resources

MDPI

Article

Spatial Planning of the Coastal Marine Socioecological System—Case Study: Punta Carnero, Ecuador

Jenny Escandón-Panchana [1], Rafael Elao Vallejo [1], Paulo Escandón-Panchana [2], Andrés Velastegui-Montoya [3,4,5] and Gricelda Herrera-Franco [2,6,*]

1. Facultad de Ciencias Naturales, Universidad de Guayaquil, Av. Raúl Gómez Lince y Av. Juan Tanca Marengo, Guayaquil 090150, Ecuador
2. Geo-Recursos y Aplicaciones GIGA, Campus Gustavo Galindo, ESPOL Polytechnic University, Km. 30.5 Vía Perimetral, Guayaquil P.O. Box 09-01-5863, Ecuador
3. Facultad de Ingeniería en Ciencias de la Tierra (FICT), ESPOL Polytechnic University, Guayaquil P.O. Box 09-01-5863, Ecuador
4. Centro de Investigaciones y Proyectos Aplicados a las Ciencias de la Tierra (CIPAT), ESPOL Polytechnic University, Guayaquil P.O. Box 09-01-5863, Ecuador
5. Geoscience Institute, Federal University of Pará, Belém 66075-110, Brazil
6. Facultad de Ciencias de la Ingeniería, Universidad Estatal Península de Santa Elena (UPSE), Avda. Principal La Libertad-Santa Elena, La Libertad 240204, Ecuador

* Correspondence: grisherrera@upse.edu.ec

Abstract: Marine-coastal ecosystems are productive and valuable habitats worldwide due to their significant contributions to human wellbeing. However, human activities, limited territorial planning, and unsustainable demand and consumption of natural goods and services put pressure on marine-coastal ecosystems. In this sense, marine-coastal planning is a management tool to contrast these forces because it manages different human activities on the coast and in the oceans over space and time, strengthening political, social, and tourist development and the economy of the territory. Our objective is to propose marine-coastal spatial planning strategies through an ecosystem-based approach for allocating a mangrove and estuarine zone conservation area. The study methodology is: (i) Compilation of information from the study area with an emphasis on regulations and protected areas. (ii) Analysis of human relations with marine-coastal ecosystems. (iii) Mapping and zoning of the conservation area. (iv) Analysis of the strengths, weaknesses, opportunities, threats and threats, weaknesses, opportunities, strengths (SWOT–TWOS) matrix to recommend strategies and guarantee the viability of marine-coastal protection. The results show zoning maps of the sector proposed as a conservation area comprising mangroves and an estuarine zone. It also approaches governance strategies or conservation management measures and protection of the marine-coastal space. Finally, as a recommendation, we propose improvements to the current municipal ordinances, guaranteeing the management and protection of the study area, and furthering achievements in the comprehensive development of land-use planning.

Keywords: marine-coastal; conservation; protection; mangrove; estuarine zone; sustainability

check for updates

Citation: Escandón-Panchana, J.; Elao Vallejo, R.; Escandón-Panchana, P.; Velastegui-Montoya, A.; Herrera-Franco, G. Spatial Planning of the Coastal Marine Socioecological System—Case Study: Punta Carnero, Ecuador. *Resources* **2022**, *11*, 74. https://doi.org/10.3390/resources11080074

Academic Editor: Farshid Aram

Received: 16 June 2022
Accepted: 29 July 2022
Published: 4 August 2022

1. Introduction

Ecosystems are natural systems that provide environmental services for living beings. Ecosystem conservation guarantees sustainable development between nature, society and the economy [1,2]. However, ecosystems suffer potential damage due to conversion and land use [3,4]. In addition, conflicts between the population, the development of economic activities, ecosystems, and the environment produce adverse effects such as overfishing, habitat destruction, climate change, and pressure on the health of the oceans. Therefore, there is the need to conserve nature in ecologically and biologically sensitive areas [5,6].

Coastal-marine ecosystems (CMEs) are the most productive socio–ecological systems in the world. They interact with human and ecological elements in time and space [7].

CMEs offer a wide variety of ecosystem services to the human population, including provision (commercial fishing and crab and lobster capture), regulation (erosion control and protection of coasts and natural phenomena), support (nutrients and species habitats), and culture (e.g., tourism, sport fishing) [8–11].

Marine-coastal zones have strong relationships and interactions due to the development of socio-spatial systems in delicate balance with competitive social and economic relations in these areas [12]. As a result, marine-coastal sites operate in a highly variable environment, and their ecosystems have anthropogenic and natural pressures that sometimes lead to their degradation. Given the problems and importance of these areas, it is necessary to use flexible management tools to sustain CMEs within the framework of marine-coastal spatial planning [13]. In addition, integrated coastal zone management allows for broad participation and resolution of conflicts between economic development needs and resource conservation [14–16]. Therefore, CME assessment has determined the importance of mangroves, estuaries, intertidal flats and coral reefs [17,18].

Mangroves are tropical and subtropical ecological systems with high environmental productivity [19–21]. They maintain and protect marine-coastal biodiversity [22]. They are sensitive to anthropogenic activities derived from urbanization and economic development [23,24]. Due to their habitat quality, mangroves are a place for spawning and reproducing the biota that inhabits its ecosystem [25,26].

The conservation of mangroves is essential since they provide multiple ecological services, control coastal erosion, and have regional tourist potential [27]. Due to this, the implementation of control, management, and planning policies appear through spatial analysis techniques, remote sensing, and indicators to preserve ecosystem services by local and regional governments [28–32].

Marine-coastal spatial planning (CMSP) is a process that contributes to CME management. It determines spatial information of territories, marine areas, population, allocation of space and time to human activities [33,34], and conflicts present in the interaction between human being and the environment [35] to achieve economic, political, environmental, and social objectives [36–38]. In addition, CMSP includes the conservation of CME through monitoring and evaluating ecosystems that meet the ecological objectives of the comprehensive management plan and consider sustainable development goals. Finally, CMSP plans present and future uses in the different areas of the territory [39,40].

A conservation plan considers ecosystems with their respective characteristics and species diversity in addition to the profitability of the conservation area in the social, economic [41], and political spheres [42]. Furthermore, valuing heritage resources contributes to promoting the conservation and efficient use of these resources [43,44]. Therefore, ecosystem conservation and protection contribute to implementing CMSP, guaranteeing a stable environment and sustainable growth [45,46].

There are different studies regarding spatial planning in marine-coastal sectors at the regional level. For example, the research case of [47] proposed a new tool to map, model, and evaluate the services offered by CMEs on Vancouver Island, Great Britain. The results showed a support tool for decision-making in CMSP. Another study on Zanzibar Island in Tanzania explored coastal areas subject to human pressures and natural resource extraction. They reported the importance of zoning through maps that identified the demands of the coastal socio–ecological system of the sector [48].

On the other hand, several authors presented a risk assessment model for marine habitats based on the participation of actors involved in the coastal sectors of Belize, a review of current regulations, the spatial distribution of marine-coastal activities, and zoning for future uses. They concluded that their study is a critical approach for CMSP in current and future ecosystem management scenarios [49]. Similarly, for a conservation planning and management study in the Galapagos Marine Reserve (Ecuador), the authors considered key actors' perceptions, expectations, and experiences. They used participatory processes for rezoning a marine protected area to define marine conservation strategies, including the local government to protect these areas belonging to the Galapagos reserve [50].

The authors of [37] developed a CMSP in the Puerto Peñasco–Puerto Lobos corridor in Mexico with a fisheries management approach using spatial and non-spatial tools. They assigned marine areas to anglers in the sector to carry out fishing activities in specific geographic regions. They used the Atlantis ecosystem model and reported ecosystem-based management benefits.

Studies on Pamurbaya mangrove conservation areas determined changes in the coastline and land areas due to accretion and erosion of the land. The authors provided development and management strategies for these sectors [51]. Similarly, for mangrove conservation and reforestation in mainland China, a study used habitat distribution patterns related to their environmental conditions and identified prime sectors for mangrove conservation [52]. In [53]'s investigation of mangroves in the Volta River estuary in Ghana, the authors demonstrated that mangrove resources are restored and managed sustainably through compliance with local and regional regulations. They promoted the conservation of coastal resources (e.g., mangroves) with benefits to the economy and the population's environment. Meanwhile, for conservation of a turbid tropical estuary, the authors considered different perspectives such as mangrove habitat analysis and biodiversity hotspots. They concluded that mangroves and their interactions with the habitat contribute to the conservation of estuaries [54].

In Australia's Port Stephens Estuary, researchers conducted a study of habitat conservation through the use of species and area ratios. As a result, they achieved objective planning in zoning, preservation, and protection of these marine areas and for species such as fish and molluscs [55]. Other studies on the conservation of Amazonian estuaries in Brazil identified protected conservation areas through the analysis of ecological and economic criteria, and used geographic information systems for the elaboration of zoning maps for the conservation of fish fauna in the region [56].

In Ecuador, researchers implemented conservation programs and protected areas to effectively preserve and recover marine ecosystems, such as rocky reefs in the province of Manabí. In addition, they diagnosed contamination and evaluated spatial distribution patterns of the disposal of marine debris that affect the Manabi coasts, either due to the influx of tourists or fishing activities [57].

