

Chapter

Galician Atlantic Islands National Park: Challenges for the Conservation and Management of a Maritime-Terrestrial Protected Area

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Abstract

At present, biodiversity conservation and management in Spanish National Parks in Spain must respond to a series of regulations at a European, national and regional level, also adapting to scientific-technical progress. The availability of increasingly precise data on the values to be conserved (ecosystems, habitats, species, geodiversity) in these protected areas enables more detailed management, but also requires more rigorous, powerful, and multidisciplinary tools. Maritime-terrestrial national parks are highly sensitive areas to public use, so their impact must be one of the most important factors to take into account when planning their management. This work evaluates the past and present challenges for conservation in Galician Atlantic Islands National Park (NW Spain), where biodiversity conservation and management has evolved over time in a significant way, providing a valid case study applicable to other national parks worldwide, as well as similar situations in other contexts and scenarios. Future challenges are arising in the National Park to improve the conservation status of natural habitats and wildlife, mainly through new European initiatives that may establish important synergies with other countries.

Keywords: biodiversity, conservation, management, National Park, Natura 2000

1. Introduction

Replace the entirety of this text with the introduction to your chapter. The introduction section should provide a context for your manuscript and should be numbered as a first heading. When preparing the introduction, please bear in mind that some readers will not be experts in your field of research.

In the 18th century, in the middle of the Enlightenment, there was still the conception that natural resources were inexhaustible and providence was trusted as

a generator of new resources, but the impact on the territory and the demographic increase originated the first initiatives to protect the natural areas in the world, linked to hunting management measures and preventing the disappearance of some species, due to its ecological [1] or esthetic [2] importance. The current concept of protection of Natural Areas has traditionally been attributed to the declaration of Yellowstone National Park, on March 1, 1872, in the United States of America.

Years later, between the late 19th and early 20th centuries, other countries imitated USA, widespread the declaration of National Parks all over the world: Australia (1879), Canada (1885), New Zealand (1891), Mexico (1898), South Africa (1898), Argentina (1903), Sweden (1909), Latvia (1911), Georgia (1912), Switzerland (1914), Italy (1916), and Spain (1918). During the 20th century, the concept of protection of Natural Areas has undergone a visible evolution in different stages [3], ranging from the protection of emblematic and singular spots at the beginning of the century, which would be increased in number and levels of protection under a great diversity of legal categories, and finally, it was intended to integrate the conservation of Natural Areas with sectoral policies and land use planning under the framework formed after 1992 "Earth Summit".

In Spain, National Parks law was approved in August 1916, which can even be considered as the first law of national parks in the World, and under this regulation, the two first National Parks appeared in 1918: Covadonga and Ordesa. After that, Franco's dictatorship (1939–1975) was a "dark period" when the protected areas regulation (and therefore new area declarations) was completely subordinated to development policies (forestry, intensive agriculture, reservoir construction, industry, gaming, fishing, tourism). The joint arrival of the democracy in 1977 along with the Spanish Constitution in 1978, paved Spain's way towards Europe, which culminated in 1986, when Spain was officially integrated into the European Economic Community (nowadays the European Union). All these changes brought new and modern regulations about protected areas and biodiversity conservation, although the biggest step was the creation Natura 2000 network, based on Directives 92/43/EEC and 79/409/EEC (now replaced by 2009/147/EC). In fact, Spain is the EU member that holds the largest area occupied by Natura 2000 sites, including 27.3% of its terrestrial area into this network [4].

Nowadays, Spain has Law 42/2007, of Natural Heritage and Biodiversity, which establishes the basic legal regime for the conservation, sustainable use, improvement, and restoration of natural heritage and Spanish biodiversity, including the regulation of natural protected areas, and obviously including the National Parks among all of them. These have been endowed with their own and specific regulatory framework, constituted by Law 30/2014, in which National Parks are considered as models for nature conservation and as examples of participatory management, and by Royal Decree 389/2016, in which the Master Plan of Spanish National Parks Network was approved, as well as the strategic objectives of the National Parks in terms of conservation, public use, research, training, awareness, cooperation, planning, coordination, monitoring, and evaluation. All this Spanish regulatory framework around protected areas and National Parks is complemented by the regional protected areas regulation, as foreseen in the Spanish Constitution.

So, Spanish Government has been consolidated for coordination function of the National Parks Network through the National Parks Autonomous Agency (OAPN the acronym in Spanish), establishing their own instruments for management, planning, social participation, as well as their own image as a brand that identifies them highlighting their value and social appreciation. On the other hand, the management and organization of National Parks correspond directly to the Spanish autonomous regions in whose territories they are located, including the maritime-terrestrial ones when there is an ecological continuity between terrestrial

and marine ecosystems, which must be supported by the best existing scientific evidence and be thus expressly recognized in the declarative law.

In this paper, as one of the first planning and dissemination tasks developed by LIFE INSULAR project (LIFE20 NAT/ES/001007), we evaluate the past, current, and future challenges for conservation in one of the most unique National Parks in Spain, Maritime-Terrestrial Galician Atlantic Islands National Park (hereinafter PNG), located in NW Spain, considering the present regulatory framework around it, as well as the intrinsic characteristics of this specific natural protected area. The document assesses the huge progress in biodiversity conservation and management that has been made in the PNG over time, including the legal designations of the archipelagos, the trends in public use, the established protection measures, the limiting of visitors, the statutory instruments for planning and management, and the consequences of all of them to halt the biodiversity loss in island natural ecosystems.

2. The Maritime-Terrestrial Galician Atlantic Islands National Park

This National Park was declared under Spanish Law 15/2002. Located on the Atlantic coast of Galician region (NW Spain), PNG is made up of four archipelagos (Cíes, Ons, Sálvora, and Cortegada) and the marine waters that surround them (Figure 1). PNG comprises a total area of 8480 ha (Table 1), corresponding the

