Analysis of Replicability of Conservation Actions across Mediterranean Europe

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Abstract: In the Regional Park of Las Salinas and Arenales of San Pedro del Pinatar, in southeastern Spain, an environmental restoration and conservation project is being developed whose principle actions include adaptation of hillocks with a saline substrate to improve the reproduction habitat of aquatic birds and increasing the production of salt, dune restoration and conservation, protection of the first dune ridge through the collection of seagrass tops, and designing and implementation of a salt quality seal, which may be useful for reproduction in other sites in the Natura 2000 network, especially in the European Mediterranean area and in the Black Sea environment. The objective of this research study was to analye and locate the sites that could possibly replicate the actions of the project. In order to do this, spatial databases were used from the Natura 2000 network, salt flats, and marshes as well as Ramsar sites and SPAMI sites, and from them a shape file of points was created in the places with the presence of maritime dunes associated with marsh systems/salt flats. One hundred thirty-one sites in the Natura 2000 network were located, of which in 105 cases, one or more of the four actions considered in this research study can be replicated. Of these, 24 cases have active or recently abandoned salt flats in which the two main actions of the project can be replicated, and 11 of these sites meet characteristics for the replicability of the four actions, of which three have not been implemented by the LIFE projects developed on those sites.

Keywords: environmental restoration; conservation; replicability; Natura 2000 network; coastal salt flats; wetlands; dune systems, natural parks

1. Introduction

Wetlands are some of the most productive and ecologically valuable ecosystems [1]. According to Barbier et al. [2], wetlands perform critical ecosystem functions and services as stopovers for migratory birds, critical nursing grounds, production of raw materials and food, maintenance of coastal fisheries, coastal protection, erosion control, and carbon sequestration. Despite their importance and increased efforts to preserve them, wetlands are still being transformed for urban development and other activities like aquaculture at a rapid pace [3]. Some authors indicate the existence of a greater awareness of the importance of wetland ecosystem functions as well as growing concerns among environmentalists [4], and this growing restlessness has resulted in a range of conservation and management approaches [5–8]. These approaches include policy instruments at different administrative levels [4] such as implementing various wetland restoration programs [9] in order to mitigate the negative impacts of socioeconomic development on these unique ecosystems [10,11] and provide resources and monetary incentives for their conservation [12,13].

There are numerous highly productive wetlands with varied ecosystem services [14] affected by anthropogenic stress due to the large coastal population [15,16]. One of the main problems encountered affects the reduction and disappearance of biological diversity, a consequence of habitat modification, usually due to conversion and degradation of...
wetlands [17]. The objectives in these cases are to promote the reduction of ecosystem stress through the identification of environmental problems in a diagnostic analysis, then establishing strategic action programs [18]. Normally, among the programmed strategies, public awareness campaigns are carried out to increase environmental awareness directed at different levels of society [19–21], including parliamentary workshops for politicians, training events for local government officials, scientific conferences, and the participation of scientists in research and reporting to university and high school students, sometimes conducting environmental camps [22].

Networks are also usually created and associations that collaborate and work with environmental organizations and NGOs [23,24] carry out biodiversity assessments that have contributed to scientific development toward the improvement of densities, distributions, and genetic diversity of populations of endangered and endemic species as well as favourable actions for the maintenance of habitats according to norms and regulations and a reduction of the risk of introduced species. The final goal of these programs is to ensure that biodiversity remains present to benefit future generations.

There seems to be, therefore, an urgent need to develop and improve ecological restoration methods to rehabilitate or restore degraded coastal wetlands. And in this context, the LIFE Project [25] that we describe below is framed.

Scholars, practitioners, and environmentalists are increasingly supportive of collaborative, ecosystem-based approaches to coastal resource management [26]. However, few researchers have focused their attention on trying to promote satisfactory improvement actions in wetlands and salt ponds that can be used in other places with similar environmental characteristics.

In this sense, the objective of this research study was to analyse and locate the sites that could possibly replicate the actions of the project, that is, those places with similar characteristics to the study area (European Mediterranean coastal environments) and with a greater possibility of being able to successfully transfer the management and tasks or studies developed in the Regional Park of Las Salinas and Arenales of San Pedro del Pinatar.

2. The Project and Study Area

2.1. The Project

A project is being developed in the Regional Park of Arenales and Salinas of San Pedro del Pinatar (southeastern of Spain) (LIFE-Salinas) in which the field of nature conservation, restoration, and improvement in the production of salt and its interrelation with the tourism industry is being studied.

The main objective is the conservation of the Audouin’s gull (Larus audouinii) and the following priority habitats: 1510 *, Mediterranean saline steppes (Limonietalia); and 2250 *, littoral dunes with Juniperus spp. in the Site of Community Importance (SCI) and Special Protection Areas for Birds (SPAs) ES0000175 “Salinas y Arenales de San Pedro del Pinatar”. On the other hand, as an added value, the project will allow favouring habitats to be included in the Habitat Directive and increase the integration and ecosystem cohesion of the SCI and SPAs. Likewise, as an added objective, the project aims to facilitate the transfer and replicability of some of its main actions outside its territorial scope (other regions or countries).

This project is expected to increase habitats of special interest after the construction of 1800 m of new salt mines and the repair of other mines, covering them with a substrate of lagoons that heat the ground and prevent the development of vegetation. The recovery of the water circuit of the Coterillo lagoon (saline wetland) will allow for the recovery of endangered species, such as the Spanish tooth carp (Aphanius iberus), and will expand the feeding area of the Audouin gull. It is also expected to halt erosion in the adjacent La Llana beach and recover and protect the ridge of dunes in its first 500 m south of the port of San Pedro del Pinatar, an important area of habitat for 1510 Mediterranean saline steppes. Stopping the erosion of the dune system of Playa de la Llana will improve the conservation of priority habitat 1510 * and benefit 10 other habitats in Annex I of the Habitat Directive.
In addition, the actions related to the improvement of the dune–beach system will make it possible to face the challenges of climate change (the rise in sea level and increase in the frequency of storms) and prevent Mediterranean waters from invading the salt lagoons adjacent to the colony of Audouin’s gulls and other species.

