

How well are Mediterranean ecosystems protected in Chile? Insights from gaps in the conservation of Chilean vertebrates

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ABSTRACT: In order to prevent the loss of biodiversity as the result of global environmental changes, it is essential to increase the amount of land within the Protected Area networks currently in place. This is particularly important in Latin American countries, for which this option is probably the safest one considering current demographic trends and short terms threats of a growing and expanding economic activity. The Chilean Protected Area systems was one of the pioneers in Latin America, dating back to 1907, however, as is the case in most countries within the region, most areas were established based on available opportunities rather than following well defined targets and long-term conservation planning strategies. In this contribution, we present the result of Gap Analysis of Chilean terrestrial vertebrates within Chilean Mediterranean area including mammals, birds, amphibians, reptiles, and freshwater fishes in reference to an updated and refined GIS cover of Chilean Protected Areas. In general we found a large number of gap species, especially among species endemic to the Mediterranean area.

1 INTRODUCTION

Most ecosystems on earth are in different states of degradation as a consequence of the direct and indirect effect of humans (Vitousek 1994, Hannah et al. 1995, Leemans and Zuidema 1995, Bradshaw and Marquet 2003). This degradation is manifested in many ways, including substantial modifications in the composition, structure, and functioning of ecosystems linked to local and global extinction of species (e.g., the biodiversity crisis, Wilson 1992 Pimm et al. 1995), alteration of biogeochemical cycles, land transformation, and overexploitation of resources. The impact of humans is so strong and pervasive that current estimates suggest that between one-third to one half of the earth's land surface has been transformed by human action (Vitousek et al. 1997). Mediterranean type ecosystems are subjected to strong threats derived from human activities and harbor a large proportion earth biodiversity and (Cowling et al. 1996, Rundel et al. 1998). Particularly, the Chilean mediterranean ecosystem is recognized as a biodiversity Hotspot (Arroyo et al. 1999, Myers et al. 2000) because of it large diversity of animal and plant species a large fraction of which are endemic.

In the context of this global change in the environment the best and least expensive strategy to preserve biodiversity is through the creation of Protected Areas (PA) wherein native species can be protected in the their natural ecosystems. A recent assessment of the global coverage of PAs indicates that 11.5% of the land surface is currently protected (Chape et al. 2003). However, there are concerns regarding how this proportion is distributed across the globe and how well it covers bio-

diversity. In fact, a recent study of the number of vertebrate species worldwide (mammals, threatened birds, and amphibians) likely to be covered in the global network of PAs (Rodrigues et al. 2003) found that a large fraction of them can be considered gap species (i.e., not currently covered in any PA). In this study, we undertake an assessment of the PA network found in the Mediterranean area of Chile by performing a Gap based on the distribution of vertebrates species.

2 METHODS

Distribution range maps (i.e., extent of occurrence Gaston 1994) for all terrestrial vertebrate species were compiled from primary and secondary literature (species accounts, regional guides, and scientific reports) as part of the National Gap analysis currently under development by the Center of Advanced Studies in Ecology and Biodiversity of the Pontificia Universidad Católica de Chile. Range maps were then digitized as individual geographic information systems polygon layers. Additionally, the maps of all Protected Areas (including those under the SNASPE as well as National Monuments, RAMSAR sites and Private Areas) were digitized as a polygon layer.

To calculate the percentage of the geographic range of a particular species represented in a protected area, we superimposed the map of each species distribution range onto the map of protected areas. Following the methodology of the Global Gap Analysis (Rodrigues et al. 2003), we assessed two different scenarios. Scenario A, is the most conservative one and counts an species as protected if its range intercept in any proportion a PA. Scenario B, on the other hand, established a representation target for each species, defined as the percentage of the species' distribution range that must overlap protected areas in order to be considered covered. Thus, all species with ranges ≤ 10000 km² were required to have 100% of their range covered, while species with ≥ 250000 km² were required to have at least 10% of their range covered. Target representations for species with range sizes between these two values were calculated by interpolation using a log-transformation (Rodrigues et al. 2003). Species were then classified as covered (100% of its target represented in protected areas), gaps (0% of its target represented in protected areas), or partial gaps (only a portion of its target represented in protected areas). All species, and in particular those that are endemic both to Chile and to the Mediterranean region (i.e., strict endemics), and the species that are endemic to the Mediterranean Region within Chile (but can be found in other countries) were included in the gap analysis. We followed the restricted definition of Mediterranean climate of di Castri (1973) and defined Mediterranean ecosystems as those under the influence of "eumediterranean" climate, which in Chile extend between 31° S to 36°30' S.