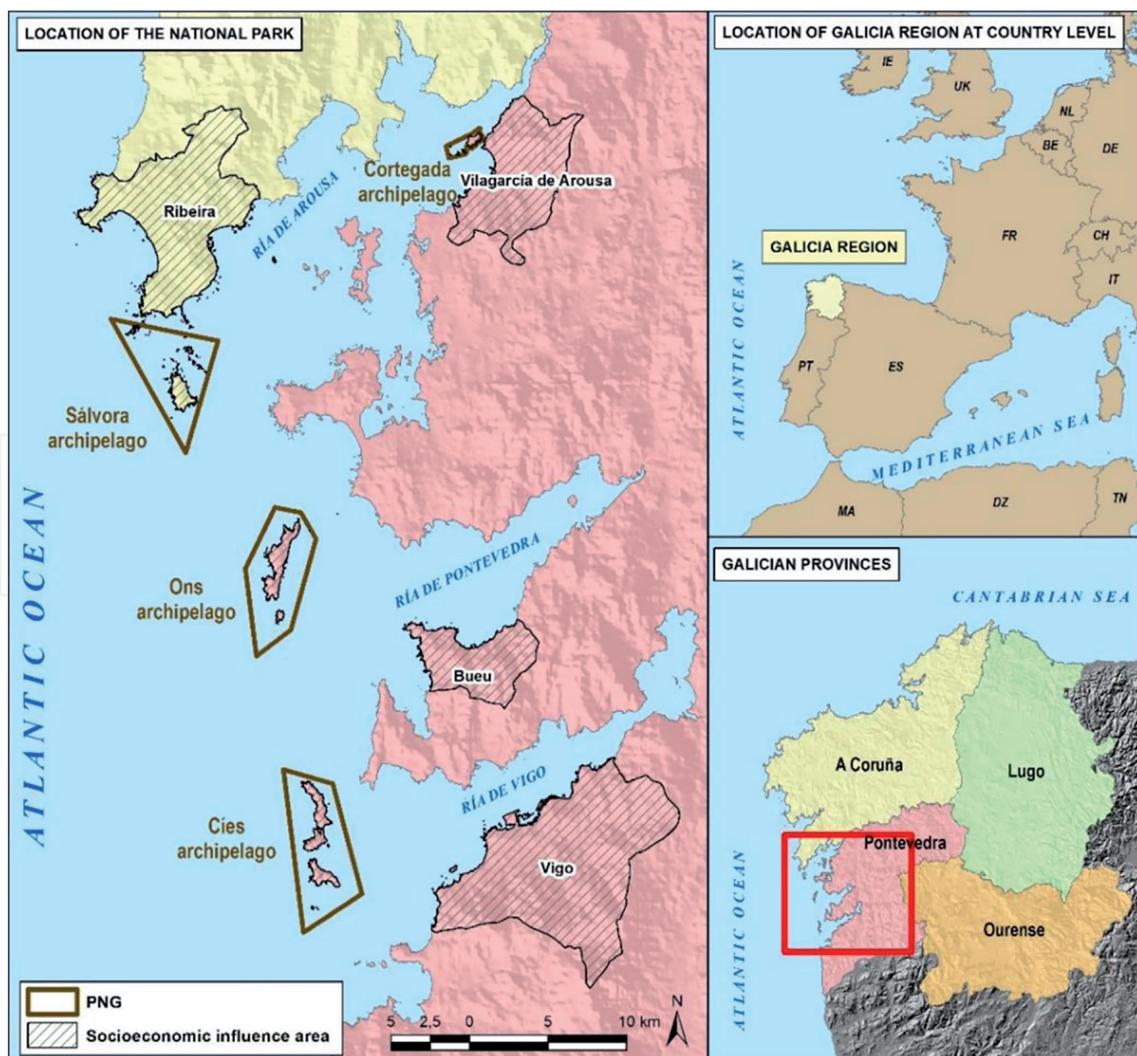


Figure 1.
Location map of PNG.

	Cíes	Ons	Sálvora	Cortegada	Total
Terrestrial area (ha)	433	470	248	44	1195
Marine area (ha)	2658	2171	2309	147	7285
Total	3091	2641	2557	191	8480

Table 1.

Marine and terrestrial area are occupied by the archipelagos of the National Park.

86% to marine waters. According to Law 15/2002, the biggest archipelago in the National Park is Cíes, with 3091 ha, of which 433 ha are terrestrial and 2658 ha are marine waters. Ons archipelago occupies 2641 ha, with 470 ha of terrestrial land (the largest terrestrial archipelago) and 2171 ha of marine waters. Sálvora Archipelago holds 2309 ha of marine waters and 248 ha of terrestrial area. Cortegada Archipelago is the smallest of the four, assuming a total area of 191 ha in the National Park, of which 43.8 ha are terrestrial lands.

Each archipelago is located in four different municipalities that are spread in two Galician provinces (**Figure 1**). Archipelagos located in Pontevedra province are Cíes (belonging to Vigo municipality), Ons (belonging to Bueu municipality), and Cortegada (belonging to Vilanova de Arousa municipality). In A Coruña province, the resting archipelago of PNG is Sálvora (belonging to Ribeira municipality). According to Laws 15/2002 and 42/2007, the whole four municipalities configure the socioeconomic influence area of PNG (**Figure 2**).

The environmental values of this territory (unique in Galicia with the status of a National Park) in the area of the Atlantic coast led to the proposal for the declaration in 1975 of the Cíes Islands as a “Natural Area” (one of the existing categories according to the legislation in force at that time), although they would finally be declared at the beginning of the 1980s under other of the existing categories, as Natural Park (Royal Decree 2497/1980), and later in 1988 as Special Protection Area for Birds (SPA) under Directive 79/409/EEC, a category that will also be given to Ons Islands in 1990.

Given the need to expand the protection scope of these first preventive approaches through a new National Park, in order to harmonize economic activities and the environment conservation, a first management plan was drafted and approved (Decree 274/1999) for Cíes, Ons, and Sálvora islands. Subsequently, it was assessed the opportunity and need to also integrate Cortegada islands, so its corresponding management plan was approved 3 years after (Decree 88/2002). So finally, the Maritime-Terrestrial Galician Atlantic Islands National Park was approved by Spanish Law 15/2002, the first and only Galician National Park.

In parallel to the National Park designation, after the approval of the Directive 92/43/EEC, the procedure for the designation of Galician Natura 2000 Network had started in 1999 with the first drafts and finished with the designation of the definitive Sites of Community Importance (SCI) in 2004. These finally were transformed to Special Areas of Conservation (SAC) in 2014, through the appropriate planning and management instrument (approved by regional Decree 37/2014) that guarantees the maintenance or, where appropriate, the reestablishment, of a favorable conservation status of natural habitats and species interesting for conservation, following the foreseen procedure by Directive 92/43/EEC. At the end of this process, Cíes, Ons, and Sálvora islands were included in three different SACs (**Figure 2**), which are managed by the autonomous region of Galicia.

Considering the high importance of the marine biodiversity of the National Park, this has two additional protection categories by international instruments. The first one was conferred in 2008, as it was integrated in OSPAR network, which is focused

