

UNIVERSIDADE DE LISBOA
FACULDADE DE CIÊNCIAS
DEPARTAMENTO DE BIOLOGIA ANIMAL



**Adaptive co-management for a multi-specific shark nursery
area in the African Atlantic (Boa Vista, Cabo Verde)**

Diogo de Melo Nobre Boa-Alma

Mestrado em Ecologia Marinha

Dissertação orientada por:

Doutora Catarina Frazão da Fonseca Ribeiro dos Santos

Professor Doutor Rui Afonso Bairrão da Rosa

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Resumo

A Baía de Sal Rei, localizada na Ilha da Boa Vista, Cabo Verde foi recentemente identificada como um berçário multiespecífico de tubarões, o primeiro até à data na região do Atlântico Africano. As espécies abrangidas por este berçário revelam uma grande importância ecológica e económica, como por exemplo o tubarão-martelo (*Sphyrna lewini*) e o tubarão-de-pontas-negras (*Carcharhinus limbatus*). O valor ecológico da Baía está ligado à sua função como habitat essencial para o recrutamento de várias espécies, servindo também como berçário para outras formas de vida marinha, tais como tartarugas marinhas e outros peixes. Existem, no entanto, pressões antropogénicas crescentes na Baía devido ao rápido crescimento do turismo, à pesca artesanal e semi-industrial, e ao desenvolvimento urbano. Estes fatores têm impactos na estrutura ecológica da Baía de Sal Rei e na integridade dos serviços de ecossistema que a mesma providencia.

O objetivo principal da presente dissertação foi analisar o potencial de desenvolvimento de um modelo de gestão que equilibre as necessidades de conservação da biodiversidade com os requisitos socioeconómicos da comunidade local. A investigação procurou não apenas identificar os principais desafios ecológicos da Baía, mas também analisar as perceções de vários grupos de agentes interessados (*stakeholders*) sobre a sua importância, com o objetivo último de propor melhores práticas para uma gestão sustentável. Foram realizadas entrevistas semiestruturadas com 49 participantes, incluindo pescadores, operadores turísticos, conservacionistas, líderes comunitários e representantes governamentais. As entrevistas procuraram recolher informação sobre a diversidade de usos da Baía, perceções sobre os benefícios associados à mesma, ameaças à vida marinha, e potenciais soluções de gestão.

Os resultados revelaram uma dependência socioeconómica significativa dos habitantes locais relativamente à Baía de Sal Rei, nomeadamente nas áreas da pesca, turismo e lazer. A pesca, tanto artesanal como semi-industrial, desempenha um papel central na economia local, com muitos entrevistados a sublinhar a importância da Baía para a mesma (por exemplo, sendo uma fonte de isco vivo). No entanto, a sobrepesca e a falta de fiscalização adequada têm contribuído para o declínio dos recursos pesqueiros, afetando negativamente tanto o ecossistema como os meios de subsistência da população local. Paralelamente, o crescimento descontrolado do turismo (incluindo o desenvolvimento de infraestruturas e a ausência de medidas de regulação eficazes), a poluição, e a pressão humana sobre os recursos naturais têm provocado uma degradação ecológica, ameaçando a biodiversidade e os serviços de ecossistema do local. A gestão inadequada de resíduos, em particular a poluição por plásticos, foi identificada como outro desafio crítico, com impactos diretos na qualidade da água e na saúde do ecossistema marinho. Muitos entrevistados expressaram uma elevada preocupação com o aumento de lixo tanto nas áreas costeiras como no interior da Baía, o que impacta negativamente a fauna local, incluindo as espécies de tubarão que utilizam a Baía como berçário. Adicionalmente, a falta de consciência ambiental e a ineficácia das políticas de conservação exacerbam estas questões. Embora exista um enquadramento legal em vigor, como o Decreto Legislativo n.º 2/2020, que proíbe a captura de determinadas espécies de tubarões, a sua implementação é limitada. As práticas ilegais continuam a representar uma ameaça significativa para a Baía. Por exemplo, a pesca industrial dentro da zona de exclusão de três milhas náuticas e a captura de isco vivo por embarcações semi-industriais são práticas frequentemente relatadas que violam ou contornam as regulamentações. Entre os entrevistados, existe a perceção de que as leis de proteção ambiental são insuficientes e mal aplicadas, existindo falta de monitorização e fiscalização, o que deixa a Baía vulnerável a uma exploração descontrolada.

Por forma a responder a estes desafios, a presente dissertação propõe um modelo de co-gestão adaptativa como solução para a gestão sustentável da Baía de Sal Rei. A co-gestão adaptativa é baseada num

processo colaborativo que envolve a participação ativa das diferentes partes interessadas (*stakeholders*), incluindo comunidades locais, autoridades governamentais e organizações não-governamentais, no desenvolvimento e implementação de estratégias de gestão. Tendo a co-gestão adaptativa uma natureza flexível, a mesma permite ajustes ao longo do tempo com base numa monitorização e avaliação contínuas. Este modelo reconhece que os ecossistemas são dinâmicos e imprevisíveis, e que uma gestão eficaz deve ser capaz de se adaptar a essas mudanças, promovendo a resiliência ecológica e o uso sustentável dos recursos naturais. A participação comunitária é central nesta abordagem. A maioria dos entrevistados destacou a importância de incluir a comunidade local no processo de tomada de decisão, demonstrando um forte apoio à ideia de que a gestão da Baía deve envolver diretamente os vários utilizadores (pescadores, operadores turísticos, habitantes, organizações não governamentais) nas discussões e na implementação de medidas de conservação. Esta abordagem é especialmente relevante em contextos onde as comunidades dependem fortemente dos recursos naturais para a sua subsistência, e onde a exclusão das mesmas dos processos de gestão pode levar à ineficácia das políticas de conservação. A co-gestão adaptativa procura assim oferecer uma abordagem que equilibra as necessidades ecológicas com os interesses económicos e culturais das populações locais, assegurando a coexistência entre a proteção da biodiversidade e meios de subsistência sustentáveis. O modelo proposto para a Baía de Sal Rei procura também abordar algumas lacunas na aplicação de políticas ambientais, fomentando uma maior colaboração entre *stakeholders* e a criação de mecanismos mais eficazes para melhorar os processos de fiscalização e cumprimento das regulamentações ambientais. A educação ambiental e as campanhas de sensibilização fazem também parte das componentes cruciais deste modelo, especialmente no que diz respeito ao envolvimento da comunidade local na conservação de tubarões e de outros recursos marinhos.

A presente dissertação aponta também para a necessidade de uma abordagem integrada na gestão da Baía de Sal Rei, combinando a criação de Áreas Marinhas Protegidas com processos de Ordenamento do Espaço Marinho. Embora o tema não seja abordado em profundidade, devido à sua complexidade, as Áreas Marinhas Protegidas podem proteger habitats críticos, como berçários, zonas de alimentação e recifes de coral, essenciais para a biodiversidade marinha e para a sustentabilidade das atividades pesqueiras. O Ordenamento do Espaço Marinho, por sua vez, pode ajudar a gerir no tempo e no espaço e a regular as diferentes atividades existentes na baía, minimizando os conflitos entre utilizadores e promovendo o desenvolvimento sustentável da região.

A presente dissertação conclui que o modelo de co-gestão adaptativa oferece uma abordagem promissora para a gestão sustentável da Baía de Sal Rei, enfatizando a importância de uma abordagem participativa e adaptativa. A co-gestão adaptativa permite não só uma maior flexibilidade face às mudanças ambientais, mas também assegura que as políticas de conservação sejam justas do ponto de vista social e economicamente viáveis, promovendo o equilíbrio entre a proteção da biodiversidade e o desenvolvimento sustentável das comunidades dependentes desses ecossistemas. Por fim, o modelo pode ser replicado noutras áreas costeiras de Cabo Verde com desafios semelhantes.

Palavras-chave: Co-gestão adaptativa, áreas marinhas protegidas, participação comunitária, Baía de Sal Rei, berçário de tubarões.

Abstract

The overall goal of the present dissertation is to investigate the feasibility of developing an adaptive co-management model for the Sal Rei Bay, located on Boa Vista Island, Cabo Verde. Previous studies have identified this Bay as a multi-specific shark nursery, the first of its kind in the African Atlantic. However, increasing anthropogenic pressures driven from tourism, artisanal and semi-industrial fisheries, and urban development, are contributing to significant ecological imbalances in the Bay. Despite the existence of environmental laws and regulations, their implementation and enforcement remain insufficient to effectively protect the Bay's biodiversity. The present research used qualitative methods, including semi-structured interviews with 49 participants from different stakeholder groups, from fishermen to conservationists, to local business owners and government representatives. Results revealed a significant socioeconomic dependence of the local population on the Bay's resources, with fisheries, tourism, and recreational activities being highlighted as primary uses. However, the lack of coordinated efforts to balance these activities with conservation objectives was a recurrent concern. Stakeholders also expressed apprehension about inadequate waste management, illegal fishing practices, and the unregulated expansion of tourism, all of which exacerbate the environmental degradation of the Bay. The dissertation advocates for an adaptive co-management approach that integrates local knowledge, adaptive decision-making, and participatory governance. This model emphasizes active engagement with local communities and stakeholders, fostering a management process that can respond to ecological unpredictability and evolving environmental conditions. By promoting community engagement together with collaboration among government entities, local resource users, and conservation organizations, the adaptive co-management model seeks to protect biodiversity while supporting sustainable economic development. The proposed model is therefore a well-suited and viable management approach for Sal Rei Bay.

Keywords: Adaptive co-management, marine protected areas, community participation, Sal Rei Bay, shark nursery.

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List of abbreviations

ACM- Adaptive Co-Management

AI- Artificial Intelligence

CBD- Convention on Biological Diversity

CM- Co-Management

COP15- 15th Conference of the Parties to the Convention on Biological Diversity

ES- Ecosystem Services

GBF- Kunming-Montreal Global Biodiversity Framework

IUCN- International Union for Conservation of Nature

LMMA- Locally Managed Marine Area

MPA- Marine Protected Areas

MSP- Marine Spatial Planning

NGO- Non-governmental Organisation

OECD- Other Effective Area-Based Conservation Measure

1.Introduction

1.1. Contextualising the study area

Cabo Verde is located off the west coast of Africa, in a tropical zone, north of the equator, and 600 kilometres from the coast of Senegal. According to the latest census data from the Cabo Verdean National Statistics Institute, Boa Vista Island has a population of approximately 12,798 inhabitants, the vast majority of which living in urban areas [1]. Of this population, 1,401 are employed in professions requiring formal training, such as technical education or bachelor’s degrees [1]. The most prominent sectors of employment include hospitality and tourism, administration/management, and fishing [1].

The population of Boa Vista Island is predominantly concentrated around the Sal Rei Bay, underscoring the Bay’s central role in local livelihoods. The Bay represents a critical source of income, primarily through tourism and associated services, such as resorts, restaurants, bars, and shops. Fisheries also play an important role, with most activities involving the capture of live bait for offshore fisheries or small-scale artisanal fisheries for local consumption. In addition to these economic activities, the Bay supports various recreational uses, including boating, snorkelling, diving, whale watching, kite surfing, and other water sports. Port activities are also concentrated in the northern section of the Bay, further emphasizing its multifaceted role as a hub of economic and social activity.

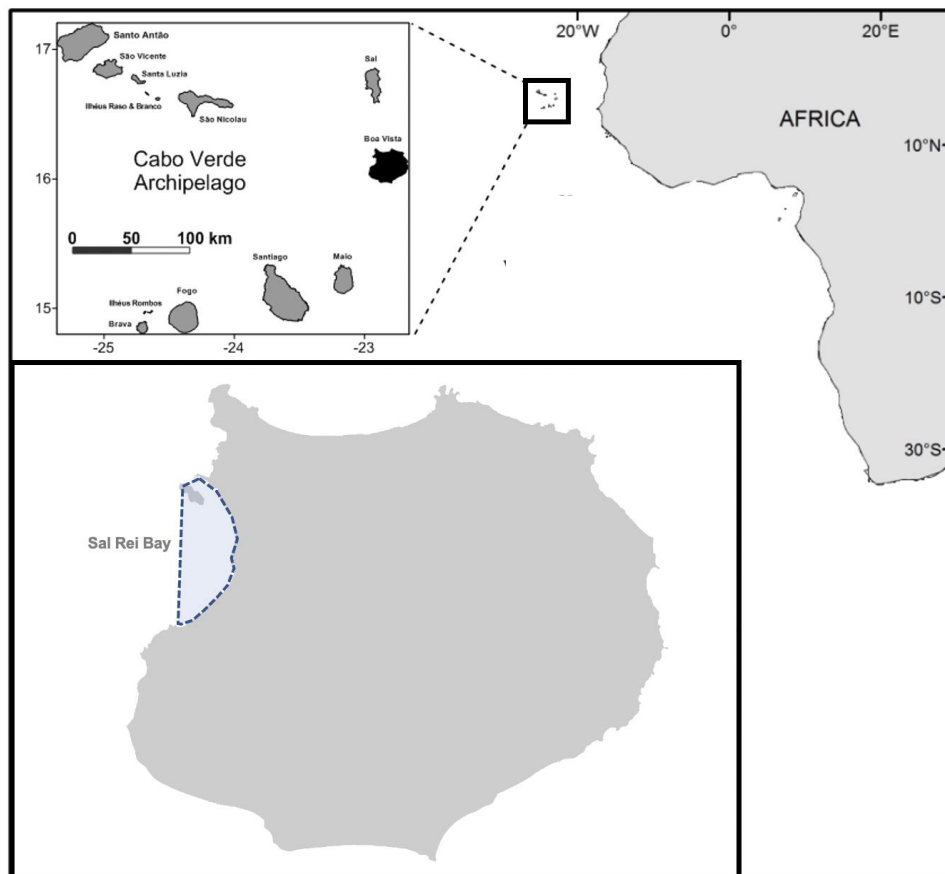


Figure 1.1 Cabo Verde archipelago; Boa Vista Island.

As the most densely populated area of the Island, Sal Rei Bay faces significant anthropogenic pressures. The combined effects of urban expansion in the city of Sal Rei, located in the north limit of the Bay, and the growing number of resorts around the Bay contribute to substantial stress on its natural resources. While the city of Sal Rei is not a large urban centre (~10,000 residents [1]), the population density and the intensive use of the Bay increase the likelihood of natural resources depletion, with ecological consequences such as the potential disappearance of several large-bodied fish species. This pattern of local extinctions has been observed in other heavily populated coastal areas [2].

1.2. Current system

Management tools for the maritime space in Sal Rei Bay are limited and their implementation is often lacking. A significant part of the Bay falls under the jurisdiction of the Port of Sal Rei as illustrated in Figure 1.2. Developing a robust management plan requires a thorough contextualization of the current situation, particularly as the management of Sal Rei Bay is regulated by Legislative Decree no. 2/2020 of 19 March Article 87 (Legislative Decree no. 2/2020 of 19 March Article 87) [3]. While there is no regional marine spatial plan for the Sal Rei Bay area, there are two protected areas: *Ilheu de Sal Rei* and *Morro de Areia*. Among these, only Morro de Areia includes coastal shallow waters, leaving much of the Bay without significant protection. This "protection vacuum" creates vulnerabilities for the Bay's ecological integrity.

The fishing fleet operating around Boa Vista Island mostly comprises artisanal boats, with a small number of semi-industrial vessels. Accordingly, the "Plano de Gestão dos Recursos da Pesca" from 2019 identifies that the fishing activity happening inside of the Bay is also mostly done by artisanal boats [3, 4]. However, it is likely that industrial vessels from foreign nations are engaging in illegal activities and using Cabo Verdean waters [5]. Legislative Decree No. 2/2020 reserves the region within 3 nautical miles (nm) from the shore exclusively for artisanal and domestic industrial fishing and prohibits foreign fleets from fishing within 12 nm. Boa Vista Island has one of the largest fishing grounds in the Cabo Verde archipelago [3]. Its abundant fishery resources attract not only local fishermen but also others from across the archipelago, particularly from Santiago Island [3]. Fishing represents a significant comparative advantage for Boa Vista, both in terms of resource availability and the profitability of related activities [3]. It is also important to mention that, according to the Legislative Decree no. 2/2020, a number of activities are prohibited in relation to several shark species (identified in Table 1.1), namely "fishing, holding, transshipment, landing, storing, selling and giving away" (part or all).