The province of Santa Elena has highlighted its geology, history, and ecological, mineral, and tourist resources, which determines the relevance of studies related to the conservation of environmental ecosystems [58]. Furthermore, the Salinas district has a delimited marine-coastal reserve, Puntilla de Santa Elena (REMACOPSE), with different ecosystems contributing to the preservation of the environment and ecotourism sector and to the geo-conservation of these sites [59]. Therefore, the study area has territorial policies such as parish and cantonal land-use plans and environmental plans such as a management plan for the tourist reserve and beach of the sea, as shown in Table S1. However, the strip adjacent to this reserve has ecosystems that require attention due to the anthropic activities in its surroundings [60–62]. Therefore, the framework of this problem poses the following research question: Can participatory marine-coastal planning be established taking into consideration the influence of the mangrove-estuary ecosystem and its impact on the environment for the sustainability of the territory?

The study's objective is to propose marine-coastal spatial planning strategies based on ecosystems for allocating a mangrove conservation area and an estuarine zone in the Punta Carnero sector. The analysis of the information refers to protection and conservation regulations and the ecological criteria identified for the marine-coastal ecosystems of the area. The participation of the population, tourists, microentrepreneurs, and agricultural unions allowed the construction of a participatory socio–ecological map. This map revealed relevant information for conserving the Punta Carnero mangroves and estuary. Furthermore, it allowed spatial zoning of natural areas and activities in the sector. Finally, SWOT analysis provided coastal marine spatial planning strategies for conserving these ecosystems.

Study Area

Santa Elena province is in the southwest of the coastal region of Ecuador. This province comprises three urban cantons: Salinas, La Libertad, and Santa Elena. To the southwest of the Salinas canton is the rocky point known as the Punta Carnero sector, where the Punta Carnero estuary is located (2°15′53.89″ and 2°17′25.92″ S; 80°54′31.39″ and 80°54′ 45.89″ W) (Figure 1) [63]. This estuary empties into and interacts with the Punta Carnero mangroves (2°17′23.56″ S and 80°54′42.68″ W) and is adjacent to the beach in La Diablica sector. The Punta Carnero mangroves cover 31 hectares of land surface and connect with the Velasco Ibarra wetland.

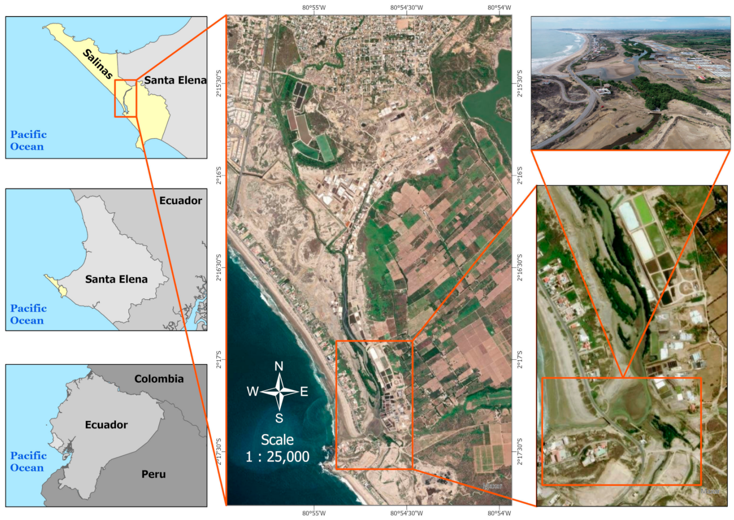

Figure 1. Location of the Punta Carnero estuary and mangroves of the Salinas district, Santa Elena Province, Ecuador.

In the Punta Carnero sector, there are different terrestrial, coastal, and marine ecosystems, such as Punta Carnero beach, which is within the Puntilla de Santa Elena Coastal Marine Faunistic Production Reserve (Remacopse) [62]. The Remacopse has an area of 52,231.75 marine hectares and 203.82 land hectares [64]. Perpendicular to the Punta Carnero beach is an adjacent strip of one kilometre in length; it is the buffer zone of the Remacopse and has an area of 6.37 hectares with a variable width of 8–40 m.

The study area presents flora and fauna with the widest diversity of wildlife on the Ecuadorian coasts. Wetlands, estuaries, and mangroves form refuges for resident and migratory birds [62]. It is a residential sector, identified according to the social approach, with a permanent population (i.e., inhabitants of the area) and a floating population (i.e., inhabitants from tourism).

The population of the Punta Carnero sector represents 2.15% of the total population of the José Luis Tamayo parish (475 inhabitants). The inhabitants have primary (39.64%), secondary (24.10%), and higher (8.07%) academic training [60]. Most of this population self-identifies as mestizo. This sector receives a large influx of tourism during two periods of the year, from January to April and from June to September. Due to the tourist reserve, this sector receives 265,922 tourists annually, of which 99.1% correspond to national tourists and 0.9% to foreign tourists [65].

The main economic activity of the Punta Carnero sector is tourism, causing the presence of surfers on Punta Carnero beach, plus sport fishing and water sports; other activities include trade, agriculture, masonry, shrimp larvae production, extraction of artisanal salt, and oil activity [61]. Based on these activities, the occupations of the inhabitants consist of 19.15% workers and merchants for tourism, 7.40% farmers, 19.52% artisans, and 18.98% elementary occupations (e.g., bricklayers and guards) [60].

2. Materials and Methods

Figure 2 presents the methodology of this study, which was based on four phases: (1) Compilation of essential information: protection and conservation regulations and selection criteria for protected areas for the conservation of mangroves and the estuary; (2) Social and ecological interaction of the study area: population's perception of marine-coastal ecosystems and planning of a participatory socio–ecological model; (3) Mapping and zoning of the conservation area; and (4) Analysis of the SWOT–TWOS matrix for the design of marine-coastal spatial planning strategies.

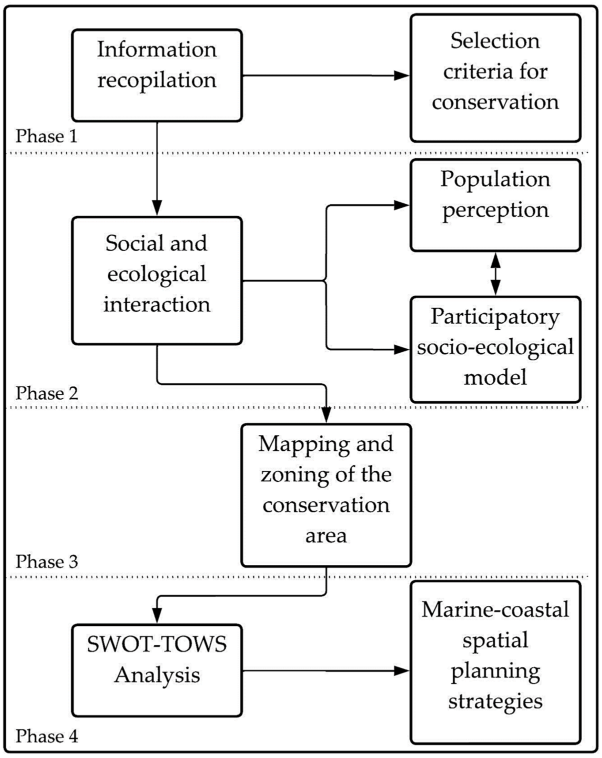

Figure 2. Research methodology.

2.1. Information Recopilation

The collection of information consisted of three phases: (1) Review of local and regional regulations in the framework of protection and conservation of ecological systems [66–70]; (2) Review of the knowledgebase to define the management of coastal resources, parameters of protection, conservation and restoration of ecosystems, and benefits of coastal protection for the adequate management of mangroves and the declaration of protected areas (e.g. mangroves, estuary, wetland and birds), as shown in Table S2; and (3) Reconnaissance of the study area through spatial and nonspatial data collection, as well as technical visits to the sector [71].

Selection Criteria for Mangrove and Estuary Conservation

The selection criteria in this study allowed the identification and prioritization of potentially significant ecological areas for conservation. In this way, there are criteria related to habitats (unique, rare habitat; fragile, sensitive habitat; and ecological integrity and representativeness) and standards related to species (conservation concern; restricted range; biological diversity; and important areas for life-history stages) [72–74].

2.2. Social and Ecological Interaction

The social and ecological interaction between the marine-coastal ecosystems of the Punta Carnero sector and the population comprised two phases: (i) Population perception and (ii) Participatory socio–ecological model.

The first phase used a survey related to the population's perception of the marine-coastal ecosystems of the sector. The survey was performed in March of 2022. Its structure included three sections: (i) Sociodemographic data of the inhabitants; (ii) Perception of knowledge of marine-coastal ecosystems, ecosystem services, interaction with the inhabitants, and local government management; and (iii) Recommendations for the conservation of these ecosystems. The representative sample was 210 people and comprised 49.52% residents of the sector, 12.86% tourists, 18.10% farmers, 7.14% artisans for salt extraction, 3.81% producers of shrimp larvae, and 8.57% hotel security staff.