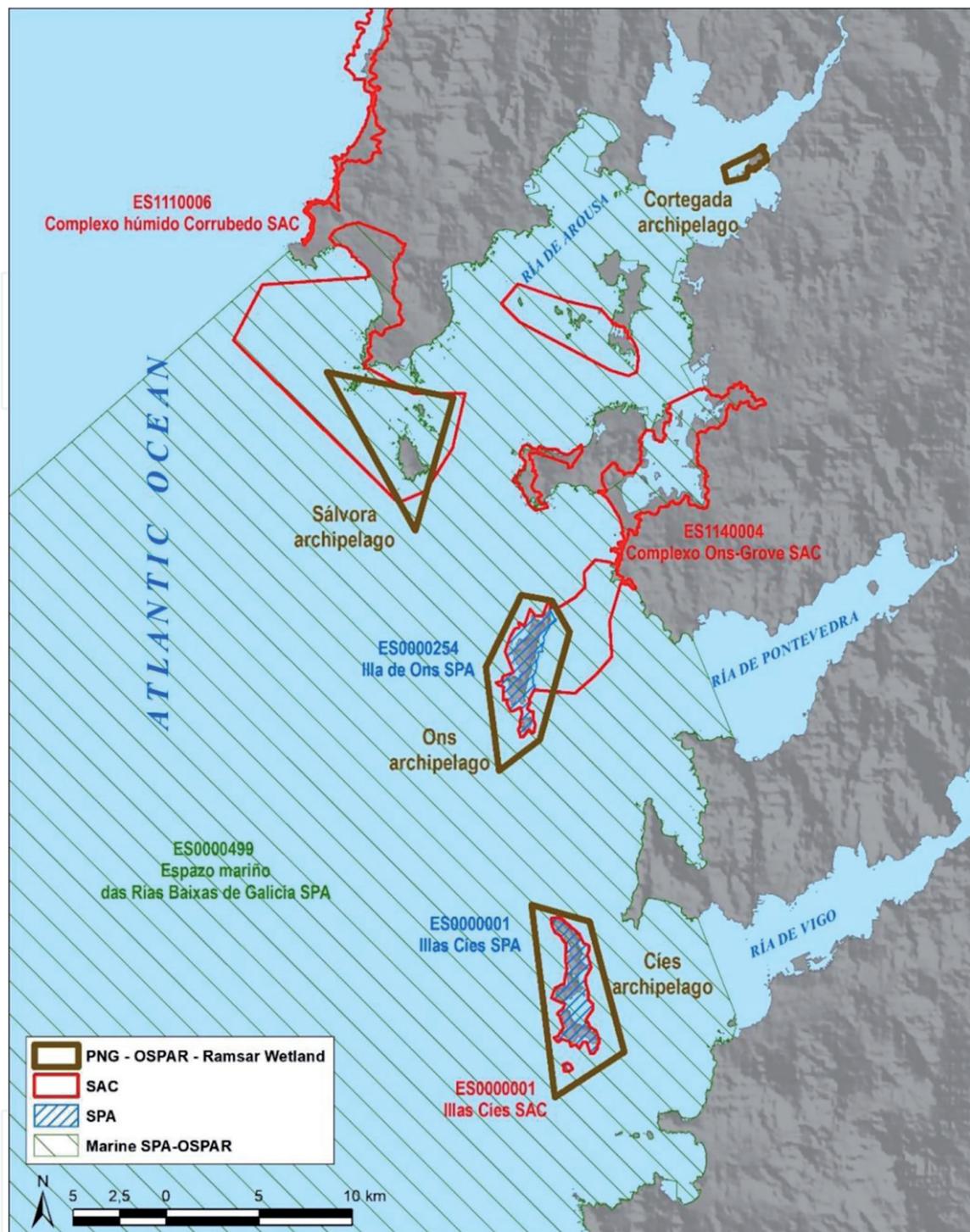


Figure 2.
Overlapping of the different categories of natural protected areas in the territorial scope of PNG.

on the protection and conservation of marine ecosystems and diversity of North-East Atlantic, becoming the first Spanish protected area under OSPAR Convention. Subsequently, the Spanish Government declared a series of SPAs in Spanish marine waters in 2014, including in one of them the Cíes, Ons, and Sálvora archipelagos of the PNG (**Figure 2**), and that was also integrated in OSPAR network. The second additional protection category by international instruments is very recent, as in May 2021 the National Park has definitely been included in the List of wetlands of international importance, as defined by the Ramsar Convention (**Figure 2**).

So Maritime-Terrestrial Galician Atlantic Islands National Park is a very important protected area into the Galician territory, and also at a Spanish level. It holds several types of protected areas (**Figure 2**), from a national (National Park),

regional (Protected Wetland), European (SAC, SPA), and international (OSPAR, Ramsar) point of view, which are overlapped and establish huge synergies between them. The biodiversity sheltered by the National Park is very important, both in terms of the protected harbored habitats and species habitats that are present.

According to the available data [5], the National Park houses a total of 34 habitat types considered of community interest in Annex I of Directive 92/43/EEC, of which eight habitats are classified as priority conservation: Coastal lagoons (1150*), Fixed coastal dunes with herbaceous vegetation-grey dunes (2130*), Atlantic decalcified fixed dunes (2150*), Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix* (4020*); Arborescent matorral with *Laurus nobilis* (5230*), Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* (6220*), Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (7210*), Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0*). The groups of habitats of community interest that register the highest number of types are those related to coastal environments and halophilic vegetation, being inventoried up to 11 different types of habitats, as well as dune systems, which register also a significant number of dune system habitats (seven types) ranging from embryonic mobile dunes to decalcified fixed dunes. Other well-represented habitat groups are natural and semi-natural grassland formations, rocky habitats and caves, temperate heaths and scrub, sclerophyllous scrubs and forests of temperate Europe.

The species that are considered as protected are those interesting for conservation as they are included in Annexes II and IV of the Directive 92/43/EEC, in Annex I of Directive 2009/147/EC, together with those listed in the Catalogues of Threatened Species in Spain (Royal Decree 139/2011) and Galicia (Decree 88/2007). The National Park includes a total of 530 species protected under all these regulations (**Table 2**). Among these taxa, it is worth noting the presence of two species considered for priority conservation according to Directive 92/43/EEC: the flora species **Omphalodes littoralis* subsp. *gallaecica* and the common sea turtle (**Caretta caretta*). In addition, 15 species included in Annex II of Directive 92/43/EEC and 16 in species included in its Annex IV, are also present in the National Park. Regarding the birds, 25 species are included in Annex I of Directive 2009/147/EC.

	HD				BD		SCTS		GCTS		Total
	P	II	IV	V	I	En	Vu	SP	E	V	
Plants	1	2	2	4	—	1	—	2	7	2	12
Invertebrates	—	4	2	1	—	—	1	6	1	4	11
Fishes	—	3	—	2	—	—	—	2	—	1	5
Amphibians	—	1	1	—	—	—	—	2	—	3	3
Terr. reptiles	—	—	1	—	—	—	—	8	1	4	8
Marine reptiles	1	1	2	—	—	—	—	1	1	1	2
Birds	—	—	—	—	25	2	4	88	1	7	123
Terr. mammals	—	2	4	—	—	—	1	3	—	1	4
Marine mammals	—	2	4	—	—	—	2	2	—	2	4
Total	2	15	16	7	25	3	9	112	11	25	530

[HD]: Habitats Directive (92/43/EEC); [P]: priority species; [II, IV, V]: Annex where the species is included; [BD]: Birds Directive (2009/147/EC); [I]: Annex I; [SCTS]: Spanish Catalog of Threatened Species; [En]: Endangered; [Vu]: Vulnerable; [SP]: List of Wild Species under Special Protection; [GCTS]: Galician Catalog of Threatened Species; [E]: Endangered; [V]: Vulnerable.

Table 2.
Protected species richness in PNG.

The cataloged species include 3 species considered as Endangered by the Spanish Catalog of Threatened Species, and 11 species considered as Endangered by the Galician Catalog of Threatened Species.

3. Conservation problems and management issues previous to PNG

Available information confirms the human presence on the islands from the Mesolithic to the Roman empire [6–11]. Throughout the Middle Ages, the islands depended on different monastic orders, maintaining a feudal regime. Between the 16th and 18th centuries, the islands maintained a system similar to the previous monastic regime, administered by the nobles of the towns located on the continent [12–14]. During this period the archipelagos will be witnesses and victims of numerous naval warlike conflicts against other nations, or against pirate invasions of various kinds [9], which led to the construction of fortifications and defensive bastions (batteries, barracks, arsenal, etc.).

