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# **Barriers to Effective Management of Mediterranean Coastal Lagoons Following Key European Union Directives: Perceptions of Managers of Natura 2000 Lagoon Sites in South France**

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Abstract: This paper focuses on the challenges for the co-implementation of two European Union Directives, i.e., the Habitats Directive and the Water Framework Directive, for the management of Mediterranean coastal lagoons as protected areas. Many of these ecosystems are included in the Natura 2000 network, the largest network of protected areas in the world. Based on semi-structured interviews with 45 stakeholders from 41 institutions, the study identified five main types of perceived barriers: economic, political and socio-cultural, historical, administrative, and ecological. The study confirmed that the coimplementation of the Habitats Directive (HD) and the Water Framework Directive (WFD) in Mediterranean coastal lagoons generated multiple and interrelated barriers. Beyond their regulatory complexity, these EU directives confronted managers with deep operational challenges. First, mismatches between administrative and ecological boundaries weakened their ability to control key ecological processes such as nutrient flows. Second, the proliferation of indicators, often perceived as disconnected from local realities, reinforced the critique of a management by numbers approach. Finally, the widespread use of regulatory exemptions, while intended to adapt EU rules to local contexts, frequently fueled persistent mistrust among stakeholders, especially in historically degraded environments. These challenges were further exacerbated by a siloed organization of administrations, limiting coordination and adaptive management. Overall, these findings call for more integrated governance frameworks, a more critical and context-sensitive use of indicators, and greater transparency in derogation procedures.

**Keywords:** biodiversity; coastal lagoon; conservation; manager; protected areas; semi-directed interviews; transitional waters; water quality

## 1. Introduction

The European Union (EU) has developed a coordinated approach to conserving natural habitats and biodiversity over the past three decades. This effort is primarily driven by key legislative frameworks, including the Habitats Directive (HD) [1] and the Birds Directive (BD) [2], which have been transposed in national laws of the member states and have led to the establishment of the Natura 2000 network—the largest network of protected areas in the world [3]. These policies are particularly relevant for Europe's extensive 68,000 km coastline [4], where ecologically significant habitats, such as coastal lagoons, require targeted conservation efforts. The HD and the BD are jointly considered as the EU nature conservation directives as they share common concepts and can each provide protection through different designations schemes. Nevertheless, the coastal lagoons in



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Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/ licenses/by/4.0/). the Natura 2000 network along the Mediterranean coast in S. France and Corsica are all protected through the HD scheme because the HD recognizes these ecosystems as priority habitats that are considered at risk of severe degradation and habitat destruction and demand, therefore, effective management strategies to achieve conservation goals.

In parallel, the Water Framework Directive (WFD) [5] also applies to coastal lagoons, classifying them as either "transitional waters" (alongside estuaries and river mouths) or "coastal waters". The coastal lagoons along the Mediterranean coast in S. France have all been classified as transitional waters. The EU nature conservation directives and the WFD are all based on a scientific foundation. While the HD and the BD are rooted in conservation biology, the WFD is rooted in different disciplines (see Table 1). Hence, the WFD focuses primarily on water quality, described by its chemical and ecological status, whereas the HD and the BD prioritize species and habitat protection.

**Table 1.** Scientific approaches for the Habitats Directive and the Birds Directive compared with the Water Framework Directive.

	Habitats Directive (HD) and Birds Directive (BD)	Water Framework Directive (WFD)
Epistemology	Conservation biology	Eco-hydrology; restoration ecology
Focus	Species (HD and BD), habitats and phytosociological units (HD only)	Water bodies and their ecological and chemical qualities
Underlying concept	Ecological corridors (green and blue networks)	Aquatic continuum (considering catchments of the water bodies)
Target	Good conservation status for habitats and species	Good ecological and chemical status
Deadline	Adaptive following review every 6 years	2015 (delayed to 2021 and then 2027)
Tool	Natura 2000 (network)	Water policies (schemes)
Coastal lagoon classification	* 1150—Coastal lagoons	Either <i>transitional waters</i> (all Mediterranean lagoons are in this category) or <i>coastal waters</i>
Transposition into French National Law	<b>1995</b> : law n° 95-101 of 2 February 1995, regarding the enhancement of environmental protection; Decree n° 95-631 of 5 May 1995 on the conservation of natural habitats and habitats of wild species of community interest	<ul> <li>2004: law n° 2004-338 of 21 April 2004 transposing the European Parliament directive 2000/60/EC</li> <li>2006: law n° 2006-1772 of 30 December 2006 on water and aquatic environments</li> </ul>

\*-in the Habitats Directive to indicate that this habitat is a priority habitat. Bold highlights specific points—like years and categories. Italics-highlight the use of specific legal terms.

Transitional waters, and particularly coastal lagoons, are specific aquatic ecosystems occurring at the land–ocean interface. Most of them are located close to densely populated and urbanized areas. Hence, the Mediterranean coastal lagoons have been heavily impacted by nutrient and contaminant loadings from their continental watersheds and suffered habitat destruction and severe pressures resulting from galloping urbanization and tourism in the coastal zone. At the same time, coastal lagoons are home to rich plant and animal communities, providing roles of biogeochemical filtering and nursery functions for the coastal sea. Coastal lagoons can also be considered as social ecological systems with important linkages with humans through use of their provisioning (e.g., fisheries and aquaculture) and cultural ecosystem services (mainly recreation, environmental education, and local cultural heritage). Hence, integrated coastal zone management is needed for these ecosystems, and managers must deal with the abovementioned social and ecological aspects and are conditioned by the legislative (particularly including the national laws derived from the HD and the WFD) and governance issues [6].