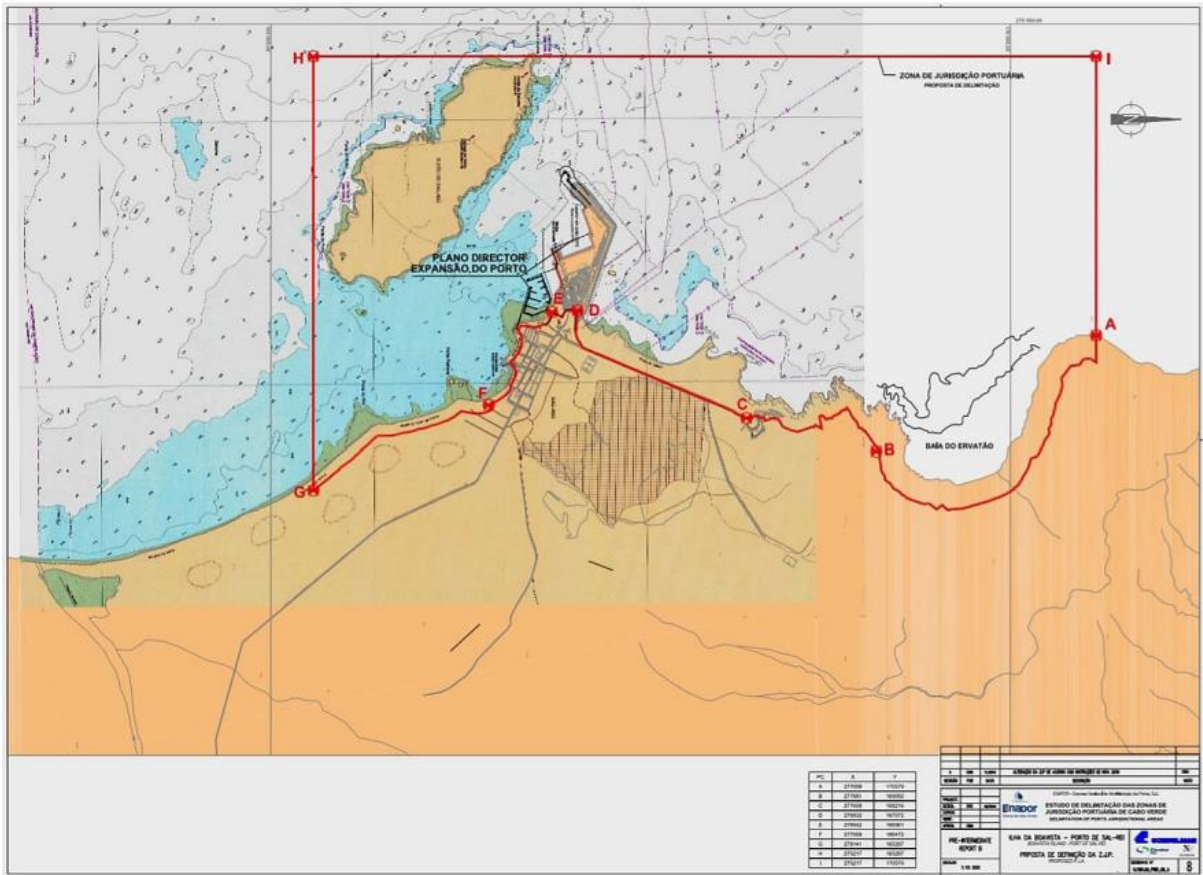


Figure 1.2 Plan of the Port Jurisdiction Zone of the Port of Sal Rei.

Table 1.1 List of sharks present in Legislative Decree no. 2/2020 of 19 March Article 87

| Common Name | Scientific name |
|--------------------|--|
| Whale shark | <i>(Rhincondon typus)</i> |
| Great White shark | <i>(Carcharodon carcharias)</i> |
| Hammerhead shark | <i>(Sphirna zygaena, Shirna lewini and Sphirna mokarran)</i> |
| Basking shark | <i>(Cetorhinus maximus)</i> |
| White-tipped shark | <i>(Carcharhinus longimanus)</i> |
| Porbeagle shark | <i>(Lamna nasus)</i> |
| Thresher shark | <i>(Alopias superciliosus)</i> |

1.3. Marine protected areas and Sal Rei Bay

The Sal Rei Bay has unique ecological values, which are fundamental for the livelihood and well-being of the population of Boa Vista Island [8]. Such features could potentially justify the establishment of marine protection measures. To date, some protected areas encompass the shallow coastal areas of the Bay. However, no protection extends to the marine area of the Bay as described by Rosa et al. [8] and illustrated in Figure 1.2. This lack of protection and the absence of strategic spatial planning [9] to manage all the activities that occur in the Bay can result in a legal vacuum, promoting unregulated development. Marine spatial planning (MSP) is a tool to organise the use of the marine space, minimizing conflicts between incompatible activities while promoting synergies, and ultimately preventing future conflicts between human uses, and with nature [9, 10]. The lack of spatial organization and planning of the marine space represents a risk for valuable natural resources and ecosystem services, forcing decision-makers to respond reactively to conflicts rather than proactively planning the sustainable development of the area [9]. Furthermore, combining MSP with the design and implementation of marine protected areas (MPAs) represents a significant step toward ensuring the sustainability of the Bay [10].

The Cabo Verdean archipelago is located in a region favourable for species of significant economic and conservation interest, such as elasmobranchs, cetaceans, and sea turtles [11,12]. Interaction with local communities reveals extensive empirical knowledge, underscoring Sal Rei Bay's role as a vital habitat for marine life. Notably, the first potential multi-specific shark nursery area in the African Atlantic was recently described in Boa Vista Island: the Sal Rei Bay nursery area [8]. This nursery supports juveniles of five shark species, namely: milk shark (*Rhizoprionodon acutus*), scalloped hammerhead shark (*Sphyrna lewini*), blacktip shark (*Carcharhinus limbatus*), Atlantic weasel shark (*Paragaleus pectoralis*), and nurse shark (*Ginglymostoma cirratum*).

Bycatch data from other islands in the archipelago (e.g., Maio Island) reveal that sharks are captured by 71% of fishing vessels, highlighting significant anthropogenic pressures on this group of top predators [13]. However, few initiatives on Boa Vista Island currently emphasise the ecological or economic value of sharks in their natural habitats. This lack of awareness may lead to inaction, exacerbating population declines. In other parts of the world where shark tourism is well established, such as in several Macaronesia Islands [14], sharks are economically valued through sustainable commercial activities aligned with conservation objectives. This has led to significant economic benefits for local communities, as exemplified in the Azores case where a new market has emerged, contributing with approximately 2 million euros to the economy in 2014 [15].

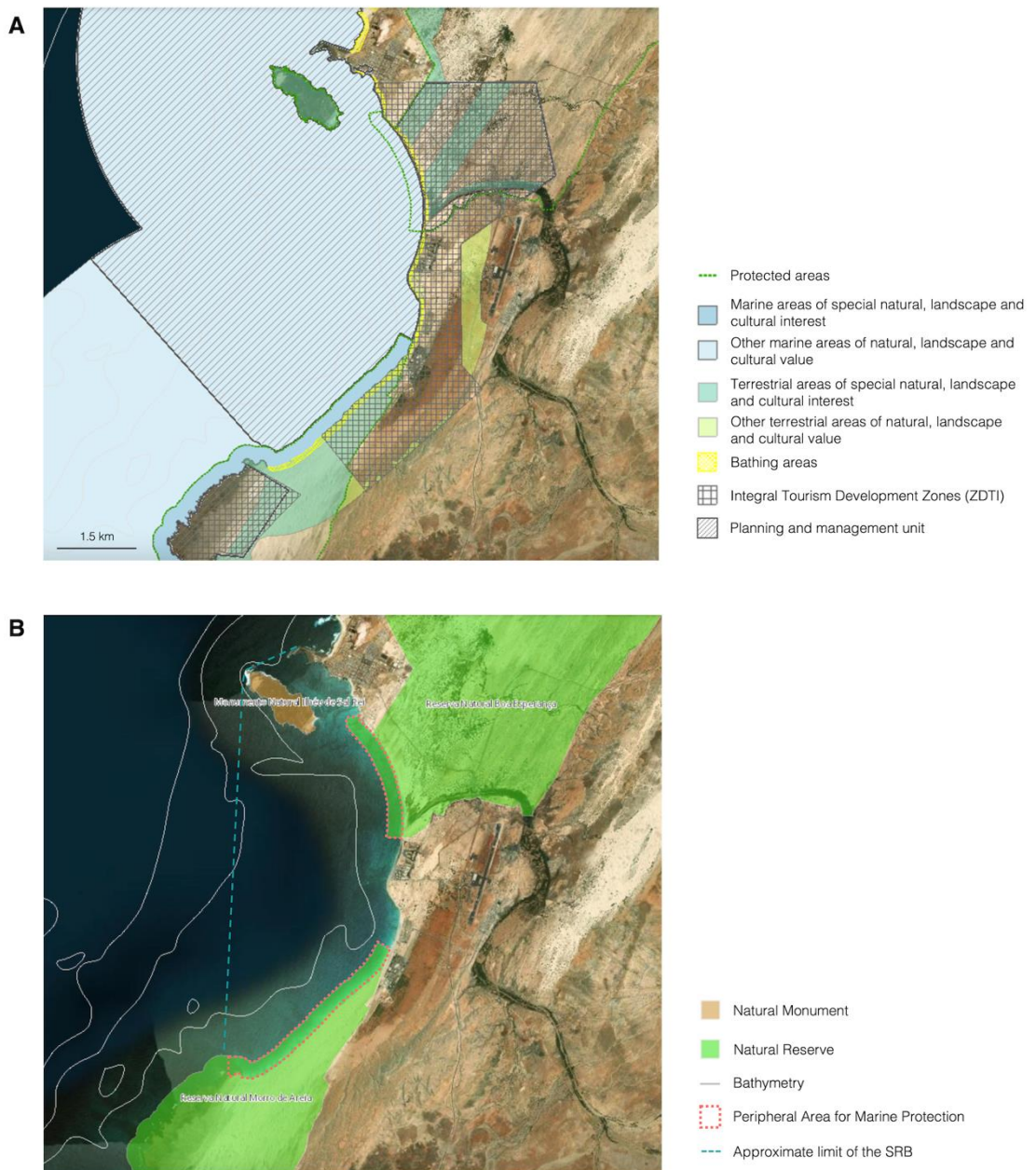


Figure 1.2 (A) Several management units are defined for the Sal Rei Bay, as defined in the coastal and marine spatial plan of Boa Vista Island (POOCM). (B) The Sal Rei Bay is partially encompassed by two Natural Reserves: “Boa Esperança” in the north and “Morro de Areia” in the south, that include Peripheral Areas for Marine Protection extending up to 300 m offshore. The Natural Monument of “Ilhéu de Sal Rei” is only terrestrial [8].

MPAs could also be used to protect the unique ecological assets present in the Sal Rei Bay, such as the shark nursery area, as well as resting areas for marine mammals and turtles [8]. Protected areas are defined as “clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” [16]. As for MPAs, they correspond to protected areas in the marine realm, which extend from the intertidal zone to the deep ocean [17]. By definition, MPAs prioritize the conservation of nature [18]. There are several types of MPAs, from full to minimal protection [18]. Also, some MPAs exist only on paper (known as “paper parks”), while others are properly implemented [18].

The establishment of an MPA progresses through several stages: (i) Proposed/Committed, by a governing or other organizing body; (ii) Designated, by law or other authoritative rulemaking; (iii) Implemented, with activated regulations; and (iv) Actively Managed, with ongoing monitoring and adaptive management [18]. During the designation phase, varying levels of restrictions can be applied, including no-take zones and zonation plans that may incorporate buffer areas [18]. Categories of MPAs include: (i) Fully Protected—no impact from extractive or destructive activities; (ii) Highly Protected—minimal impact; (iii) Lightly Protected—moderate impact; and (iv) Minimally Protected—high total impact, although still meeting the International Union for Conservation of Nature (IUCN) criteria for MPAs [18]. No universal model exists for MPA creation, as each area has its unique set of challenges, priorities and goals. To be considered an MPA, ecological values must be the primary management priority. Alternatively, areas focused on resource-based protection rather than ecological values, such as Locally Managed Marine Areas (LMMAs), may still yield ecological benefits but are classified as Other Effective Area-Based Conservation Measures (OECMs) [19, 20]. Effective MPA management requires regulations, legal frameworks, and spatial planning. Here, MSP can also play an important role [10]. According to Ehler and Douvère [9], MSP can be used to accommodate and regulate all the activities that take place within a management area. Allocating defined areas and time periods for different activities based on ecological, social and economic goals, reduces conflicts and promotes sustainable ocean use.

However, the lack of effective communication with local communities represents one of the main challenges for the development, implementation, and effective management of MPAs and MSP processes [21]. The adoption of co-management (CM) models represents a leap forward towards improving this issue, by involving local stakeholders in the decision-making process thus improving communication and self-compliance [22]. Conventional top-down, command-and-control management approaches often struggle to integrate social-ecological feedback and adapt, limiting their effectiveness [23]. For this reason, a second model has also been gaining prominence for MPAs: the adaptive co-management model (ACM) [22].

The CM model consists of shared decision-making between governments and stakeholders, including local communities, non-governmental organisations (NGOs), fishers, business owners, and tourism operators [22]. Some of the advantages of CM include enhancing stakeholder participation, fostering legitimacy, transparency, and accountability [22]. It also promotes cooperation, collaboration, and social interaction among community members [24]. In other areas where CM has been implemented, financial and community resources, including job opportunities and business financing, have improved [25]. However, even if co-management aligns with good governance principles, it may still fall short of achieving ecological health and socio-economic well-being due to the lack of flexibility that is required to respond to ecosystem changes, limiting its capacity to ensure ecological and socio-economic well-being [22]. ACM addresses CM's limitations by introducing adaptability into the management framework. This approach acknowledges uncertainty and external factors, emphasizing the need for continual adaptation based on the outcomes of implemented measures [22]. ACM integrates ecological, economic, and social goals, using adaptive management strategies to refine actions dynamically [23, 26]. As a hybrid model, ACM combines the participatory strengths of CM with the responsive flexibility of adaptive management [22].

Following previous recommendations [27], the design of the management plan should follow four steps: (i) preparation of a draft, (ii) revision (e.g., public revision or revision by stakeholders), (iii) validation (e.g., by the official body in charge), and (iv) implementation (starting to apply the plan in the MPA or MPAs). After the implementation of the management plan, two more processes take place:

revision and renewal; with a timeframe that should be specified in plans. Effective plans are grounded in three pillars: (1) a clear goal statement; (2) a conceptual model; and (3) a decision framework [26]. The “goal” statement shapes the project design and guides the creation of performance criteria, which contributes to the evaluation of the system's success. The conceptual model ensures the project is effectively designed to achieve its goal. A system-development matrix provides a structured decision framework, enabling adaptive responses to monitoring insights and ensuring progress toward established goals.

Given the ecological and socio-economic contexts of the Sal Rei Bay, its primary activities (fishing, tourism, water sports, and maritime transport) [28], and insights from similar case studies [29], the Bay represents an ideal candidate for ACM development and implementation. ACM aligns with principles of good governance, addressing local needs while accommodating the dynamic nature of ecosystems [22]. The growing popularity of Boa Vista Island, coupled with increased migration and tourism-related activities [1] underscores the need for participatory and adaptive management strategies to preserve the Bay’s natural values [30]. Further, Sal Rei’s relatively small population facilitates community engagement in management efforts in the Bay.

Developing an ACM model for Sal Rei Bay also aligns with global biodiversity conservation and ocean sustainability goals, such as the Convention on Biological Diversity’s (CBD) Kunming-Montreal Global Biodiversity Framework (GBF). The latter was adopted during the fifteenth meeting of the Conference of the Parties (COP 15) and includes 23 action-oriented global targets for urgent action until 2030 (Table 1.2) [31]. A GBF target of particular relevance in this context is Target 1 (Table 1.2), which emphasizes participatory, integrated, and biodiversity-inclusive spatial planning to halt biodiversity loss by 2030, while respecting Indigenous Peoples and local community rights [31]. Additional GBF targets, such as Targets 2-5 and 7-11, provide further support for developing an ACM model for Sal Rei Bay, addressing key ecological and socio-economic challenges (Table 1.2).