During the 19th century, residents from the nearby coasts moved to the islands to attend to them and carry out various labors. The four archipelagos supported a population that ranged from 30 to 550 neighbors per island (depending on the island size). The insular inhabitants developed agriculture (potatoes, corn, vegetables), intense livestock activity, fishing, and shellfish. The islands were also used as a hunting ground, as well as different industries and facilities were installed (salt-ing, lighthouses, etc.) in which the inhabitants of the islands worked [15–20].

During the 20th century, these infrastructures and facilities declined or were automated, as the quality of life in the continent was improved notably. This caused the archipelagos to gradually lose their resident population. The loss of population motivated the reduction (even total loss) of the crop areas due to the abandonment of cultivated lands, which were replaced by natural ecosystems (coastal heaths, sand dunes, etc.). This process was more evident in Sálvora and Cortegada islands, where agricultural activity was abandoned earlier, and this was not replaced by other actions, as happened in Cíes and Ons. In this way, Sálvora and Cortegada recovered their naturalness as they were subjected to natural dynamic processes, and the crop fields were replaced by dune habitats, coastal heaths, and native forests so that they currently have most of their occupied surface by natural ecosystems.

The depopulation of the islands progressed in parallel with growing activity in Cíes and Ons of the Spanish Forest Heritage (PFE the acronym in Spanish), created in 1935 but whose activity was definitely boosted from 1940, after the Spanish Civil War. The activity of the PFE focused for more than 20 years on the transformation of the natural habitats in the island territories (coastal heaths, fixed dunes, humid dune slacks) through productive afforestation [21–24] with exotic species (*Pinus* spp., *Eucalyptus* spp., *Acacia* spp.), many of which have the invasive capacity, following a methodology that was used in the rest of the Spanish coastal ecosystems [25]. So, natural communities of great biodiversity value were replaced by very low value synanthropic invasive formations that were potentially harmful to the surrounding ecosystems, although the high natural elements hosted by these islands had motivated them to be previously proposed in 1917 to be declared a “Notable Site” under the 1916 National Parks Law and the provisions that developed it [26], and there were also previous available scientific works that highlighted the relevant role of the insular natural environment [27, 28]. The activity of the PFE was especially relevant in Cíes, where it passed from a scenario characterized by natural herbaceous and shrub island habitats to a landscape in which exotic wooded formations occupy more than half of the surface [29]. In Ons, the afforestation was carried out in a smaller proportion, although it was also established at the expense of natural coastal habitats.

The afforestation of these island territories was used as an indoctrination measure of a country under an authoritarian regime in a context of political isolation and economic autarchy [30], to show and evaluate the “patriotic and lucrative work” that the PFE forestation works constituted. However, the high surface area that they reached in Cíes was a source of conflict with the few residents who still lived in the archipelagos, which led to them causing the uprooting of forest plants and even causing intentional fires with the purpose of destroying plantations. But the presence of inhabitants on the islands was in a regressive phase so that in the 1970s there were hardly any inhabitants left on the islands. Afforestation, on the contrary, was consolidated, so that even in the first Spanish vegetation cartographies, the forest plantations were already represented as the dominant coverage in the island territories [31]. The replacement of the PFE by Conservation Nature Institute (ICONA the acronym in Spanish) in 1971, abandoned the “lucrative” argument of forestation, but its vision of insular ecosystems was that of “arid, rugged, harsh, sterile and bare lands”, and whose afforestation was necessary to improve its appearance so any visitor who arrived by sea to the Cíes could find a Spain “warm, fertile, forested, rich, industrial and peaceful”. So, afforestation in this archipelago continued to be carried out by ICONA at the expense of natural habitats and still using exotic species, which is why they continued to win criticism from environmental sectors [17, 20, 32].

Starting in the 1960s, an unusual interest in tourism began to grow on the coast in general, and on the island territories in particular. The Cíes Islands played an important role in this new phenomenon, derived from the accelerated abandonment of its inhabitants and the growing promotion as a destination for touristic excursions. In this way, organized boat visits to the islands began to be promoted, which attracted numerous groups of people who uncontrollably accessed places of high ecological fragility, such as cliffs, fixed dunes, coastal heaths, rocky slopes, and humid dune slacks, causing a high negative impact on natural ecosystems due to the promotion of garbage, the production of fires due to uncontrolled bonfires, the erosion and loss of natural habitats, the collection of wild flora species, or the capture and nuisance of wild fauna population species.

In many of these cases, the high attraction that the Cíes islands had for the enjoyment and recreation of visitors, motivated an excessive profusion of free and uncontrolled camping, which was carried out in a completely unsustainable way. Due to the increasing interest in the island lands, a new trend began by the former inhabitants towards the sale of their few private properties. As a result of this process, the new buyers proceeded to build chalets, sheds, shacks, additions, etc., in an uncontrolled way and without any kind of permit or authorization, accompanied in many cases by the introduction of ornamental non-native plant species to decorate the properties of the new owners, although many of these species over time showed a high invasive potential, negatively affecting the surrounding natural ecosystems. So much so, that in the late 1970s it was possible to identify the presence of more than 300 uncontrolled shacks, and as many tents, dispersed throughout the island territory, without any type of environmental criteria or caution [17]. At the end of every summer season, a Dantesque spectacle of garbage and waste covered the islands: several boats were necessary to eliminate the kitchens, refrigerators and even ping-pong tables that were scattered throughout the island, as well as an intense smell of latrine invaded the area permanently.

In addition to the afforestation of PFE and ICONA, as well as uncontrolled buildings and public use, during the summers of the 1970s, some of the islands (the South Island of Cíes, mainly) were occupied by companies of Special Operational Commands (COES the acronym in Spanish) of the Spanish Army, who remained in the island territories performing survival practices. For this, they did not hesitate

to build cabins using trunks and branches that were cut down or removed from the trees present on the islands, as well as they fed on everything that could be edible for humans, eggs, and chickens of seabirds, mainly [20]).

4. The first considerations of the islands as a natural protected area

All the described impacts generated several conservation problems on the natural habitats and on flora and fauna species of the island territories, constituting a threat to their long-term maintenance. These consequences, and fundamentally those derived from the presence of uncontrolled people in the archipelagos, were detected and denounced in the local media and several publications, so since 1975 Vigo municipality started various proposals for the declaration of the Cíes Islands as a natural protected area. ICONA was also developing at that time an inventory of the areas that could receive the declaration of one of the categories of natural protected areas established in the then current Law 15/1975 [33], and Cíes islands were the first proposed area in Pontevedra province. So the situation was completely favorable, and finally, in 1980, the Cíes Islands were considered as a Natural Park, in order to “preserve such an exceptional place and the need to properly condition it so that it could be enjoyed and admired by present and future generations. Its beauty was joined to the presence of very interesting colonies of seabirds that nested in the islands, such as the European herring gull, the European shag, and the common guillemot”.