The most transferable action of the project is the design and implementation of a quality and environmental protection certificate for the salt produced in the Mediterranean salt flats that are included in the Natura 2000 network. In the following link all the information on this project can be found: https://lifesalinas.es/en/home/ (accessed on 31 May 2021).

2.2. Study Area

The project intervention area is limited to the Regional Park of the Salinas and Arenales de San Pedro del Pinatar (Figure 1) in the extreme north of the coast of the Region of Murcia (southeastern Spain) within the municipality of San Pedro del Pinatar, its northern limit coinciding with the provincial limit between the provinces of Murcia and Alicante and in its southern limit borders the area called Las Encañizadas, an area of natural communication between the Mediterranean and the Mar Menor, with very shallow depths (50–100 cm) where a traditional method of fishing called Encañizada is still actively used. This space is about 65 km long and 1.4 km at its widest part, and geomorphologically constitutes the northern closure of the La Manga del Mar Menor spit, a 22 km long strip that separates the Mediterranean from the coastal lagoon called the Mar Menor (the largest salt lake in Europe). This lagoon is the remnant of an old bay, wider than the current lagoon, filled over the last 10 million years [27]. The closure of the spit has been occurring since the beginning of the Quaternary period via sediments from the mouth of the Segura River, transported south by the littoral current that is cut off in Cabo de Palos. The sediments were deposited around some islands of volcanic origin, more or less aligned in a north–south direction (Calnegre and Monte Blanco), and on the Tertiary sandstone reefs of Pedrucho, Estacio and Punta de Algas [28]. The almost definitive closure already occurred about 2000 years ago, but communication with the Mediterranean is maintained through artificial channels or natural gullies [29].

It is a protected natural area made up of a complex set of wetlands, occupied mainly by extensive areas destined for salt exploitation and adjacent ecological systems of great interest. There is an important biota adapted to the presence of water [30,31], and if we look at the definition of wetlands established at the Ramsar Convention, which states that “For the purposes of this Convention, wetlands are extensions of areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water the depth of which at low tide does not exceed six meters”, this natural space can be considered to be a unique wetland.

It was declared a Nature Park, or Protected Nature Reserve, in 1985, with a total area of 856 hectares, and in 1992 it acquired the status of Regional Park. Since 1994 it has been included in the List of Wetlands of International Importance (according to the Ramsar Convention). The importance of this wetland as a nesting, wintering, and migration site for a large number of migratory birds, such as flamingos, avocets, stilts, etc., led to it being declared a Special Protection Area for Birds (SPAB) in 1998 (Resolution of 13 October 1998; BORM nº 246 of 24 October 1998), with an area of 841.75 ha, thus becoming part of the Natura 2000 network of the European Union.

As an integral part of the Mar Menor, it is also a Specially Protected Area of Mediterranean Importance (SPAMI). In addition, due to its fauna values (reptiles such as the red-tailed lizard, the \textit{Pimelia} sp. beetle, endangered fish such as the Spanish tooth carp, small crustaceans such as \textit{Artemia} sp., and various species of bats, in addition to the aforementioned birds) and flora (tamarisks, salicornias, marjoram trees and rushes in the salt marshes, and Aleppo pine, mastic, black hawthorn, birds-foot-trefoil, lily, thistle or sea caterpillar, on the dune ridge), and practically coinciding with the SPAB space, it was also declared a Place of Community Importance.
The majority of the park, about 500 hectares of the 856 total, is occupied by the premises of the salt mine, consisting of three types of salt ponds and the processing facilities of the Spanish company Salinera Española, owner of the salt works prior to the delimitation of the Maritime Public Domain and current operating owner. In front of the Mediterranean-facing side of the park, between 0.50 m and 30 m deep, there are extensive meadows of *Posidonia oceanica*, a seagrass exclusive to the Mediterranean. *Posidonia*, an important primary producer, provides a high amount of oxygen and regulates CO₂. Furthermore, due to its positioning parallel to the coast, it forms an effective barrier that considerably reduces and...
dissipates wave energy [32]. Likewise, it traps the sand moved by the waves, preventing its transport beyond the closing depth of the submerged beach. On the other hand, the dead parts of the plant are transported by the waves to the beach, where they end up forming important accumulations of banquets that serve as a refuge and nesting place for some birds, such as the black-footed plover (Charadrius alexandrinus), in addition to being food for many species of crustaceans and molluscs, which, in turn, feed the many seabirds in the area. Likewise, after being removed from the beach during the tourist season, it has been used to protect the dune ridge from the onslaught of waves in storms with winds coming from the east, with the dead parts of the plant accumulating on the dune front.

3. Materials and Methods

The study of the replicability and transferability of the project actions required the analysis and extrapolation of the environmental characteristics of the study area. Although most of the actions can be carried out in places with characteristics that are very different from the target area of the project. An attempt was made to exclusively identify areas that may have similar attributes from a conservation point of view, for which the analysis of spatial data has been necessary in order to optimize the choice of potential areas of replicability and transferability of some of the improvement and conservation actions contemplated in the project. In particular, the specific actions subject to transferability would be the following:

(a) The adaptation of hillocks with saline substrate: These actions are aimed at improving the reproduction habitat of aquatic birds and increasing the production of salt. This action has a twofold objective: (i) on the one hand, the adaptation of hillocks with saline substrate aims to increase the production of salt by 3%, since it is intended to repair the deteriorated hillocks and build new ones to expand the circulation circuit of the water, which will accelerate heating; (ii) on the other, it represents an improvement in the nesting conditions of Larus audouinii, since it aims to increase the nesting habitat of this and other species in Annex I of the Birds Directive by 17% (Recurvirostra avosetta, Charadrius alexandrinus, Gelochelidon nilotica, Sterna hirundo, Sternula albifrons, and Sterna sandvicensis). At the end of the 1990s, only two colonies of Larus audouinii made up 85% of its world population. The most important was located in the Ebro Delta, with 60% of the world population [33], and the second largest colony was in the Chafarinas Islands, which had 25% of the total population. In recent decades, and despite the increase in breeding pairs, the wintering population of Larus audouinii has been reduced and dispersed [34]. The survival of the chicks depends on several factors such as the quality of the parents, the availability of food, the hatching order, the rates of predation, diseases, and climatic and habitat conditions [35–39]. Despite the variety of spaces used for breeding, both in the Ebro Delta and in the Salinas and Arenales Regional Park of San Pedro del Pinatar, the species Larus audouinii selects the hillocks of the salt ponds as habitats. A very favourable habitat is sandy saline patches and sandy areas without vegetation or with a moderate vegetation cover. The high salt content of the salt substrate used in this action favours this type of condition, and the correct circulation of the water in the saltworks will allow for the expected increase in production. For the selection of spaces, three minimum criteria have been considered: that the area is Mediterranean, that it is included in the Natura 2000 network, and that it has an area of artificial salt marshes/salt marshes.