Table 1.2 Targets 2-5 and 7-11 of the Global Biodiversity Framework.

| GBF target | Target description |
|---|--|
| TARGET 1: Plan and Manage all Areas to Reduce Biodiversity Loss | Ensure that all areas are under participatory, integrated and biodiversity inclusive spatial planning and/or effective management processes addressing land- and sea-use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of Indigenous Peoples and local communities. |
| TARGET 2: Restore 30% of all Degraded Ecosystems | Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity. |
| TARGET 3: Conserve 30% of Land, Waters and Seas | Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures, recognizing indigenous and traditional territories where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories. |
| TARGET 4: Halt Species Extinction, Protect Genetic Diversity, and Manage Human-Wildlife Conflicts | Ensure urgent management actions to halt human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species, to significantly reduce extinction risk, as well as to maintain and restore the genetic diversity within and between populations of native, wild and domesticated species to maintain their adaptive potential, including through in situ and ex situ conservation and sustainable management practices, and effectively manage human-wildlife interactions to minimize human-wildlife conflict for coexistence. |
| TARGET 5: Ensure Sustainable, Safe and Legal Harvesting and Trade of Wild Species | Ensure that the use, harvesting and trade of wild species is sustainable, safe and legal, preventing overexploitation, minimizing impacts on non-target species and ecosystems, and reducing the risk of pathogen spillover, applying the ecosystem approach, while respecting and protecting customary sustainable use by indigenous peoples and local communities. |
| TARGET 7: Reduce Pollution to Levels That Are Not Harmful to Biodiversity | Reduce pollution risks and the negative impact of pollution from all sources by 2030, to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects, including: (a) by reducing excess nutrients lost to the environment by at least half, including through more efficient nutrient cycling and use; (b) by reducing the overall risk from pesticides and highly hazardous chemicals by at least half, including through integrated pest management, based on science, taking into account food security and livelihoods; and (c) by preventing, reducing, and working towards eliminating plastic pollution. |
| TARGET 8: Minimize the Impacts of Climate Change on Biodiversity and Build Resilience | Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through nature-based solutions and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity. |
| TARGET 9: Manage Wild Species Sustainably To Benefit People | Ensure that the management and use of wild species are sustainable, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and those most dependent on biodiversity, including through sustainable biodiversity-based activities, products and services that enhance biodiversity, and protecting and encouraging customary sustainable use by indigenous peoples and local communities. |
| TARGET 10: Enhance Biodiversity and Sustainability in Agriculture, Aquaculture, Fisheries, and Forestry | Ensure that areas under agriculture, aquaculture, fisheries and forestry are managed sustainably, in particular through the sustainable use of biodiversity, including through a substantial increase of the application of biodiversity friendly practices, such as sustainable intensification, agroecological and other innovative approaches, contributing to the resilience and long-term efficiency and productivity of these production systems, and to food security, conserving and restoring biodiversity and maintaining nature's contributions to people, including ecosystem functions and services. |
| TARGET 11: Restore, Maintain and Enhance Nature's Contributions to People | Restore, maintain and enhance nature's contributions to people, including ecosystem functions and services, such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters, through nature-based solutions and/or ecosystem-based approaches for the benefit of all people and nature. |

1.4. Objectives

The overall goal of the present dissertation is to investigate the suitability of developing an ACM model for Sal Rei Bay, Boa Vista Island, Cabo Verde. In order to achieve this goal, a deep understanding of the perceptions and preferences of a variety of local stakeholders about the opportunities and challenges faced in the Bay is fundamental. This study therefore uses the application of questionnaires to explore the following key topics:

- (1) Analyse stakeholders' perceptions of the benefits derived from the Sal Rei Bay;
- (2) Analyse the current uses of the Sal Rei Bay;
- (3) Analyse stakeholders' perceptions of threats and pressures to the Sal Rei Bay;
- (4) Investigate potential adaptive co-management solutions for the Sal Rei Bay.

2. Methodology

2.1. Study area and data sampling

The present work was developed under the scope of a scientific field mission carried under project NGANDU that took place from July to September 2023. During such period, semi-structured interviews were conducted in person close to the local population of Boa Vista Island. As the population of the Island is largely concentrated in the city of Sal Rei, and because the goal of the present work was to evaluate perceptions of users of the adjacent Sal Rei Bay, most interviews were conducted close to the inhabitants of the city. Interviews were also conducted close to individuals from other areas, namely Rabil, but only targeting people who claimed to use the Sal Rei Bay (Figure 1.1). Interviewees were selected based on three main criteria: (1) representativeness of different types of stakeholders (e.g., fishermen, fishmongers, beach bars and restaurant owners, local lodging, hotels, tourists, craftsman, dive centres tourism operators, conservationists, port authorities, and government authorities); (2) community ambassadors (individuals well known and respected amongst the local community generally by referral of other community members); (3) filling the demographic gap left by the two previous criteria. The interviews are shown in Table 2.1, the sum of all interviews is higher than N of interviews because some individuals fit more than one category.

Table 2.1 Occupation of the sampled group

| <i>Category</i> | <i>Fishmongers</i> | <i>Fisherman (excluding industrial fishing)</i> | <i>Beach bars and restaurants owners</i> | <i>Local lodging (owners)</i> | <i>Hotels (management)</i> | <i>Tourists (returners)</i> | <i>Other communities out of Sal Rei</i> | <i>Craftsman</i> | <i>Dive-centres (owners and staff)</i> | <i>Tourist operators</i> | <i>Port sector</i> | <i>Conservationists (NGOs and consultants)</i> | <i>Decisionmakers</i> | <i>General inhabitants</i> |
|-----------------|--------------------|---|--|-------------------------------|----------------------------|-----------------------------|---|------------------|--|--------------------------|--------------------|--|-----------------------|----------------------------|
| <i>N</i> | 2 | 9 | 6 | 2 | 2 | 2 | 1 | 3 | 3 | 13 | 2 | 4 | 5 | 7 |

A total of 49 out of 51 valid interviews were conducted from August 3 to August 31, 2023. Some of the interviews (N=3) were excluded from the analysis due to a lack of understanding of the questions by the interviewee almost always related to language barriers. In some questions, the total number of varied from 49 due to the lack of understanding of the question by the interviewee rendering the answer invalid. When the total differs from 49, the N is mentioned in the presentation of the results. All interviews were conducted in Portuguese (the official language of Cabo Verde) and by the same two individuals (the author and a senior research scientist from project NGANDU; see Table 2.2). The identity of the interviewees was kept anonymous throughout this study. However, individual quotes are used in the results and discussion sections to emphasise expressed opinions (these were first translated

to English, given that interviews were conducted in Portuguese). To keep anonymity but yet provide relevance and reliability to interviewees statements, the latter were broadly identified using their field of work as identifiers and a number when interviewing individuals with similar titles. (e.g. *Fisherman 01*). The interviews were conducted with residents and non-residents of the Island of Boa Vista. With non-residents being working migrants or long-term returning tourists. Non-residents had to be well integrated and understanding of the local community dynamics of Sal Rei in order to give a reliable and valuable testimony of this increasing demographic group. Most of the interviews were conducted in Sal Rei with residents and non-residents from Sal Rei 92% (N=47) and the rest of neighbouring villages, such as Povoação Velha and Rabil.

Table 2.2 Number of interviews conducted by each interviewer

| <i>Interviewer</i> | <i>Nº of Interviews</i> |
|-----------------------|-------------------------|
| <i>Diogo Boa-Alma</i> | 46 |
| <i>Vasco Pissarra</i> | 5 |

A survey protocol was developed to conduct semi-structured interviews (English and Portuguese templates available in Annex 1). The rationale for conducting these interviews was the relevance of understanding the perceptions of inhabitants of Boa Vista Island on the importance of Sal Rei Bay and its protection, in order to better support local conservation and management efforts. In order to address this objective, a set of key questions was compiled and organized into nine main sections as follows:

- A) general introduction;
- B) human uses and activities in the Sal Rei Bay;
- C) benefits derived from the Sal Rei Bay;
- D) threats and pressures;
- E) management approaches.
- H) personal stories related to the Bay;
- G) socioeconomic characteristics.
- H) interviewee's assessment;
- I) interviewer's assessment.

The interviews used a semi-structured format, therefore following the interview script while still allowing conversations to depart from it whenever relevant themes or personal experiences were introduced [32]. The interviews also comprised three types of questions: *yes* or *no* answers; multiple options; and open-ended answers. For these last two types, respondents were allowed to select more than one option, so the total percentages can exceed 100%. The complete interview script is available in the supplementary section, but the most relevant questions are highlighted in Table 2.3.

Table 2.3 Most relevant interview questions

| | |
|---------------------|--|
| <i>Question 2.5</i> | With what purpose do you use the Sal Rei Bay? |
| <i>Question 2.7</i> | In which sector do you work? |
| <i>Question 3.2</i> | Why is the Sal Rei Bay important for you? Why? |
| <i>Question 3.3</i> | What benefits do you take from the Bay? |
| <i>Question 3.5</i> | Is the Sal Rei Bay important for the people of Boa Vista Island? Why? |
| <i>Question 3.7</i> | Is the Sal Rei Bay important for marine life? Why? |
| <i>Question 4.1</i> | What are the main threats for the ocean beach and marine life in Sal Rei Bay? |
| <i>Question 4.2</i> | What are the main activities being developed in the Bay? |
| <i>Question 4.4</i> | How important is to reduce threats and pressures in Sal Rei Bay and why? |
| <i>Question 4.6</i> | Do you know of any management model for the Bay, if yes describe it. |
| <i>Question 4.9</i> | How would you describe the Sal Rei Bay 15 years ago? |
| <i>Question 5.2</i> | Is the protection of the Bay important for you? Why? |
| <i>Question 5.4</i> | Do you think the community should be involved in the protection of the Bay? Why? |
| <i>Question 5.5</i> | How do you think the involvement of the population should be done? |
| <i>Question 5.8</i> | Would you like to contribute to the protection of the Bay? If yes, in which of these categories? |

2.2. Data analysis

All questions were analysed using descriptive statistics in Microsoft Excel. More advanced statistical analyses (e.g., correlations) were not performed due to the reduced number of respondents. Closed answers, such as *yes/no* or multiple options, were directly processed in Excel. To process open-ended questions, answers were categorized. Such categories were created to capture to the best possible extent coincident opinions and cover the array of statements provided. While consistency among categories was a priority within sections of the interview, it was not always attainable due to the need to encompass divergent opinions. Furthermore, when using manual selection categories were created and split into two main groups to highlight general perceptions towards the Sal Rei Bay: “utilitarian importance” and “natural value”.

For open-ended questions with a lot of divergences, an Artificial Intelligence (AI) bot (Chat GPT) was used to analyse and categorize the contents of interviews. Afterwards, all clusters were manually crosschecked to avoid misinterpretations and errors by the AI bot. The prompts used are attached to the corresponding table in Annex 2. The resulting categories for each question are presented in Annex 3 with the corresponding testimonies. It is important to note that each provided answer can correspond to more than one category by including more than one idea.

In Question 5.5, respondents were asked, "How do you think the involvement of the population should be done?" Further analysis was conducted to associate the types of involvement suggested in the answers to demographic groups. This analysis was specific to this question, aiming to identify the most commonly agreed-upon suggestions across different demographics. However, it is important to note that the correlation is only indicative, as the sample size is not large enough to yield statistically significant results.

3. Results and Discussion

3.1. Demographic and socioeconomic characterization of interviewees

Demographics were considered when targeting interviewees. An approximation to the Island demographic was one of the priorities. We should also consider that there were specific stakeholders targeted based on the role that they play in the community. With that, possibly offsetting the approximation to the demographics of the Island. As shown in Table 3.1, some age groups were under-represented, such as the age groups 15-24; 25-34; 55-64 and 65+, compared to the age groups of 35-44 and 45-54 that were over-represented. This offset can relate to target stakeholders and community influencers belonging to the 35-44; 45-54 age groups. Gender was marginal benefited towards the male gender with 58% of males being interviewed, 2.9% above the Island population. This is linked to certain key demographic groups, such as fishermen and government roles, which are predominantly male-dominated.

Table 3.1 INE Demographics/Sample comparison[1]

| <i>Age groups</i> | <i>Total</i> | <i>15-24</i> | <i>25-34</i> | <i>35-44</i> | <i>45-54</i> | <i>55-64</i> | <i>65+</i> |
|-----------------------|---------------|--------------|--------------|--------------|--------------|--------------|------------|
| <i>Population</i> | 8949 | 1608 | 2634 | 2416 | 1120 | 607 | 564 |
| <i>Percentage (%)</i> | 100,0% | 18,0% | 29,4% | 27,0% | 12,5% | 6,8% | 6,3% |
| <i>Sample</i> | 51 | 3 | 12 | 17 | 15 | 2 | 2 |
| <i>Percentage (%)</i> | 100% | 5,9% | 23,5% | 33,3% | 29,4% | 3,9% | 3,9% |
| <i>Difference</i> | - | -12,1% | -5,9% | 6,3% | 16,9% | -2,9% | -2,4% |

The nativeness of all interviewees is reflected in Table 3.2. It is important to note that interviews were conducted not only with people from Boa Vista. The interviews largely targeted Cabo Verdeans composing 77.6% of the interviews (N= 38) but also people from foreign countries with 22.4% (N= 11). Also, it is important to notice that even amongst the Cabo Verdeans a big part of the interviewees was not originally from Boa Vista Island. Boa Vista Island was represented by 33% (N=16) of all interviewees and other Cabo Verdean Islands by 43% (N=21). In the latter case, Santiago and São Vicente were the most prominent islands with 16.3% and 14.3% of interviewees, respectively (N=8, and N=7). From foreign countries, Portugal appears as the more prominent with 6.1% (N=3) Foreigners were included due to the increase migration to Boa Vista Island from neighbouring countries, either for work (Fishing; Tourism industry), or leisure (case of most European countries).

Table 3.2 Nativeness of the sampled group

| <i>Nativeness</i> | <i>Boa Vista</i> | <i>Santiago</i> | <i>São Vicente</i> | <i>Fogo</i> | <i>Santo Antão</i> | <i>Italy</i> | <i>Brazil</i> | <i>São Tomé</i> | <i>Guiné Bissau</i> | <i>Portugal</i> | <i>Belgium</i> | <i>United Kingdom</i> | <i>France</i> | Total: | <i>Cape Verde</i> | <i>Other countries</i> |
|-------------------|------------------|-----------------|--------------------|-------------|--------------------|--------------|---------------|-----------------|---------------------|-----------------|----------------|-----------------------|---------------|---------------|-------------------|------------------------|
| <i>N</i> | 17 | 8 | 7 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 49 | 38 | 11 |
| <i>%</i> | 34,7 | 16,3 | 14,3 | 6,1 | 6,1 | 4,1 | 2,0 | 2,0 | 2,0 | 6,1 | 2,0 | 2,0 | 2,0 | 100,0 | 77,6 | 22,4 |

The sample of interviewees does not mirror the population's educational trend (Table 3.3). Higher education is overestimated by 25.5% more than the trend in Boa Vista due to the bias towards local business owners, management positions and decision-makers. This group is generally represented by individuals with a higher education. Primary school comes overestimated and middle school underestimated since a representative part of the interviewees frequented middle school but did not complete it and with it being only eligible for the completion of primary school. Although not representative of the population of the entire Island, the interviews had some bias towards active users or beneficiaries of the Bay.

Table 3.3 Comparison between education level of sampled group and general population

| <i>Education</i> | <i>No education</i> | <i>Primary school</i> | <i>Middle school</i> | <i>High school</i> | <i>Higher education</i> | <i>Other</i> | <i>Total:</i> |
|------------------------------|---------------------|-----------------------|----------------------|--------------------|-------------------------|--------------|---------------|
| <i>Population</i> | 558 | 729 | 6099 | 3233 | 891 | 102 | 11612 |
| <i>Percentage (%)</i> | 4,8% | 6,3% | 52,5% | 27,8% | 7,7% | 0,9% | 100,0% |
| <i>Sample</i> | 1 | 19 | 6 | 8 | 17 | 0 | 51 |
| <i>Percentage (%)</i> | 2,0% | 37,3% | 11,8% | 15,7% | 33,3% | 0,0% | 100,0% |
| <i>Difference</i> | -2,8% | 31,0% | -40,8% | -12,2% | 25,7% | -0,9% | |

3.2. Human uses and activities in the Sal Rei Bay

The Sal Rei Bay has a prominent role in the life of the interviewees. With (N=48; 94.1%) most of the sampled group lives in Boa Vista Island during the entire year. Also to note the long-time connection with the Island with 41% (N=21) of the interviewees living in the Island for more than 20 years, and 74.5% (N=38) for more than 5 years. The Sal Rei Bay has a presence on the life of the sampled group with 80% (N=41) of the individuals claiming to use the Bay at least once a week and 47% (N=24) claiming to do it daily. The answer to question 2.5 of the questionnaire “What use do you have for the Sal Rei Bay” as represented in Table 3.5. The most common answers being “to work” (N=25; 49%); “go to the beach” (N=41; 80%); “recreational fishing” (N=22; 43.1%); recreational activities (such as non-paying water sports, like surf, wind sports or snorkelling) and frequenting bars and restaurants with 31% (N=16) of the sampled group.