The protection regime of the new Natural Park was established in 1982, protecting all-natural values, as these were considered the geological, botanical, faunal, and landscape values, as well as archaeological and historical remains. To preserve all these, every user should be properly authorized by ICONA, establishing some expressly prohibited activities such as the access of visitors through unauthorized places or in a greater number than authorized by ICONA, the free camping, the garbage disposal, or the bonfires, among many others. According to this regulation, the Managing Board of the National Park established and approved in the same 1982 year a limit of 3000 persons per day in Cíes islands. Regarding urban uses, these did not appear expressly forbidden, but a procedure was established to eliminate the clandestine invasions, occupations, exploitation, and installations, as well as the mandatory coordination with the urban policy, including the elaboration of a Special Plan for Protection of the Natural Park. Even this plan was never approved, the declaration of the Natural Park would serve to paralyze the irregular construction activity in the archipelago, accompanied by dismantling and demolition of illegal constructions [20].

The transfer of the competencies in nature conservation to Galician regional government (Xunta de Galicia) were initially established Royal Decree 167/1981, which were finally consolidated by Royal Decrees 1706/1982 and 1234/1983, a new regulation was established in the Natural Park in 1983, in order to regulate the access of visitors to the islands. Joining to the 3000 persons per day limit, the visits to the Natural Park started to be prohibited when, through collective, public, or private boats of transport, a number greater than 10 people disembarked, or when they were disembarked by a place not expressly authorized by Xunta de Galicia. The visits of less than 10 people should be provided by the appropriate authorities of the National Park staff.

Regarding the forest plantations, the declaration of the Natural Park did not contribute to their environmental suitability. Although the new afforestation with exotic species would be partially replaced by native species plantations [34], ICONA still kept planting some areas with non-native species (*Quercus rubra*, *Fraxinus ornus*)

between 1979 and 1994, or they even made mixed plantations (with native and non-native species). The basis of these actions does not differ much from the plantations made by PFE during the mid-20th century, as they lacked a prior assessment and they were carried out without a proper species selection criterion.

So, as a consequence of the Natural Park declaration, the wooded area in the islands continued to be increased, as a result of the forest plantations, but also it could be ascertained the invasive potential of some of the introduced species (*Eucalyptus globulus*, *Acacia dealbata*, *Acacia melanoxylon*), as they formed new several stands surrounding the previously planted plots, or even they formed new ones away from them. The resultant forest formations from all these plantations and the subsequent stands formed by invasive alien trees were represented in the vegetation maps at the end of the 20th century [35, 36], so high natural value habitats (coastal heaths, fixed dunes, humid slacks) were lost or negatively affected in these areas, although to a lesser extent than during the PFE period.

On the opposite, the definitive abandonment of the islands by the irregular residents and the elimination of their illegal constructions, allowed in these areas to increase the fixed dunes and coastal heaths in the archipelago, so natural values of the islands could partially recover. But as a result of the previous continued presence of these people, as well as by the continuation of transit of external visitors to the islands (even their presence was controlled by the Natural Park staff), the colonization of herbaceous invasive alien species was identified [34]. Perhaps the most worrying case is *Arctotheca calendula*, although there are other species that also occupy significant areas, like *Zantedeschia aethiopica*, *Cortaderia selloana*, *Tritonia x crocosmiiflora*, *Carpobrotus edulis*, *Vinca difformis*, *Yucca gloriosa*, *Arundo donax*, *Tropaeolum majus*, etc.

In any case, all the efforts made in Cíes were evident and also favorable for the seabird colonies that were the main reason for the Natural Park declaration, so all those reached benefits allowed Cíes to be designated as a Special Protection Area for Birds (SPA) under Directive 79/409/EEC, as SPA "Illas Cíes" (ES0000001).

Although the other archipelagos (Ons, Sálvora, Cortegada) were not foreseen to be designated as natural protected areas in short term after Cíes Natural Park declaration, they were suffering some kind of similar conservation problems, so specific regulations were necessary to be approved, but outside the legal framework for natural protected areas.

The Ons situation during the 1980s and 1990s was very similar to Cíes. The new afforestation made from 1984 used native and exotic species [34], some of them with invasive potential, and mostly over high natural and seminatural value habitats (coastal heathland, hay meadows). The forest plantations were accompanied by a high density of new paths and roads, causing a high fragmentation of natural habitats, reducing their conservation status, and decreasing their permeability for the migration and genetic exchange of wild species. The basis of these actions was very similar to those made by PFE during the mid-twentieth century, as they lacked a prior assessment and they were carried out without a proper species selection criterion.

The unregulated access of visitors to Ons, especially during the summer, was motivating uncontrolled camping and shaft establishment in unsuitable locations and causing ecological, landscape, and social damages, so conservation measures were necessary. As Ons island territories were completely owned and managed by Xunta de Galicia, this regional public administration established in 1985 a first regulation for the access of visitors to the islands, so new permanent and non-permanent constructions were forbidden, only allowing to camp in the area enabled for this purpose, and including the prohibition of bonfires. This first regulation was later updated in 1994, in order to prevent new impacts over high fragility

insular areas, establishing a limit of 80 people staying overnight in the campsite. However, new studies of insular carrying capacity were being drafted at that time, so when they were available, a new regulation was approved in 1995, in order to update the applicable rules to visitors and adapt the management, considering the improvement of the camping area, as it was prepared to receive 200 people. But the demand for new visits to the islands continued to be increasing, so the campsite was enlarged again, and 4 years later the limit raised up to 400 people in 1999, including the prohibition of circulation for motor vehicles.

As a result of all these regulations, Ons islands were allowed to be designated as a Special Protection Area for Birds (SPA) under Directive 79/409/EEC, as SPA “Illa de Ons” (ES0000254), because of the importance of the seabird colonies that were present in the insular territories.

Sálvora island did not suffer any significant change during the 1980s and 1990s, because it had been depopulated earlier than Cíes and Ons, it still was private property, and it was not so interesting for touristic purposes as this island is located in the outer part of Ulla river estuary, surrounded by very rough sea and many rocky reefs, making very difficult the approaching for boats. In fact, Sálvora has a long history of shipwrecks, which has led it to be described as a “boat cemetery” [37].

In the opposite, Cortegada island is located in the inner part of Ulla river estuary, surrounded by very calm waters and sandy flats, so the touristic interest was very high during the 1980s and the 1990s. It was privately owned by a real estate company [38, 39] whose main goal was the urbanization of the island, including hotels, chalets, casino, sporting marina, etc. This even motivated that a proper plan was drafted and approved by Vilagarcía de Arousa council, in order to adapt the municipality planning to allow Cortegada urbanization. But the lack of funding, coupled with the discovery of archaeological remains on the island, delayed this initiative, which was increasingly finding opposition from local environmental groups [40]. The natural and archaeological values, as well as the awareness rising from the society, led Xunta de Galicia in 1991 to establish a preventive protection regime for Cortegada island (through Decree 193/1991), according to the then current Law 4/1989 (that had substituted Law 15/1975), especially regarding the probable urban uses that were being planned at that time and that could potentially constitute a disturbance factor. This meant that any authorization or activity license to be developed in the archipelago that could transform its natural reality should be submitted to a mandatory and binding report from the regional public body responsible for urban and land use planning. This protection regime would be reinforced by the Complementary and Subsidiary Urban Norms of Pontevedra province, which in the same 1991 year would finally include the whole archipelago like “Natural Area”, which meant that it was excluded from any possible urbanistic development.