(b) Dune restoration and conservation: The objective of this action is to stabilize the dunes located in the first 500 m at sea level of the Port of San Pedro del Pinatar (Figure 1) through the installation of sand collectors. This action will allow the reduction of wind speed, reducing the load of sand transported outside the dune–beach system, increasing the volume of deposits [40]. In addition, the action includes the elimination of the paths formed by the trampling of pedestrians along the dune system, for which perimeter fencing around those first 500 m of dune ridge from the north access will be
made, which are the most deteriorated by the continuous passing of bathers during the summer months. The action will also include the recovery of the accumulated sand in one of the salt ponds and its transfer to the eroded area of the dune to restore its original state. The criteria for the selection of replicable spaces are the presence of dune–beach systems with the possibility of installing sand collectors, and the possibility of eliminating exotic species and introducing or revegetating with species included in Habitats of Community Interest (Annex I, Directive Habitats).

(c) Protection of the first dune ridge (the only ridge in some cases) through the collection on the dune front of seagrass tops (*Posidonia oceanica*, *Zostera marina*, *Cymodocea nodosa*, etc.) that accumulate on the beaches during coastal storms.

(d) Designing and implementation of a salt quality seal: To design and apply the methods, procedures, and criteria for obtaining a salt quality certificate for salt flats in the Natura 2000 network, compatible with the conservation of the territory and biodiversity.

3.1. Data Sources

Once the criteria for the actions with the possibility of replication were established, several spatial databases were used that contain the areas of the European Union with characteristics similar to those of the Salinas and Arenales Regional Park in San Pedro del Pinatar. The spatial data sources that were used are the following:

(a) Natura 2000 network: Provided by the European Environmental Agency, it contains, in shapefile format, the points and polygons of the spaces included in the Natura 2000 instrument, an ecological network of protected areas created to guarantee the survival of the most valuable species and habitats in Europe. Natura 2000 is based on the 1979 Birds Directive and the 1992 Habitats Directive. This version covers reporting since 2017. The database includes 27,738 sites within the scope of the European Union, with codes, types of places, and release dates.

(b) Salt flats and marshlands: This dataset shows the distribution of marshlands and salt flats (currently active or active until recently that still conserve salt structures) worldwide in polygon and point shapefile format. The database has been created and provided by the World Conservation Monitoring Center (UNEP-WCMC). All the sources used for its elaboration are included in the metadata [41] and include articles, reports, and documents reviewed by peers as well as databases created by non-governmental and governmental organizations, universities, institutes of independent research, and researchers worldwide. In total, it outlines 26,398 places around the world, with relevant data such as altitude, area, type, name, and international codes.

(c) Ramsar sites: Provided by the Ramsar Sites Information Service, contained in CSV format, this dataset contains information on the criteria, name, region of location, ecosystems, main threats, and coordinates of the 2342 Ramsar sites around the world.

(d) SPAMIs: For the treatment of spatial data related to the SPAMI areas, two KML (Key-hole Markup Language) files were used, one of points and the other of polygons. The data were obtained through the Mediterranean Centre for Marine and Environmental Research (CMIMA).

(e) Dune–beach system zones: From the previous data sources, a shapefile of points was generated for the places with the presence of maritime dunes associated with the marshland/salt marsh systems. This database was created from a photointerpretation of the Mediterranean Coast.

The treatment of spatial data was carried out with the free software QGIS, an open-source geographic information system (GIS), licensed under the General Public License (GNU) that constitutes a project of the Open-Source Geospatial Foundation (OSGeo). QGIS enables the processing of spatial data in raster and vector file formats. The version used in the present study was 2.18.
3.2. Procedure

From the coordinates of the Ramsar sites database, the CSV file was transformed into a shapefile. Once the databases shared the same format, the data was cross referenced in order to obtain the places that meet the requirements of the Salinas and Arenales of San Pedro del Pinatar Regional Park, located in the Mediterranean, which belong to the Ramsar Convention, and will be represented in the UNEP-WCMC database of salt flats and marshes and included in the Natura 2000 network of the European Union. The crossing of the three databases was carried out from the vector data management tools of the QGIS software. The expected results when carrying out this methodology were the location of spaces similar to the target area of the LIFE-Salinas Project.

Using aerial photographs, the elements of each location were located and information, such as the presence of dunes and activity or abandonment of the saltworks, was collected through photointerpretation (Figure 2).

![Figure 2. Conceptual scheme of the methodology followed. Source: ewn elaboration.](image)

4. Results and Discussion

4.1. The Natura 2000 Network in the Area of the European Mediterranean and the Black Sea

In the Natura 2000 network database, 131 sites located on the European Mediterranean coast, the Black Sea, and Portugal were identified that meet all or some of the conditions and attributes of the Regional Park of the Salinas and Arenales of San Pedro del Pinatar, always from the point of view of conservation. That is, coastal lagoons/marshes, wetlands and/or salt structures currently active or inactive but easily recoverable, and coastal beaches and dunes with or without the presence of seagrass meadows on the nearby and underlying marine platform.

After analysing the conditions for the replicability of some of the four actions contemplated in this research study, 26 sites were eliminated that, although being marshes or other types of coastal wetland, do not have salt structures or dune ridges, and, consequently, do not meet the conditions for the replicability of any of the four actions that are proposed as replicable. It should be noted that Malta also has some active salt flats [42], such as the Bugibba salt flats, but this site was dismissed because it is in an excessively urban environment in which there is no beach or, of course, a dune ridge; and also the historic Qbajjar salt flats, which are more than 2000 years old and dug directly into the sandstone of a fossil beach, which today is about 3 m above sea level.