The second phase included the participation of several actors from the Punta Carnero sector through participatory workshops [75–77]. The participants were actors identified according to a survey and technical visits. For this, we invited the inhabitants, neighbourhood directors, presidents of associations, governmental and non-governmental entities, and sector guilds. On average, 40 people attended each of the three workshops. The meetings lasted two hours, and the technical research team led workgroups. Each group had different actors such as inhabitants of the sector, tourists, agricultural association members, formal and informal associates of salt extraction, micro-entrepreneurs producing shrimp larvae, public sector workers from the local government, and guilds of the hotel security staff of Punta Carnero. This dynamic built a collaborative socio–ecological model through a causal loop diagram (CLD). The CLD determined the variables and causal links that describe the system, including problems or benefits that influence its behaviour [78,79]. The arrows represent the cause-and-effect relationship between the different variables [79]. When the connection was positive, it used the (+) sign on the effect it produced on the variable.

On the contrary, a negative relationship used the character (−). Further, feedback loops determined a closed loop. For example, the reinforcement feedback loop (R) strengthened the initial variable, while the equilibrium feedback loop counteracted it [78,80].

2.3. Zoning of the Conservation Area

Zoning was carried out through the base map of satellite images already available using the ArcGIS Pro program. Delimitation of the different regions and ecosystems within the scope-of-interest identified the following areas and activities: farming, dry tropical forest, estuary, wetland, mangrove forest, wastewater treatment, salt production, sea-side, bare soil, urban area, and shrub vegetation [19].

2.4. SWOT-TOWS Analysis

The SWOT–TWOS matrix determined the marine-coastal spatial planning strategies contributing to conserving the Punta Carnero mangroves and estuary. Construction of the SWOT was based on population perception data and participatory workshops with inhabitants, tourists, and trade associations [81,82].

3. Results

The study found priority habitats for conservation with their respective ecosystem services. It also proposed a participatory socio–ecological map, a zoning map of natural areas and activities in the sector, and recommendations for marine-coastal spatial planning strategies for conserving the mangroves and the estuary.

3.1. Priority Habitats for Conservation

Table 1 presents the marine-coastal ecosystems of the Punta Carnero sector and important initiatives for the conservation of biodiversity as identified through ecological criteria of habitats and species for their preservation. These criteria identified various bird species and four habitats: Punta Carnero mangroves and estuary, Velasco Ibarra wetland, and the Remacopse protected area. According to the habitat criteria, the mangrove swamp and the estuary are unique, fragile, and sensitive ecosystems due to human activities (e.g., salt and oil extraction). On the other hand, they have a high degree of ecological integrity as they are a spawning habitat for different species of birds. Further, they show representativeness for being in an area adjacent to a protected area (i.e., Remacopse).

Table 1. Ecological criterial of essential areas for the conservation of mangroves and estuaries.

Marine-Coastal Ecosystems	Criterial							
	Habitat				Species			
	Unique, Rare Habitat	Fragile, Sensitive Habitat	Ecological Integrity	Representativeness	Conservation Concern	Restricted Range	Biological Diversity	Important Area for Life-History Stages
Punta Carnero Mangrove	A	A	A	A	A	NA	A	A
Punta Carnero Estuary	A	A	A	A	NA	NA	A	NA
Velasco Ibarra Wetland	A	NA	NA	A	NA	NA	NA	NA
* Protected area (Remacopse)	A	NA	A	A	A	A	A	A
* Migratory bird nesting sites	NA	NA	NA	NA	A	A	A	A

A: applicable; NA: not applicable; * important initiatives for biodiversity conservation.

On the other hand, the three monitoring events in the winter season identified 25 species of migratory birds, including Pelican Gannet, Garza Nívea, and Spoonbill species [83,84]. These birds interact with the various ecosystems surrounding the Punta Carnero mangrove. Furthermore, due to the small territorial extension of the mangroves, these birds have a restricted geographic range. Therefore, the Punta Carnero mangroves are an important area for the life-stages of migratory birds.

3.2. Ecosystem Services of the Punta Carnero Mangroves

The participatory workshops identified the marine-coastal ecosystems of the mangroves and Punta Carnero estuary with their respective ecosystem services. Similarly, the workshops recognized the interaction of the mangroves and estuary with other surrounding ecosystems and their relationship with the local population.

Table 2 presents the perception results of the participatory analysis regarding ecosystem services offered by the mangroves, listing ecological benefits of provision (specifically for domestic consumption; e.g., crab and shell capture), regulation (e.g., protection of the Punta Carnero coastal profile), support (e.g., nesting sites of migratory birds), and culture (e.g., tourism).

Table 2. Ecosystem services offered by the Punta Carnero mangroves.

Type of Services	Ecosystem Services
Provisioning	Food for domestic consumption (capture of crabs and shells). Agriculture and Livestock.
Regulating	Air quality. Carbon capture. Erosion control. Soil fertility. Protection of Punta Carnero coastline. Protection from natural phenomena.
Supporting	Avoiding soil salinization. Substrate nutrients. Migratory bird refuge.
Cultural	Environmental education. Natural heritage. Ecotourism. Source of inspiration.

3.3. Participatory Socioecological Map

Construction of the participatory socio–ecological map (PSM) included the participation of the population of the Punta Carnero sector, formal and informal associates of salt extraction, agricultural associates, and the guardians' union.

After identifying ecosystem services, the PSM presents a holistic approach to the dynamics between the actors, ecosystem services, and the affectation and benefits of the CME. The causal relationships and feedback loops of the PSM show the existing connections of cause-and-effect and the interrelation of various variables that intervene in the model. The environmental pressures of the various anthropogenic activities and the diversity of ecological services of the CME in the sector support the suitability of this approach.

The participants identified that conserving the Punta Carnero mangroves and estuary is the primary ecosystem function in the socio–ecological model, promoting the conservation of the CME in the sector.

Figure 3 shows how various variables under a causal structure influence the mangrove and estuary conservation variables. The participants highlighted the importance of tourism in the sector. They identified that increases in tourism produce more significant activity in ecotourism, leading to the preservation of the mangroves and estuary and in the incidence of increased infrastructure for the sector. However, there is no compliance with existing local public policies for territorial urban development.

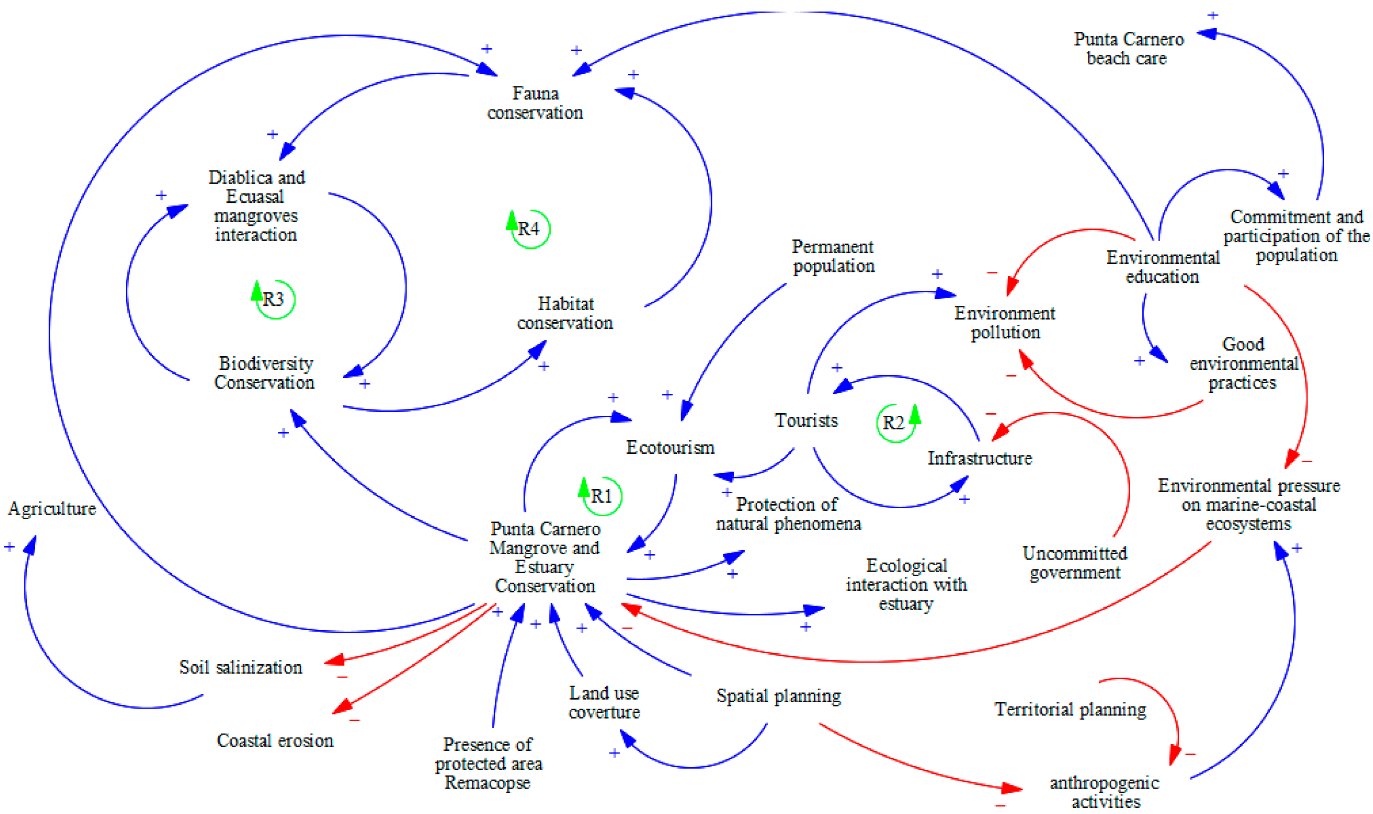

Figure 3. PSM for conservation of the Punta Carnero mangroves and estuary.