At the end of 1990s, Cíes Natural Park was 10 years working, the rest of the islands had specific regulations to guarantee their conservation, and the efforts were starting to be successful at European level, with two SPAs in Cíes and Ons. In this scenario, it was necessary to expand the protection scope from Cíes to other Galician Atlantic islands in order to harmonize their economic activities and environment conservation, so a first joint management plan was drafted and approved (Decree 274/1999) for Cíes, Ons and Sálvora islands. The singularity and faunal richness of all these islands, as well as their variety of plant communities, high-value landscape, and geomorphology, justified the general interest of their conservation and met the criteria to become a National Park. Subsequently, it was assessed the opportunity and need to also integrate Cortegada islands, as they harbored similar natural, cultural and ethnographic values, so its corresponding management plan was approved 3 years after (Decree 88/2002). In accordance with the unique and fragile ecosystems and landscapes that deserve special protection in

the four archipelagos, both management plans designed a zonation for them. But it was established that this was considered as an indicative or preliminary zonation to serve as guidance until the moment it should be definitely established in their corresponding Master Plan for Use and Management (mandatory Plan according to the legal framework on protected areas).

So, all the necessary steps had been made, and the Maritime-Terrestrial Galician Atlantic Islands National Park was finally approved by Spanish Law 15/2002, first and only Galician National Park. The situation was also favorable to new natural protected areas initiatives, because the approval of the Directive 92/43/EEC had started, in parallel to the National Park declaration, the procedure for the designation of Galician Natura 2000 Network in 1999 with the first drafts, continued with the designation of the definitive Sites of Community Importance (SCI) in 2004, and the definitive transformation to Special Areas of Conservation (SAC) in 2014 through regional Decree 37/2014 approval. At the end of this process, these islands were included into three different SACs: Cíes was included in SAC “Illas Cíes” (ES0000001), Ons was included in “Complejo Ons-O Grove” (ES1140004), and Sálvora was included in SAC “Complejo húmido de Corrubedo” (ES1110006).

5. Actual challenges and strategies for biodiversity conservation

Five months after the declaration of PNG, an ecological catastrophe occurred in the archipelagos, as they received the impact of the oil spill from the Prestige oil tanker, which sank 130 miles off the Galician coast. Sálvora and Ons were the most exposed islands, although Cíes also received a significant amount of oil. This discharge caused negative effects on marine and terrestrial ecosystems, including their habitats and species [41–46]. The clean-up work to remove the fuel from the coasts of Galicia lasted for 20 months. However, the importance of the islands of PNG in the coastal dynamics was confirmed during this great tragedy, since these archipelagos acted as a natural barrier against fuel, preventing a large part of it from reaching the neighboring coasts, especially the estuaries of Vigo, Pontevedra and Arousa, one of the most productive marine territories in the Atlantic Ocean.

In any case, the PNG declaration would entail a change in the management criteria of the terrestrial ecosystems of the archipelagos, beginning to carry out works and actions aimed at improving the conservation status of natural ecosystems, by reducing their impact factors fundamentally.

In Cíes islands, small experiments were beginning to be carried out on the elimination of non-native wooded formations planted by PFE and ICONA. The elimination of these formations responded to biodiversity conservation criteria since the occupation of the territory by forest plantations of non-native species caused a decrease of conservation status for natural habitats, as well as a break in the connectivity of ecosystems and therefore a reduction of their permeability for the present species. The elimination of exotic tree plantations also met safety criteria: sometimes, the size achieved by planted trees for more than 60 years caused these stands to reach a state of senescence, with high sizes that pose a risk of falling trees that could cause damage to natural components, people or real estate. Moreover, the presence of herbaceous invasive alien species still continued after the PNG declaration [47], so several initiatives for their removal started. Besides the herbaceous invasive alien species (*C. edulis*, *Arcthoteca calendula*, *Z. aethiopica*, *C. selloana*, *Tritonia x crocosmiiflora*, etc.), they started elimination of *E. globulus* and *A. melanoxylon* that previously invaded and encroached natural habitats. Nowadays, the invasive alien species conservation problem is one of the main concerns in NW Spain [48].

The elimination of forest plantations and invasive alien species formations was complemented by several actions for the recovery of fixed dunes. In Cíes, at various points of the islands, small formations of *E. globulus* and *A. melanoxylon* were eliminated on coastal scrub and dune habitats, and in parallel a series of visitor access control devices were installed for several years, preventing the transit of people in the dune system of Rodas beach. In Ons, a few forest plantations were carried out with native species, with a purpose to restore degraded areas, and dune regeneration actions also started on the beaches of Melide and Canexol, consisting in the elimination of tree and herbaceous invasive species (*E. globulus*, *A. melanoxylon*, *C. edulis*) and followed by the establishment of exclusion zones from people transit, to favor the regeneration of dune habitats. In Sálvora, the prohibition of transit through dune systems since PNG declaration led to the recovery of the degree of coverage of its characteristic herbaceous formations. In Cortegada, small areas of *Pinus* and *Eucalyptus* formations started to be removed, since the degree of senescence of these formations advised their elimination due to the high risk and danger to the surrounding habitats, as well as to the visitors of PNG.

All these measures allowed the recovery of habitats degraded by uncontrolled public use prior to the declaration of PNG, which caused sand erosion and area loss of the different types of natural habitats. The implementation of these measures made it possible to stop the area loss, and even achieve an increase in the occupied area by the dunes. An increase in the degree of coverage of the characteristic species of dune habitats was also achieved, as well as a recovery of their natural structure, which results in an improvement of the functionality of the dune ecosystem, and ultimately in an improvement of its future prospects.

The success of these initiatives would result in the recognition of these archipelagos as a new protected area under the European legal framework, which would join the SACs and SPAs that had already been previously designated by the regional government in Cíes, Ons, and Sálvora. In this way, the Spanish Government declared in 2014 a series of new SPAs in Spanish marine waters (Order AAA/1260/2014), including in one of them the maritime waters under Spanish sovereignty or jurisdiction that are surrounding these same three archipelagos (Cíes, Ons and Sálvora): SPA “Espacio Marino de las Rías Baixas de Galicia” (ES0000499).

Futhermore, considering the high importance of the marine biodiversity of PNG, this received two additional protection categories by international instruments. The first one was conferred in 2008, as it was integrated in OSPAR network, which is focused on the protection and conservation of marine ecosystems and diversity of North-East Atlantic, becoming the first Spanish protected area under OSPAR Convention. The second one is very recent, as in May 2021 PNG has definitely been included in the List of wetlands of international importance, as defined by the Ramsar Convention. This declaration implies its automatic consideration as “Protected Wetland”, a regional category of protected area that is specifically designed for Galician wetlands that fulfill a function of international importance for natural resources conservation and especially as a habitat for waterfowl.