The managers of the coastal lagoon Natura 2000 sites are, therefore, increasingly faced with the challenges of applying both the HD and the WFD simultaneously. Specific ecological issues resulting from the co-implementation of the HD and the WFD have been

addressed for different aquatic systems including (1) rivers and associated floodplains [7,8] and (2) freshwater lakes [9,10]. Research on coastal lagoons has disproportionately focused on the WFD, while the implications of simultaneously implementing the HD and the BD in these aquatic ecosystems remain largely unexplored [6]. This is particularly striking given that discussions on the co-implementation of the WFD and the Marine Strategy Framework Directive (MSFD, 2008) began just two years after the latter's adoption [11,12]. Other studies of co-implementation of the WFD and the HD for aquatic ecosystems have focused more on the legislative, social, governance, and management aspects of the co-implementation of both directives [13–15]. Our hypothesis is that implementation of the HD and the WFD at the local level for coastal lagoon sites is often complicated by bureaucratic, scientific, and institutional barriers, which can hinder the achievement of conservation and environmental performance objectives.

This study examined these challenges by focusing on coastal lagoons in southern France as case studies. Through semi-structured interviews with key stakeholders involved in the management of coastal lagoons in southern France and Corsica, we analyzed the factors that slowed or obstructed EU directive implementation [16] and assessed their impacts on environmental performance [17]. Specifically, we investigated the following:

- How managers perceive and navigate directive implementation, including knowledge gaps and operational constraints;
- Key barriers to directive co-implementation, particularly when multiple regulations interact in complex ways.

By addressing these issues, our study provides insights into the institutionalization of Mediterranean coastal lagoon management, offering a clearer understanding of how regulatory frameworks function in practice. The article is structured as follows: First, we present the research methodology, outlining the qualitative approach and survey design. A geographical map of the study area and the involved stakeholders will illustrate the scope of our analysis. Next, we detail our findings step by step, followed by a discussion of key emerging themes. Finally, we conclude with recommendations based on our findings and highlight avenues for future research.

## 2. Materials and Methods

The geographic distribution of the studied coastal lagoons in southern France and Corsica is illustrated in Figure 1 using a map [18] of coastal lagoons along the Mediterranean Sea in the south of France. These ecosystems face complex, interdependent pressures from various activities, creating wicked issues-problems with no clear solutions, shaped by institutional constraints and external pressures [19]. Additionally, decision-making is influenced by contradictory demands [20], limited knowledge, and uncertain priorities [21]. To explore these challenges, we adopted a qualitative research approach based on grounded theory [22] and a neo-institutionalist perspective [23]. This lens examined how formal and informal institutions interacted, adapted, and sought social legitimacy through mimicry (isomorphism). Using a multi-case study method [24] and semi-structured interviews [25], we analyzed the experiences and perceptions of stakeholders involved in coastal lagoon management. Our focus was on barriers to directive implementation, how managers navigate regulatory complexity, and their strategies for achieving conservation goals under the Habitats Directive (HD) [1], the Birds Directive (BD) [2], and the Water Framework Directive (WFD) [5]. We examined how stakeholders defined obstacles, perceived solutions, and responded to intertwined challenges. Additionally, we explored resistance to solutions, which arose from deeply embedded systemic issues [26], requiring interdisciplinary collaboration [27] to address effectively.



**Figure 1.** Map of coastal lagoons along the Mediterranean Sea in the south of France. Map based on Carthage V3.0 database [18]. Red dots indicate the coastal lagoons that were cited by the respondents participating in the focused interviews. The lagoons occurred in coastal departments of the three administrative regions of south France, i.e., Occitanie (departments: Pyrénées Orientales, Aude, Hérault, and Gard), Région Sud, Provence, Alpes, Côte d'Azur (departments: Bouches-du-Rhône, Var, and Alpes-Maritimes), and Corsica (departments: Haute-Corse and Corse du Sud).

The following section details the multi-step process designed to progressively explore and analyze the reference frameworks mobilized by coastal lagoon managers. This process combined qualitative data collection, an automated thematic analysis, and an in-depth interpretative analysis aimed at revealing emerging dimensions beyond pre-structured categories.

**Step 1. Stakeholder interviews and data collection**: Between June and July 2021, focused interviews were conducted with 45 stakeholders from 41 organizations involved in coastal lagoon management. These included state services, local authorities, protected areas, research institutions, and NGOs. Interviewees were selected based on their roles in implementing the Habitats Directive (HD) [1], the Birds Directive (BD) [2], and the Water Framework Directive (WFD) [5]—ranging from direct managers to researchers and decision-makers. For consistency, "stakeholders" and "managers" were used interchangeably. This qualitative approach, rooted in textual analysis and structured discourse interpretation, allowed for in-depth data acquisition while ensuring comparability [25]. Coastal lagoons were analyzed as multiple cases, a method effective for theory-building [24]. The interviews followed a 27-question survey guide (see Supplementary Materials) covering the following:

- Respondent background;
- Institutional roles and practices;
- Directive implementation (barriers, drivers, and solutions);
- Narrative insights.

The dataset included nominative variables (categorical data) and ranked/quantitative elements (e.g., Likert scales, word frequency, and geographic coverage).