The reinforcing loop R1 presents the relationship between ecotourism and conservation of the mangroves and estuary. That is, the preservation of these ecosystems produces an increasing trend in different ecotourism activities developed in the natural environment of the sector. Simultaneously, the economic income generated by these activities positively affects the conservation of these ecosystems. Loop R2 determines that the higher the tourist density in the sector, the more infrastructure is required. In the perception of the inhabitants, the infrastructure will allow tourism growth.

On the other hand, those involved stated that the increase in the rate of tourists leads to more significant pollution of the environment. However, they indicated that environmental education, public awareness, and best environmental practices counteract such contamination. Similarly, they ensured that educational campaigns motivate the community's collaboration, participation, and commitment to conserving marine-coastal ecosystems. Indeed, all these actions require the commitment of sectional organizations (e.g., compliance with the municipal ordinances and management plans), non-governmental organizations, and other organizations dedicated to preserving these ecosystems.

Among the problems observed by the participants, they identified anthropogenic activities, such as salt and oil extraction in the sector, that put pressure on the marine-coastal ecosystem and affect the conservation of the mangroves and estuary. The ordering of the territory and the spatial planning of these ecosystems are essential variables in the socio–ecological map. Both relate to the control and reduction of anthropic activities. The spatial planning of ecosystems will improve land-use conflicts and human activities in the sector, which affects the importance of conserving the CME in the study area.

The conservation of the Punta Carnero mangroves and estuary has a positive influence on the preservation of biodiversity. For the participants, the diversity of species (birds) and marine-coastal ecosystems leads to the growing conservation trend of bird habitats and fauna, so these habitats become nesting sites for birds. Therefore, they stated that the conservation of biodiversity produces an interaction between the remaining ecosystems located to the north (Ecuasal mangroves) and south (Diablica mangroves) of the mangroves under study and vice versa (R3). In addition, the participants indicated that preserving the diversity of bird species results in protecting these ecosystems and vice versa (R4).

Finally, the participants determined other consequent benefits of conserving the Punta Carnero mangroves and estuary, such as increased protection of coasts against natural phenomena and ecological interaction with different ecosystems. In addition, preserving these ecosystems reduces erosion of the Punta Carnero coastal profile and decreases the salinization of soils, making soils suitable for agriculture.

3.4. Zoning Map

Figure 4 presents the spatial zoning of activities (farming, wastewater treatment, salt production, and urban areas) and natural areas (dry tropical forest, estuary, mangrove forest, wetland, seaside, bare soil, and shrub vegetation) of Punta Carnero (Figure 4a). The Punta Carnero estuary and mangrove swamp together with the remaining mangrove swamp of La Diablica form nesting sites for various bird species; these two ecosystems show ecological integrity for their conservation (Figure 4b).

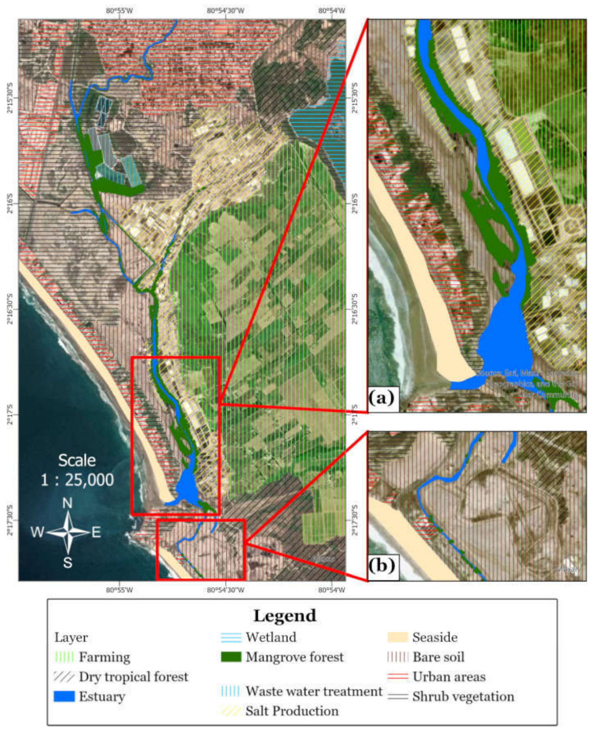

Figure 4. Delimitation of areas and ecosystems of the Punta Carnero sector. (**a**) Activities and natural areas of Punta Carnero. (**b**) Interaction of the Punta Carnero mangrove with the remaining La Diablica mangrove.

3.5. Spatial Planning Strategies

Tables 3 and 4 show the SWOT–TWOS matrix according to the analysis of the study area.

Table 3. SWOT analysis of study area.

	Strengths		**Opportunities**
A	The main economic activities are tourism, agriculture, and the production of shrimp larvae.	a	Development plans for land-use planning and beach conservation. Management plan for the tourist reserve and beach of the sea.
B	Environmental services with biodiversity.	b	Related studies to generate alternatives/solutions in the sector.
C	Tourist activities are compatible with agriculture due to the proximity of farms.	c	Participatory stakeholders (inhabitants, agricultural associations, guilds of the hotel security staff, local government, and artisans).
D	A unique ecosystem of the sea, coast, oil resources, agriculture, salt deposits, sun, and beach tourism.	d	Socio–ecological system for development and promotion.
E	Coastal marine reserve adjacent to the mangrove swamp and Punta Carnero estuary. These ecosystems are in the buffer zone of the resource.		
	Weaknesses		**Threats**
(A)	Low awareness of the conservation of this sector by those involved.	(a)	Problems are due to land use and its natural environment due to the sector's economic activities.
(B)	Weak promotion of mangroves and estuary.	(b)	Uncontrolled urban growth.
(C)	Lack of links with universities, sectional government, and community for the generation of development plans.	(c)	Lack of commitments between local and external entities to take channels of control and territorial planning.
(D)	Deficient territorial planning of sector.	(d)	Sectional organizations such as the Ministry of the Environment, Water and Ecological Transition are not taking action.
		(e)	Effects due to climate change.
		(f)	External migration of birds.

Table 4. TWOS strategy matrix.

	Strengths + Opportunities		Strengths + Threats
Aa	Application of territorial ordinances for marine-coastal conservation.	ABd	Strategic alliances with governmental and nongovernmental organizations for developing ecotourism projects compatible with marine-coastal ecosystems.
Db	Involvement with private and public sectors and community for the joint planning of mangrove and estuary conservation (local government, guilds, residents, and entrepreneurs).	Cb	Marine-coastal geotourism strip or cord.
	Weaknesses + Opportunities		**Weaknesses + Threats**
(A)c	Strategic alliances with stakeholders to promote/empower the importance of marine-coastal conservation.	(C) (D) (a) (b) (c) (d)	Regulation through ordinances/territorial planning according to the needs of the sector.
(C)ab	Coordinate actions through working groups with universities/companies for conservation alternatives in this sector.		

4. Discussion

Some marine-coastal spatial planning processes include the actions of the social community in ecosystem management programs. This study considers a socio–ecological system with the active participation of a very diverse groups of stakeholders, which allows for the successful management of environmental resources. In addition, it contributes to the delimitation of natural areas and human activities in a marine coastline and proposes spatial planning strategies to preserve ecosystems.

The participatory socio–ecological system obtained relevant socio-spatial data for the spatial planning and management of marine-coastal ecosystems. This system is essential due to the inclusion of different actors in the sector (e.g., inhabitants, tourists, local companies, and government) [76]. These actors reflected and deepened their understanding of the presence of ecosystems (e.g., mangroves and estuaries) and their interaction with the environment. Furthermore, the participation and influence of the community were vital elements in decision-making due to the diversity of meanings, opinions, and values that the population assigned to the different habitats and species in the sector [85]. Similarly, other studies highlighted the importance of participatory planning. They collected and integrated the empirical and scientific knowledge of the inhabitants and those involved in various coastal-zone projects [86], such as the identification, assessment, and mapping of ecosystem services [87–89]; the mangrove zoning and management plan [77]; and adaptive management in estuarine program development [90].

Moreover, other territorial projects, such as the regeneration of the Varvakeios Square, have obtained a series of community-driven proposals [91]; likewise for the development of rural communities facing water scarcity, where the participatory process is essential to solve these challenges [92,93]. These studies identified problems and contributed to the reduction of negative interactions between the land and sea. On the contrary, other investigations lack debate in decision-making and the participation of the actors that are part of the socio–ecological system, providing little understanding of the benefits and ecosystem services some natural areas offer [87,94]. Further, in some regions of the world, conservation policies have excluded the participation of coastal communities and co-management frameworks to preserve mangroves [95].

Mangrove swamps hosts a diversity of local and migratory birds that find important habitats for different life-cycle phases, especially spawning and feeding. The interaction of the mangroves and the Punta Carnero estuary combines various ecological criteria related to conserving habitats and species in the sector. These ecosystems represent fragile and sensitive areas with high environmental integrity required for their preservation. According to the residents, this could be an ideal argument for conserving mangroves and estuarine zones. However, these natural areas have not been designated conservation or protected zones. Some studies have determined different ecological criteria for the conservation potential of ecosystems. They promote the conservation of coastal resources and point out that the diversity and abundance of species and habitats make mangroves and estuaries the most valuable and productive ecosystems on the planet [18,72]. Not only do they have a rich habitat diversity for birds [96], but they also have coral communities [30] and fish fauna [56]; further, they improve water quality, reduce the impact of flooding, store large amounts of carbon [97], and have a variety of substrate nutrients [4].