Thus, after this initial screening, 105 sites were selected in which one or more of the four actions considered can be replicated (Appendix A and Figure 3). Of these, 26 do not have any other protection figure apart from belonging to the Natura 2000 network.
Forty-five are, in addition to the Natura 2000 network, Ramsar sites, 62 are ZEPI sites, and in 28 cases both figures overlap.

By country, Italy (IT) is by far the country with the most sites in the Natura 2000 network in which one or more project actions can be carried out (43 sites). Spain (ES) has 19 sites, in France (FR) 14 sites were located, Greece (GR) has 11 sites, in Portugal (PT) there are 6 sites, Croatia (HR) has 5 sites, and in Bulgaria (BG) 4 sites were located. Finally, in Estonia (SI), Romania (RO), and Cyprus (CY), one site was located in each of them (Appendix A).

![Figure 3](image_url)

**Figure 3.** Sites of the Natura 2000 network and location of the 11 sites where the hillocks repair actions with a saline substrate, quality sealing and dune restoration, and conservation can be replicated. The boxed codes correspond to the 11 most favourable replicability sites. Source: own elaboration.

4.2. Replicability

Although there are numerous scientific articles that offer methodologies and proposals for actions to be carried out in places with similar environmental characteristics, there are not so many that describe actions developed in LIFE projects and specifically address their replicability and transferability to other projects that contain related environmental improvement objectives [43,44]. In this sense, it is necessary to search for projects with similar objectives in order to establish replicable actions and obtain a certain guarantee of the expected results. On the other hand, when its intention is to find out the scope of the transferability of a project, geography as a discipline and its currently most common work tools, such as geographic information systems (GIS), facilitate the search for locations with similar environmental patterns [45].
The analysis of the possibilities of replication of the actions of the aforementioned project showed that the dune restoration and conservation actions (sand collectors, control of exotic species, and revegetation) could be replicated in 103 of the 105 selected sites (Appendix A). Only two sites lack a dune ridge: Saline di Priolo, a small salty lagoon in southwestern Sicily in which at some point in the past there was a small saline installation, and Paludi presso il Golfo di Manfredonia, some salt pans located in a small inland lake separated from the Adriatic Sea by just over 2 km, which is completely urbanized today. According to Irene Prisco et al. [46], various regulatory and management tools are commonly used to prevent the negative effects of human trampling on sand dune habitats, but few studies have attempted to assess the effects of walks on the vegetation of the dunes. Several studies have highlighted the value of the ecosystem and the diversity of these habitats, threats, vulnerability, and the need for urgent conservation actions. Among other authors, Bonari et al. [47] provided examples of restoration and effective management. In addition, Bezzi et al. [48] developed a coastal dune management geodatabase, while Pinna et al. [49] applied sand trap systems to replant key dune species with the help of fences and boardwalks to reduce human trampling.

Of these 103 sites with the possibility of dune restoration and conservation, in 62 this action could be supported with the collection of banquettes of seagrasses for their protection against maritime storms [50–52], since in front of the coast of these sites there are oceanic Posidonia meadows or other phanerogams capable of generating banquettes that can be used for the protection of the dune front.

On the other hand, the actions of the repair of hillocks with a saline substrate and implementation of a quality seal in the production of salt could only be replicated in 24 sites where saltwork structures with current activity (industrial or artisanal) were located, or even sites with recently inactive saltworks, meaning that the salt structures are still in good condition and could eventually be used again for the production of salt. In this sense, the sites with salt flats located in this study differ from those mentioned in the “guidelines for the environmental management of salt flats in the Mediterranean and the Black Sea” [19], which include a list of the most recently located salt flats in the Mediterranean and the Black Sea, in which there are 80 salt flats, not including those in Portugal, a country in which we located two salt flats. Of the 80 salt flats, the document considers 37 (13 more than those mentioned in this study, or 15 if we subtract the two in Portugal) to be active. But it was found that, for example, some of the salt flats that were counted in Spain are salt flats that had been abandoned for a long time [53,54], and, in some cases, as occurs in the site of Lo Poyo in the Mar Menor, it is a saline wetland where salt activity was never exerted; so given the discrepancies with the list of salt flats presented in the aforementioned document, and as long as an in-depth review of the salt sites is not carried out, updating and preparing a new list of industrial and artisanal salt flats, active and not active in the Mediterranean and the Black Sea, we could consider the sites located in this study as valid.

Regarding the 24 salt flat sites located in our research study, in 11 of them the replication of the repair actions of hillocks with a saline substrate and a quality seal can be accompanied by those of the restoration and conservation of dunes and protection of dunes through the collection of gorse of phanerogams. That is, there are 11 sites where the four proposed actions can be replicated, the location of which is shown in the following cartography (Figure 3).

To determine if conservation actions were carried out in the selected sites, equal to or similar to those contemplated in this project, and, therefore, if replicability would be repetitive, a search was carried out of the LIFE projects and their general objectives developed at different sites (Table 1).

It was verified that conservation projects linked to the LIFE program were carried out in 18 sites with proposals for actions that are in some way related to the proposals in this study. In two of those sites there were 2 and 3 linked projects. In another 7 sites it is possible that projects were developed, perhaps not linked to the LIFE program, or perhaps, for which information was not found (sometimes the projects that were found developed
actions that are very different from those contemplated and listed here). Therefore, in principle, these are very suitable sites for the replicability of the actions of this project. In some cases, all the actions could be replicated, as in the Stagno di Santa Caterina site on the island of Sardinia, one of the most favourable places due to its similarity with the surroundings of the Regional Park of Salinas and Arenales of San Pedro del Pinatar, since it has active salt flats, dune ridges in the process of erosion, and oceanic Posidonia meadows that generate a large number of banquettes. In fact, among the activities of the LIFE-Salinas Project, a visit to the Stagno di Santa Caterina site is planned to explore the possibility of collaboration with its managers and to transfer and replicate the actions set out in this paper. In addition, the sites located in Portugal, Ria Formosa and Sapais de Castro Marim, which despite being close to the Atlantic meet Mediterranean environmental and climatic conditions, are conducive to replicating the repair of hillocks with a saline substrate, implementation of a quality seal, and dune restoration and conservation; but it would be little or not at all viable for the protection of the dune ridge with tufts of seagrasses.