**Step 2. Data structuring, coding, and automated thematic analysis**: Interview transcripts were coded manually to extract 52 provisional variables, mostly nominative (grouped by semantic similarity) and some quantitative (e.g., frequency counts), structuring a  $52 \times 45$  matrix for comparison. The reference texts included laws, decrees, and policies. Institutions (*n* = 41) were classified by administrative, economic, and political status following institutional theory [28], assuming isomorphism in discursive practices. Relationships between institutions, reference texts, and variables were explored using multivariate analyses, including Factorial Correspondence Analysis (FCA) and hierarchical clustering (see Supplementary Materials, Figure S1). An automated thematic analysis, based on the Alceste method [29] and implemented via Iramuteq software (IRaMuTeQ 0.7 alpha 2, http://www.iramuteq.org, (accessed on 21 April 2025)), was conducted to identify lexical structures and dominant vocabulary trends [30], focusing on perceived barriers to directive implementation. This first-order analysis provided a structured foundation for the in-depth interpretative analysis developed in step 3.

Step 3. In-depth interpretative analysis and emergence of new dimensions: Step 3 followed an interpretive paradigm, viewing reality as a social construction [31]. It acknowledged both objective and subjective facts, emphasizing stakeholders' experiences and interpretations [32]. The analysis focused on sense-making and sense-giving to understand how EU directives are perceived and implemented in Mediterranean coastal lagoon management and, in particular, what may constitute a barrier or obstacle to the achievement of their conservation management objectives [33]. The dataset consisted of 340 pages of transcribed discourse, offering a panoramic view of themes discussed [34]. The thematic content analysis was conducted, segmenting the corpus into hierarchical nodes (parent/child) based on outputs from step 2. The goal was to identify second-order (emerging) themes not revealed in previous analyses, particularly subtle but recurring factors influencing the targets (cf. Table 1) of "good ecological status" (the WFD) and "good conservation status" (the HD). Relevant content was coded by theme, resulting in a structured data framework with new emerging dimensions for deeper understanding. The process was facilitated by NVivo 11 software (NVivo version 11, https://lumivero.com/products/nvivo/, (accessed on 21 April 2025)), which streamlined coding and data aggregation. The model was progressively refined through iterative analyses, including repeated factorial correspondence analyses to enhance validity [35].

This research was conducted in compliance with European ethical standards, particularly those established under French regulations and codified by the CNRS for research ethics and transparency. All interviews were anonymized, and participants were informed, both collectively and individually, about data management and access. The interviewed managers were anonymized at two levels:

- Organizational grouping: Each participant was assigned a code identifying his/her organization. The 41 organizations initially represented were grouped into 4 main categories.
- 2. Chronological coding of interviews: A new coding system was then applied according to the chronological order of the interviews. Each participant was given an anonymous code combining their organizational affiliation and the order of their interview (e.g., Type\_Org\_Int10).

This double anonymization guaranteed both the protection of individual identities and a categorization relevant to data analysis.

## 3. Results

#### 3.1. Type of Institutions, Profile of Interviewees, and Relationships

#### 3.1.1. Categorization of the 41 Institutions

Seven major reference texts were mentioned by interviewees including bathing water quality (Bathing WQ), regulation relative to the management of aquatic habitats and flood prevention (French GEMAPI law [36]), the Wetlands Convention (RAMSAR), Natura 2000 documents (N2000), the Water Framework Directive (WFD), the Habitats and Bird Directives (HD and BD), and the Marine Strategy Framework Directive (MSFD). Using a Factorial Correspondence Analysis (FCA) of the relationships between institutions and reference texts (see Figure S1, Supplementary Material), five groups were identified that were in agreement with the classification of Mintzberg [28]. However, to obtain a more balanced representation among groups, it was decided to lump dialogue and decision-making instances together with the regional natural parks and reserves into a single category (n = 8), which was also justified by considering both the Ki2 and the short distance between these two organizations in the FCI plane. Hence, the following four categories were identified, and their distribution is shown in Figure 2.



**Figure 2.** Distribution of the different categories of the 41 institutions, based on a Factorial Correspondence Analysis (FCA) of the relationships between institutions and refence texts. The categorization was coherent following the literature [28]. However, to achieve a more balanced representation among groups, it was decided to lump the dialogue and decision-making instances together with the regional natural parks and reserves into a single category (n = 8); see text for explanation.

- 1. Academics and other public scientific institutions (n = 7);
- 2. State services and state agencies in S. France, which are local antennae (in French "services de l'état déconcentrés") of the administrations of the state (*n* = 10);
- 3. Dialogue and decision-making instances that are public or private associations, together with regional natural parks and reserves institutions sharing conservation objectives (n = 8);
- 4. Decentralized governments comprising regions, departments, municipalities, and inter-municipal structures that compose the territorial governmental patchwork (n = 16).

The distribution of the different categories of institutions (Figure 2) showed that the public sector was predominantly represented by local governments accounting for almost 40%, state departments and agencies for almost a quarter, and research organizations for 17%. The other 20% were respondents from dialogue and decision-making instances with parks and natural reserves that had either a public or a private status. However, we followed the approach of Bozeman [37], who considered that the distinction between public

and private organizations was more related to the degree of constraints, dependence on political authority, and the means allocated than to its legal status and property regime. Hence, we considered that all these organizations were "publicness-oriented", meaning they were under political influence.

