



## Review

## Out of sight, out of mind: Threats to the marine biodiversity of the Canary Islands (NE Atlantic Ocean)



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## ABSTRACT

Lack of knowledge of the marine realm may bias our perception of the current status and threats to marine biodiversity. Less than 10% of all ecological literature is related to the ocean, and the information we have on marine species that are threatened or on the verge of extinction is scarce. This lack of information is particularly critical for isolated areas such as oceanic archipelagos. Here we review published and grey literature on the current status of marine organisms in the Canary Islands as a case description of the consequences that current out-of-sight out-of-mind attitudes may have on this unique environment. Global change, as represented by coastal development, pollution, exotic species and climate change, are currently affecting the distribution and abundance of Canarian marine organisms, and pose multiple threats to local species and communities. Environmental risks are significant at community and species levels, particularly for threatened species. Failure to address these trends will result in shifts in local biodiversity with important ecological, social, and economic consequences. Scientists, policy makers, educators, and relevant societal groups need to collaborate to reverse deleterious coastal biodiversity trends.

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### 1. Introduction

Conservation practitioners often consider extinctions to be a minor issue for marine plants and animals compared with terrestrial species (Edgar et al., 2005). However, the relatively low proportion of threatened marine species on the Red List (IUCN, 2006) may be due to low threat levels in marine realm, or to the out-of-sight and data deficient nature of the marine environment where population trend data are extremely scarce (Raffaelli et al., 2005). Thus, poor knowledge of biodiversity may lead to an underestimation of the number of threatened species in the marine realm (Roberts and Hawkins, 1999).

Oceanic island ecosystems are disproportionately threatened, with about half of the 724 animal extinctions documented over the past 400 years relating to island species (CBD, 2010). They harbour concentrations of endemic species and unique biological assemblages, with many regarded as biodiversity hotspots (Mittermeier et al., 2004; Whittaker and Fernández-Palacios, 2007). For example, over 90% of Hawaiian species are endemic

(Gagné, 1988), while >50% of vertebrates are endemic in Mauritius (Jones and Hartley, 1995). Oceanic islands are inherently less resilient to biodiversity loss than their continental counterparts (Frankham, 2005); they are typically more at risk of natural disturbances (e.g. strong storms, volcanic eruptions) while human-induced threats (e.g. introduced species, habitat destruction) may be more concentrated, and recruitment may depend on propagules travelling long distances (Kinlan et al., 2005).

Here, we use the Canary Islands as a case example of an oceanic archipelago affected by local (e.g. coastal development, pollution, industrial activities, fishing) and global (e.g. climate change) human-induced threats. Along with the Hawaiian Islands, the Canary Islands comprise the most heavily populated oceanic archipelago and amongst the best studied. Moreover, its subtropical location constitutes an intermediate step between Atlantic-Mediterranean and Tropical Atlantic regions, and can be used as a reference to better understand tropicalization processes caused by global sea warming.

There are four major groups of Macaronesian seamounts along with four emerged archipelagos (Fernández-Palacios et al., 2011). In relation with island ontogeny, the process of island emergence would be expected to enhance speciation and regional marine

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biodiversity through the long term, compensating losses due to catastrophic events and island submergence (Whittaker et al., 2007). However, in the Canary Islands and further afield across Macaronesia, marine geological studies (i.e. seamount exploration, ocean-floor scanning) have largely been used to model present and past patterns in terrestrial biotas (Fernández-Palacios et al., 2011) rather than in the marine realm.

The Canary archipelago covers 7493 km<sup>2</sup> and is situated between 27°39'N to 29°24'N and 13°25'W to 18°10'W. It comprises seven major islands (Lanzarote, Fuerteventura, Gran Canaria, Tenerife, La Gomera, La Palma and El Hierro) and several islets, such as La Graciosa (an inhabited and heavily visited islet) and Alegranza off Lanzarote, and Lobos off Fuerteventura. Tenerife is the largest island (2034 km<sup>2</sup>) while Fuerteventura is the second largest (1660 km<sup>2</sup>) and the closest to the African continent (90 km distance).

The unique wildlife of the Canary Islands has long been recognized worldwide, with about 4000 known endemic species in terrestrial and marine realms (Martin et al., 2010). However, steadily increasing environmental problems threaten biodiversity of this archipelago. For example, one of the most important stressors in the marine realm is coastal population pressure, which is patchy and heavily concentrated in the overcrowded capital islands of Tenerife and Gran Canaria, where density exceeds 400 people per km<sup>2</sup>. The remaining islands are less affected by anthropogenic pressures associated with urbanization, including harbours, pipelines and desalination plants. The western islands (La Palma, La Gomera and El Hierro), in particular, have been developed without the massive coastal tourism resorts typical of the capital islands.

The Canarian marine environment is publicly perceived to be in a threatened condition, with local media regularly focusing on four issues: (i) overfishing (recreational and commercial), (ii) uncontrolled population expansion of the sea urchin *Diadema africanum*, (iii) spread of coastal development (e.g. harbours, marinas, resorts), and (iv) proliferation of jellyfishes (see Fig. 1).