Paradoxically, the improvement of the conservation status of island ecosystems, and the promotion of new protected areas at a European and international level, would increase the demand for visits to the PNG archipelagos, in order to know and enjoy their landscape, their coasts, and their beaches. Every summer more and more people would visit the island territories, both in organized groups and on a discretionary basis, reaching the islands in collective or individual transport boats. The archipelagos that receive the highest number of visits are those with the largest continental area (see **Table 3**): Cíes often exceeds 300,000 annual visitors, Ons easily exceeds 140,000 visitors a year, Sálvora can reach more than 20,000 visits/year, and Cortegada often exceeds 10,000 visitors in the busiest years. In total, PNG is easily over 400,000 visits/year, touching 490,000 visitors during the peak years.

	Cies	Ons	Sálvora	Cortegada	Total
Area					
Terrestrial	433 ha	470 ha	248 ha	44 ha	1195 ha
Marine	2658 ha	2171 ha	2309 ha	147 ha	7285 ha
Visitors/year					
2021	270,798	139,734	13,048	5390	428,970
2020	208,404	95,918	10,183	4065	318,570
2019	296,205	150,684	14,908	10,477	472,274
2018	291,283	160,468	21,380	13,092	489,953
2017	303,516	102,178	14,243	10,354	440,661

Source: National Parks Autonomous Agency.

Table 3.

Visitors per year in PNG archipelagos during 2017–2021 period (until September 15, 2021).

In comparison with the Spanish Network of National Parks, PNG is among the ones with the lowest number of visitors per year, especially compared to some of the large mountain National Parks (**Table 4**), such as Guadarrama (33,960 ha) or Picos de Europa (67,128 ha), which can receive up to 2–3 million visitors a year. However, taking into account the territorial dimensions of PNG, with barely 1200 ha of land area, it receives a significant annual number of visitors, not negligible, similar or even higher than that of other large terrestrial National Parks, such as Aigüestortes (14,119 ha), Doñana (54,252 ha), or Monfragüe (18,396 ha).

Comparing the island National Parks (**Table 5**), the number of visits is directly proportional to those that occupy a greater land area. Such is the case of the Canarian National Parks such as Garajonay (3986 ha), Taburiente (4387 ha), Teide (18,990 ha), and Timanfaya (5107 ha), which range from more than 500,000 visitors a year in Taburiente, to more than 4 million annual visitors in Teide. The smallest insular National Parks, PNG, and Cabrera, both with a land area of just over 1000 ha, reach more than 400,000 visits per year in PNG, and just over 120,000 visits per year in Cabrera. Not inconsiderable figures, especially in the case of the Galician islands, taking into account that both are the only National Parks that have the consideration of “Maritime-Terrestrial” within the Spanish Network of National Parks, since their land area is a minority and they are mostly occupied by marine waters (7285 ha in the Galician islands representing 86% of the National Park, and 89,478 ha in Cabrera representing 99% of the National Park), making them difficult for visitors to arrive from the nearest coasts because the access is only possible by boat as there are no airports within these island territories.

The gradual increase of visitors to PNG (**Table 3**), given the condition of a National Park, motivated the preparation of a study of the carrying capacity of these archipelagos [49]. The concept of carrying capacity is a term widely used in the study of ecology, tourism, or sustainable use of resources [50–53], trying to approximate the maximum number of visitors that can use an area without significant alterations to the conservation status of the vulnerable elements or to the quality of the visitor experience. Traditional management approaches based on the strict application of the carrying capacity principle are suboptimal, so an adaptive management framework has been demanded, but it has been scarcely explored [54].

The results of the study of the carrying capacity [49], after taking into account the physical, psychological, ecological-environmental, global, and seasonal carrying capacity, allow establishing the maximum thresholds of visitors per day

National parks	2013	2014	2015	2016	2017	2018	2019
Aigüestortes	433,529	485,935	525,067	586,334	560,086	552,014	560,723
Cabañeros	84,616	88,196	100,993	104,565	112,760	108,561	100,493
Cabrera	93,291	108,038	120,505	121,189	126,143	118,232	82,007
Doñana	277,173	296,777	300,287	288,637	288,759	258,683	388,325
Garajonay	817,220	865,493	828,758	870,486	907,277	1,245,480	1,016,324
Guadarrama	1,140,910	2,815,024	2,989,556	2,440,128	2,691,890	2,284,293	1,519,039
Monfragüe	278,400	253,153	288,644	280,319	288,589	263,036	457,555
Ordesa	589,400	590,050	598,950	608,950	566,950	578,850	589,450
Picos Europa	1,545,830	1,842,272	1,913,858	2,101,293	2,047,956	1,958,240	1,791,411
PNG	318,034	363,121	399,890	400,465	440,661	489,953	472,274
S. Nevada	611,095	690,150	780,702	734,539	732,657	655,259	789,756
T. Daimiel	250,295	155,755	192,025	181,106	170,098	196,623	157,424
Taburiente	375,180	392,990	445,084	509,183	525,961	510,600	487,060
Teide	3,292,247	3,212,632	3,289,444	4,079,823	4,327,527	4,330,994	4,443,628
Timanfaya	1,452,365	1,575,029	1,655,772	1,703,258	1,723,276	1,692,339	1,626,970
Total	11,559,585	13,734,615	14,429,535	15,010,275	15,510,590	15,243,157	14,482,439

Source: OAPN visitor count data.

Table 4.
Number of visitors per year in the Spanish Network of National Parks during the 2013–2019 period.

	PNG	Cabrera	Garajonay	Taburiente	Teide	Timanfaya
Area						
Terrestrial	1195 ha	1.316 ha	3.986 ha	4.387 ha	18.990 ha	5.107 ha
Marine	7285 ha	89.478 ha	—	—	—	—
Visitors/year						
2019	472,274	82,007	1,016,324	487,060	4,443,628	1,626,970
2018	489,953	118,232	1,245,480	510,600	4,330,994	1,692,339
2017	440,661	126,143	907,277	525,961	4,327,527	1,723,276
2016	400,465	121,189	870,486	509,183	4,079,823	1,703,258
2015	399,890	120,505	828,758	445,084	3,289,444	1,655,772
2014	363,121	108,038	865,493	392,990	3,212,632	1,575,029
2013	318,034	93,291	817,220	375,180	3,292,247	1,452,365
2012	280,798	104,499	752,095	354,901	2,660,854	1,474,383
2011	322,396	185,358	825,638	424,832	2,731,484	1,549,003
2010	292,374	160,306	610,254	387,805	2,407,480	1,434,705
2009	274,716	60,662	625,801	377,349	3,052,830	1,371,349
2008	254,000	60,804	860,000	408,088	2,866,057	1,600,175
2007	238,939	76,541	884,858	389,024	3,142,418	1,748,149
2006	213,897	71,987	854,824	377,582	3,349,204	1,778,882
2005	213,897	71,987	854,824	377,582	3,349,204	1,778,882
2004	182,394	73,540	859,860	367,938	3,540,195	1,815,186
2003	171,999	66,535	641,754	395,264	3,364,873	1,841,431

Source: OAPN visitor count data.

Table 5.
Number of visitors per year in the insular National Parks during the 2003–2019 period.