Sousa et al. [55], when studying long-term land use change in Ria Formosa, argued that in areas of high conservation value, new policies that stimulate the development of an ecosystem approach to economic activities should be considered. According to these authors, aquaculture simultaneously improves regional environmental status and sustainable socioeconomic development.

In other cases, actions would only be feasible in the salt flats, such as at the Salinas di Trapani site, which is without an appreciable dune ridge, and at the Marais et zones humides Îlîs Ô l’Îltang de Berre site in France. Likewise, at the Embouchure du Stabiaccu, Domaine Public Maritime et îlot Ziglione site on the island of Corsica (with inactive but recoverable salt pans), actions on dunes could be replicated.

Of the sites where projects had been developed, 7 (4 in Italy, 2 in France, and 1 in Bulgaria) were co-participants in the same project, the LIFE MC SALT, whose main objective was “conservation, management, and rehabilitation of active salt flats, dunes, and coastal wetlands”, and in which actions similar to those proposed in this paper had been developed. However, it was not possible to verify that the hillock repair had been carried out with a saline substrate or that a quality seal had been implemented or that the dune ridge had been protected with seagrass tops. In this sense, they are also sites where at least these three actions could be replicated.

In Limnothalassa Angelochoriou (Greece), the LIFE 09/NAT/E/000343 project (2010–2015) also developed actions, in some cases, similar to those proposed in this paper, but it did not develop actions to restore hillocks with a salt substrate or implement a quality seal for the salt produced or protect the dune ridge with banquettes. The situation is similar in Seoveljske soline” (Slovenia), where the LIFE 09/NAT/SL/000376-MANSALT project (2010–2019) had as objectives (i) to establish control over the water regime of the salt flat and restore degraded areas, (ii) raise awareness about the importance of traditional salt production, which preserves nature and allows sustainable development of the local community, and (iii) present a model of good practice on the use of traditional methods in the reconstruction of the salt mine, that are closely related to many of the objectives of our LIFE-Salinas project but none of the four actions proposed in this research study are exactly considered as replicable and would greatly improve the rest of the actions of restoration and environmental conservation.

In Spain, the LIFE09 NAT/ES/000520 (LIFE-Delta Lagoon) project, developed between 2010 and 2014, carried out actions quite similar to those proposed in this paper (Table 1), but as in the rest of the projects found, it did not contemplate the recovery of hillocks with a salt substrate or the implementation of a quality seal for the salt produced, since its objective in the old San Antonio salt flats was only to recover the connectivity of the salt ponds. There were also no actions on the dunes, so the replicability of the actions of this project is also feasible. In the other 8 remaining sites, the objectives and actions of the developed projects are further from the replicable actions proposed, so they are sites with many possibilities of replication of the actions proposed here.
Among the projects prior to LIFE-Salinas that had generated replicability through their actions, we can mention some whose methodologies inspired actions carried out in our LIFE-Salinas project. Thus, for example, in a Mediterranean environmental context, we can cite the project “MC-SALT—Environmental Management and Restoration of Mediterranean Salt Works and Coastal Lagoons”, with actions in Italy, France, and Bulgaria over the period (2013–2016), and with the objective of preserving native species and dunes. This project had a precedent in the LIFE Valli di Comacchio [56], focused on the ecological restoration and conservation of habitats in the salt flats and SCI of the same name, but in the case of the LIFE MC-SALT, for the first time the optimization of the water flow in the salt flats was contemplated to improve their performance.

Outside the Mediterranean area, the ARCOS LIFE 2014–2018 project focused on actions aimed at improving the state of conservation of the dune ecosystems of the Cantabrian coast (northern Spain), starting from a fragile situation due to both natural and anthropic threats [57]. Its actions included the elimination of non-native tree cover, the elimination of exotic species, the planting of dune species, and the installation of sand traps for the development of the dunes. These last two actions are key to proper management of Mediterranean dunes [58] and are usually carried out in any project that includes dune restoration.

Table 1. Sites of the Natura 2000 network with industrial or artisanal salt flats and projects developed in them related to one or more of the actions proposed in this study.

| Site Code   | Sites                                   | Condition * | Related Life Projects                                                                 |
|-------------|-----------------------------------------|-------------|---------------------------------------------------------------------------------------|
| BG0000270   | Atanasovsko ezero                       | A           | LIFE17 NAT/BG/000277 (2010–2014) Improving the management of the coastal wetland complex |
|             |                                         |             | LIFE17 NAT/BG/000362 (2012–2018) Establishing a functional and efficient structure for the management of the water of the coastal area |
|             |                                         |             | LIFE17 NAT/BG/000558 (2018–2024) Improving the state of coastal lagoons and their long-term conservation |
| ES0000140   | Bay of Cádiz                            | R           | LIFE Litoral Cádiz. LIFE03 NAT/E/000054 (2003–2006) Restoration, conservation, and management actions in coastal ecosystems (wetlands, dunes) |
| FR9310019   | Camargue                                | A           | LIFE MC SALT LIFE 10/NAT/IT/000256 (2011–2015) Conservation, management, and rehabilitation of active salt flats, dunes, and coastal wetlands |
|             |                                         |             | LIFE + ENVOLL LIFE 12 NAT/FR/000538 (2013–2018) Protection of seabirds in saline environments |
| GR2310001   | Delta Achelouou, Limnolalasssa Mesolongiou—Aitolikou, Ekvoles Evinou, Nisoi Echinades, Nisos Petalas | A           | LIFE95 NAT/GR/001111 (1995–1999) Contribute to the conservation of the slender curlew (Numenius temuirostris) |
| ES0000020   | Delta de l’Ebre                         | A/R         | LIFE09 NAT/ES/000520 LIFE-Delta Lagoon (2010–2014) Improving the ecological status and hydrological connectivity of the Alfacada lagoon. Mitigating the effects of the coastal regression. Improving the status of priority habitats and species. |
|             |                                         |             | LIFE-Delta Lagoon (2010–2014) Developing monitoring and dissemination measures of the ecological values of the restored areas. |
Table 1. Cont.