Table 3.4 Answer to the question 2.5 of the interview “What uses do you have for the Sal Rei Bay”

| <i>Question 2.5 What use do you have for the Sal Rei Bay?</i> | <i>Work</i> | <i>Go to the beach</i> | <i>Bars and restaurants</i> | <i>Recreational fishing</i> | <i>Recreational activities</i> | <i>Sport activities(paying)</i> | <i>Resident in the Bay</i> | <i>Camping</i> |
|---|-------------|------------------------|-----------------------------|-----------------------------|--------------------------------|---------------------------------|----------------------------|----------------|
| <i>N (Statements)</i> | 25 | 41 | 16 | 22 | 16 | 3 | 25 | 1 |
| <i>Percentage (%)</i> | 49,0 | 80,4 | 31,4 | 43,1 | 31,4 | 5,9 | 49,0 | 2,0 |

By looking at the results from section B of the questionnaire, it is noticeable that there is a strong connection between people from Sal Rei and the Bay. Most interviewees, 80% (N=41) state that they use the Bay at least once a week. There is an overall perception that most users of the Bay not only take advantage of the natural beauty but also a utilitarian view of the Bay. This area for most of the sample group is essential for their livelihood either for business purposes, food source, or cultural value. There are several activities taking place in the Bay and identified by the people. There are: Fishing (N=27; 61.4%), Water sports (N=21; 47.7%), Tourism and leisure (N=19; 43.2%), Restaurants and bars (N=10; 22.7%), Community activities (N=8; 18.2%), Environmental and conservation (N=5; 11.4%), Accommodation (N=3; 6.8%). All these activities are not mutually exclusive, however, most rely on provisioning and regulating Ecosystem Services (ES) [33], such as fish availability, for fisheries, touristic activities like snorkelling and kayaking and food provision for local businesses and population. Other noteworthy ES are water quality for beach and water sports purposes. Most of these activities exist due to the good ecological health of the Bay [33]. There has been an influx of migrants to Boa Vista Island either from other Island of Cabo Verde or other parts of the world [1], this can be associated

with the increased attraction of Boa Vista as a tourist destination [34], which also attracts other migrants looking for work opportunities [35]. Similar scenarios happened in other parts of the world where development growth of the location generates an increasing pressure on the resources and a more pressing need for a management plan that ensures the sustainability of these communities [36]. The importance of good ecological status of the Bay should not be overlooked when talking about the lower income families, the Bay represents an important food source [37]. Testimonies of the interviewees stated, *“There was a big impact of fishing in the Bay during the COVID-19 years”* (Government fishery worker); *“You couldn’t put nets in the Bay, but during COVID-19 they lifted that rule”* (Museum worker) showing that in a moment of crisis, the Bay was heavily used as primary food source for a lot of families around the Bay. These testimonies combined with the answers to the questionnaire highlight the reliance of Boa Vista inhabitants on Sal Rei Bay.

The Sal Rei Bay is a critical socio-economic hub for the local population of Boa Vista Island, the local population's perceived uses of the Bay are three main sectors. The tourist sector with Wind and water sports (Kite surf, kayaking, paddleboard snorkelling and diving) as well as beach bars restaurants and concessions. The cultural sector, where the leaser use of the Bay is part of the daily routine of locals as well as traditional celebrations takes place annually. Thirdly we have the fisheries operating in the Bay, *“There is a critical effort during the summer because there are many semi-industrial boats fishing for live bait in the Bay”* (Government worker 01) with semi-industrial fisheries catching bait fish for offshore fishing, traditional small-scale fisheries that supply local restaurants and communities as well as the self-consumption fisheries that are used to suppress nutritional needs of the household [3].

3.3. Importance of the Sal Rei Bay to Boa Vista inhabitants

When asked about the importance of Sal Rei Bay, most interviewees answered, “very important” (N=40; 78%), some answered, “somehow important” (N=6; 12%), and only one person believed it was not important at all. When asked *“why”*, the reasons mentioned varied between utilitarian aspects (51.8%) and natural value (48.2%); (Figure 3.1). Standing out in the utilitarian section is “Social/Landscape” compromised by 53.1% (N=26) mentioned the beauty of the area and/or its importance for their social life, and “Fishing” mentioned by 34.7% (N=17;) of the time, followed closely by tourism and business reasons. When talking about the natural value of the Bay although often mentioned, most interviewees referenced the natural richness as a whole (N=22; 44.9%), with the specific natural asset of the fish nursery being mentioned more often with 24.5% of answers (N=12) closely followed by turtles only thirdly sharks, only mentioned 18.4% (N=9). To this question, 3 people didn’t know how to answer and only 49 gave valid responses.

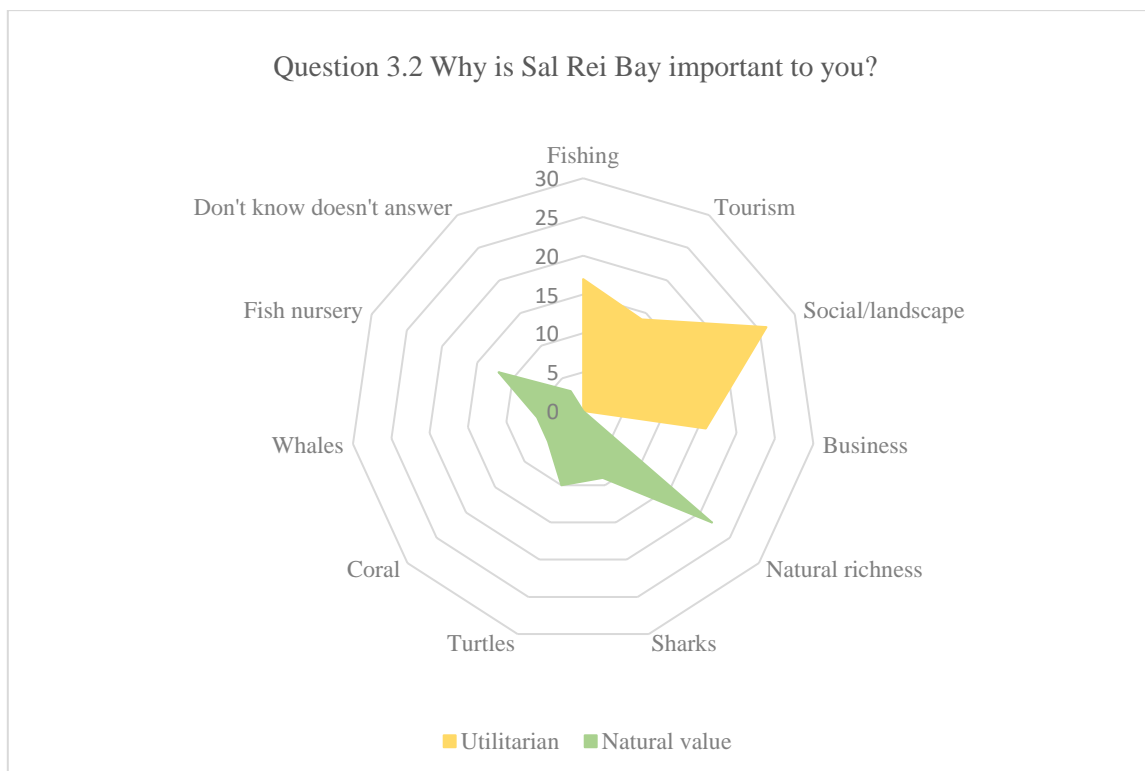


Figure 3.1 Graphical representation of the answer to the question 3.2 of the interview " Why is Sal Rei Bay important to you?"

When asked about the benefits taken from the Bay, “Nursery area for marine life” was mentioned by 56.9% (N=29) as a benefit, with the same frequency as “Business opportunities”, only surpassed by the mention of Spiritual Value and Leisure 52.9% and 79.4% respectively (N=30; N=45). Jumps to the attention the mention of the Bay as food source (N=20; 39.2%) showing the population reliance on this resource. As visible in Table 3.6

Table 3.5 Answer to the question of the interview 3.3 "What benefits do you take from the Bay?"

| Question 3.3 What benefits do you take from the Bay? | Leisure | Traditional importance | Spiritual value | Food source | Business opportunities | Nursery area for marine life | other |
|---|----------------|-----------------------------------|------------------------|--------------------|-----------------------------------|---|--------------|
| N (Statements) | 45 | 27 | 30 | 20 | 29 | 29 | 9 |
| Percentage (%) | 88,2 | 52,9 | 58,8 | 39,2 | 56,9 | 56,9 | 17,6 |

When asked if Sal Rei Bay was important for the people of Boa Vista the results showed that it was “Yes” for 95.9% of people (N=47), and “No” for 2.0% (N=1) and 2.0% “Don’t know” (N=1). When asked “why?” the answers were mainly utilitarian, with Tourism 40.8% (N=20), Social/Landscape 63.3% (N=31), Business 34.7% (N=17) and Fishing 34.7% (N=17) vastly overtaking any natural value answer, with mentions of Fish nurseries (N=5; 10.2%) and general statements of Natural richness (N=11; 22.4%). The utilitarian view is vastly bigger than the natural values of the Bay when it comes to the perception of the importance of the Island. This can be easily illustrated by Figure 3.2.

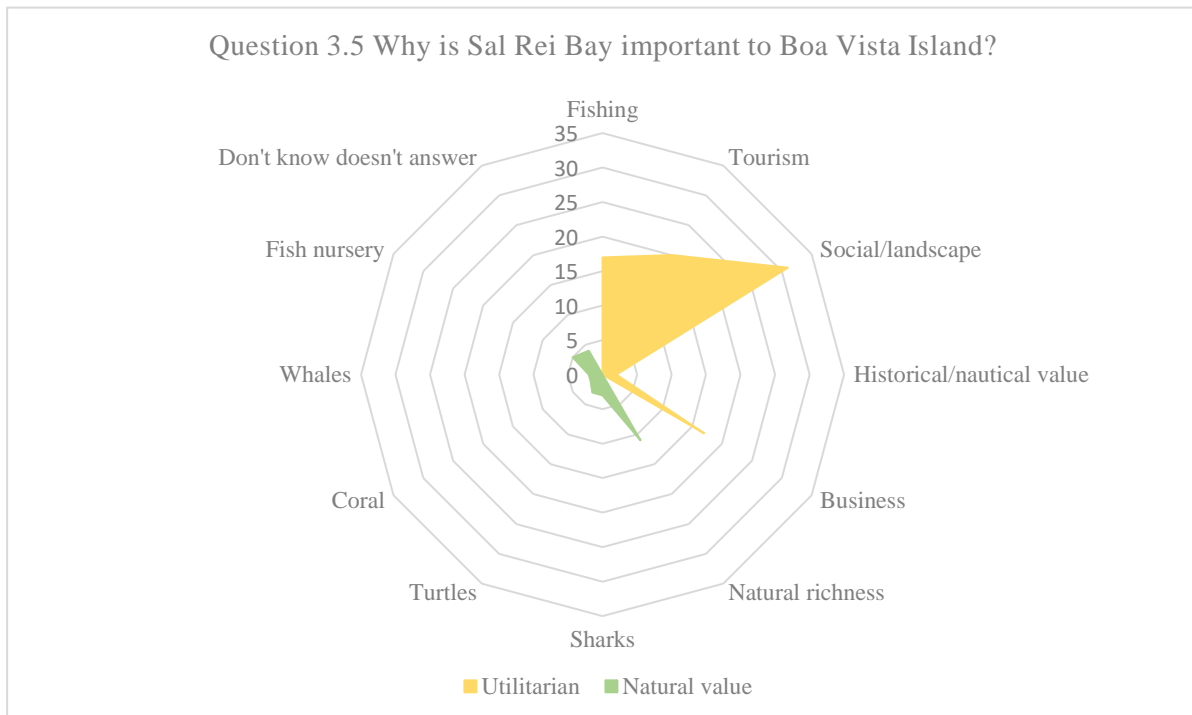


Figure 3.2 Graphical representation of the answer to the question 3.5 of the interview “Why Sal Rei Bay is important to Boa Vista Island?”

One of the questions included in the questionnaire was the importance of marine life in Sal Rei Bay. Out of 45 valid answers, the majority answered “Yes” (N=39; 86.7%) and only a few disagreed, saying “No” (N=2; 4.4%), and some were unsure how to answer (N=4, 8.9%). When asked “why the answers were categorized into several groups, as shown in Figure 3.3 Notably, responses highlighting natural values were the most common (N=94; 71.8%). Within natural values, sharks were often mentioned (N=18; 40%) along with turtles (N=19; 42%) and fish nurseries (N=18; 40%). In contrast, utilitarian values were mentioned less often (N=37; 28.2%), with fishing being the only significant utilitarian activity highlighted (N=17; 38%). When talking about the importance of marine life, the responses emphasize a stronger association with natural values as it is graphically represented in Figure 3.3.

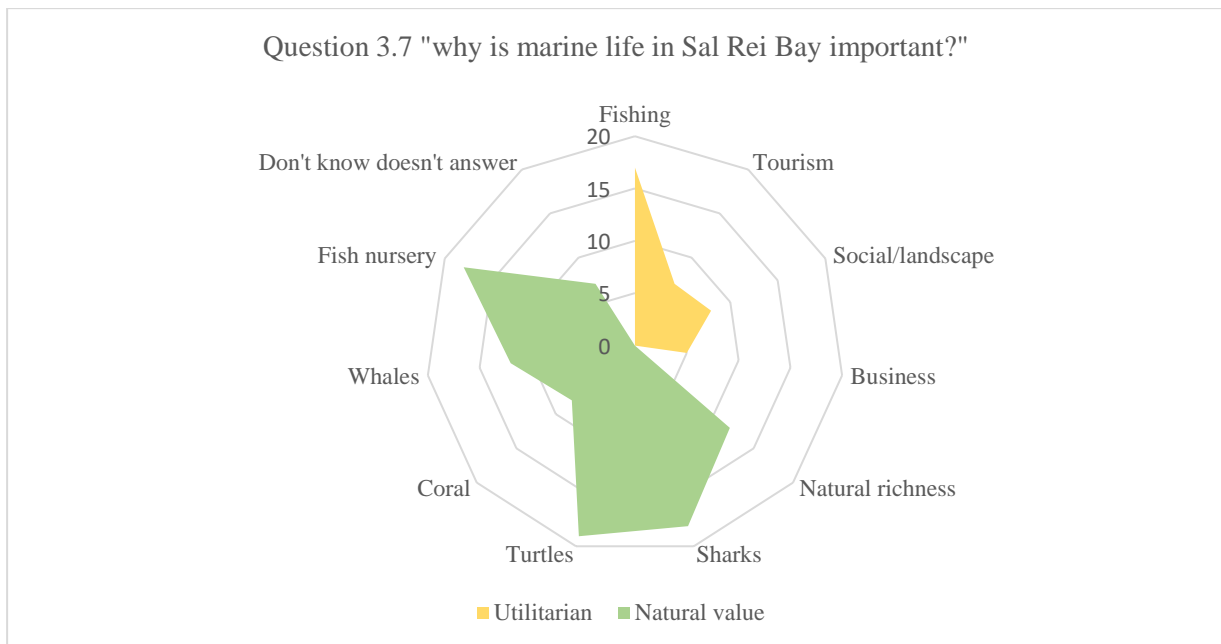


Figure 3.3 Graphical representation of the answer to the question 3.7 of the interview "why is marine life in Sal Rei Bay important?"

When expressing the importance of the Bay in their lives most respondents indicated that it held significance for them, demonstrating a moderate level of connection with the Bay's natural values. However, this connection was generally not deeply ingrained. Notably, the Bay's role as a fish nursery was frequently mentioned during interviews (N=12; 24.5%) as personally important. This perception was predominantly associated with fishermen.

"Yes, it's very important because, as an Island, these are our natural resources, and we have to know how to deal with them. When I was fishing there wasn't so much demand and there was room for the animals to grow. With so much fishing there's no more growth inside Bay and Bay is almost dead. There's a shark nursery here and it's a shame to see people killing sharks for no reason out of a lack of awareness." (Artisanal fisherman).

The population generally recognizes the Bay's value for both business and leisure purposes. This is evident in the responses to Question 3.3, where the most frequently reported benefits were leisure, spiritual value, and economic opportunities. Groups such as fishermen and tourist operators particularly those engaged in whale watching and diving demonstrated greater awareness of the marine life within the Bay.

When asked about the importance of the Bay to Boa Vista Island, almost all respondents, except two, emphasized its significance. However, these perceptions were largely utilitarian, with most responses overlooking the Bay's ecological richness. While some respondents mentioned natural values, such as biodiversity and fish nurseries, these were infrequent. This suggests a disconnect between the Bay's ecological assets and their perceived relevance to business and tourism.

The Bay is widely regarded as a gathering place for locals and tourists, offering business opportunities rooted in its scenic beauty and proximity to the water. However, the connection between

these touristic opportunities and the Bay's natural values is generally weak. Interestingly, when explicitly asked, “Is the Sal Rei Bay marine life important?”, responses shifted to highlight natural values.

In summary, the majority of respondents recognize the Bay's critical role as a driver of the local economy and an integral part of Sal Rei's social life, both at personal and community levels. While there is general awareness of the presence of marine life—such as shark and fish nurseries, turtles, and whales—their importance to tourism and the local economy is not well established [33] . This suggests that natural aspects may be undervalued unless directly addressed. Additionally, some respondents provided contradictory answers, likely influenced by the framing of the questions. The order of the questions was intentionally designed to minimize bias and encourage authentic responses regarding the Bay's significance

3.4. Threats and pressures in the Sal Rei Bay

In section D of the questionnaire, interviewees were asked about the biggest threats to Sal Rei Bay and the scale of impact on the marine environment. Three key issues were frequently mentioned. The most commonly identified threat was garbage (physically visible trash) (N=26; 53.1%), followed by fishing activities and by-products (N=19; 38.8%) and motorized tourism (N=14; 28.6%). Some other issues are reflected in Figure 3.4 such as human pressure, pollution, and unregulated construction although not as broadly identified by the population. Only 10.2% (N=5) of the population believed that there were no threats to marine life in Sal Rei Bay.