#### 3.1.2. Distribution of Fields of Knowledge and Expertise Among Institutions

The respondents had various academic backgrounds comprising six clearly identified fields of knowledge, i.e., ecology, hydrogeology, water management, planning, agronomy, and environment. Knowledge, as it is gathered, experienced, and shared, was considered as an area of specific expertise on which an organization can rely on. The proportions of these fields among the ensemble of 45 respondents are shown in Figure 3(left). Sixteen percent of respondents, however, mentioned another field of knowledge (9%) or N/A (7%). Ecology accounted for more than 1/3 among the interviewees. Above a quarter of them (26%) had expertise in a water-related field. A minority of profiles were diverse and more broadly orientated. Figure 3(right) shows that the distributions of respondent profiles varied among institution type.



**Figure 3. Left-panel**: Six fields of knowledge and expertise (ecology, Hydro geo = hydrogeology, Water\_Manag = water management, planning, Agro = agrology/agronomy, and Envir = environment) and their proportions among the 45 respondents of the 41 institutions. **Right panel**: Proportions of knowledge field profiles for each of the four different types of institutions (see Section 3.1.1 and Figure 2).

From these descriptive results we could observe the following:

- Research institutions were more specialized, with expertise concentrated in water (63%) and ecology (38%). Notably, hydrogeology (50% of water experts) was mainly found in research and local governments but rarely in other institutions.
- In state agencies, half of the respondents were specialized in ecology, followed by agronomy (20%) and water management (20%), aligning with their ministerial and bureaucratic structure [38,39].
- Parks and reserves had a diverse mix of expertise, with ecology (40%) and water management (25%) as dominant fields.
- Local and regional governments showed the widest range of expertise, reflecting their diverse responsibilities. Ecology and planning were the most common profiles (21% each), with planning being unique to this group, emphasizing forecasting and anticipation.

3.2. Implications and Dimensional Analysis: Hierarchical Classification of Barriers

Summarizing Section 3.1, we observed the following three main features:

- Organizations could be clustered into four main groups (Figures 2 and 3) based on the frames of reference on which the respondents relied on. The reference's assemblages created thinking schemes, i.e., a more or less heterogeneous set of references sustaining their theoretical construction. These thinking schemes differed significantly over institutions.
- The bulk of organizations were in the public sphere, and those with a private status were public-oriented.
- Each type of institution differed in terms of the range of academic profiles, suggesting
  more or less disciplinary ways of working or more or less siloed practices, within
  the institutions.

Potential implications of these findings were mentioned, including that institutions, by virtue of their public nature, may be more porous to political influence. The crucial role of managers was also underscored. In particular, the understanding of environmental issues by the respondents was based not only on their knowledge but also on patterns of thinking. This could influence the responses they provided within their organizations and, hence, their assessment of performance (achievement of objectives). An important step was therefore to look at their interpretations of obstacles through a thematic analysis, based on their reading key to deduce key dimensions and highlight contexts. The results of this automatic thematic analysis are illustrated below with a hierarchical classification (Figure 4).



**Figure 4.** Hierarchical classification tree for barriers, which resulted in identifying five barrier classes. The corpus, composed of 45 texts, output 3922 occurrences for 1177 different forms. The five classes were designated as (1) economic, (2) political and socio-cultural, (3) historical, (4) administrative, and (5) ecological barriers.

The hierarchical classification shown in Figure 4, identified the following five main classes of barriers, i.e., economic, political and sociocultural, historical, administrative, and ecological:

 Class 1: Economic (21%)—Barriers stem from economic reforms, budget cuts, and shifting political priorities, reducing human and financial resources. The COVID-19 crisis further intensified these challenges. Economic activities, such as tourism and infrastructure development, also contribute to environmental pressures.

- Class 2: Political and socio-cultural (13.4%)—Issues arise from decentralization (e.g., French GEMAPI law [36]), overlapping responsibilities, and conflicting priorities between conservation and economic development (e.g., flood prevention vs. infrastructure projects). Some political barriers also intersect with social and cultural practices, such as hunting and recreational activities.
- Class 3: Historical (9.2%)—Past policy decisions in favor of industry, hydroelectricity, and agriculture have left lasting ecological damage, including pollution and land use conflicts. These persistent issues create a heritage of environmental degradation still relevant today.
- Class 4: Administrative (30.2%)—Bureaucratic red tape, regulatory contradictions, and communication gaps hinder policy implementation. Coordination struggles between local and state authorities create inefficiencies in managing time, resources, and sectoral priorities.
- Class 5: Ecological (26.1%)—Barriers relate to lagoon classification issues, outdated assessments, and gaps in ecological data, particularly regarding groundwater and ecosystem changes. Inadequate indicators and evaluation methods raise doubts about the accuracy of ecological status assessments.

Economic, political and sociocultural, and historical barriers are closely linked as current challenges stem from past economic and policy decisions. The political dimension is future-oriented, requiring new skills, resources, and trade-offs, while economic concerns reflect the practical constraints of managing political expectations. Administrative and ecological barriers form another cluster as conservation efforts depend on directive implementation. These domains rely on indicators and data-driven management, yet translating broad qualitative EU directives into actionable policies remains complex and often impractical. This classification highlights how barriers are interconnected, emphasizing the need for integrated, adaptive management approaches in coastal lagoon governance.