This study recognised the various anthropogenic activities (e.g., extraction of salt and oil) that put pressure on the marine-coastal ecosystem. As a result, it reduced the perception that affected economic groups or sectors defend their activities against any management, which involves a collaborative environment without confrontations in the planning of the socio–ecological system. The conservation management of these ecosystems considers the control and possible reduction of human pressures, which strategically generates preventative alternatives for conserving these habitats and their species. In addition to these ecosystems' representativeness, they are proximate to a protected area. Some studies show interest in managing and monitoring anthropogenic pressures [35,98]. They establish that these activities could be considered ecologically sustainable pressures, including ecotourism due to its coastal biodiversity and oil and gas exploration [46,99]. In addition, they highlight the interest in education plans with regard to contamination levels due to human activity in natural and artificial habitats [100,101] and pressures-based mangrove conservation and restoration plans [102].

The management of marine-coastal ecosystems requires including human activities for a sustainable future for coastal populations within the spatial planning of participatory socio–ecological systems. This framework integrates ecosystems, the pressure of human activities, ecosystem services, and the interaction of ecosystems with the population. In addition, it supports the need for territorial development and the conservation of the marine-coastal ecosystem.

Finally, it is essential to highlight the study's limitations: (a) the complexity of involving all stakeholders of the socio–ecological system; (b) guaranteeing community commitment; and (c) lack of public awareness and knowledge of the environmental ecosystem services of the settlers.

5. Conclusions

This study configures CMSP strategies through a participatory socio–ecological model, where diverse perceptions of those involved and the floating population (due to tourist activity) are necessary to recognise marine-coastal ecosystems, their ecosystem services, and their interaction with the environment and people. In conclusion, 85% of the population agrees with preserving and protecting the mangrove swamp and estuary of Punta Carnero due to the environmental benefits and human well-being provided by these ecosystems. This participatory approach demonstrated a reliable way to obtain spatial data from the community and to propose co-management for conserving the Punta Carnero mangroves and estuary. In addition, it contrasts the pressures faced by the mangroves with the capacity to provide rich biodiversity, natural spawning sites, and marine-coastal resources of the sector.

The active participation of local governments will lead to the control and regulation of municipal ordinances, which improves the management of the marine-coastal resources of the Punta Carnero sector. Furthermore, territorial organization policies and joint spatial planning with all the actors will allow monitoring and follow-up of anthropogenic pressures, possibly converting them into ecologically sustainable forces for the local development of the territory and the conservation of ecosystems. Therefore, this includes geotourism projects that integrate human activities, oil resources, tourism, and the protection of marine-coastal ecosystems. Another essential strategy is the environmental education of the participants involved in the socio–ecological model, because this strengthens the actors' commitment to the territorial ordering plans and demonstrates their interest in the preservation of the mangroves and the Punta Carnero estuary.

The study highlights the importance of fusing the social, ecological, and economic contexts that integrate the different perceptions to strengthen and diversify the policies, practices for preserving, and conservation plans for ecosystems in the sector, identifying benefits that guarantee the sustainable development marine-coastal sites.

This study recommends guidelines for future research in the framework of marine-coastal spatial planning: (i) Promote the benefits and protection services of coastal marine ecosystems in communities; and (ii) Consider all the factors that directly and indirectly affect the assessment of ecosystem services provided by mangroves and estuaries.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/resources11080074/s1, Table S1: Environmental and territorial plans of the Punta Carnero sector. Table S2: Knowledge base for managing protection and conservation of marine-coastal ecosystems in the Punta Carnero sector.

Author Contributions: Conceptualization, J.E.-P., R.E.V., P.E.-P. and G.H.-F.; methodology J.E.-P., G.H.-F. and P.E.-P.; software, A.V.-M.; investigation, J.E.-P., G.H.-F., P.E.-P. and A.V.-M.; writing—original draft preparation, J.E.-P., P.E.-P. and G.H.-F.; writing—review and editing, J.E.-P., P.E.-P., A.V.-M. and G.H.-F.; supervision, R.E.V. and G.H.-F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: This study was possible thanks to research derived from the master's thesis of J.E-P at the University of Guayaquil (UG). We thank Lcda. Laura Hurtado from the International Conservation Organization of Ecuador, Blga. Anita Agreda from Birds and Conservation Birdlifes in Ecuador, Blga. Beatriz Ladines, administrator of REMACOPSE, and GAD Salinas canton for her technical collaboration in the study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Peng, J.; Liu, Y.; Li, T.; Wu, J. Regional Ecosystem Health Response to Rural Land Use Change: A Case Study in Lijiang City, China. *Ecol. Indic.* **2017**, *72*, 399–410. [CrossRef]
2. Pan, Z.; He, J.; Liu, D.; Wang, J.; Guo, X. Ecosystem Health Assessment Based on Ecological Integrity and Ecosystem Services Demand in the Middle Reaches of the Yangtze River Economic Belt, China. *Sci. Total Environ.* **2021**, *774*, 144837. [CrossRef]
3. Salampessy, M.L.; Febryano, I.G.; Martin, E.; Siahaya, M.E.; Papilaya, R. Cultural Capital of the Communities in the Mangrove Conservation in the Coastal Areas of Ambon Dalam Bay, Moluccas, Indonesia. *Procedia Environ. Sci.* **2015**, *23*, 222–229. [CrossRef]
4. Wickramasinghe, S.; Borin, M.; Kotagama, S.W.; Cochard, R.; Anceno, A.J.; Shipin, O.V. Multi-Functional Pollution Mitigation in a Rehabilitated Mangrove Conservation Area. *Ecol. Eng.* **2009**, *35*, 898–907. [CrossRef]
5. Douvere, F. The Importance of Marine Spatial Planning in Advancing Ecosystem-Based Sea Use Management. *Mar. Policy* **2008**, *32*, 762–771. [CrossRef]
6. Manea, E.; Bianchelli, S.; Fanelli, E.; Danovaro, R.; Gissi, E. Towards an Ecosystem-Based Marine Spatial Planning in the Deep Mediterranean Sea. *Sci. Total Environ.* **2020**, *715*, 136884. [CrossRef] [PubMed]
7. Chakraborty, S.; Gasparatos, A.; Blasiak, R. Multiple Values for the Management and Sustainable Use of Coastal and Marine Ecosystem Services. *Ecosyst. Serv.* **2020**, *41*, 101047. [CrossRef]
8. Arkema, K.K.; Verutes, G.M.; Wood, S.A.; Clarke-Samuels, C.; Rosado, S.; Canto, M.; Rosenthal, A.; Ruckelshaus, M.; Guannel, G.; Toft, J.; et al. Embedding Ecosystem Services in Coastal Planning Leads to Better Outcomes for People and Nature. *Proc. Natl. Acad. Sci. USA* **2015**, *112*, 7390–7395. [CrossRef] [PubMed]
9. Müller, F.; Bicking, S.; Ahrendt, K.; Kinh Bac, D.; Blindow, I.; Fürst, C.; Haase, P.; Kruse, M.; Kruse, T.; Ma, L.; et al. Assessing Ecosystem Service Potentials to Evaluate Terrestrial, Coastal and Marine Ecosystem Types in Northern Germany—An Expert-Based Matrix Approach. *Ecol. Indic.* **2020**, *112*, 106116. [CrossRef]
10. Sangha, K.K.; Stoeckl, N.; Crossman, N.; Costanza, R. A State-Wide Economic Assessment of Coastal and Marine Ecosystem Services to Inform Sustainable Development Policies in the Northern Territory, Australia. *Mar. Policy* **2019**, *107*, 103595. [CrossRef]
11. Herbst, D.F.; Gerhardinger, L.C.; Vila-Nova, D.A.; de Carvalho, F.G.; Hanazaki, N. Integrated and Deliberative Multidimensional Assessment of a Subtropical Coastal-Marine Ecosystem (Babitonga Bay, Brazil). *Ocean Coast. Manag.* **2020**, *196*, 105279. [CrossRef]