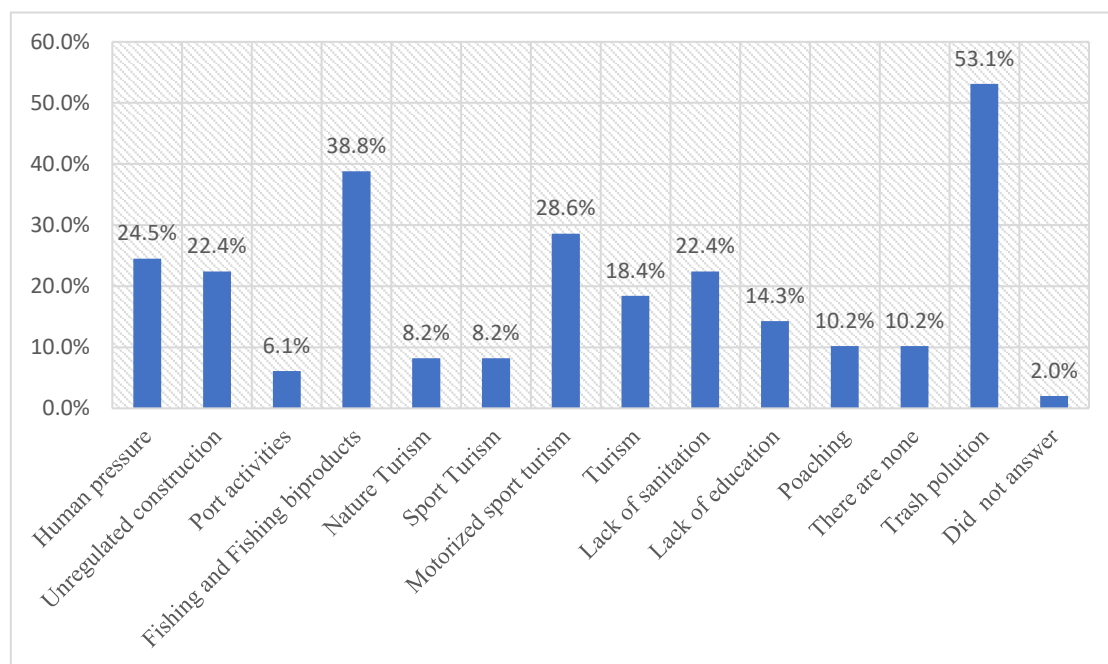


Figure 3.4 List of threats and (%) of mentions by the population to the Sal Rei Bay in question 4.1 “In Your understanding what are the biggest threats to Sal Rei Bay”

When asked about the activities associated with Sal Rei Bay, the responses were predominantly focused on fishing and water sports. Out of a total of N=44 answers, fishing and water sports were the

most frequently mentioned activity, with 61.4% (N=27) and 47.7% (N=21) respectively closely followed by Tourism and leisure (N=19, 43.2%).

Restaurants and bars were also mentioned (N=10; 22.7%), indicating their role in the local economy. Community activities and events mentioned 18.2% (N=8), reflect social engagement in the area. A small group also mentioned environmental and conservation activities (N=5; 11.4%). Accommodation was not one of the main answers (N=3; 6.8%). These findings highlight the multifaceted role of Sal Rei Bay in the community, emphasizing its utilitarian and social importance. These results are graphically represented in Figure 3.6.

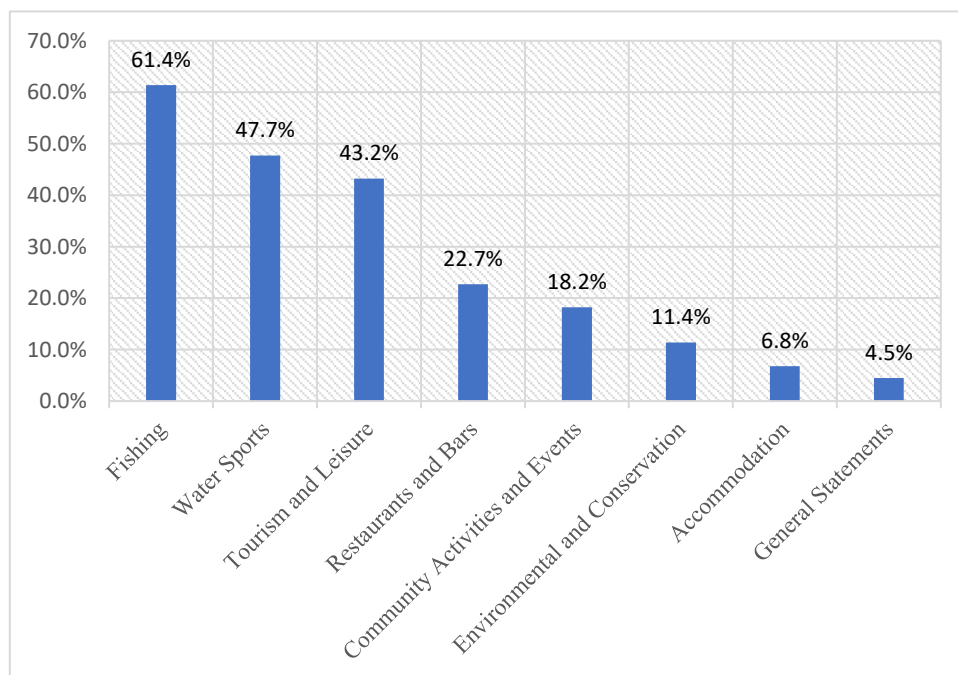


Figure 3.5 Percentage of mentions per category of uses of the Bay in question 4.2 “What are the main human activities developed in the Bay area?”

When asked about the importance of reducing said pressures, the response by most of the interviewees was one of concern (N=34; 71%) with most believing it’s very important to do so. Only some (N=5; 10%) believed that the pressures were not a concern at all. When asking why people thought it was important, or not, to reduce the pressures on marine life in Sal Rei Bay (N=48), the responses were split between utilitarian and natural reasons. The answer “Nature” was referenced most often (N=23; 47.9%), followed by "Impact on Local Population" (N=21; 43.8%) and "Tourism" (N=14; 29.2%). Other notable responses included "Intrinsic Natural Value" (N=12; 25.0%), which differs from “nature” because in this category a mention of a specific value exists opposing to “nature” as a general term. There was also some concern with "Beach Quality" (N=9; 18.8%), and some were concerned with the "Implementation Difficulties" (N=9; 18.8%) of the reduction of pressures. A few individuals deemed that pressures in the Bay could affect "Fishing," (N=8; 16.7%). Only 4.2% (N=2) didn’t know how to answer the question. Results a graphicly presented in Figure 3.7.

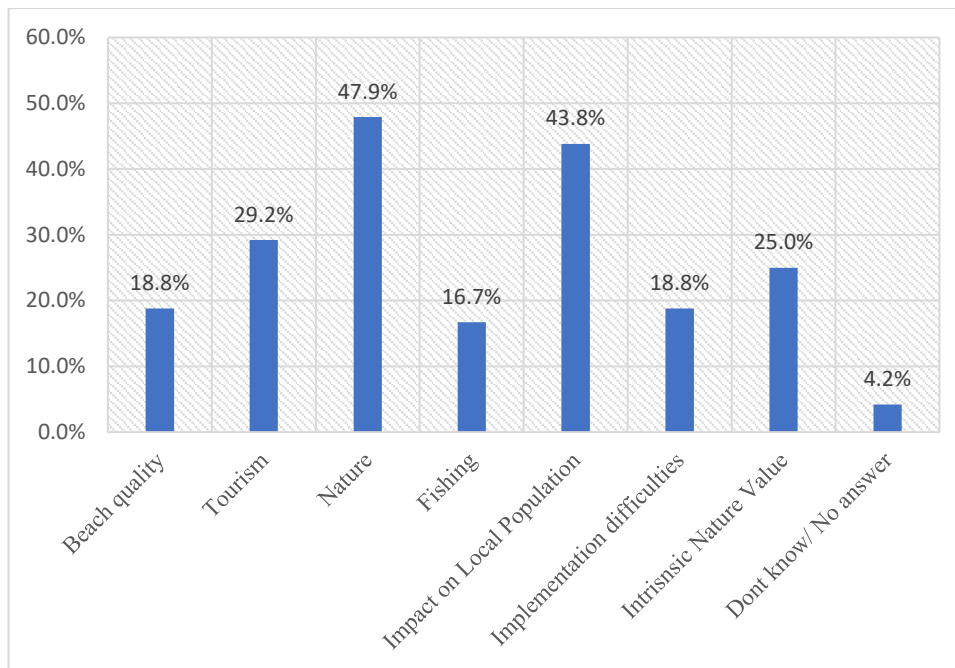


Figure 3.6 Answer to question 4.4 of the interview “Why it’s important to reduce the pressures in Sal Rei Bay?”

As for the challenges and pressures that Sal Rei Bay is faced with, most were mentioned during the interviews in question 4.1 “To you, what are the biggest threats for Sal Rei Bay”. The most often identified threats have been trash and pollution with the entire Island facing challenges when it comes to trash collection and processing, and sanitation. Waste disposal practices in insular states are far from being sustainable, with a significant amount of litter ending up in oceans and coasts, while illegal dumping, landfilling, and backyard burning are predominant means of disposal [38] this problem has been identified by the population and field observations. This can impact the Bay marine life and have a negative effect on the fisheries around the Island [39]. Other threats also identified by the population were related the unregulated fisheries and lack of surveillance by local authorities. Testimonies like these:

“Rubbish; the unnecessary capture of sharks. There is an urgent need for experts to sensitise fishermen and show the negative impacts that shark fishing is causing”. (Former fisherman)

“People are the biggest threat to the Bay non-selective fishing nets have bycatch on dogfish and sell very small fish on the market.” (Artisan street vendor).

These testimonies reflect a lack of knowledge and awareness of the impacts that harmful and unregulated fishing practices can have on marine ecosystems and local economy [40].

Other identified threat to the Bay is tourism and what comes with it, unregulated touristic activities and the added pressure and need for infrastructure (housing, sanitation, energy supply)[41]. Some tourist activities such as boating or quad bike use in the dunes have been reported as harmful by some of the testimonies. Boating for the impacts of the noise and anchors on the reef [42], and the disruptive effects that excess noise can have on the marine environment [43], unregulated mass tourism can happen to create conflicts with other stakeholders and have a negative environmental impact according to [44]. Some testimonies that address this issue are as follows:

“Unsustainable tourism, the mentality and lack of education that need to be changed, there is still the use of turtle and shark meat.” (Tour Operator)

“(…) the electronic tent near the Alisios creates a lot of pollution both from plastics in the glasses and sound and light but sanitation is one of the biggest problems, (…) above all there is a lack of sewerage.” (Local Accommodation Owner)

“Beach bars can have direct pressure on the coastline. Tourist boats should be used in a sustainable way.” (Hotel Manager)

One of the last pressures identified during the interviews relates to the construction of the pier of the Sal Rei Port. There are interviewees stating that the construction of the pier changed the dynamic of the currents instead of the Bay, and that the accumulation of sand in the middle of the Bay has increased from year to year. This excessive sedimentation is believed to have a harmful effect on the coral reef and contribute to the decrease of this habitat according to [45]. Decreasing the coral reef area and biodiversity according to [46] is believed to have a negative impact on fish assemblage and number that rely on this habitat for shelter. This in order will affect any human activity that relies on said habitat.

“The harbour is the biggest threat. Locals warned that it would have a major impact. 3 islets were destroyed to build the harbour. People going about their business without looking after the corals. A few years ago, there was a bacterium that affected the turtles”. (Kite-surf School Owner)

“(…) in 2011 the construction work on the harbour was finished, THIS changed the bottoms. in the past the rocky bottom was bigger.” (Government Employee 01)

There are some threats that were not identified however the possibility of their existence should be acknowledged. A fast-growing population due to the influx of migrants can take time to stabilize and create social bonds, this can create divergent groups with different connections to the area. However further investigation on the subject is necessary, being the question out of the scope of the current work. According to [47] “In spite of the contribution of migrant fishers to the economic and social development of the local communities where the migrants are installed (for example, the creation of jobs, sources of revenues, exchanges between local and migrant communities), there are an increasing number of conflicts between local and migrant populations, conflicts which can lead to a rejection of migrants, and their expulsion from the host villages”.

To sum up, the main challenges that are identified by the population and field observations are Sanitation and residue management; Fisheries regulation and compliance, the human pressures of massified tourism, the impact of the change in sediment dynamics, lack of social cohesion in certain groups and a lack of trust in local government. These problems can have a direct or indirect impact on the Sal Rei Bay or the implementation of a management model.

3.5. Management and conservation of the Sal Rei Bay

In section E) interviewees (N=48) were asked about the existing management models of Sal Rei Bay, with the great majority of people answering that they weren't aware of any (N=19; 39.5%) or that there was none (N=15; 31.3%); only a minority was aware of the existence of some kind of management model for the Bay (N=14; 29.2%). When asked to identify which models or rules are in place (N=16) individuals were able to answer and more than half (N=9; 56.3%) mentioned some kind of “Fishing Regulation”.

Table 3.6 awareness of types of regulations existing in Sal Rei Bay Answer to the question 4.6 of the interview

| <i>Category</i> | <i>Fishing Regulations</i> | <i>Environmental Conservation (Turtles, etc.)</i> | <i>Beach Use and Activities Restrictions</i> | <i>Boating and Anchoring Regulations</i> | <i>Protected Areas</i> |
|-------------------------|-------------------------------|---|--|--|------------------------|
| <i>Statement ID 4.6</i> | 1, 6, 7, 8, 9, 11, 20, 24, 30 | 25, 26, 28 | 10, 13, 30 | 19, 30 | 16 |
| <i>N (statements)</i> | 9 | 3 | 3 | 2 | 1 |
| <i>Percentage (%)</i> | 56,3 | 18,8 | 18,8 | 12,6 | 6,3 |

Asked if the management was appropriate and why, out of N=24 valid answers, the answers were mainly “no” with 58.3% (N=14) with only 16.7% (N=4) believing that, there is an appropriate management of the Bay, and 20.9% (N=5) not knowing if the management was appropriate. When asked “Why?” (table 3.8) Out of N=19 answers the main reasons that surfaced are as follows: 15.8% (N=3) agree that the existing rules are suitable, 5.3% (N=1) agree that the area covered is adequate. The remaining answers reflected the non-suitability of the current model associated to lack of enforcement and compliance of the existing rules (N=4; 21.1%) and the idea of insufficient or inadequate rules to the management of the Bay (N=4; 21.1%). There is a more consensual agreement (N=6; 31,6%) that there is a lack of resources for the management of the Bay. Is believed by a few that (N=3; 15.8%) current management is insufficient to address current environmental concerns. There are some note-worthy testimonies that mention the lack of clear communication, combined with diminished human and monetary capital for the general management, governance and enforcement.

“Enforcement is weak, and people only see everything being done, so there is a sense of impunity.” (Conservationist 01).

“(…) it is important to be well communicated what exists and what practical things are being done in the management of the Bay.” (Local accommodation owner).

“It's important that people feel listened to and that their contribution is valid here there are few assets so it's important that people join the cause.” (Government employee 02).

“We do more rescues than the police. There are few boats and few people.” (Tour operator).

Table 3.7 Answer to the question 4.8 “Do you believe current management is suitable? why?” divided by positive (suitable) and negative (not suitable) answers

| <i>Reason (Suitable)</i> | <i>Adequate Rules in Place</i> | <i>Specific Areas Covered by Rules</i> | <i>Reason (Not Suitable)</i> | <i>Lack of Enforcement and Compliance</i> | <i>Insufficient or Inadequate Rules</i> | <i>Need for More Resources</i> | <i>Environmental Concerns</i> |
|--------------------------|--------------------------------|--|------------------------------|---|---|--------------------------------|-------------------------------|
| <i>Statement ID 4.8</i> | 3, 6, 7 | 22 | <i>Statement ID 4.8</i> | 2, 9, 17, 18 | 5, 8, 16, 15 | 1, 11, 13, 14, 20, 21 | 12, 14, 19 |
| <i>N (Statements)</i> | 3 | 1 | <i>N (Statements)</i> | 4 | 4 | 6 | 3 |
| <i>Percentage (%)</i> | 15,79 | 5,26 | <i>Percentage (%)</i> | 21,05 | 21,05 | 31,58 | 15,79 |

In questions 4.9 and 4.10, people were asked to describe the Bay 15 years ago and 15 years from now respectively. With majority of the interviewees described a Bay with more pristine conditions, often associated with the word “better”, more marine life, less human pressure and less development as stated 15 years ago, as represented in Table 3.9. In question 4.10, the general statements reflect a Bay fifteen years from now with degraded environmental conditions and less marine life. Additionally, none of the interviewees expects a Bay with more marine life, as shown in Table 3.10.