#### 3.3. Perceptions of the Problem by the Respondents in the Light of the Different Barriers

The barriers highlight the difficulty of reconciling diverse interests and values in the management of coastal lagoons. The results showed that respondents referred to a much broader set of legal texts than EU directives, reflecting the complexity of coastal governance. A key factor is the unique legal status of coastal lagoons, often managed as commons, where use is regulated by multiple public policies rather than property rights. This regulatory overlap means that EU directives are interpreted and applied differently, depending on stakeholders' priorities, values, and perceived risks to ecosystems and their services. The interaction of environmental activities and pressures creates a web of interconnected challenges or wicked issues [40], making the implementation of the EU directives even more complex.

Below are some dimensions highlighted in the in-depth analysis, which refer to wicked issues specific to the coastal lagoon's management, unlike other obstacles such as political and economic ones, which are generally not singular. However, it is important to emphasize again the strong political–economic interconnection to the following set of factors.

3.3.1. The EU Directives: An Aggregation of Red Tape, Viewed as Fuzzy Concepts, Difficult to Implement or Co-Implement

All respondents agreed that EU directives help to improve the conservation of ecosystems, but many see them as overly bureaucratic (red tape), restrictive, and representing a real challenge to apply in local contexts. This rigidity may explain poor results or misleading performance feedback. The complexity of the rules, unclear indicators, and excessive regulations make the EU directives hard to implement and unpopular. A key issue is the vague definition of Mediterranean coastal lagoons, particularly the French interpretation of the Water Framework Directive (WFD), which only considers permanent water bodies for coastal lagoons and has introduced the criterium of a minimum size of 50 ha [6]. As a result, some coastal lagoons are misclassified, poorly defined, or entirely overlooked, leading to uncertainty about their proper categorization. This results in inconsistent management, trial-and-error approaches, and debates on how to define and classify coastal lagoons. Specific concerns included the following:

- Size criteria: Small (<50 ha) and temporary lagoons [41] are often excluded.
- Indicators: Some are unsuitable or too numerous or fail to consider key ecological factors like seasonal changes, ecosystem evolution, and interactions (in terms of species, pollution, and connection between water bodies).
- Data gaps: Lack of initial data and insufficient monitoring make it hard to assess ecological status accurately.
- Funding and administrative issues: These further complicate effective lagoon management.

The Habitats Directive (HD) and the Birds Directive (BD) share similar problems. Definitions for good conservation status are unclear, making it difficult to classify and manage protected areas. Spatial challenges arise due to mismatches between administrative and ecological boundaries, bureaucratic inefficiencies, and inconsistent conservation strategies. Additionally, many respondents considered the objectives as weak, several indicators as inadequate, and highlighted that together with scientific data gaps, the EU directives create uncertainty about conservation priorities. Another major challenge is the integration of these EU directives. While they generally align, their different scopes (species, habitats, and watersheds) and focuses (biological for the BD and the HD and ecohydrological and chemical for the WFD) sometimes lead to contradictions. The complexity increases when additional laws or regional policies are considered, especially since coastal lagoons exist at the land–sea interface. Conflicts also arise with other policy goals, such as renewable energy development or agricultural policies that encourage wetland destruction for farming. In conclusion, implementing these EU directives together is highly complex, making localized management extremely difficult.

## 3.3.2. Administrative Dimension of Barriers: Bureaucratic Failures

The administrative dimension relates to legal frameworks (EU directives, laws, etc.) and the challenges of enforcement, influenced by conceptual ambiguities, bureaucratic constraints, and lack of coordination. A major issue is the siloed organization of administrations, which hinders communication and leads to contradictory assessments and stagnation. Coastal lagoons, due to their localization at the land–sea interface, often suffer from ambiguous administrative status, complicating their management. Strategic documents, meant to guide management, are often rigid, outdated, or difficult to adapt to local contexts. The complexity of drafting them discourages meaningful updates, reinforcing a status quo. Frequent staff turnover exacerbates administrative inefficiencies, making it difficult to find qualified contacts or ensure continuity in decision-making.

Another key challenge is competency gaps, particularly regarding financial, technical, and human resources. Local authorities struggle to balance multiple responsibilities, including new obligations like the management of aquatic environments and flood prevention (French GEMAPI law) [36], adding to institutional uncertainty. Overlapping territorial layers and organizational redundancies create coordination issues, stakeholder tensions, and competition between institutions, sometimes leading to avoidance of responsibility. Additionally, time constraints were frequently mentioned, linked to resource shortages and bureaucratic delays. The mismatch between administrative processes and ecological timescales was a source of frustration, affecting both decision-making and environmen-

tal outcomes. Managers also reported dissatisfaction with ineffective tools, conflicting priorities, and inadequate response strategies, which further contributed to poor ecological performance. These issues are closely related to the historical and particularly to the ecological challenges identified in this study and described below.

#### 3.3.3. Historical Dimension of Barriers: Heritage as a Barrier

The historical dimension reflects the lasting impact of past activities on coastal lagoons, contributing to management challenges and stakeholder tensions. Poor ecological performance is often linked to the inertia of a degraded habitat, where recovery is slow despite corrective actions. This lack of resilience fuels conflicts, ethical dilemmas, and doubts about past political and economic decisions or proposed ecological solutions.

A key issue is the irreversibility of past environmental damage—even after harmful activities cease, their effects persist. Lagoon landscapes have evolved through land divisions, reforms, and shifting uses, creating path dependencies and administrative complexities. In some cases, legislation and measures have been interpreted by stakeholders as inconsistent following derogations issued to adapt the implementation of EU directives and national law to historical contexts, resulting in a loss of confidence in public authorities, as well as conflicts, including legal ones.