### 1.1. Threatened species

Compared to terrestrial species, few marine species are listed under the Canarian Threatened Species Protection Act (Law 4/2010, Boletín Oficial de Canarias (BOC), 4th June 2010). A total of zero “Extinct”, four “Endangered”, nine “Vulnerable”, and six in need of “Special Protection” are recognized, with an additional 39 marine species included within a new category of “Species of Interest for Canarian Ecosystems”. Listed species in the Canarian catalogue mostly comprise algae (15 species) and molluscs (12 species).

Discrepancies exist between the IUCN Red List, National Catalogue of Endangered Species, and Canarian Catalogue of Endangered Species (Martin, 2009). The IUCN criteria are designed to identify global threat status (Butchart et al., 2005), however distribution ranges are based on absolute thresholds, which are rarely consistent with range sizes typical of species in smaller islands (Martin, 2009).

Here we discuss several threatened species in the Canary Islands that are included in the Canarian Endangered Species List, as well as other species that have undergone recent population declines. Where provided, distribution range sizes were calculated as area of occupancy based on the number of 500 m × 500 m grid cells in which the species is known to occur. This provides only an approximation to the true range size occupied by a species.

Overall trends in the classification of species in Catalogues and re-evaluations made in the last two decades point to a net decrease in the number of species classified as threatened. In addition, discretionary changes in the nomenclature of categories and selection criteria have apparently altered the effective levels of species

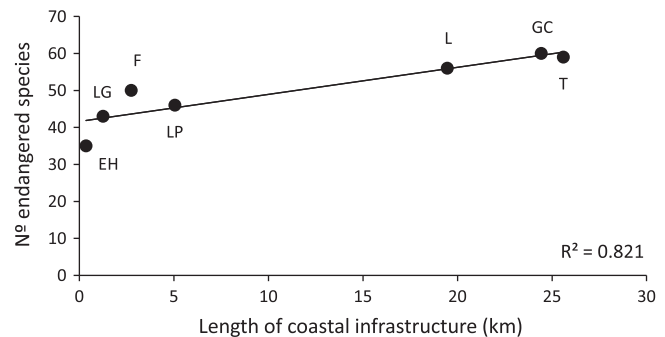


Fig. 1. Correlation between number of endangered species and the total length of coastline infrastructure (km) on each island. EH, El Hierro; LG, La Gomera; LP, La Palma; F, Fuerteventura; L, Lanzarote, GC, Gran Canaria; T, Tenerife.

protection, with terms that are somewhat vague from a conservation perspective (Tables 1 and 2). Only two explicit categories (“Threatened with Extinction” and “Vulnerable”) have survived these subsequent changes, though with a net reduction in the number of taxa included. In recent years, for example, fewer species are listed in the “Threatened with Extinction” sections for cetaceans and turtles in the Canarian Lists (Table 3). These changes may reflect: (i) updating of species status due to new information, such as revised taxonomy, distribution, population sizes and trends, (ii) prevalence of more inclusive categorization at a Spanish national scale though delisting from the Canarian region, or (iii) political interference to effectively reduce protection status of areas and species to ease development schemes (i.e. “political dismantling of the conservation network”, Fernández-Palacios and de Nascimento, 2011). The more important of the listed species are described below.

The four marine species currently included as “In danger of extinction” in the Canarian Catalogue of Endangered Species comprise the alga *Gracilaria cervicornis*, the seagrass *Zostera noltei*, the lobster *Palinurus echinatus* and the seal *Monachus monachus*. These species are restricted to only one or two coastal localities in the Canary archipelago, with the exception of *P. echinatus*, which has several populations formed by a low number of individuals (<3) that are probably unviable.

Table 1

Evolution of numbers of taxa in different categories of threat, showing changes in categories applied for marine taxa from the Canary Islands.

Status	2001 <sup>a</sup>	2009 <sup>b</sup>	2010 <sup>c</sup>	2011 <sup>d</sup>
Threatened with Extinction	15(3)	6	4	6
Sensitive to Habitat Alteration	11(2)			
Vulnerable	37(5)	3	8	12
Of Special Interest	16			
Not threatened <sup>f</sup>	0(33)			
To be removed from catalogue <sup>e</sup>				
Of Interest for Canarian Ecosystems		19	35	
Special Protection Regime <sup>e</sup>				27
Total taxa	79	28	47	45

<sup>a</sup> Decree 151/2001, July 23th, the Canarian Catalogue of Threatened Species was launched (within parentheses, taxa from the 2001 list evaluated in 2004).

<sup>b</sup> Legislative Proposal (7L/PPL-0011 Del GP Coalición Canaria (CC), del Catálogo Canario de Especies Protegidas).

<sup>c</sup> Law 4/2010, June 4th, the Canarian Catalogue of Protected Species.

<sup>d</sup> Canarian species included in the “Decree 139/2011, February 4th, to the establishment of the List of Wild Species of Special Protection Regime and the Spanish Catalogue of Threatened Species.

<sup>e</sup> Category announced only in one year, with a different category announced in subsequent years. The category “Sensitive to Habitat Alteration” has not been applied from 2004 onwards.

<sup>f</sup> Following the Canarian Government 2004 Evaluation.

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