Table 3.8 Answer to question 4.9 of the interview “how was the Bay 15 years ago?”

| <i>4.9 how was the Bay 15years ago?</i> | <i>Better</i> | <i>Worst</i> | <i>Equal</i> | <i>"- "human pressure</i> | <i>"+"human pressure</i> | <i>More marine life</i> | <i>Less marine life</i> | <i>More sharks</i> | <i>Fewer sharks</i> | <i>Less populated/developed</i> | <i>Don't know No answer</i> |
|---|---------------|--------------|--------------|---------------------------|--------------------------|-------------------------|-------------------------|--------------------|---------------------|---------------------------------|-----------------------------|
| <i>N (Statements)</i> | 16 | 5 | 4 | 6 | 2 | 20 | 4 | 4 | 0 | 10 | 2 |
| <i>Percentage (%)</i> | 33,3 | 10,4 | 8,3 | 12,5 | 4,2 | 41,7 | 8,3 | 8,3 | 0,0 | 20,8 | 4,2 |

Table 3.9 Answer to question 4.9 of the interview “How do you see Sal Rei Bay 15 years from now?”

| 4.10 “how do you see the Bay 15 years from now?” | Better | Equal | Worse | With more marine life | With less marine life | No answer | Equal marine life |
|--|--------|-------|-------|-----------------------|-----------------------|-----------|-------------------|
| <i>N</i> (Statements) | 4 | 4 | 30 | 0 | 24 | 4 | 1 |
| Percentage (%) | 8,3 | 8,3 | 62,5 | 0,0 | 50,0 | 8,3 | 2,1 |

The perception of the conservation trends of the Bay is one of degradation. This perspective is based on the perspective of the Bay 15 years ago in question 4.9, where the Bay was mostly described as less developed and having less human pressure and more marine life, particularly fish and coral. The future perspective was addressed in 4.10 of the Bay in a 15-year time most stated a scenario of increased degradation if things remain as they are currently, the few positive responses to this question were associated with positive thinking and faith, such as:

“I think it will get better; we don't have to think negatively, we have to be positive.” (Fishmonger).

3.6. Social participation in protection

This section of the interview was focused on the importance of protecting the Bay for the local population, possible solutions, and community involvement in the process. When inquired if the Sal Rei Bay should be protected? Out of N=47 most answers were “yes” (N=45; 95.6%) and, with only 4.4% (N=2) of individuals answering “don’t know”. When asked “why?” (Table 3.11), importance for the local population was the most popular answer (N=28; 59.6%) followed by Nature protection (N=26; 55.3%) and tourism benefits (N=14; 29.8%) is also important to mention the awareness of a part of the population that protection can benefit fisheries (N=7; 14.9%).

When asked about the importance of the local community being involved in the protection and management of the Bay most answered “yes” (N=47; 95.9%) with only 4.1% (N=2) not knowing if community involvement was important. When asked “why?” (Table 3.12) a representative part mentions of increase in the commitment of local communities to the protection of Sal Rei Bay in “Community responsibility and stewardship” (N=19; 42.2%); followed by “Ensuring compliance and enforcement” (N=13; 28,9%) and “Improving management outcomes” (N=9; 20.0%). It is noteworthy the opportunity to explore “Local knowledge and expertise” (N=6; 13.3%) and “Cultural and social connection to the Bay” (N=6; 13.3%) as an outcome of community involvement. Mentioned less often we have “economic interests and benefits” (N=5; 11,1%) and individuals mentioned the challenges and difficulties of community involvement (N=4; 8.9%).

Table 3.10 answer to the question 5.2 “Why do believe Sal Rei Bay should be protected?”

| 5.2 “Why do you believe Sal Rei Bay should be protected?” | Tourism benefits | Good how it is | Fishing benefit | Difficult to implement | No need for protection | Nature protection | Landscape protection | Important for the population | Don't know, no answer |
|--|-------------------------|-----------------------|------------------------|-------------------------------|-------------------------------|--------------------------|-----------------------------|-------------------------------------|------------------------------|
| N (Statement) | 14 | 0 | 7 | 2 | 0 | 26 | 8 | 28 | 2 |
| Percentage (%) | 29,8 | 0,0 | 14,9 | 4,3 | 0,0 | 55,3 | 17,0 | 59,6 | 4,3 |

Table 3.11 Answer to question 5.4 “Why is it important for local community to be involved in the protection of the Bay?”

| Category | Community Responsibility and Stewardship | Improving Management Outcomes | Local Knowledge and Expertise | Ensuring Compliance and Enforcement | Economic Interests and Benefits | Cultural and Social Connection to the Bay | Challenges in Implementation and Mixed Opinions |
|--------------------------|--|--------------------------------------|--------------------------------------|---|--|--|--|
| Statement IDs 5.4 | 6, 9, 13, 15, 16, 22, 23, 26, 27, 28, 29, 30, 32, 33, 34, 36, 40, 44, 46 | 4, 6, 12, 18, 24, 28, 36, 37, 45 | 13, 26, 30, 33, 38, 40 | 1, 3, 4, 5, 6, 11, 12, 19, 24, 36, 37, 41, 42 | 16, 25, 26, 32, 44 | 15, 17, 22, 23, 34, 35 | 2, 7, 20, 31 |
| N (statements) | 19 | 9 | 6 | 13 | 5 | 6 | 4 |
| Percentage (%) | 42,2 | 20,0 | 13,3 | 28,9 | 11,1 | 13,3 | 8,9 |

In question 5.5 (Table 3.14) when asked about ways the community can be involved in the management of Sal Rei Bay the answer N=45 was with the answers were created in the following Categories (Table 3.13) The answers to 5.5 stated that general Collaboration and Community Involvement (N=14; 32.6%) was the most popular option followed by Education and Awareness (N=11; 25.6%). Involving the community in the creation of Infrastructure and Resource Management (N=11; 25.6%) was a popular option similar to the direct involvement in Environmental Conservation and Protection (N=10; 23.2%), the need for Communication and Information Dissemination (N=6; 14.0%) was also mentioned and the need for Government and Institutional Support (N=9; 20.9%) of community actions were the fairly common answer. Economic Opportunities and Sustainable Development (N=6; 16.3%) was the least mentioned choice for community involvement, reinforcing the already mentioned disconnection between natural assets and economic gains.

Table 3.12 Criteria of the categories created for question 5.5

| <i>Categories</i> | <i>Criteria</i> |
|---|--|
| <i>Education and Awareness</i> | Answers that focus on educating the community, particularly the younger generation, about the importance of the Bay, environmental protection, and sustainable practices. Emphasizes the need for consistent educational programs, awareness campaigns, and early childhood education. |
| <i>Collaboration and Community Involvement</i> | Advocates for collaborative efforts between various stakeholders, including local authorities, NGOs, and community members, to ensure the Bay's protection. Highlights the importance of forming working groups, ensuring visible management, and involving everyone in decision-making processes. |
| <i>Infrastructure and Resource Management</i> | Emphasizes the need for improving infrastructure related to waste management, fishing practices, and ecotourism. Advocates for better facilities, clear regulations, and organized supervision to ensure sustainable use of the Bay's resources. |
| <i>Environmental Conservation and Protection</i> | Focuses on initiatives to reduce pollution, protect wildlife, and maintain the ecological balance of the Bay. Suggests practical actions like beach cleanups, stricter regulations on fishing, and campaigns to raise environmental awareness. |
| <i>Communication and Information Dissemination</i> | Stresses the importance of effective communication through signage, media (e.g., radio), and community meetings to inform the public about the Bay's regulations and the importance of conservation efforts. |
| <i>Government and Institutional Support</i> | Highlights the role of government and institutions in mediating, supporting, and enforcing initiatives for the Bay's management. Focuses on creating policies, providing resources, and ensuring that community voices are included in decision-making processes. |
| <i>Economic Opportunities and Sustainable Development</i> | Advocates for balancing economic development with conservation, including creating job opportunities in conservation and sustainable tourism, and ensuring that economic activities do not harm the Bay's ecosystem. |

Table 3.13 Distribution of answers through the categories of question 5.5 of the interview “In what ways you think community can be involved in the management of Sal Rei Bay”

| <i>Category</i> | <i>Education and Awareness</i> | <i>Collaboration and Community Involvement</i> | <i>Infrastructure and Resource Management</i> | <i>Environmental Conservation and Protection</i> | <i>Communication and Information Dissemination</i> | <i>Government and Institutional Support</i> | <i>Economic Opportunities and Sustainable Development</i> |
|--------------------------|--|---|---|--|--|---|---|
| <i>Statement IDs 5.5</i> | 2, 3, 16, 17, 30, 31, 35, 36, 37, 44, 45 | 1, 5, 8, 11, 12, 15, 21, 24, 25, 26, 27, 28, 29, 34, 35 | 6, 7, 9, 10, 13, 18, 19, 20, 38, 39, 43 | 4, 23, 32, 33, 36, 41, 42, 43, 44, 45 | 14, 19, 26, 32, 33, 40 | 2, 15, 18, 22, 24, 25, 27, 42, 43 | 9, 18, 20, 23, 36, 41, 46 |
| <i>N(statements)</i> | 11 | 14 | 11 | 10 | 6 | 9 | 7 |
| <i>Percentage (%)</i> | 25,58 | 32,56 | 25,58 | 23,26 | 13,95 | 20,93 | 16,28 |

Comparing the answers with the demographics associated with them in Table 3.15 was noticeable that the most consensual answers across the different groups of the population although not the most common answers were Education and Awareness and Collaboration and Community Involvement as shown by the results in table 3.14. With both being mentioned often across most demographic groups. This analysis can be indicative of the management actions that would have more adhesion and be more consensual through the community of Sal Rei. Furthermore, it can reflect which actions would have more adhesion by demographic group. Tourism professionals showed a preference for being involved in communication and Information Dissemination and Public sector workers prioritised education and awareness. Fishermen generally prefer economic opportunities and sustainable development. Community members prioritize being able to participate in the decisions about infrastructure and resource management while decision-makers advocate for more involvement in government and institutional support.

Table 3.14 Top 2 categories answered by each demographic in question 5.5

| Demographic group | Tourism professionals | Public sector workers | Fishermen | Community members | Decision-makers | NGOs & Conservationists |
|--------------------------|---|--------------------------------------|--|--|---|---|
| Top Category 1° | Communication and Information Dissemination | Education and Awareness | Economic Opportunities and Sustainable Development | Infrastructure and Resource Management | Government and Institutional Support | Environmental Conservation and Protection |
| Percentage 1° (%) | 27.3 | 33.3 | 31.8 | 29.1 | 28.6 | 35.2 |
| Top Category 2° | Education and Awareness | Government and Institutional Support | Infrastructure and Resource Management | Economic Opportunities and Sustainable Development | Collaboration and Community Involvement | Education and Awareness |
| Percentage 2° (%) | 24.2 | 22.2 | 22.7 | 23.6 | 21.4 | 29.4 |

When asked in 5.6 if they have ever contributed to the protection of the Bay, and if yes how? Out of N=35 answers, 88.6% (N=31) believed they have contributed to the protection of the Bay while 11.4% (N=4) admit not having done so. The most common ways of contributing are Beach cleaning campaigns (N=11; 31.4%) as the most popular choice and sustainable practices at work (N=8; 22.9%) in close second, most of the answers in this category are associated with tourist operators / business owners, or people working directly on conservation projects. An interesting fact is the association of people with fishing activity to the answer category Reporting issues to the Authorities (N=6; 17.1%) showing eagerness for compliance and regulations.

In question 5.7 people were asked if they would like to contribute to the protection of the Bay, 94.1% (N=48) answered “Yes”, while 2.0% (N=1) answered “No”

When presented with options of which ways would be preferable to contribute to the protection of the Bay in 5.8. The answers show that most options of Table 3.16 were generally accepted by most of the population except for the monetary contributions with especially low adhesion to the tax-paying option. This option was only being accepted by 39.2% (N=20) in contrast with supporting an NGO (N=45; 88.2%). The low adherence to monetary contribution, options is widely related to the perception of most, that funds will end up being diverted and not well used. This perception reflects the need for a more transparent system. With testimonies like “*We already pay to many taxes and the money doesn't go to the correct use (Local business owner)*” being fairly common.

Table 3.15 Answer to the question 5.8 “In what way would you like to contribute to the protection of the Bay”

| 5.8 In what way would you like to contribute to the protection of the Bay | Participating in meetings with decision makers | Advocating about the importance of the subject | Supporting an NGO | Collaborating with scientists | Paying a onetime monetary fee | Paying a tax for the protection of the Bay |
|--|---|---|--------------------------|--------------------------------------|--------------------------------------|---|
| Total (N) | 42 | 43 | 45 | 42 | 27 | 20 |
| Percentage (%) | 82,35 | 84,31 | 88,24 | 82,35 | 52,94 | 39,22 |

How the involvement is perceived majorly emphasises the community's duty to protect, care for, and take ownership of the Bay, Highlighting the need for collective action.

“Working together with the same mentality and together with the government.” (Beach Bar Cook).

Community involvement is necessary to ensure that rules and regulations are followed. This includes the belief that local participation helps in monitoring, enforcement, and compliance with established guidelines.

“Because without community participation, the community won't be educated or informed, and therefore the mission of Bay's management won't be fulfilled.” (Local accommodation).

Finally, it is suggested that community involvement is crucial for achieving better results in the Sal Rei Bay management. With mentions to the need of the community to be educated, informed, or involved to ensure effective and successful management.

“It's important to form working, decision-making and participation groups. And that there is visible implementation and management. It's important that people feel listened to and that their contribution is valid. There are few means here, so it's important that people join the cause.” (Government employee 02).

From the results of this section, there is a clear will of the sampled group to have some level of protection on the Sal Rei Bay. When asked most believed that it would have a positive impact on the local community, would be important for nature protection and believed that it would benefit tourism in the region. Important to note that some believe that it would also benefit local fisheries. During this

section was also noticeable that it is a priority to have the involvement of local communities with almost all agreeing with the statement.

Based on the interviews and the results from this section possible solutions for the inclusion of local communities in the management process and protection of the Bay proposed by the interviewed group include:

Education and communication; aid in the creation of support infrastructure for fisheries and touristic activities; creation of work groups to discuss management solutions, having community involved in conservation and management campaigns and the support of new business opportunities that promote the sustainable use of the Bay resources.

“We need to educate the new generation. The municipality has a summer camp project. Lectures and informative talks are also important”. (Tourist agent, kite).

“(…) put a concrete ramp at “Temam chê” so that boats can get in and out of the water there.” (Local accommodation).

It can be expected that different stakeholders try to sway the co-management process to benefit their own agenda [48]. This reiterates the importance of clear and transparent communication with a clear set of goals during the development and implementation of the co-management process. This pattern becomes evident when analysing the demographics associated with the proposed solutions for the management of the Bay. Groups like NGOs & Conservationists prioritising Environmental Conservation and Protection, and Fishermen having as priorities Economic Opportunities Sustainable Development and Infrastructure and Resource Management. During the development process it's important that these agendas are disclosed and clear to all. Having a public agenda will help reach common ground and a better suited solution.

4. Conclusions

4.1. A potential model for the management of the Sal Rei Bay

Based on the discussions in previous sections, Adaptive Co-Management (ACM) is considered the most suitable solution for managing Sal Rei Bay. Cabo Verde, as a Small Island Developing State (SIDS) [49], faces common challenges in implementing and enforcing regulations [50]. This is particularly true in the maritime sector, where ensuring compliance and conducting surveillance is both resource-intensive and difficult [51]. In this context, ACM stands out as the most effective management model, offering the advantage of self-imposed compliance [53], which helps alleviate the strain on the limited resources of the state

Other areas that have implemented adaptive co-management have seen improvements in participation in conservation and development projects [52]. This approach can strengthen relationships within the community, indirectly benefiting the co-management of regions beyond Sal Rei Bay [48]. While both co-management and adaptive co-management may encounter challenges during the implementation phase, the latter is an improvement over the former [54]

In conclusion ACM is seen as an improvement of CM, addressing most of the challenges that are present in the region. With the model addressing and aiding in the resolution of issues such as, public engagement/participation and transparency. With these having a cascading effect in the promotion of self-compliance, addressing enforcement difficulties, and also creating a sense of connection and ownership that strengthens social bonds between inhabitants and the bay of Sal Rei. All this while promoting the protection and sustainable use of the area, taking in consideration everchanging conditions that need an adaptable approach.