| Site Code     | Sites                                                                 | Condition | Related Life Projects                                                                 |
|---------------|----------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------|
| FR9400586     | Embouchure du Stabiaccu, Domaine Public Maritime et îlot Ziglione     | R         | LIFE + ENVOLL LIFE 12 NAT/FR/000538 (2013–2018) Preparatory actions in the Sigean salt flats and conservation of the old marshes |
| FR9112006     | Etang de Lapalme                                                     | R         | LIFE + ENVOLL LIFE 12 NAT/FR/000538 (2013–2018) Preparatory actions in the Sigean salt flats and conservation of the old marshes |
| FR9112007     | Étangs du Narbonnaïs                                                 | A/R       | LIFE Salinas Torre Vieja LIFE 08/NAT/E/000077 (2010–2011) Creation of a decantation and ecological recovery circuit for the La Mata and Torrevieja lagoons |
| ES0000485     | Mata and Torrevieja Lagoons                                         | A         |                                                                                      |
| GR1220005     | Limnothalassa Angelochoriou                                          | A         | Improving the conservation status of coastal lagoons, salty steppes, and beds of posidonia (Posidonia oceanica), as well as priority seabird species such as the curl (Numenius tenuirostris) and the pygmy cormorant (Microcarbo pygmeus) |
| FR9301597     | Marais et zones humides liUs O l’Utang de Berre                     | A         |                                                                                      |
| IT9110038     | Paludi presso il Golfo di Manfredonia                                | A         | LIFE 09/NAT/E/000150 (2010–2019) Improving the conservation status of priority wetlands, lagoons, coastal dunes, and saline steppes |
| FR9101406     | Petite Camargue                                                     | A         | LIFE MC SALT LIFE 10/NAT/FR/000256 (2011–2016) Conservation, management and rehabilitation of active salt flats, dunes, and coastal wetlands |
| BG0000152     | Pomoriysko ezero                                                    | A         | LIFE MC SALT LIFE 10/NAT/BG/000256 (2011–2016) Conservation, management and rehabilitation of active salt flats, dunes, and coastal wetlands |
| PTZPE0017     | Ria Formosa                                                          | A         |                                                                                      |
| IT4070007     | Salina di Cervia                                                    | A         | LIFE MC SALT LIFE 10/NAT/IT/000256 (2011–2016) Conservation, management, and rehabilitation of active salt flats, dunes, and coastal wetlands |
| ITA090013     | Saline di Priolo                                                    | R         | LIFE MC SALT LIFE 10/NAT/IT/000256 (2011–2016) Conservation, management, and rehabilitation of active salt flats, dunes, and coastal wetlands |
| ITA010007     | Saline di Trapani                                                   | A         |                                                                                      |
| FR9312008     | Salins d’Hybres et des Pesquiers                                    | R         | LIFE MC SALT LIFE 10/NAT/FR/000256 (2011–2016) Conservation, management, and rehabilitation of active salt flats, dunes, and coastal wetlands |
| PTZPE0018     | Sapais de Castro Marim                                              | A         |                                                                                      |
| SI5000018     | Seoveljske soline                                                   | A         | LIFE 09/NAT/SI/000376-MANSALT (2010–2019) Establish control over the water regime of the saline and restore degraded areas. Raise awareness about the importance of traditional salt production, which preserves nature and allows sustainable development of the local community. Present a model of good practices on the use of traditional methods in the reconstruction of the saline. |
Table 1. Cont.

| Site Code | Sites                                      | Condition * | Related Life Projects | Project | Main Objective                                                                 |
|-----------|--------------------------------------------|-------------|-----------------------|---------|--------------------------------------------------------------------------------|
| ES0000084 | Ses Salines d’Eivissa i Formentera         | A           |                       |         | -                                                                               |
| ITB044003 | Stagno di Cagliari                         | A           | GILIA                 | LIFE96 NAT/IT/003106 (1997–2002) | Restore the environmental quality of the Stagno di Cagliari. Elimination of landfills. Cessation of the entry of wastewater. |
| ITB040022 | Stagno di Molentargius e territori limitrofi | A           | LIFE MC SALT          | LIFE 10/NAT/IT/000256 (2011–2016) | Conservation, management, and rehabilitation of active salt flats, dunes, and coastal wetlands |
| ITB042223 | Stagno di Santa Caterina                   | A           |                       |         | -                                                                               |

* Note: Salinas: A = active; R = recoverable. In Bold: sites where the four proposed actions can be replicated. Source: own elaboration.

According to Sun et al. [59], coordination between different scales and administrative levels, as well as international cooperation, should be fundamental strategies for improving the management and conservation of wetlands. Likewise, according to Gumiero et al. [60], the successful management of natural resources is much more than developing good science, it requires working together with the many agents and/or actors involved, and above all sharing knowledge through diverse case studies.

5. Conclusions

LIFE projects require the dissemination of actions and their replication at the European level. In this context, the LIFE-Salinas Project has always sought to implement a large part of its actions. The methodology used in its nature conservation actions is transferable and replicable in a large part of the Mediterranean area, and transferability is optimal in coastal places with dune systems and with saline exploitations, especially if they are located within the Natura 2000 network. Beyond the economic and social importance of Mediterranean salt pans, this research study highlights the importance of maintaining their activity, since it is key in the conservation of coastal wetlands.

The creation and use of spatial databases constitute a key tool when analysing the replicability of actions of environmental improvement projects such as the one at hand. In addition to providing information, they allow working with different variables in a unified way.

In short, the actions of the project contemplated in this paper can be replicated for a large number of sites in the Natura 2000 network in the Mediterranean area. Among these actions, it is worth highlighting, as a novel contribution, the repair of hillocks with a salt substrate, which improves the production of salt and the habitat of seabirds, and the implementation of a quality seal for the production of salt.