Public authorities often struggle to implement effective solutions as interventions may yield disappointing or unintended ecological outcomes. Overall, coastal lagoons are seen as the products of past decisions with irreversible consequences, making them exceptionally complex to manage. Their historical legacy is deeply intertwined with ecological, cultural, political, and economic factors, further complicating conservation efforts.

#### 3.3.4. Ecological Challenges: Knowledge Gaps, Crises, and Competing Interests

The ecological dimension presents significant barriers in defining and assessing coastal lagoons, primarily due to knowledge gaps, habitat inertia, and unexpected ecological responses. Some mitigation measures—such as water quality improvements or green agricultural policies—have even been perceived as counterproductive (e.g., Etang de Thau and Etang de l'Or). Managers also face ethical dilemmas, such as balancing restoration efforts with uncertain outcomes or choosing between competing conservation priorities (e.g., fish versus bird).

Frequent ecological crises, including pollution, anoxia, habitat degradation, and biodiversity loss, exacerbated by climate change, make it difficult to achieve the objectives of EU directives. Industrial discharges, freshwater influxes, and increasing salinity further destabilize these fragile ecosystems, sometimes leading to delayed compliance deadlines. The COVID-19 pandemic added new pressures, affecting both ecosystems and management capacity. Lockdowns and restricted travel led to unusual human activity in protected areas, increasing habitat disturbances. At the same time, budget cuts, administrative slowdowns, and reduced on-site monitoring further hindered conservation efforts. The pandemic also highlighted the fragility of local economies dependent on fishing, tourism, and recreation, exacerbating existing tensions between environmental protection and economic sustainability.

Invasive species, such as the American blue crab (*Callinectes sapidus*) and invasive algae, present significant new challenges, particularly regarding control strategies and economic costs. The lack of recognition of exotic invasive species in the HD and the WFD complicates management, although this is certainly an important issue in the MSFD. Moreover, certain non-invasive species also remain overlooked, despite their ecological importance.

Conflicting land and water use interests intensify these challenges. Agriculture, tourism, and biodiversity protection often compete for resources, particularly in the context of climate change and water scarcity. For instance, the artificial maintenance of natu-

ral conditions, particularly in relation to traditional ecosystem services like provisioning or cultural activities (e.g., recreation), is seen as a challenge and simultaneously raises ethical concerns.

A recurring theme in interviews was ignorance—managers cited knowledge gaps in species behavior, ecosystem interactions, and monitoring. Some lagoons remain understudied due to limited accessibility or public awareness, while scientific expertise is fragmented across different institutions. These gaps raise fundamental questions about defining "good ecological" and "good conservation status". Some managers question the effectiveness of current water quality indicators, noting that overly strict sanitation measures can make water "too clean" for sustaining shellfish productivity.

#### 3.3.5. Cultural Influences and Institutional Distances

The cultural dimension encompasses traditional activities, local practices, and differences in values, norms, and institutional approaches. Geographic isolation, particularly in insular societies, fosters distinct cultural perceptions that influence environmental attitudes and compliance with regulations. Some traditional or emerging recreational activities (e.g., kitesurfing and paddling) generate new conflicts due to deeply rooted habits or resistance to change.

In Corsica, respondents displayed strong beliefs about water resources, often contradicting scientific evidence. While natural environments are valued, there is limited awareness of ecological issues. Unlike on the mainland, lagoon-related conflicts are rarely cited as economic and political priorities dominate decision-making, increasing the risk of lagoon destruction for urban expansion. Institutional remoteness also plays a role. Differences arise from hierarchical, academic, and bureaucratic structures, where state agencies and universities are often detached from local realities due to rigid protocols and monodisciplinary approaches. Decentralized governments, in contrast, are more responsive to public pressure—except in insular contexts, where political influence is more personal and administrative processes are complex due to co-governance challenges.

Finally, cultural traditions and resistance to change continue to shape management approaches, which is consistent with the literature highlighting the importance of the cultural dimension [42]. Some stakeholders prioritize traditional uses over conservation efforts, reinforcing long-standing administrative and ecological challenges.

Addressing these barriers will require integrated strategies that balance environmental needs, economic pressures, and evolving social expectations. These cultural insights align with findings on administrative, historical, ecological, economic, and political barriers, highlighting the interconnected nature of management challenges in coastal lagoons.

## 4. Discussion and Conclusions

The EU directives HD and BD have been of paramount importance for endorsing protection measures in coastal lagoons in Europe. This is particularly supported by the inclusion of most of the larger permanent coastal lagoon sites in the Natura 2000 network. The environmental protection of coastal lagoons is further enhanced through water policies, which have been shaped in the EU member states through the WFD with a clear focus on the ecological state of surface waters with obligations of results. The interviewed respondents, all stakeholders involved in coastal lagoon management in south France, recognized the importance and positive impacts of these EU directives. However, this study revealed that many of these stakeholders perceived barriers in the execution of their task. In this study we checked our hypothesis that implementation of the nature conservation EU directives HD and BD together with the WFD at the local level is often complicated by bureaucratic, scientific, and institutional barriers. Our analysis showed that such barriers indeed exist,

while we also revealed other barriers related to ecological issues, economic conditions, specific context (i.e., Covid pandemia period), or emerging phenomena (e.g., invasive species and new types of pollution such as plastics) and historical and cultural aspects.