3 RESULTS AND DISCUSSION

In total, Mediterranean ecosystems in Chile cover 96.514 km² representing 12% of the continental Chile. The total number of PAs within this area is 33 covering only 3.02% of the surface area of Mediterranean ecosystems. This small percentage stands in sharp contrast with the ca. 20% covered at national scales. The total number of vertebrate species found in Chile is 658, including freshwater fish, amphibians, reptiles, birds and mammals. Of these, 346 (52%) occur to some extent in the Mediterranean region (Fig. 1). Relative to the total number of species in Chile, birds is the taxonomic group better represented in the Mediterranean region, followed by freshwater fish, and mammals. According to our strict definition of Mediterranean area, there are 30 strict endemic vertebrate species, representing 8.6 % of the total number found in the area and 4.6% of the total at the country level. However, this number increases up to 50 species endemic to the Mediterranean area only (but present in other countries). Thus, 12% of Chile harbours 52% of its vertebrate biodiversity. The small percentage of land within Mediterranean Chile that is currently protected is cause of strong concern (see also Arroyo and Cavieres 1997, Simonetti 1999).

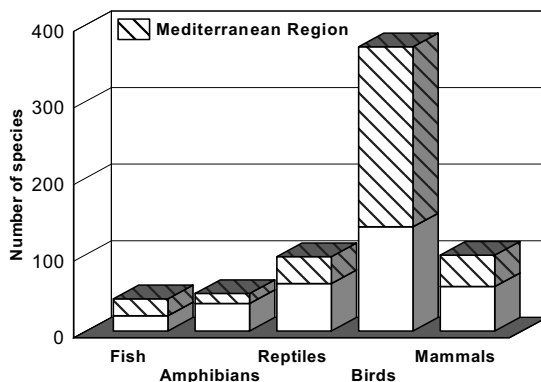


Figure 1. Number of vertebrate species in Chile and within the Mediterranean area.

The results of the Gap analysis (Scenario A) for the vertebrates of the Mediterranean area shows that 34 (9.8%), out of the total number of species, are gap species and that 10 of them are endemic to the Mediterranean area (i.e., 20% of the total number of the Mediterranean endemics). Under Scenario B, the total number of Gap species increases up to 36. However, as shown in Figure 2, when this analysis is restricted to endemic species only, the number of partial gaps (i.e., those species that under scenario B reach less than the 100% of their representation target) increases dramatically to more than 90% of the strict endemics or endemic species.

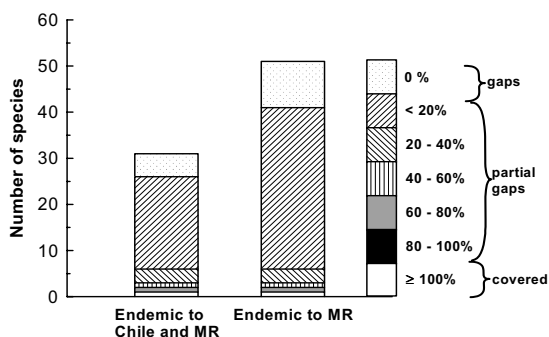


Figure 2. Number of gap (scenario A) and partial gaps (scenario B) among the total number of species that are strict endemics or endemics to the Mediterranean region (MR) of Chile.

Our estimates can be considered as conservative, for species occurrences are inferred from geographic distributions or extent of occurrence (Gaston 1994), which include areas of unsuitable habitats and where the species will likely not be found. Similarly, our analysis assumes that PAs are of a large enough size to harbor viable populations of each species, which is most likely not the case (Simonetti and Mella 1997). Thus, in reality, vertebrate species within the Mediterranean area of Chile are likely to be more threatened, and this is especially acute for endemic species (see also Simonetti 1999). Unfortunately, the prospects for biodiversity in Mediterranean Chile is not promising, for most land is in private hands, are highly productive and highly priced. In this context Private Protected Areas should be actively promoted. But in addition to this, especial attention should

be given to conservation efforts in the “semi-natural matrix” (Brown et al., 2003), or land neither intensively used for cities or agriculture nor set aside as natural reserves, for these areas are likely to harbor a large fraction of the Mediterranean biodiversity.

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