The successful implementation of an Adaptive Co-Management (ACM) approach relies on empowering stakeholders in Sal Rei Bay, with a particular focus on changing perceptions of shark species. This can be achieved through public education that highlights the economic value associated with the presence of these species. Empowering the community and fostering a sense of responsibility toward the Bay will result from these educational initiatives [23]. Such actions will also help prevent social inequality, reduce dependency, and enhance public access to information regarding Bay management [22]. Empowerment can be further supported by sponsoring innovative initiatives that align with ACM goals for the area [23], such as a continuous environmental training program in schools and local communities.

“The need for conservation protection programmes to be more focused on the community with community education, because otherwise when the NGOs funding runs out, mentalities won't have changed” (Government employee 01).

Another challenge identified during the fieldwork was the lack of capacity within the fishing community to organize, as the previous fishing association was not operational at the time of the interviews. This can represent a challenge for the implementation of any management model for the Bay. A lack of associative movements can increase the difficulty in the communication and coordination of actions and practices [55]. The creation of workgroups with individual stakeholders' groups can aid in the adaptability of the managerial plans and decrease tensions between divergent groups [22] this action is referred to in Figure 4.1. This is especially true in conservation conflicts, where ACM can mitigate disputes between polarised stakeholders [54].

Having semi-structured interviews allowed the collection of statements that can give us a glimpse into Sal Rei fishing community:

“I fought for the association, but it didn't work, it was so bad that I didn't want to take part anymore, I don't want to make enemies, and I don't get anything out of taking part in the association. The fishermen don't get together, it's the only Island where the association exists but it doesn't work. It was founded in 2017 and then it stopped for a year and the board didn't work well.” (Local fisherman)

Long-term commitment to ACM can be challenging, due to stakeholder turnover and loss of interest [54]. Following the advice of other studies [22] annual audits and assessments to the effectiveness of the MPA objectives of ecological health, socio-economic well-being, and good governance, can increase transparency, ease communication.

For the implementation of an adaptive co-management in Sal Rei Bay figure 4.1 exemplifies a possible structure for the management of the Bay. Composed of a managing board with elected representatives of each stakeholder group. This will enhance celerity in smaller issues that don't require full-on public consultation. The managing board is responsible for the creation of firstly clear goal statement; a conceptual model; and a decision framework, that should come to public consultation. After the conceptualization of a clear vision, the board should develop a managing plan that should go through the previously described stages in section 4.4.

The board is responsible for the yearly evaluation of the outcomes related to the implementation of the management plan and necessary adaptations ensuring the transparency of the process [22]. Board members should rotate every 5 years to prevent burnout of community members [54]. The NGO should be independent and have no political ties. Their role is to ensure the transparency of the process, and communication of the managing plans, ensuring rotation of the board of members and providing scientific support during the decision-making process. The creation of different work groups is made to ensure a common vision and the interests within each sector, easing the negotiating process between different sectors, and create a common vision that satisfies most groups.

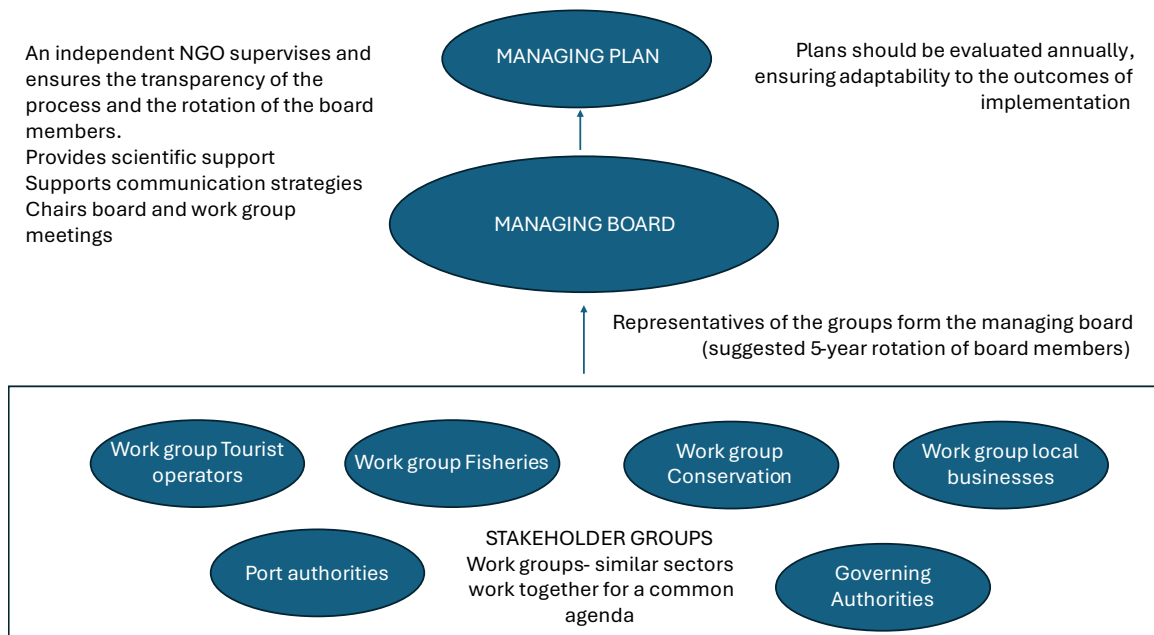


Figure 4.1 – structure proposition for the adaptive co- management of the Sal Rei Bay

4.2. Limitations of the study

It is noteworthy the good cover of the main stakeholders and an extensive range of different perspectives. Future improvements to the study are associated with a more extensive cover of the non-users of the bay that actions may direct or indirectly affect this area. Is worth mention the incapacity of some interviewees to answer all questions due to a lack of knowledge on the subject, time, or understanding of the question. For that reason, the N-Total ranges between questions and in some scenarios make comparisons difficult.

Open-ended questions are often more challenging to analyse because the responses need to be categorized, and they can be quite diverse. However, in this study, open-ended questions yielded more relevant results, providing a larger and more detailed amount of information that better captured the interviewees' realities.

4.3. Final remarks

The Sal Rei Bay is a critical socio-economic hub for the local population of Boa Vista Island, supporting a wide range of activities from tourism and fisheries to cultural practices and self-sustenance. However, the Bay is facing significant challenges that threaten its ecological integrity and the livelihoods of those who depend on it. The key issues identified include unregulated fishing practices, pollution, the impacts of mass tourism, and the lack of effective waste management. Additionally, the rapid influx of migrants and the subsequent strain on resources underscore the need for a robust management framework that can address these growing pressures.

The current management system, characterized by a lack of enforcement and overlapping jurisdictions, is insufficient to safeguard the Bay's resources. The existing legislative tools, while providing a foundation, are not adequately implemented, leading to gaps in protection and conservation efforts. This situation is exacerbated by a general lack of trust in local government, with many residents sceptical about the effective use of tax revenue for environmental protection.

The proposed management model emphasizes the importance of community involvement and co-management, where local stakeholders play an active role in decision-making processes. This approach is crucial in fostering a sense of ownership and responsibility among the local population, ensuring that conservation measures are not only implemented but also adhered to. By integrating the local community into the management framework, it is possible to enhance compliance with regulations, improve monitoring efforts, and ensure that the Bay's natural resources are used sustainably.

The management model must also address systemic issues such as lack of marine spatial planning and waste management infrastructure, which are essential for reducing the environmental pressures on the Bay. Transparent communication and clear goal setting are vital in navigating the diverse interests of stakeholders, from NGOs focused on environmental conservation to fishermen prioritizing economic opportunities. By aligning these interests through a co-management model, it is possible to create a sustainable future for Sal Rei Bay, where ecological health and socio-economic development coexist in harmony.

In conclusion, the future of Sal Rei Bay hinges on the successful implementation of a management model that is inclusive, transparent, and adaptive. By addressing the identified challenges and prioritizing community involvement, it is possible to protect the Bay's ecological integrity while supporting the livelihoods and cultural heritage of the local population.

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6. Annexes

Annex 1: Script of the interviews Portuguese and English

Percepções sobre a importância da Baía de Sal Rei

ID da entrevista: **Entrevista #:** _____ **Data:** ___/___/_____ **Entrevistador:**

Secção A: Introdução geral

Bom dia, sou aluno de mestrado da Universidade de Lisboa, em Portugal, e estou a desenvolver um estudo sobre a importância da Baía de Sal Rei para a população da Ilha da Boa Vista. Para esse efeito, temos um conjunto de perguntas sobre o tema, que demoram cerca de 15 minutos a completar. A sua participação é muito importante para o sucesso deste estudo, pelo que agradecemos a sua colaboração. Não há respostas certas nem erradas, estamos interessados na opinião de cada um. Toda a informação recolhida é anónima e confidencial, e pode parar de responder a qualquer momento.

1.1. Está interessado em participar? **Sim** **Não**

1.2. Em caso afirmativo, autoriza a utilização das suas respostas de forma anónima e confidencial no âmbito deste estudo? **Sim** **Não** (*autorização verbal ou escrita*)

Secção B: Utilização da Baía de Sal Rei

2.1. Vive na Boa Vista? **Sim, todo o ano** **Sim, em algumas partes do ano** (*quais?*):

Não (*terminar entrevista*)

2.2. Há quantos anos vive na ilha?

2.3. Em que localidade vive? (*e.g., Sal Rei, Rabil, Povoação Velha, ...*)

2.4. Utiliza a Baía de Sal Rei? **Sim** **Não** (*passar para 2.7*)

2.5. Com que fim? (*múltiplas respostas possíveis*)

Para trabalhar (*passar directamente para pergunta 2.7 e só depois voltar à 2.6*)

Ir à praia

Ir a bares e restaurantes na praia

Praticar pesca recreativa (*e.g., pesca à linha, caça submarina*)

Praticar actividades aquáticas recreativas (*e.g., surf, kitesurf, stand-up paddle, ...*)

Praticar actividades *desportivas* (*iguais às recreativas, mas pelas quais se paga; especificar qual*)

Sou morador (*especificar se Sal Rei, veleiro, ...*)

Outro: _____

2.6. Com que frequência?

- Todos os dias 1 a 2 vezes por semana 1 a 2 vezes por mês
 Outra: _____

2.7. Trabalha em que sector?

- Pescador artesanal
 Pescador semi-industrial
 Peixeira/Vendedor de peixe
 Bar/restaurante de praia
 Centro de mergulho
 Hotéis (e.g., Riu, Iberostar, ...)
 Alojamento local (e.g., Alisios, Ca Madeira Deluxe, ...)
 Agentes turísticos (e.g., kitesurf, whale watching, tours terrestres, ...)
 Artesão
 Conservação (e.g., ONGs, consultores de agências governamentais, ...)
 Sector portuário
 Entidades tomadoras de decisão (e.g., Direção Nacional Ambiente, Inspeção das Pescas, Câmara Municipal)
 Outra: _____

Secção C: Benefícios da Baía de Sal Rei

3.1. A Baía de Sal Rei (o mar, a praia, toda a vida marinha que aí existe) é importante para si?

- Nada importante Pouco importante Média importância Muito importante

3.2. Porquê? (resposta aberta)

3.3. Que benefícios tira desta área?

Culturais: Lazer Manutenção de tradições Valor espiritual Outro:

Socioeconómicos: Alimento Oportunidade de negócio Outro:

Ambientais: Área de berçário de espécies marinhas Outro:

3.4. Acha que a Baía de Sal Rei (mar, praia, vida marinha) é importante para a população da Ilha da Boa Vista em geral? Sim Não Não sei

3.5. Porquê? (resposta aberta)

3.6. Acha que a Baía de Sal Rei é importante em termos de vida marinha? Sim Não Não sei

3.7. Porquê? (resposta aberta)

Secção D: Ameaças/pressões na Baía de Sal Rei

4.1. Quais são, para si, as maiores ameaças para a Baía de Sal Rei (que afectam o mar, a praia, a vida marinha existente)? (resposta aberta)

4.2. Quais são as principais actividades humanas que se desenvolvem na Baía de Sal Rei?

4.3. Quão importante é diminuir as ameaças/pressões humanas existentes?

Nada importante **Pouco importante** **Média importância** **Muito importante**

4.4. Porquê? (*resposta aberta*)

4.5 Sabe se existe algum modelo de gestão da baía? **Sim** **Não** **Não sei**

4.6. Se sim, qual? (*resposta aberta; se não, passar para 4.9*)

4.7. Acha que esse modelo de gestão é apto para as presentes atividades e ameaças? **Sim** **Não** **Não sei**

4.8. Porquê? (*resposta aberta*)

4.9. Como descreveria o estado da Baía há 15 anos atrás? (*resposta aberta; e.g., melhor, pior, na mesma...*)

4.10. Caso não se altere nada na gestão, como acha que estará a baía daqui a 15 anos? (*resposta aberta*)

Secção E: Soluções de co-gestão na Baía de Sal Rei

5.1. Para si, era importante a Baía ser protegida? **Sim** **Não** **Não sei**

5.2. Porquê? (*resposta aberta*)

5.3. Acha que a comunidade de Sal Rei devia estar envolvida na gestão da baía? **Sim** **Não** **Não sei**

5.4. Porquê? (*resposta aberta*)

5.5. De que maneira é que a comunidade pode estar envolvida na gestão? (*resposta aberta*)

5.6. Acha que contribui ou já contribuiu para a proteção/ gestão sustentável da Baía de Sal Rei? (se sim como?)

5.7. Gostava de contribuir para a proteção/gestão sustentável da Baía de Sal Rei? **Sim** **Não** **Não sei**

5.8. De que forma acha que podia contribuir?

Participando em reuniões com decisores

Falando sobre a importância do tema

Dando apoio a uma ONG

Colaborando com cientistas

Dando uma contribuição monetária única

Pagando um imposto

Outra:

Secção F: Histórias da Baía

6.1. Há alguma **história** — positiva e/ou negativa — sobre a Baía que gostasse de partilhar? (*resposta aberta*)

Secção G: Características socioeconómicas

Para terminar pedimos-lhe que responda a algumas questões que nos permitam caracterizar os vários inquiridos. Toda a informação recolhida é confidencial e será usada apenas para tratamento estatístico.

7.1. Sexo: **Feminino** **Masculino** *(não perguntar, anotar apenas)*

7.2. Idade? _____

7.2. Naturalidade (cidade/ilha)? _____

7.3. Qual o seu nível de escolaridade completo?

Nenhum **Primário** **Básico (9º ano)** **Secundário** **Ensino superior** **Não responde**

Secção H: Avaliação do Inquirido *(fazer estas perguntas de seguida sem dizer que é outra secção)*

8.1. Como avalia o grau de dificuldade nas respostas a este questionário?

Muito fácil **Fácil** **Difícil** **Muito difícil**

8.2. Como avalia o interesse deste questionário para si?

Muito interessante **Interessante** **Pouco interessante** **Nada interessante**

MUITO OBRIGADO PELA COLABORAÇÃO! ----- (FIM)

Secção I: Para o Entrevistador *(a preencher depois da entrevista terminar)*

9.1. Condições da entrevista:

Sozinho **Com outras pessoas presentes** **Com intervenção de outras pessoas**

9.2. Atenção do entrevistado:

Muito fraca **Razoável** **Boa** **Muito boa**

9.3. Compreensão das questões:

Muito fraca **Razoável** **Boa** **Muito boa**

Perceptions about the importance of the of Sal Rei Bay

Interview ID: **Interview #:** _____ **Date:** ___/___/_____ **Interviewer:**

Section A: General introduction

Good morning, I am a master's student at the University of Lisbon, in Portugal, and I am developing a study on the importance of the of Sal Rei Bay for the population of the Island of Boa Vista. To this end, we have a set of questions on the subject, which take about 15 minutes to complete. Your participation is very important for the success of this study, so we thank you for your collaboration. There are no right or wrong answers, we are interested in everyone's opinion. All information collected is anonymous and confidential, and you can stop responding at any time.