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Appendix A

Table A1. Sites of the Natura 2000 network. Characteristics and replicability.

| Sites                              | Code          | Ha   | Ramsar | SPAMI | Replicability |
|------------------------------------|---------------|------|--------|-------|---------------|
|                                    |               |      |        |       | 1 2 3         |
| Aiguamolls de l’Alt Empordà        | ES0000019     | 10,850.6 |       |       | X             |
| Alimini                            | IT9150011     | 3719.6       | X        | X | X |
| Alykes Larnakas                    | CY6000002     | 1568.6        | X        | X | X |
| Amvrakikos Kolpos, Limnothalassa   | GR2110004     | 23,227.2    | X        | X | X |
| Katafourko Kai Korakonisia         | BG0002527     | 7218.2        | X        | X | X | X |
| Atanasovsko ezero                  | FR9110108     | 4839.2        | X        |       |               |
| Bahía de Cádiz                     | ES0000140     | 10,550.7      | X        | X | X |
| Basse plaine de l’Aude            | FR9110108     | 4839.2        | X        |       |               |
| Bosco Pantano di Policoro e Costa I| IT9220055     | 1798.7        | X        | X | X |
| Ionica Foce Sini                   |               |      |        |       |               |
| Camargue                           | FR9310019     | 220,509      | X        | X | X |
| Capo di Pula                       | IT042216      | 1582.1        | X        |       |               |
| Complexe lagunaire de Salses-Leucate| FR9112005   | 7668.1        | X        |       |               |
| Comporta                           | PTCON0034     | 32,149.2      | X        | X | X |
| D’Addaia a s’Albufera              | ES0000233     | 2817.1        | X        | X | X |
| Delta Acheelooou, Limnothalassa    | GR2310001     | 35,730.0      | X        | X | X | X |
| Mesolongiou—Aitolikou, Ekvoles Evinou, Nisos Echinades, Nisos Petalas |       | | | | |
| Delta Axiou—Loudia—Aliakmona—Alyki | GR1220010     | 28,926.6      | X        | X | X | X |
| Kitrous                            |               |      |        |       |               |
| Delta de l’Ebre                    | ES0000200     | 48,627.5      | X        | X | X | X |
| Delta del Po                       | IT3270023     | 24,988.8      | X        | X | X |
| Delta Dunrii i Complexul Razim—Sinoie | ROSPA0031 | 507,816        | X        | X | X |
| Delta Evrou                        | GR1110006     | 12,397.7      | X        | X | X | X |
| Delta Neretve                      | HR5000031     | 23,836.8      | X        | X | X |
| Duna del Lago di Burano            | IT51A0032     | 98.2          | X        |       |               |
| Duna e Lago di Lesina—Foce del Fortore | IT9110015 | 9845.0        | X        | X | X |
| EKvoles Kalama                     | GR2120001     | 8637.7        | X        | X | X |
| Embouchure de l’Argens            | FR9301127     | 1379.5        | X        |       |               |
| Embouchure du Stabiaccu, Domaine Public Maritime et l’îlot Ziglione | FR9400086     | 195.8        | X        |       |               |
| Est et sud de BÚziers               | FR9112022     | 6085.8        | X        |       |               |
| Estuario do Tejo                   | PTCON0009     | 44,132.7      | X        |       |               |
| Etang de Lapalme                   | FR9112006     | 3911.9        | X        | X | X |
| Etang de Mauguiro                  | FR9112017     | 7020.0        | X        |       |               |
| Étang de Thau et lido de Spé Ogde  | FR9112018     | 7750.7        | X        |       |               |
| Sites                                      | Code         | Ha          | Ramsar | SPAMI | Replicability |
|-------------------------------------------|--------------|-------------|--------|-------|---------------|
| Étangs du Narbonnais                      | FR9112007    | 12,257.2    | X      | X     |               |
| Étangs palavasiens                        | FR9101410    | 6599.5      | X      | X     |               |
| Fernão Ferro/Lagoa de Albufeira           | PTCN00054    | 4330.5      | X      | X     |               |
| Foce dell’Isonzo—Isola della Cona         | IT3330005    | 2668.5      | X      | X     |               |
| Lago di Burano (b)                        | IT51A0033    | 490.0       | X      |       |               |
| Laguna di Caorle—Foce del Tagliamento     | IT3250033    | 4377.6      | X      | X     |               |
| Laguna di Marano e Grado                  | IT3320037    | 16,363.4    | X      | X     |               |
| Laguna di Orbetello                       | IT51A0026    | 3698.4      | X      |       |               |
| Laguna di Venezia                         | IT3250046    | 55,148.0    | X      |       |               |
| Lagunas de la Mata y Torrevieja           | ES0000485    | 3742.9      | X      | X     | X             |
| l’Albufera                                | ES0000471    | 29,338.5    | X      |       |               |
| L’Albufereta                              | ES0000226    | 444.2       | X      |       |               |
| Le Cesine                                 | IT9150014    | 648.0       | X      | X     |               |
| Limnes Vistonis, Ismaris—Limnotalasses    | GR1130010    | 17,740.8    | X      |       |               |
| Porto Lagos, Alyki Ptelea, Xirolimni, Karatza | GR1220005    | 373.6       | X      | X     | X             |
| Limnotalassa Angelochoriou                | GR2330009    | 2350.6      | X      | X     |               |
| Limnotalassa Kotychi—Alyki Lechajon        | IT9150015    | 7016.4      | X      |       |               |
| Litorale di Gallipoli e Isola S. Andrea   | IT9150009    | 7255.1      | X      |       |               |
| Litorale di Ugento                        | IT9150014    | 648.0       | X      |       |               |
| Mandra—Poda                               | BG0000271    | 6146.6      | X      |       |               |
| Marais et zones humides liÜs O l’Útang de Berre | FR9301597    | 1559.6      | X      |       |               |
| Marismas de Isla Cristina                 | ES6150005    | 2499.9      | X      |       |               |
| Marismas del Odiel                        | ES0000025    | 6626.9      | X      |       |               |
| Marismas del rio Piedras y Flecha del Rompido | ES6150006    | 2411.6      | X      |       |               |
| Marjal de la Safor                        | ES5233030    | 1247.6      | X      | X     |               |
| Marjal dels Moros                         | ES0000470    | 627.9       | X      | X     |               |
| Ortazz, Ortazzino, Foce del Torrente Bevano | IT4070009    | 1254.7      | X      |       |               |
| Padule della Trappola, Bocca d’Ombrone    | IT51A0013    | 490.0       | X      |       |               |
| Padule di Diaccia Botrona                 | IT51A0011    | 1349.2      | X      |       |               |
| Paludi di Capo Feto e Margi Span          | ITA010006    | 351.0       | X      |       |               |
| Paludi presso il Golfo di Manfredonia     | IT9110038    | 14,470.3    | X      |       |               |
| Pantani della Sicilia sud-orientale, Morghella, di Marzamemi, di Punta Pillieri e Vendicari | ITA090029    | 3575.5      | X      |       |               |
| Parco Nazionale del Circeo                | IT6040015    | 22,205.0    | X      |       |               |
| Petite Camargue                           | FR9101406    | 34,410.6    | X      |       |               |
| Pialassa dei Piomboni, Pineta di Punta Marina | IT4070006    | 463.9       | X      |       |               |
| Pineta di Cervia                          | IT4070008    | 194.2       | X      |       |               |
| Pomorje oce zerro                         | BG0000152    | 922.1       | X      |       |               |
| Prat de Cabanes i Torreblanca             | ES0000467    | 1945.5      | X      |       |               |
| Privlaka—Ninski zaljev—Ljubaki zaljev     | HR40000005   | 2001.0      | X      |       |               |
| Promontorio, dune e zona umida di Porto Pino | ITB040025    | 2707.0      | X      |       |               |
| Punta Entinas-Sabinar                     | ES0000485    | 1980.9      | X      |       |               |
| Ria de Alvor                              | PTCN00058    | 1459.4      | X      |       |               |
Table A1. Cont.