Given the cornerstone role of the HD, with its designation of the Natura 2000 sites, together with the WFD for protecting the coastal lagoons in Europe, from a management point of view, it is paramount to facilitate the tasks of the stakeholders involved in the practical management of these lagoons. Managers of nature conservation sites must cope with a very wide array of aspects [43] that span a much wider spectrum than the individual fields of study of the majority of academics and scholars. Indeed, previous studies where the co-implementation of the HD and the WFD in other aquatic ecosystems were studied have focused either on the ecological aspects [7-10] or on the on the legislative, social, and governance aspects [13–15]. We have adopted a multi-case study method [24] to cover a wide range of lagoons (see Figure 1) and semi-structured interviews [25], which through its open character allowed the managers to express their perceptions along a very wide spectrum of issues. The barriers perceived by these managers were classified in five classes, i.e., (1) economic, (2) political and socio-cultural, (3) historical, (4) administrative, and (5) ecological. Nevertheless, there was a strong link between the administrative and the ecological barrier. Mismatches between administrative and ecological spatial units are a typical example of such linkages. Hence, the delimitation of the coastal lagoon Natura 2000 sites (HD) often does not comprise the entire watersheds of these lagoons, while the WFD focuses on the management of these watersheds. As a result, the managers of Natura 2000 sites often feel that they have not full mastery of the nutrient and pollutant inputs into their aquatic ecosystems and must collaborate at wider geographical and institutional scales with water policies. Nevertheless, for rivers in Greece, despite anticipated synergy between the WFD and the HD, the ecological conditions, according to WFD indicators, inside Natura 2000 protected areas were on average not better than those outside [8]. In S. France, however, improved waste water treatments—in line with the WFD—have resulted in oligotrophication and ecological restoration of many coastal lagoons, although the most heavily eutrophied lagoons show long periods of inertia [6].

It may appear surprising that 26% of perceived barriers belong to the ecological class. This may relate to the fact that many managers have a background of training in ecology and may be specifically aware of and concerned by the knowledge gaps in this field. The vagueness of indicators may result from ambiguities between the indicators used for the HD and the WFD. Hence, in Scandinavia it was reported that while many lakes represent a high interest for the conservation of threatened macrophyte species (i.e., species listed on the IUCN red list [44]), large proportions of these lakes were actually classified as lakes of moderate or worse ecological status based on WFD macrophyte indicators [9]. On the other hand, for Chara-dominated lakes in Lombardy the implementation of the WFD chemical and biological quality indicators and monitoring systems was very constructive for the conservation purposes defined in the HD [10]. For the coastal lagoons in S. France, no strong discrepancies have been reported between the WFD and the HD biological indicators. While the WFD indicators for ecological quality have been adopted for the Mediterranean coastal lagoons in France since 2005, protocols for the assessment of their conservation status have been developed more recently. This was achieved through the Life-MARHA-project [45], which assured that its pelagic and benthic indicators were coherent among the WFD and the HD for these French Mediterranean coastal lagoons. During our interviews in 2021, these protocols were still under development, which may explain the perceived vagueness. Some respondents also perceived a potential conflict for coastal lagoons exploited for shellfish farming (e.g., Etang de Thau) and suggested that the oligotrophication induced by WFD water policies had gone too far ("water too clean"), thus jeopardizing planktonic productivity for feeding the shellfish. Shellfish farming also links to the historical, economic, and cultural barriers as this activity was introduced in S. France early in the 20th century and forms part of the local economy and cultural identity. In addition, the proliferation of exotic invasive species (e.g., the American blue crab, *C. sapidus*) represents novel challenges that have often not been anticipated.

A further challenge, more related to the interconnected dimensions of economics, politics, and historical context, relates to habitats that have been damaged for a long time by economic interests with a political and therefore administrative background, generating lasting tensions and fueling conflicts. We then observed an increase in ambiguity around the data on which the stakeholders are arguing but also around the value. According to a framework of ambiguity and pernicious environmental challenges or wicked issues [40], this refers to two categories of uncertainty concerning knowledge and values. On one hand, there are disagreements because the field of knowledge is not stabilized or is in the process of being acquired, with data deficiencies, which means that knowledge is vague and sometimes lacking and that regulatory texts are consequently inadequate. On the other hand, there is disagreement about the very nature and scale of the problems to be solved and therefore about the resources deployed, which are judged to be weak, simply irrelevant, or in violation of objectives.

Clearly, the case of administrative derogations, curtailing the application of national law and the EU directives for achieving good ecological status, generates tensions of this kind and the type of dilemmas theorized by Rittel and Webber [46] and their followers (for reviews, see [47,48]). Complex private–public environmental cases [40] have been described such as protected areas along the Mediterranean coast affected by long-term industrial pollution [49,50]. Dilemmas echo ethical questions that are quite widespread in the different dimensions. Typically, why favor one activity over another or one species over another? In these situations, the justifications provided by the texts and procedures appear weak or ethically questionable [51,52].