12. Karani, P.; Failler, P. Comparative Coastal and Marine Tourism, Climate Change, and the Blue Economy in African Large Marine Ecosystems. *Environ. Dev.* **2020**, *36*, 100572. [CrossRef]
13. Tsilimigkas, G.; Rempis, N. Maritime Spatial Planning and Spatial Planning: Synergy Issues and Incompatibilities. Evidence from Crete Island, Greece. *Ocean Coast. Manag.* **2017**, *139*, 33–41. [CrossRef]
14. Ahmad, H. Bangladesh Coastal Zone Management Status and Future Trends Application of Machine Learning in Oceanography View Project Bangladesh Coastal Zone Management Status and Future Trends. *J. Coast. Zone Manag.* **2019**, *22*, 1–7. [CrossRef]
15. Ahmed, A.; Drake, F.; Nawaz, R.; Woulds, C. Where Is the Coast? Monitoring Coastal Land Dynamics in Bangladesh: An Integrated Management Approach Using GIS and Remote Sensing Techniques. *Ocean Coast. Manag.* **2018**, *151*, 10–24. [CrossRef]
16. Clark, J.R. *Coastal Zone Management Handbook*; Clark, J.R., Ed.; CRC Press: Boca Raton, FL, USA, 2018; ISBN 9781315139654.
17. Yang, Q.; Liu, G.; Hao, Y.; Zhang, L.; Giannetti, B.F.; Wang, J.; Casazza, M. Donor-Side Evaluation of Coastal and Marine Ecosystem Services. *Water Res.* **2019**, *166*, 115028. [CrossRef] [PubMed]
18. Liu, C.; Liu, G.; Yang, Q.; Luo, T.; He, P.; Franzese, P.P.; Lombardi, G.V. Emergy-Based Evaluation of World Coastal Ecosystem Services. *Water Res.* **2021**, *204*, 117656. [CrossRef]
19. Zamboni, N.S.; Noleto Filho, E.M.; Carvalho, A.R. Unfolding Differences in the Distribution of Coastal Marine Ecosystem Services Values among Developed and Developing Countries. *Ecol. Econ.* **2021**, *189*, 107151. [CrossRef]
20. Charrua, A.B.; Bandeira, S.O.; Catarino, S.; Cabral, P.; Romeiras, M.M. Assessment of the Vulnerability of Coastal Mangrove Ecosystems in Mozambique. *Ocean Coast. Manag.* **2020**, *189*, 105145. [CrossRef]
21. Adame, M.F.; Connolly, R.M.; Turschwell, M.P.; Lovelock, C.E.; Fatoyinbo, T.; Lagomasino, D.; Goldberg, L.A.; Holdorf, J.; Friess, D.A.; Sasmito, S.D.; et al. Future Carbon Emissions from Global Mangrove Forest Loss. *Glob. Chang. Biol.* **2021**, *27*, 2856–2866. [CrossRef]
22. Wang, Y.-S.; Gu, J.-D. Ecological Responses, Adaptation and Mechanisms of Mangrove Wetland Ecosystem to Global Climate Change and Anthropogenic Activities. *Int. Biodeterior. Biodegrad.* **2021**, *162*, 105248. [CrossRef]
23. Moschetto, F.A.; Ribeiro, R.B.; de Freitas, D.M. Urban Expansion, Regeneration and Socioenvironmental Vulnerability in a Mangrove Ecosystem at the Southeast Coastal of São Paulo, Brazil. *Ocean Coast. Manag.* **2021**, *200*, 105418. [CrossRef]
24. Kesavan, S.; Xavier, K.A.M.; Deshmukhe, G.; Jaiswar, A.K.; Bhusan, S.; Sukla, S.P. Anthropogenic Pressure on Mangrove Ecosystems: Quantification and Source Identification of Surficial and Trapped Debris. *Sci. Total Environ.* **2021**, *794*, 148677. [CrossRef] [PubMed]
25. Marlianingrum, P.R.; Kusumastanto, T.; Adrianto, L.; Fahrudin, A. Valuing Habitat Quality for Managing Mangrove Ecosystem Services in Coastal Tangerang District, Indonesia. *Mar. Policy* **2021**, *133*, 104747. [CrossRef]
26. Ghosh, S.C.P. A Review of Threats and Vulnerabilities to Mangrove Habitats: With Special Emphasis on East Coast of India. *J. Earth Sci. Clim. Chang.* **2015**, *6*, 270. [CrossRef]
27. Spalding, M.; Parrett, C.L. Global Patterns in Mangrove Recreation and Tourism. *Mar. Policy* **2019**, *110*, 103540. [CrossRef]
28. Trégarot, E.; Touron-Gardic, G.; Cornet, C.C.; Failler, P. Valuation of Coastal Ecosystem Services in the Large Marine Ecosystems of Africa. *Environ. Dev.* **2020**, *36*, 100584. [CrossRef]
29. Friess, D.A.; Yando, E.S.; Wong, L.W.; Bhatia, N. Indicators of Scientific Value: An under-Recognised Ecosystem Service of Coastal and Marine Habitats. *Ecol. Indic.* **2020**, *113*, 106255. [CrossRef]
30. Mateos-Molina, D.; ben Lamine, E.; Antonopoulou, M.; Burt, J.A.; Das, H.S.; Javed, S.; Judas, J.; Khan, S.B.; Muzaffar, S.B.; Pilcher, N.; et al. Synthesis and Evaluation of Coastal and Marine Biodiversity Spatial Information in the United Arab Emirates for Ecosystem-Based Management. *Mar. Pollut. Bull.* **2021**, *167*, 112319. [CrossRef] [PubMed]
31. Gutting, R.; Syrbe, R.U.; Grunewald, K.; Zimmer, M.; Mehlig, U.; Helfer, V. The Benefits of Combining Global and Local Data—A Showcase for Valuation and Mapping of Mangrove Climate Regulation and Food Provisioning Services within a Protected Area in Pará, North Brazil. *Land* **2021**, *10*, 432. [CrossRef]
32. Herrera-Matamoros, V.; Velastegui-Montoya, A. GIS-Based Analysis of Tourism Potential Case Study: Rural Regions El Morro and Posorja, Guayas, Ecuador. In Proceedings of the 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, Brussels, Belgium, 11–16 July 2021; pp. 6544–6547.
33. Gorman, D.; Corte, G.; Checon, H.H.; Amaral, A.C.Z.; Turra, A. Optimizing Coastal and Marine Spatial Planning through the Use of High-Resolution Benthic Sensitivity Models. *Ecol. Indic.* **2017**, *82*, 23–31. [CrossRef]
34. Economou, A.; Kotsev, I.; Peev, P.; Kathiojotes, N. Coastal and Marine Spatial Planning in Europe. Case Studies for Greece and Bulgaria. *Reg. Stud. Mar. Sci.* **2020**, *38*, 101353. [CrossRef]
35. Levine, A.S.; Feinholz, C.L. Participatory GIS to Inform Coral Reef Ecosystem Management: Mapping Human Coastal and Ocean Uses in Hawaii. *Appl. Geogr.* **2015**, *59*, 60–69. [CrossRef]
36. Papageorgiou, M. Coastal and Marine Tourism: A Challenging Factor in Marine Spatial Planning. *Ocean Coast. Manag.* **2016**, *129*, 44–48. [CrossRef]
37. Morzaria-Luna, H.; Turk-Boyer, P.; Polanco-Mizquez, E.I.; Downton-Hoffmann, C.; Cruz-Piñón, G.; Carrillo-Lammens, T.; Loaiza-Villanueva, R.; Valdivia-Jiménez, P.; Sánchez-Cruz, A.; Peña-Mendoza, V.; et al. Coastal and Marine Spatial Planning in the Northern Gulf of California, Mexico: Consolidating Stewardship, Property Rights, and Enforcement for Ecosystem-Based Fisheries Management. *Ocean Coast. Manag.* **2020**, *197*, 105316. [CrossRef]