| Sites                                | Code         | Ha         | Ramsar | SPAMI | Replicability |
|---------------------------------------|--------------|------------|--------|-------|---------------|
|                                       |              |            |        |       | 1  | 2  | 3  |
| Ria Formosa                           | PTZPE0017    | 23,362.6   | X      | X     | X  | X  |
| Sacca di Goro, Po di Goro, Valle Dindona, Foce del Po di Volano | IT40600005    | 4867.7     | X  | X  | X  | X  | X  |
| S’Albufera de Mallorca                | ES0000038    | 2207.0     | X  | X  | X  |
| S’S’Albufera des Grau                  | ES0000234    | 2544.9     | X  | X  | X  |
| Salina di Cervia                      | IT4070007    | 1095.2     | X  | X  | X  |
| Salinas de Santa Pola                 | ES0000120    | 2511.4     | X  | X  | X  | X  |
| Saline di Augusta                     | ITA090014    | 63.6       | X  | X  |
| Saline di Trapani                     | ITA010007    | 1010.1     | X  | X  | X  | X  |
| Salins d’HyPres et des Pesquiers      | FR9312008    | 961.1      | X  | X  |
| Sapais de Castro Marim                | PTZPE0018    | 2154.0     | X  | X  |
| Seoveljske soline                     | SJ000018     | 968.8      | X  | X  | X  | X  |
| Ses Salines d’Eivissa i Formentera    | ES0000084    | 16,488.1   | X  | X  | X  | X  |
| Shablerski ezeren kompleks            | BG0000156    | 3177.0     | X  | X  | X  |
| Sen Bou i barranc de sa Vall          | ES0000238    | 1177.7     | X  | X  |
| Stagni di Colorstrai e delle Saline   | ITB040019    | 1154.8     | X  |
| Stagni e Saline di Punta della Contessa | IT9140003   | 2861.7     | X  | X  | X  |
| Stagno di Cabras                      | ITB030036    | 4810.0     | X  | X  |
| Stagno di Cagliari                    | ITB044003    | 3769.5     | X  | X  | X  | X  |
| Stagno di Corru S’Ittiri              | ITB030032    | 5730.0     | X  | X  |
| Stagno di Mistas di Oristano          | ITB030034    | 1626.5     | X  |
| Stagno di Molentargius e territori limitrofi | ITB040022 | 1279.7     | X  | X  | X  | X  |
| Stagno di Putzu Idu (Salina Manna e Pauli Marigosa) | ITB030038 | 599.4 | X |
| Stagno di Santa Caterina              | ITB042223    | 627.5      | X  | X  |
| Torre Colimena                        | IT9130001    | 2682.6     | X  | X  |
| Torre Guaceto                         | IT9140008    | 548.8      | X  | X  |
| Torre Manfria, Biviere e Piana di Gela | ITA050012   | 25,166.5   | X  | X  | X  | X  |
| Torre Veneri                          | IT9150025    | 1743.2     | X  |
| UÜe Mirne                             | HR3000433    | 125.5      | X  | X  |
| Valle Bertuzzi, Valle Porticino—CanneviP | IT4060004 | 2689.0     | X  | X  |
| Velo i Malo Blato                     | HR4000004    | 661.2      | X  | X  |
| Vene di Bilocchio, Sacca di Bilocchio, Foce del Fiume Reno, Pineta di Bilocchio | IT4060003 | 2242.4 | X  | X  | X  |
| Ygrotopos Neas Fokaiais               | GR1270013    | 422.4      | X  | X  |
| Ygrotopos Ekvolon Kalama Kai Nisos Prasoudi | GR2120005 | 8649.1     | X  | X  |
| Ygrotopos Schinia                     | GR3000016    | 2102.3     | X  | X  |

**Note:** In this table, the sites that have conditions for the replicability of one or more actions of the project have been marked. Replicable actions: 1 = saline substrate in hillocks and a quality seal (meaning that there are active saline structures at present or those that were active until recently on which this action can be implemented; 2 = sand collectors, removal of exotic species, and revegetation (meaning that it has dune/beach systems); 3 = protection of the dune ridge by means of seagrass tops (meaning that there are seagrass meadows that can provide seagrass tops). Source: own elaboration.

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