely related mountain lion (*Puma concolor*) was introduced; due to its close relation to the panther, so a hybrid of the species may live on through artificial inbreeding, conserving the species [21]. However, without initial human intervention, the panther's habitat would have been left unaffected, potentially reducing the decline. So, is it the responsibility for humans to preserve and repair a single species if they are responsible for the damage?

However, extinction and the decline of species is not exclusive to human influence, and is a perfectly natural process, and though humans might be altering landscapes and habitats and at unprecedented rates, can our influence truly be seen as unnatural. Some species are able to adapt and fulfil niches available to these altered habitats. For example, the Peregrine falcon (*Falco peregrinus*) has adapted to urbanised environments, utilising building ledges as nesting spots and capitalising on pigeons as prey or the pink salmon (*Oncorhynchus gorbuscha*) altering migration patterns due to rising water temperatures within Alaska. Whilst some species can adapt, human influence can save species and targeting species comes at a bias towards certain taxa at great cost, what wider ecological consequences and implications does this single species approach to conservation have.

In an ecosystem, a keystone species often refers to a dominant predator whose removal from the environment may lead to a rapid expansion of prey species populations, and can have detrimental effects on the environment and decrease overall biodiversity [22,23]. One famous case study of where the conservation priority was of a re-introduction keystone species is Yellowstone National Park. By the end of 1996, 31 Canadian wolves (*Canis lupus occidentalis*) were introduced into the Yellowstone National Park, in efforts to counter the expanding population of elk (*Cervus Canadensis*). Since the disappearance of wolves in the park in the 1930's, the absence of wolves took a large amount of predatory pressure off the elk within the park, despite still being preyed upon by grizzly bears (*Ursus arctos*) and cougars (*Puma concolor*) [24]. There were two main consequences that resulted from the increased elk population. The elk pushed the National Park to the limits of its carrying capacity, and in the winter the elk migrated around the park less, browsing heavily on the young willow, aspen and cottonwood plants. Which reduced browsing opportunities for the following year and reduced the resource availability for the beaver (*Castor canadensis*), which depend on the willow for winter survival [25,26].

Following the reintroduction of wolves to the park the elk population reduced dramatically and this had many benefits to the wider ecosystem. Firstly, the risk of predation altered the behavior of the elk population causing them to rapidly migrate around grazing areas, or avoid areas of the park, reducing and protecting the open valleys from overgrazing [25,27]. Following this, tree

height rapidly increased, bare valleys began to flourish with forest willow, aspen and cottonwood. This in turn attracted an increase of bird species to the area, of both songbirds and migratory birds [26]. The availability of willow also allowed beaver numbers to recover, with Yellowstone currently being home to nine beaver colonies. These eco-system engineers then created niches for other species, such as the dams built becoming habitats for otters, Muskrats and many amphibian species [24].

The wolves did not just solely predate upon the elk, but also upon coyotes, resulting in an increase in rabbit and mice populations. Which increased resource availability for hawks, weasels, foxes and badgers [26]. The carcasses left by the predation also increased resource availability for carrion feeders such as ravens and bald eagles [28]. The regenerated vegetation also gave bigger yields of berries, increasing bear populations, which in turn reinforced the impact of the wolf population by preying upon the elk [25,27].

As a result of the regenerating forests, the banks of the river systems with the national park began to stabilise, the rivers began to meander less, the channels narrowed and soil erosion around the riverbanks reduced [25,27]. The introduction and conservation of this single species not only dramatically increased biodiversity within the National Park, the productivity of the ecosystem but also changed its physical geography [29].

Whilst Yellowstone National Park, can be deemed a success for the wider ecosystem, not all conservation efforts have been so beneficial to the wider biological community. Even after the success of Yellowstone National Park, in 1998 Simberloff argued that the single species management approach to conservation was outdated and a wider approach to conserving landscapes should be adapted. Due to both financial and time constraints, it is near impossible to monitor every aspect of biodiversity in an ecosystem. Therefore several 'shortcuts' for monitoring biodiversity have been adapted, by observing a single or protected species. Claims that this indicator species concept is problematic as there is no consensus on what the species is actually supposed to indicate, due to being able to define which species is the most affective at on what needs to be indicated, with these species potentially only needing or providing small niches not beneficial for the wider community. Therefore, being able to pinpoint a truly beneficial species for the conservation for a landscape may not be as applicable for every habitat type. Additionally in these conservation fund raising efforts for flagship species, these often large charismatic vertebrates are often not good indicators for the landscapes and the management strategies of two flagship species could be counterintuitive and conflict against one another.

In New Zealand, Towns, et al. [30] suggest that for successful

conservation a combination and balance of flagship species and indicator species needs to be established, and that this could be achieved in 3 main ways, 1: developing and establishing long term goals for both the species and eco-systems, 2: introduce a ranking process to identify species and populations that cannot presently survive in the wild within their natural range and 3: viewing community restoration and habitat protection as complementary, not alternative.

Forrest et al. (2010) investigated the effectiveness of single species conservation in a multi-use landscape. They found that whilst funding was being focused on saving wild tiger species (*Panthera Tigris*) in 13 countries, only 21% of habitats had some type of formal protection, with only 9% being protected or recognized under some form of IUCN categories. So, whilst 79% of tiger habitats are still undertreat, could funding for the conservation of this species be better implemented protecting the habitats, opposed to monitoring and place efforts in increasing tiger population numbers in at risk areas.

There are countless case studies on how focusing conservation efforts on single keystone species is beneficial for the wider ecosystems, such as the plateau pika (*Ochotona curzoniae*) in the Tibetan plateau, which burrows provide homes to small birds and lizards, serves as a primary prey species that also creates microhabitat disturbance that results in an increase in plant species richness [31], or the Brazilian lion tamarins (*Leontopithecus*) was used as a flagship species to protect forest areas within South America [32].

Though these keystone species may only provide a small niche service for the habitat, many regards that taking an umbrella species approach to conservation management strategies would be more beneficial for habitats and eco-systems [33]. An umbrella species is one that needs large tracts off a habitat, and that by fulfilling this species needs, and that by proxy, other species will automatically be saved, is deemed a better approach to conservation. However, if a majority of other species fall under this 'umbrella' is more a matter of faith than research. With NGO's only using 80 flagship species and with 61% of campaigns only raising funds for the species itself, Smith, et al. [34] sought to identify 'Cinderella' species, which are chosen for both their conservation appeal and charismatic look to draw public attention. Whilst flagship species are a critical fund-raising tool, they aim to create wider biodiversity benefits 'by proxy', but they should be used with caution. Raising the profile of a species in indigenous areas may cause resentment from locals who utilise the habitat for survival [35].

The issues in single species conservation are about being able to correctly allocate and select key stone species that have a

wider ecological benefit to the ecosystem [36]. But whilst species such as wolves in Yellowstone may generate large amounts of conservation revenue and benefit the landscape, single species conservation needs to focus on swaying public perception of species that are more important for the ecosystems, than they are charismatic. The public may benefit from taking a more biocentric view to conservation, where all species are of equal value, but sadly more often than not species are valued differently.

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