(**Table 6**). This study was used as a scientific basis for the thresholds that would be established by the Master Plan of Use and Management (MPUM) of PNG, approved by Decree 177/2018, constituting the first protected area in Galicia to implement a study of these characteristics within its regulatory scope. The overall objective of this plan was the maintenance or, where appropriate, the reestablishment, in a favorable conservation status, of natural habitats and flora and fauna species of interest for conservation, taking into account economic, social, and cultural requirements, as well as regional and local particularities. So, MPUM included the provisions of the PNG Declaration Law (Law 15/2002) and of its initial planning instruments (Decree 274/1999, Decree 88/2002), as well as those established by Law 30/2014 on National Parks and by the Master Plan of the National Parks Spanish Network (Royal Decree 389/2016). Obviously, MPUM incorporated the guiding principles of European (Directives 92/43/EEC and 2009/147/EC), Spanish (Law 42/2007), and regional (Law 9/2001, currently replaced by Law 5/2019; Decree 37/2014) regulations of natural heritage, biodiversity, and protected areas.

In addition to the establishment of a carrying capacity limit for PNG archipelagos based on scientific-technical criteria, the MPUM (Decree 177/2018) defined definitive zoning, taking as orientation the preliminary zonation of the initial management plans (Decree 274/1999, Decree 88/2002), and following the criteria established in the Master Plan of the National Parks Spanish Network (Royal Decree

	Cíes		Ons		Sálvora		Cortegada	
	PS	LS	PS	LS	PS	LS	PS	LS
A	1600–1800	0	1200–1300	0	0	0	0	0
B	100–200	250–450	100–200	250–450	150–250	150–250	150–250	150–250
C	2000	—	—	—	—	—	—	—
D	500–600	0	250–300	0	—	0	—	0
E	75–125	0	60–70	0	15–20	0	15–20	0
F	250–450	—	250–450	—	150–250	—	150–250	—

[PS]: Peak Season; [LS]: Low Season; A: límite de acceso diario en las navieras autorizadas para la realización de transporte colectivo; B: límite de acceso diario en grupos organizados y autorizados; C: límite de acceso diario por transporte marítimo (A + B); D: límite de personas en el camping; E: límite de fondeos diarios. Temporada baja; F: límite de acceso diario en grupos organizados y autorizados.

Table 6.

Maximum thresholds of visitors per day in PNG archipelagos, according to carrying capacity study [49].

389/2016) for the zoning of maritime-terrestrial national parks. These criteria determine that vertical dimension has to be taken into account to adapt the delimitation of the marine zonation to the different depths and ecosystems, considering the water column, the seabed, and the isobaths. This aspect was incorporated into the zoning of Decree 177/2018, in which various marine zones of moderate use are contemplated on the surface of marine waters, while the seabed is included in another category of zoning (reserve marine zone, restricted-use marine zone). So, PNG has become the first Spanish National Park that has implemented this three-dimensional methodology in its zoning scope and therefore has integrated it into its measure regime for management and conservation of natural heritage and biodiversity, when it comes to establish certain limitations of use for the different zoning categories that are defined in MPUM. In addition, taking into account the Natura 2000 consideration of PNG archipelagos, the zonation of the MPUM also kept a direct correspondence with the zoning units of the Master Plan of the Galician Natura 2000 Network (Decree 37/2014), in accordance with Law 42/2007, which provides that the Spanish categories of protected areas must be assigned to those internationally recognized, for the purposes of homologation and compliance with international commitments.

At present, after the initial conservation actions that followed the declaration of the National Park, and the regulation of visitor access according to the load capacity established with scientific-technical criteria, new challenges are being posed in the Atlantic islands of Galicia. In September 2021 has started a new LIFE project entitled “Integrated strategy for sustainable management of insular habitats in Natura 2000 islands of the Atlantic Ocean”, whose acronym is LIFE INSULAR (LIFE20 NAT/ES/001007). It’s a project that targets a favorable conservation status of fixed grey-dunes habitat (2130*) and its contact habitat (4030) in Atlantic Ocean islands, spread across Atlantic and Macaronesian biogeographical regions. The project has a transnational scope, so eight Spanish and Irish Natura 2000 SACs have been selected to develop conservation actions, addressing common conservation problems and threats to increase the area and improve the structure and future prospects of targeted insular habitats in five different islands from both Member states. Three of them will be islands from PNG: Cíes, Ons, and Sálvora. Best practices of proven effectiveness will be applied, from September 2021 to December 2026, on targeted insular habitats to address common conservation problems and threats from a transnational approach. The covered area by the targeted habitats will be increased by elimination of old senescent forest plantations established by PFE and ICONA,

cultivation of characteristic plant species of insular habitats, and their restoration. Their structure and function will be improved through the control of competition against plant invasive alien species, as well as their future prospects through the improvement of habitat knowledge and protection measures against anthropogenic pressures. The project will be complemented by a transnational strategy to inform and raising public awareness to the general public about the relevance, natural values, and ecosystem services provided by insular ecosystems, as well as transferring the measures developed in the project for their replicability at the EU level through specific replication and networking strategies. LIFE INSULAR is expected to have a great demonstrative character, allowing high replicability and transferability to other European island territories, or even worldwide, so it is considered that the selected insular territories will be representative from two biogeographical regions where European Natura 2000 islands in the Atlantic Ocean are located.

6. Conclusions

Biodiversity conservation and management in Spanish-protected areas have evolved over time in a significant way, and especially the Galician Atlantic Islands National Park, one of the two maritime-terrestrial National Parks in Spain. Prior to its declaration as a National Park, during the 20th century the islands that form it were gradually depopulated, which caused the abandonment of agrosystems and their substitution by natural habitats recovery. But from the 1950s the PFE first, and ICONA second, transformed coastal scrubs and dune systems by afforestation with exotic species (some of them invasive species), constituting a decrease in the conservation value of the islands, as high-natural value habitats are substituted by low-natural value forest formations. During the 1960s and 1970s the uncontrolled visitors caused a lot of damages to the natural heritage of the archipelagos. The Cíes Natural Park declaration in 1980, and subsequently the establishment of several protection measures in the rest of the archipelagos, helped to halt the biodiversity loss in these islands.

Finally, the declaration of the Maritime-Terrestrial Galician Atlantic Islands National Park introduced a new way of management under scientific-technical criteria, that was executed in these four archipelagos through developing conservation actions to restore habitats, assessing the conservation problems, and halting the impacts. This change of perspective made possible a significant improvement of the conservation status of natural ecosystems, allowing new declarations of a huge number of protected areas at regional, national, European, and international level, overlapping and reaching important synergies between them.

So this National Park has become a reference in Galician and Spanish conservation scheme, as a lot of visitors travel to the islands in order to know first-hand the natural values that have motivated the declaration of all those different categories of protected areas. This has led to establish the National Park planning several limits of number of visitors depending on the island, the season, or the type of tourism they are developing.

Nowadays, new challenges arise in the National Park, such as the removal and control of plant invasive alien species, the elimination of senescent forest formations, or the restoration of natural ecosystems using characteristic plant species of insular habitats employing local and compatible genetic material for plant production. The genetic characterization of the insular plant reproduction material, versus the continental one, appears as one of the future fields for further research in the archipelagos. The start of new European initiatives to achieve these goals within the islands, establishing important synergies with other countries, is a valid alternative and powerful for reaching success in improving the conservation status of natural habitats and wildlife.

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