38. Ehler, C.; Douvere, F. *Ioc Marine Spatial Planning: A Step-by-Step Approach toward Ecosystem-Based Management*; IOC. Manuals and Guides, Vol. 53, 2013; Unesco: Paris, France, 2009.
39. Halpern, B.S.; Diamond, J.; Gaines, S.; Gelcich, S.; Gleason, M.; Jennings, S.; Lester, S.; Mace, A.; McCook, L.; McLeod, K.; et al. Near-Term Priorities for the Science, Policy and Practice of Coastal and Marine Spatial Planning (CMSP). *Mar. Policy* **2012**, *36*, 198–205. [CrossRef]
40. Ouellette, W.; Getinet, W. Remote Sensing for Marine Spatial Planning and Integrated Coastal Areas Management: Achievements, Challenges, Opportunities and Future Prospects. *Remote Sens. Appl. Soc. Environ.* **2016**, *4*, 138–157. [CrossRef]
41. Satyanarayana, B.; Mulder, S.; Jayatissa, L.P.; Dahdouh-Guebas, F. Are the Mangroves in the Galle-Unawatuna Area (Sri Lanka) at Risk? A Social-Ecological Approach Involving Local Stakeholders for a Better Conservation Policy. *Ocean. Coast. Manag.* **2013**, *71*, 225–237. [CrossRef]
42. Kim, J.H.; Park, S.; Kim, S.H.; Lee, E.J. Identifying High-Priority Conservation Areas for Endangered Waterbirds Using a Flagship Species in the Korean DMZ. *Ecol. Eng.* **2021**, *159*, 106080. [CrossRef]
43. Carrión-Mero, P.C.; Morante-Carballo, F.E.; Herrera-Franco, G.A.; Maldonado-Zamora, A.; Paz-Salas, N. The Context of Ecuador's World Heritage, for Sustainable Development Strategies. *Int. J. Des. Nat. Ecodyn.* **2020**, *15*, 39–46. [CrossRef]
44. Herrera-Franco, G.; Carrión-Mero, P.; Morante-Carballo, F.; Herrera, G.; Briones-Bitar, J.; Blanco-Torrens, R. Strategies for the Development of the Value of the Mining-Industrial Heritage of the Zaruma-Portovelo, Ecuador, in the Context of a Geopark Project. *Int. J. Energy Prod. Manag.* **2020**, *5*, 48–59. [CrossRef]
45. Muñoz, M.; Reul, A.; Plaza, F.; Gómez-Moreno, M.L.; Vargas-Yañez, M.; Rodríguez, V.; Rodríguez, J. Implication of Regionalization and Connectivity Analysis for Marine Spatial Planning and Coastal Management in the Gulf of Cadiz and Alboran Sea. *Ocean Coast. Manag.* **2015**, *118*, 60–74. [CrossRef]
46. Domínguez-Tejo, E.; Metternicht, G.; Johnston, E.; Hedge, L. Marine Spatial Planning Advancing the Ecosystem-Based Approach to Coastal Zone Management: A Review. *Mar. Policy* **2016**, *72*, 115–130. [CrossRef]
47. Guerry, A.D.; Ruckelshaus, M.H.; Arkema, K.K.; Bernhardt, J.R.; Guannel, G.; Kim, C.K.; Marsik, M.; Papenfus, M.; Toft, J.E.; Verutes, G.; et al. Modeling Benefits from Nature: Using Ecosystem Services to Inform Coastal and Marine Spatial Planning. *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* **2012**, *8*, 107–121. [CrossRef]
48. Käyhkö, N.; Khamis, Z.A.; Eilola, S.; Virtanen, E.; Muhammad, M.J.; Viitasalo, M.; Fagerholm, N. The Role of Place-Based Local Knowledge in Supporting Integrated Coastal and Marine Spatial Planning in Zanzibar, Tanzania. *Ocean Coast. Manag.* **2019**, *177*, 64–75. [CrossRef]
49. Arkema, K.K.; Verutes, G.; Bernhardt, J.R.; Clarke, C.; Rosado, S.; Canto, M.; Wood, S.A.; Ruckelshaus, M.; Rosenthal, A.; McField, M.; et al. Assessing Habitat Risk from Human Activities to Inform Coastal and Marine Spatial Planning: A Demonstration in Belize. *Environ. Res. Lett.* **2014**, *9*, 114016. [CrossRef]
50. Burbano, D.V.; Meredith, T.C.; Mulrennan, M.E. Exclusionary Decision-Making Processes in Marine Governance: The Rezoning Plan for the Protected Areas of the 'Iconic' Galapagos Islands, Ecuador. *Ocean Coast. Manag.* **2020**, *185*, 105066. [CrossRef]
51. Prasita, V.D. Determination of Shoreline Changes from 2002 to 2014 in the Mangrove Conservation Areas of Pamurbaya Using GIS. *Procedia Earth Planet. Sci.* **2015**, *14*, 25–32. [CrossRef]
52. Hu, W.; Wang, Y.; Dong, P.; Zhang, D.; Yu, W.; Ma, Z.; Chen, G.; Liu, Z.; Du, J.; Chen, B.; et al. Predicting Potential Mangrove Distributions at the Global Northern Distribution Margin Using an Ecological Niche Model: Determining Conservation and Reforestation Involvement. *For. Ecol. Manag.* **2020**, *478*, 118517. [CrossRef]
53. Aheto, D.W.; Kankam, S.; Okyere, I.; Mensah, E.; Osman, A.; Jonah, F.E.; Mensah, J.C. Community-Based Mangrove Forest Management: Implications for Local Livelihoods and Coastal Resource Conservation along the Volta Estuary Catchment Area of Ghana. *Ocean Coast. Manag.* **2016**, *127*, 43–54. [CrossRef]
54. Marley, G.S.A.; Deacon, A.E.; Phillip, D.A.T.; Lawrence, A.J. Mangrove or Mudflat: Prioritising Fish Habitat for Conservation in a Turbid Tropical Estuary. *Estuar. Coast. Shelf Sci.* **2020**, *240*, 106788. [CrossRef]
55. Davis, T.R.; Harasti, D.; Kelaher, B.; Smith, S.D.A. Defining Conservation Targets for Fish and Molluscs in the Port Stephens Estuary, Australia Using Species-Area Relationships. *Ocean Coast. Manag.* **2017**, *136*, 156–164. [CrossRef]
56. Mourão, K.R.M.; Martins Sousa Filho, P.W.; José de Oliveira Alves, P.; Frédou, F.L. Priority Areas for the Conservation of the Fish Fauna of the Amazon Estuary in Brazil: A Multicriteria Approach. *Ocean Coast. Manag.* **2014**, *100*, 116–127. [CrossRef]
57. Figueroa-Pico, J.; del Valle, D.M.; Castillo-Ruperti, R.; Macías-Mayorga, D. Marine Debris: Implications for Conservation of Rocky Reefs in Manabi, Ecuador (Se Pacific Coast). *Mar. Pollut. Bull.* **2016**, *109*, 7–13. [CrossRef] [PubMed]
58. Franco, G.H.; Mero, P.C.; Bitar, J.B. Management Practices for a Sustainable Community and Its Impact on Development, Manglaralto-Santa Elena, Ecuador. In Proceedings of the LACCEI International Multi-Conference for Engineering, Education and Technology, Montego Bay, Jamaica, 24–26 July 2019; Latin American and Caribbean Consortium of Engineering Institutions: Boca Raton, FL, USA, 2019.
59. Herrera-Franco, G.; Montalván-Burbano, N.; Carrión-Mero, P.; Jaya-Montalvo, M.; Gurumendi-Noriega, M. Worldwide Research on Geoparks through Bibliometric Analysis. *Sustainability* **2021**, *13*, 1175. [CrossRef]
60. Gobierno Autónomo Descentralizado de José Luis Tamayo Plan de Desarrollo y Ordenamiento Territorial de José Luis Tamayo. Available online: http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdiagnostico/0968552060001_PDyOT-DG_JOSELUISTAMAYO%20version%20final_24-06-2015_11-47-44.pdf (accessed on 19 July 2022).