From an institutional perspective, there is an expectation that organizations sharing certain characteristics will mirror one another and mimic one another. For instance, environmental strategies have been observed to be homogeneous in response to institutional in both the public [53] and private [54] sectors. There is indeed an isomorphism that can be verified through networking, which is amplified by several phenomena. First, administrative *bricolage* due to the weakness of resources is commonly mentioned, and this tinkering appears to be standard practice within many organizations. This phenomenon is also driven by the high level of turnover among the people involved, who navigate within a number of similar or closely related organizations under temporary contracts. Despite this, this precarious functioning with regard to human resources was marginally seen as an asset in terms of cumulative knowledge and experience when it came to managing areas sharing the same issues. However, heterogeneities were also identified, leading to calls for investigation of managers' personal characteristics as they may influence their understanding of institutional pressures [55]. According to this perspective, it is postulated that specific managerial attributes influence the strategic responses of organizations to environmental issues and the decisive role of managers in understanding them (e.g., [56]. More precisely, in a context of ambiguity, managers are likely to rely on their own knowledge and interpretations and are susceptible to be biased by their background characteristics [57], such as educational background [58]. Some studies also link educational background to organizational behaviors and outcomes [59]. Therefore, various characteristics of the managers were considered in this study, including their academic profile. These influences were confirmed through the reference diagrams put forward.

While, coastal lagoons have a wide diversity of property regimes [60], which is already a basic ingredient of complexity, in fact, the littoral zone is "common", in the sense that its usage is not submitted to property rights but rather to a very large set of public regulations, which adds another level of complexity. So, among this superposition of regulations, the EU directives may be interpreted and implemented differently according to the priorities (interests and values) of a multitude of stakeholders, with respect to the uses they wish to conserve or develop, and the risks they perceive as affecting the ecosystems that sustain them (i.e., ecosystem services). These activities and uses interact with more or less intensity on lagoon ecosystems, and these pressures are intrinsically complex and often interdependent, creating a network of wicked issues involving a wide range of dimensions that may affect the health of lagoons in the sense of the objectives set by the EU directives.

To conclude, beyond its specific focus on the Habitats Directive and the Water Framework Directive, one of the key contributions of this study lies in revealing how managers dealing with Mediterranean coastal lagoons navigate a much broader and more complex normative landscape. Although our survey initially targeted these two European directives, the interviews showed that managers rarely operated within the strict boundaries of a single EU directive. Instead, they spontaneously mobilized a wide range of legal, policy, and operational references, often associating them through personal experience, institutional memory, or practical considerations. This diversity of references is not anecdotal. On the contrary, it reflects the multi-dimensional nature of coastal lagoon management, where environmental, social, economic, and political objectives frequently overlap and sometimes conflict. Far from indicating confusion, this multiplicity of references reveals the cognitive reality of management practices on the ground and highlights the need for research to take seriously this operational complexity when analyzing directive implementation. We believe this is a valuable insight for future research and for the design of more integrated and adaptive management frameworks.

Beyond this initial contribution, our study also highlights two additional key findings with significant managerial and policy implications. First, it sheds light on the growing criticism of management by numbers in biodiversity conservation. Many managers question the relevance and operational value of certain indicators, often perceived as disconnected from local ecological realities and unable to capture the complexity and dynamics of living systems. However, beyond the provided ecological explanations, this criticism of indicators must also be understood as part of a broader criticism of new public management logics deeply embedded in public administrations. This indicator-driven culture, often supported by a quest for measurable performance [61], tends to reduce complex socio-ecological realities to simplified numerical targets [62], sometimes perceived as disconnected from local contexts, public values [37], and ecological dynamics. This calls for a more critical and context-sensitive use of indicators in conservation policies. Second, our analysis underscores the pivotal role—and long-lasting effects—of regulatory exemptions in the implementation of directives. Often adapted to local socio-economic priorities, these exemptions are frequently perceived as opaque, arbitrary, or disconnected from ecological concerns. In historically degraded environments, where past decisions continue to constrain present management, such exemptions tend to fuel enduring mistrust and institutional defiance. These findings call for greater transparency, clearer justification, and better contextual adaptation when granting exemptions, in order to preserve both conservation objectives and stakeholder trust.

This study sets the stage for searching for solutions that help overcome the institutional and operational barriers identified in this study. Therefore, we plan outreach to the stakeholders involved in coastal lagoon management soon to inform them of the results of the current study and engage with them in a participatory approach. This will focus on solution-oriented prospectives, documenting and evaluating innovative practices, governance arrangements, or management tools. Finally, our results also point to several promising directions for future research. First, comparative studies could examine whether the patterns of normative multiplicity and adaptive *bricolage* identified here are specific to Mediterranean contexts or more broadly characteristic of multi-level environmental governance in Europe. Second, longitudinal and interdisciplinary investigations are needed to better understand the long-term impacts of regulatory exemptions on institutional trust and ecological outcomes. Third, there is a pressing need to co-develop locally meaningful, ecologically robust, and socially legitimate indicators, through participatory approaches that bridge science, policy, and practice. Fourth, more attention should be devoted to identifying and characterizing emerging socio-ecological phenomena—often subtle, local, or still poorly documented—that challenge conventional conservation frameworks but carry significant implications for governance and adaptive capacity.

**Supplementary Materials:** The following supporting information can be downloaded at https:// www.mdpi.com/article/10.3390/environments12050137/s1: Method: survey guide used for the semidirective interviews; Figure S1: Factorial Correspondence Analyses (FCA); Table S1: Anonymized interviews by type of institutions and variables; Table S2: Summary table of the barrier classes adopted in this study.

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## Abbreviations

The following abbreviations are used in this manuscript:

- BD Birds Directive
- EU European Union
- HD Habitats Directive
- WFD Water Framework Directive

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