61. Gobierno Autónomo Descentralizado del Cantón Salinas Plan de Desarrollo y Ordenamiento Territorial del Cantón Salinas. Available online: http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdocumentofinal/0960001380001_DIAGNOSTICO%20PDOT%202015%20marzo_13-03-2015_20-29-41.pdf (accessed on 11 June 2022).
62. Ministerio del Ambiente. *Plan de Manejo Reserva de Producción de Fauna Marino Costera Puntilla de Santa Elena*; 2020. Available online: https://www.ambiente.gob.ec/wp-content/uploads/downloads/2020/07/Acuerdo-Ministerial-Nro.-MAE-2020-006.pdf (accessed on 20 July 2022).
63. Ayerza(h), R. Seed Characteristics, Oil Content and Fatty Acid Composition of Moringa (Moringa Oleifera Lam.) Seeds from Three Arid Land Locations in Ecuador. *Ind. Crops Prod.* **2019**, *140*, 111575. [CrossRef]
64. Herrera-Franco, G.; Carrión-Mero, P.; Alvarado, N.; Morante-Carballo, F.; Maldonado, A.; Caldevilla, P.; Briones-Bitar, J.; Berrezueta, E. Geosites and Georesources to Foster Geotourism in Communities: Case Study of the Santa Elena Peninsula Geopark Project in Ecuador. *Sustainability* **2020**, *12*, 4484. [CrossRef]
65. Ministerio de Turismo del Ecuador Visitas a Las Áreas Naturales Protegidas del Ecuador. Available online: https://servicios.turismo.gob.ec/areas-naturales-del-ecuador (accessed on 25 July 2022).
66. Asamblea Nacional del Ecuador. *Constitución de la República del Ecuador, Quito*; 2008; pp. 1–216. Available online: https://www.asambleanacional.gob.ec/sites/default/files/documents/old/constitucion_de_bolsillo.pdf (accessed on 2 May 2022).
67. Asamblea Nacional del Ecuador. *Código Orgánico del Ambiente, Quito*; 2017. Available online: https://www.ambiente.gob.ec/wp-content/uploads/downloads/2018/01/CODIGO_ORGANICO_AMBIENTE.pdf (accessed on 4 May 2022).
68. Asamblea Nacional del Ecuador. *Código Orgánico Integral Penal, COIP, Quito*; 2014. Available online: https://www.defensa.gob.ec/wp-content/uploads/downloads/2021/03/COIP_act_feb-2021.pdf (accessed on 2 May 2022).
69. Asamblea Nacional del Ecuador. *Reglamento al Código Orgánico del Ambiente, Quito*; 2019. Available online: https://site.inpc.gob.ec/pdfs/lotaip2020/REGLAMENTO%20AL%20CODIGO%20ORGANICO%20DEL%20AMBIENTE.pdf (accessed on 2 May 2022).
70. Congreso Nacional del Ecuador. *Ley Forestal y de Conservación de Áreas Naturales y Vida Silvestre, Quito*; 2004. Available online: https://www.galapagos.gob.ec/wp-content/uploads/downloads/2016/08/25_Ley_Forestal_y_de_Conservacion_de_Areas_Naturales_y_Vida_Silvestre_29_dic_2014.pdf (accessed on 4 May 2022).
71. Nguyen, T.P.; Luom, T.T.; Parnell, K.E. Mangrove Allocation for Coastal Protection and Livelihood Improvement in Kien Giang Province, Vietnam: Constraints and Recommendations. *Land Use Policy* **2017**, *63*, 401–407. [CrossRef]
72. Asaad, I.; Lundquist, C.J.; Erdmann, M.V.; Costello, M.J. Ecological Criteria to Identify Areas for Biodiversity Conservation. *Biol. Conserv.* **2017**, *213*, 309–316. [CrossRef]
73. Dubois, R.; Proulx, R.; Pellerin, S. Ecological Uniqueness of Plant Communities as a Conservation Criterion in Lake-Edge Wetlands. *Biol. Conserv.* **2020**, *243*, 108491. [CrossRef]
74. Carlucci, R.; Manea, E.; Ricci, P.; Cipriano, G.; Fanizza, C.; Maglietta, R.; Gissi, E. Managing Multiple Pressures for Cetaceans' Conservation with an Ecosystem-Based Marine Spatial Planning Approach. *J. Environ. Manag.* **2021**, *287*, 112240. [CrossRef] [PubMed]
75. Herrera-Franco, G.; Alvarado-Macancela, N.; Gavín-Quinchuela, T.; Carrión-Mero, P. Participatory Socio-Ecological System: Manglaralto-Santa Elena, Ecuador. *Geol. Ecol. Landsc.* **2018**, *2*, 303–310. [CrossRef]
76. Gray, S.; Voinov, A.; Paolisso, M.; Jordan, R.; Bendor, T.; Bommel, P.; Glynn, P.; Hedelin, B.; Hubacek, K.; Introne, J.; et al. Purpose, Processes, Partnerships, and Products: Four Ps to Advance Participatory Socio-Environmental Modeling: Four. *Ecol. Appl.* **2018**, *28*, 46–61. [CrossRef] [PubMed]
77. Rakotomahazo, C.; Ravaoarinorotsihoarana, L.A.; Randrianandrasaziky, D.; Glass, L.; Gough, C.; Boleslas Todinanahary, G.G.; Gardner, C.J. Participatory Planning of a Community-Based Payments for Ecosystem Services Initiative in Madagascar's Mangroves. *Ocean Coast. Manag.* **2019**, *175*, 43–52. [CrossRef]
78. Inam, A.; Adamowski, J.; Halbe, J.; Prasher, S. Using Causal Loop Diagrams for the Initialization of Stakeholder Engagement in Soil Salinity Management in Agricultural Watersheds in Developing Countries: A Case Study in the Rechna Doab Watershed, Pakistan. *J. Environ. Manag.* **2015**, *152*, 251–267. [CrossRef] [PubMed]
79. Zhang, T.; Tan, Q.; Zhang, S.; Zhang, T.; Zhang, W. A Participatory Methodology for Characterizing and Prescribing Water-Energy-Food Nexus Based on Improved Casual Loop Diagrams. *Resour. Conserv. Recycl.* **2021**, *164*, 105124. [CrossRef]
80. Lopes, R.; Videira, N. Modelling Feedback Processes Underpinning Management of Ecosystem Services: The Role of Participatory Systems Mapping. *Ecosyst. Serv.* **2017**, *28*, 28–42. [CrossRef]
81. Carrión-Mero, P.; Borja-Bernal, C.; Herrera-Franco, G.; Morante-Carballo, F.; Jaya-Montalvo, M.; Maldonado-Zamora, A.; Paz-Salas, N.; Berrezueta, E. Geosites and Geotourism in the Local Development of Communities of the Andes Mountains. A Case Study. *Sustainability* **2021**, *13*, 4624. [CrossRef]
82. Gkoltsiou, A.; Mougiakou, E. The Use of Islandscape Character Assessment and Participatory Spatial SWOT Analysis to the Strategic Planning and Sustainable Development of Small Islands. The Case of Gavdos. *Land Use Policy* **2021**, *103*, 105277. [CrossRef]
83. The CornellLab of Ornithology E-Bird. Available online: https://ebird.org/hotspot/L2763042 (accessed on 11 June 2022).
84. Haase, B.J.M. *Guide to the Sea-and Coastal Birds of Ecuador, the Ecuasal Lakes and the Galapagos Islands*; InTech: Guayaquil, Ecuador, 2019.
85. Katikiro, R.E.; Kweka, O.L.; Minja, R.; Namkesa, F.; Ponte, S. Stakeholder Engagement and Conservation Outcomes in Marine Protected Areas: Lessons from the Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP) in Tanzania. *Ocean Coast. Manag.* **2021**, *202*, 105502. [CrossRef]

86. Rempis, N.; Alexandrakis, G.; Tsilimigkas, G.; Kampanis, N. Coastal Use Synergies and Conflicts Evaluation in the Framework of Spatial, Development and Sectoral Policies. *Ocean. Coast. Manag.* **2018**, *166*, 40–51. [CrossRef]
87. Brown, G.; Fagerholm, N. Empirical PPGIS/PGIS Mapping of Ecosystem Services: A Review and Evaluation. *Ecosyst. Serv.* **2015**, *13*, 119–133. [CrossRef]
88. Lopes, R.; Videira, N. Valuing Marine and Coastal Ecosystem Services: An Integrated Participatory Framework. *Ocean Coast. Manag.* **2013**, *84*, 153–162. [CrossRef]
89. Damastuti, E.; de Groot, R. Participatory Ecosystem Service Mapping to Enhance Community-Based Mangrove Rehabilitation and Management in Demak, Indonesia. *Reg. Environ. Chang.* **2019**, *19*, 65–78. [CrossRef] [PubMed]
90. Deitch, M.J.; Gancel, H.N.; Croteau, A.C.; Caffrey, J.M.; Scheffel, W.; Underwood, B.; Muller, J.W.; Boudreau, D.; Cantrell, C.G.; Posner, M.J.; et al. Adaptive Management as a Foundational Framework for Developing Collaborative Estuary Management Programs. *J. Environ. Manag.* **2021**, *295*, 113107. [CrossRef] [PubMed]
91. Stratigea, A.; Kikidou, M.; Patelida, M.; Somarakis, G. Engaging Citizens in Planning Open Public Space Regeneration: Pedio Agora Framework. *J. Urban Plan. Dev.* **2018**, *144*, 05017016. [CrossRef]
92. Herrera-Franco, G.; Carrión-Mero, P.; Aguilar-Aguilar, M.; Morante-Carballo, F.; Jaya-Montalvo, M.; Morillo-Balsera, M.C. Groundwater Resilience Assessment in a Communal Coastal Aquifer System. The Case of Manglaralto in Santa Elena, Ecuador. *Sustainability* **2020**, *12*, 8290. [CrossRef]
93. Herrera-Franco, G.; Carrión-Mero, P.; Alvarado, N. Participatory Process for Local Development: Sustainability of Water Resources in Rural Communities: Case Manglaralto-Santa Elena, Ecuador. In *World Sustainability Series*; Springer: Berlin, Germany, 2018; pp. 663–676.
94. Martin, C.L.; Momtaz, S.; Gaston, T.; Moltschaniwskyj, N.A. A Systematic Quantitative Review of Coastal and Marine Cultural Ecosystem Services: Current Status and Future Research. *Mar. Policy* **2016**, *74*, 25–32. [CrossRef]
95. Onyena, A.P.; Sam, K. A Review of the Threat of Oil Exploitation to Mangrove Ecosystem: Insights from Niger Delta, Nigeria. *Glob. Ecol. Conserv.* **2020**, *22*, e00961. [CrossRef]
96. Morelli, F.; Benedetti, Y.; Floigl, K.; Diego Ibáñez-Álamo, J. How Are Natura 2000 Protected Areas Covering Different Components of Avian Diversity in Spain? *Ecol. Indic.* **2021**, *133*, 108452. [CrossRef]
97. Osland, M.J.; Feher, L.C.; López-Portillo, J.; Day, R.H.; Suman, D.O.; Guzmán Menéndez, J.M.; Rivera-Monroy, V.H. Mangrove Forests in a Rapidly Changing World: Global Change Impacts and Conservation Opportunities along the Gulf of Mexico Coast. *Estuar. Coast. Shelf Sci.* **2018**, *214*, 120–140. [CrossRef]
98. Dissanayake, A.; Galloway, T.S.; Jones, M.B. Seasonal Differences in the Physiology of Carcinus Maenas (Crustacea: Decapoda) from Estuaries with Varying Levels of Anthropogenic Contamination. *Estuar. Coast. Shelf Sci.* **2011**, *93*, 320–327. [CrossRef]
99. Blake, D.; Augé, A.A.; Sherren, K. Participatory Mapping to Elicit Cultural Coastal Values for Marine Spatial Planning in a Remote Archipelago. *Ocean Coast. Manag.* **2017**, *148*, 195–203. [CrossRef]
100. Thiel, M.; Bravo, M.; Hinojosa, I.A.; Luna-Jorquera, G.; Miranda, L.; Núñez, P.; Pacheco, A.S.; & Vásquez, N. Anthropogenic Litter in the SE Pacific: An Overview of the Problem and Possible Solutions. *Rev. Gestão Costeira Integr.* **2011**, *11*, 115–134. [CrossRef]
101. Aguilera, M.A. Artificial Defences in Coastal Marine Ecosystems in Chile: Opportunities for Spatial Planning to Mitigate Habitat Loss and Alteration of the Marine Community Structure. *Ecol. Eng.* **2018**, *120*, 601–610. [CrossRef]
102. Goldberg, L.; Lagomasino, D.; Thomas, N.; Fatoyinbo, T. Global Declines in Human-Driven Mangrove Loss. *Glob. Chang. Biol.* **2020**, *26*, 5844–5855. [CrossRef]