1.1. Interested in participating? **Yes** **No**

1.2. If yes, do you consent to the use of your answers anonymously and confidentially within the scope of this study? **Yes** **No** *(verbal or written permission)*

Section B: Use of the Sal Rei Bay

2.1. Lives in Boa Vista? **Yes, all year round** **Yes, in some parts of the year** *(which ones?):*
 No *(end interview)*

2.2. How many years have you lived on the Island?

2.3. In which locality do you live? *(e.g., Sal Rei, Rabil, Povoação Velha, ...)*

2.4. Do you use Sal Rei Bay? **Yes** **No** *(move to 2.7)*

2.5. To what end? *(multiple possible answers)*

To work *(go directly to question 2.7 and only then return to 2.6)*

Go to the beach

Going to bars and restaurants on the beach

Practice recreational fishing *(e.g., angling, spearfishing)*

Practice recreational water activities *(e.g., surfing, kitesurfing, stand-up paddle, ...)*

Practice sports activities *(same as recreational, but for which you pay; specify which)*

I'm a resident *(specify whether Sal Rei, sailboat, ...)*

Other: _____

2.6. How often?

Every day **1 to 2 times a week** **1 to 2 times per month**

Other: _____

2.7. In which sector do you work?

- Artisanal fisherman**
- Semi-industrial fisherman**
- Fishmonger/Fish Vendor**
- Beach bar/restaurant**
- Dive Centre**
- Hotels** (e.g., Riu, Iberostar, ...)
- Local accommodation** (e.g., Aliios, Ca Madeira Deluxe, ...)
- Agentes turísticos** (e.g., kitesurf, whale watching, tours terrestres, ...)
- Craftsman**
- Conservation** (e.g., NGOs, consultants to government agencies, ...)
- Port sector**
- Decision-making entities** (e.g., National Directorate for the Environment, Fisheries Inspectorate, City Council)
- Other:** _____

Section C: Benefits of King Salt Bay

3.1. Is Sal Rei Bay (the sea, the beach, all the marine life that exists there) important to you?

- Not important** **Unimportant** **Medium importance** **Very important**

3.2. Why? (open answer)

3.3. What benefits do you get from this area?

Cultural: **Leisure** **Maintaining traditions** **Spiritual Value** **Other:**

Socioeconomic: **Food** **Business opportunity** **Other:**

Environmental: **Marine Species Nursery Area** **Other:**

3.4. Do you think that the Bay of Sal Rei (sea, beach, marine life) is important for the population of Boa Vista Island in general? **Yes** **No** **Don't know**

3.5. Why? (open answer)

3.6. Do you think the Bay of Sal Rei is important in terms of marine life? **Yes** **No** **Don't know**

3.7. Why? (open answer)

Section D: Threats/pressures in Sal Rei Bay

4.1. What are, for you, the biggest threats to the of Sal Rei Bay (which affect the sea, the beach, the existing marine life)? (open answer)

4.2. What are the main human activities that take place in the of Sal Rei Bay?

4.3. How important is it to reduce existing human threats/pressures?

- Not important** **Unimportant** **Medium importance** **Very important**

4.4. Why? *(open answer)*

4.5 Do you know if there is a Bay management model? **Yes** **No** **Don't know**

4.6. If yes, which one? *(open answer; if not, move to 4.9)*

4.7. Do you think that this management model is suitable for the present activities and threats? **Yes**
 No **Don't know**

4.8. Why? *(open answer)*

4.9. How would you describe the state of the Bay 15 years ago? *(open answer; e.g., better, worse, the same...)*

4.10. If nothing is changed in management, what do you think the Bay will be like in 15 years? *(open answer)*

Section E: Co-management solutions in Sal Rei Bay

For you it is important that the bay is protected?

Yes **No** **Don't know**

5.2. Why? *(open answer)*

5.3. Do you think that the community of Sal Rei should be involved in the management of the Bay?
Yes **No** **Don't know**

5.4. Why? *(open answer)*

5.5. How can the community be involved in management? *(open answer)*

5.6. Do you think you contribute or have contributed to the protection/sustainable management of the Rei Salt Bay? (if yes how?)

5.7. Would you like to contribute to the protection/sustainable management of Sal Rei Bay? **Yes**
No **Don't know**

5.8. How do you think you could contribute?

Participating in meetings with decision-makers

Talking about the importance of the topic

Supporting an NGO

Collaborating with scientists

Giving a one-time monetary contribution

Paying a tax

Other:

Section F: Histories of the Bay

6.1. Is there any **story** — positive and/or negative — about the Bay that you would like to share? *(open answer)*

Section G: Socio-economic characteristics

To conclude, we ask you to answer some questions that allow us to characterize the various respondents. All information collected is confidential and will be used only for statistical treatment.

7.1. Sex: **Female** **Male** (*don't ask, just write down*)

7.2. Age? _____

7.2. Place of birth (city/Island)? _____

7.3. What is your complete education level?

None **Primary** **Basic (Grade 9)** **High school** **University** **Doesn't answer**

Section H: Respondent Assessment (*ask these questions below without saying that it is another section*)

8.1. How do you assess the degree of difficulty in answering this questionnaire?

Very easy **Easy** **Difficult** **Very difficult**

8.2. How do you assess the interest of this questionnaire for you?

Very interesting **Interesting** **Little interesting** **Not interesting**

THANK YOU VERY MUCH FOR YOUR COLLABORATION! ----- (END)

Section I: For the Interviewer (*to be completed after the interview is over*)

9.1. Conditions of the interview:

Alone **With others present** **With the intervention of others**

9.2. Attention of the interviewee:

Very weak **Reasonable** **Good** **Very good**

9.3. Understanding the issues:

Very weak **Reasonable** **Good** **Very good**

Annex 2: Table of AI Prompts

Table 6.1 Table of questions where AI was used and respective prompts

| Question N° | Prompt |
|---|--|
| <p>Question 4.6 “Are you aware of any management model for Sal Rei Bay? If Yes which one?”</p> | <ul style="list-style-type: none"> • Arrange the following statements in similar categories. each statement can belong to more than one category. Create a table and don’t leave out the id number of each statement |
| <p>Question 4.8 "Do you think the current management program is appropriate to the Bay.?"</p> | <ul style="list-style-type: none"> • Now to a new set of questions do a similar analysis, the question is "do you think the current management program is appropriate to the Bay." <p>group in categories that believe the model is not suitable and the same for the reasons that make the model suitable</p> |
| <p>Question 5.2 “Why should The Sal Rei Bay be protected?”</p> | <ul style="list-style-type: none"> • Do the same analysis for a different question " why should The Sal Rei Bay be protected?" • Need to use all statements provided with the prompt and find categories that suit all of them, plus a table |
| <p>Question 5.4 “Why is it important for local community to be involved in the protection of the Bay?”</p> | <ul style="list-style-type: none"> • Do the same for this new set of answer to the question and describe the criteria for each category. |
| <p>Question 5.5 “In what way should community be involved?”</p> | <ul style="list-style-type: none"> • Now build two tables, one with the percentage of people that answered in each category, with the number of the response identified in a collum, and a second table with the percentage of each demographic in each category • Boil down table two with the two most represented choices for each demographic with the corresponding percentages • Join security staff, parents, barmen, artisans, in community members. environmental advocates in NGOs. Retired professionals in community members and hotel managers in tourism professionals, redo the analysis with those demographics |
| <p>Question 5.6 “have you ever contributed to the protection of the Bay, and if yes how?”</p> | <ul style="list-style-type: none"> • We asked if people already contributed, to the protection of the Bay, give me the percentage of yes and now and categorize how they contributed in similar groups with the percentage of each group • Show me the criteria used for the divisions and all the testimonies in each category |

Annex 3: Map of answers per category when using the AI bot

Table 6.2 table of Questions and respective Answers per category

| Question 4.6 Categories “Are you aware of any management model for Sal Rei Bay? If Yes witch one?” | Interview answers |
|---|--|
| Fishing Regulations | <p>1: <i>"prohibition of lobster fishing in the summer"</i> (Artisanal fisherman 01)</p> <p>6: <i>"You can't go to the Estoril area to catch fish"</i> (Artisanal fisherman 02)</p> <p>7: <i>"You can't let go of the entrails in the Bay so as not to attract sharks"</i> (Artisanal fisherman 03)</p> <p>8: <i>"You can't put nets 200 m from the beach"</i> (Artisanal fisherman 04)</p> <p>9: <i>"You can't catch bait on the beach with a net less than 200 m away"</i> (Artisanal fisherman 05)</p> <p>11: <i>"In the place to tie the boats, you cannot fish"</i> (Artisanal fisherman 06)</p> <p>20: <i>"There are guidelines in Lais that prohibit the use of nets in Bay"</i> (Artisanal fisherman 07)</p> <p>24: <i>"You could not fish with nets"</i> (Artisanal fisherman 08)</p> <p>30: <i>"You cannot fish in the Bay"</i> (Artisanal fisherman 09)</p> |
| Environmental Conservation (Turtles, etc.) | <p>25: <i>"You can't catch sharks or turtles"</i> (Conservation manager 01)</p> <p>26: <i>"It is forbidden to ride a 4-wheeler during the turtle spawning season"</i> (Foundation volunteer)</p> <p>28: <i>"You cannot affect turtles and nests, and you cannot throw garbage in the sea"</i> (Conservation manager 02)</p> |
| Beach Use and Activities Restrictions | <p>10: <i>"You can't take the dog to the beach and the boats can't enter the beach"</i> (Bartender 01)</p> <p>13: <i>"You can't play The Ball on the beach"</i> (Bartender 02)</p> <p>30: <i>"You can't unload and carry people on the beach"</i> (Bartender 03)</p> |

| | |
|---|---|
| Boating and Anchoring Regulations | 19: <i>"Now there is greater responsibility for port management"</i> (Tourism manager) 30: <i>"Vessels cannot circulate inside the buoys"</i> (Tourism manager) |
| Protected Areas | 16: <i>"We have 2 protected areas"</i> (Conservation Manager) |
| Question 4.8 "Do you think the current management program is appropriate to the Bay.?" | Interview answers |
| Adequate Rules in Place | 3: <i>"Yes, there are rules, but I'm not sure which ones."</i> (Kite tour agent) 6: <i>"You can't go and catch fish in the Estoril area."</i> (Public tourism management body) 7: <i>"You can't let go of the fish guts in Bay so as not to attract sharks."</i> (Fishmonger 01) |
| Specific Areas Covered by Rules | 22: <i>"Each club does a little of what it must do to have an order of activities."</i> (Fisherman and musician) |
| Lack of Enforcement and Compliance | 2: <i>"I don't know, I think it's worked with common sense."</i> (Beach bar catering) 9: <i>"It has to come from the community to protect the island is our home."</i> (Beach bar cook) 17: <i>"There isn't because it's not a protected area, so there's no plan of its own."</i> (Retired cargo shipowner) 18: <i>"There is still none for the Baia."</i> (Artisan ex-fisherman) |
| Insufficient or Inadequate Rules | 5: <i>"If there are rules, they are not complied with, period."</i> (Artisan street vendor) 8: <i>"You can't put fishnets 200 m from the beach."</i> (Fish monger 02) 15: <i>"All the rules that exist I think come from civil society."</i> (Owner of mobile kitesurfing school) 16: <i>"We have 2 protected areas."</i> (Restaurant and bar owner) |
| Need for More Resources | 1: <i>"Yes, the involvement of all Cape Verdean and foreign locals is necessary."</i> (Diving centre owner) 11: <i>"If it's not to leave garbage and not to touch the turtles, yes."</i> (Bartender beach) 13: <i>"You can't play football at the beach."</i> (museum employee) |

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| | <p>14: <i>"The population does not respect the rules."</i> (Beach bar owner 02)</p> <p>20: <i>"There are laws that prohibit the use of fishnets in the Bay."</i> (Artisanal fisherman 01)</p> <p>21: <i>"People still put the anchor."</i>(Artisanal fisherman 02)</p> |
| Environmental Concerns | <p>12: <i>"If by chance there is the maritime police, they don't think so."</i> (Artisanal fisherman 03)</p> <p>14: <i>"The population does not respect the rules."</i> (Beach bar worker)</p> <p>19: <i>"Now it has greater responsibility for port management."</i> (Taxi driver)</p> |
| Question 5.2 "Why should The Sal Rei Bay be protected?" | Interview answers |
| Environmental Protection (Marine Life, Ecosystems) | <p>2: <i>Yes, because snorkelling and food in the water can cause very concentrated pressure on the islet and the river near the islet. We need to be careful because the concept of protection can be misinterpreted.</i> (Beach bar restaurant 02)</p> <p>11: <i>People don't bring their trash. There are people catching turtles at night, so the Bay should be protected. We are not valuing our Bay.</i> (Beach bar bartender)</p> <p>16: <i>To protect fish, lobsters, sharks, and marine life</i></p> <p>22: <i>It is important to protect the Bay because of its beauty and the animals there, but plastic ends up being the biggest problem.</i> (Artisanal fisherman)</p> <p>29: <i>By protecting the Bay and the species, we will make it last longer and have more food.</i> (Decision-maker)</p> <p>30: <i>So that there are turtle nesting areas.</i> (Port sector)</p> <p>31: <i>There used to be military patrols to protect the turtles. Jet skis also end up affecting them.</i> (Tour operator)</p> <p>36: <i>Because there are sharks, turtles, and many fish, it should be protected for its unique and beautiful marine life.</i> (Touristic operator)</p> |

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| | <p>37: <i>It's a nursery. If we don't protect the beginning of life, it's a problem not only for the Bay but for the whole island. Enforcement is the hardest part.</i> (Conservationist 01)</p> <p>38: <i>To protect nurseries of turtles, sharks, and fish.</i> (Volunteer, Turtle Foundation)</p> <p>39: <i>Protected, yes, but I don't like rules.</i> (Touristic boat operator)</p> <p>43: <i>Because the marine life there is important.</i> (Local fisherman)</p> <p>45: <i>It's important for the animals and for us.</i> (Hotel cook)</p> <p>46: <i>Because there is a nursery for several species.</i> (Conservationist 02)</p> <p>48: <i>It helps in conserving marine life. Less coral is being destroyed; without coral, there's nothing, and the fish leave. We need to create conditions and alternatives.</i> (Dive centre owner 03)</p> |
| <p>Future Generations and Sustainability</p> | <p>5: <i>It's important to protect the Bay for the future of the island.</i> (Street vendor artisan)</p> <p>14: <i>To be able to modernize and evolve for the future.</i> (Beach bar)</p> <p>15: <i>For future generations.</i> (Owner of a mobile kite school)</p> <p>26: <i>Preserve what we have, gain more sustainability, and leave something for future generations.</i> (Decision-maker 01)</p> |
| <p>Economic and Touristic Value</p> | <p>9: <i>It has to be protected. They care more about tourism. The whites care more than Cape Verdeans, but we wait for the government. Only hotels will be built.</i> (Beach bar cook)</p> <p>25: <i>Because it is a treasure, an unimaginable heritage. For 12 years, I've brought friends, and everyone loves it. People have unique life experiences in this Bay.</i> (Tourist)</p> <p>28: <i>Very much so, because the economic value here depends a lot on the environment and the landscape.</i> (Conservationist 03)</p> |

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| | <p>33: <i>Because even as a protected area, it can continue to have activities, add to scientific knowledge, and benefit the island.</i> (Diving centre owner 02, tour operator)</p> <p>42: <i>The beach is very important for everyone in Boa Vista. People don't have access to other beaches, and it's very expensive. It's important for tourists too, and it helps my business.</i> (Fruit vendor, market)</p> |
| <p>Need for Regulation and Enforcement</p> | <p>1: <i>We don't need many rules, but we must ensure that fishing limits and fishing gear/jet skis are respected.</i> (Diving owner 01)</p> <p>2: <i>Yes, because snorkelling and food in the water can cause very concentrated pressure on the islet and the river near the islet. We need to be careful because the concept of protection can be misinterpreted.</i> (Beach bar restaurant #2)</p> <p>3: <i>Otherwise, it will get ruined. Especially with quad bikes—there must be laws and documents.</i> (Wind surf touristic operator)</p> <p>6: <i>Yes, for me, it was important to have some kind of control over activities and zoning of the areas.</i> (Government employee 01)</p> <p>7: <i>It's important for everyone to follow the rules so that there are better conditions.</i> (Fish vendor)</p> <p>10: <i>Some more rules are needed, but not to control everything.</i> (Artisanal fisherman 03)</p> <p>20: <i>Because minors go to the sea, and there isn't much education.</i> (Bartender)</p> <p>21: <i>Yes, I think it's important to protect the Bay, put up trash signs, and supervise the beach.</i> (Kite tourism agent)</p> <p>27: <i>The delegation made a proposal, but it didn't advance. It was a participatory proposal that involved the population.</i> (Decision-maker 02)</p> <p>31: <i>There used to be military patrols to protect the turtles. Jet skis also end up affecting them.</i> (Tour operator)</p> |

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| | <p>32: <i>It's the only way to protect the Bay; things have progressed too much not to have protection—at least partial protection.</i> (Government employee 02)</p> <p>37: <i>It's a nursery. If we don't protect the beginning of life, it's a problem not only for the Bay but for the whole island. Enforcement is the hardest part.</i> (Conservationist 01)</p> <p>39: <i>Protected, yes, but I don't like rules.</i> (Boat tour operator)</p> <p>44: <i>Because people bathe their dogs there, and that's for people. There needs to be more control due to trash and other things.</i> (Taxi driver)</p> |
| <p>Cultural and Social Importance</p> | <p>4: <i>Without being radical, there needs to be space for human activities with responsibility, without imposition. It's important to focus on education and information! Waste management.</i> (Local accommodation)</p> <p>8: <i>It's important for users and children to be able to continue using the Bay.</i> (Fish vendor)</p> <p>18: <i>Yes, I would very much like there to be more respect for the place.</i> (Retired cargo shipper)</p> <p>23: <i>Because it's a monument of the city.</i> (Fisherman and musician)</p> <p>27: <i>The delegation made a proposal, but it didn't advance. It was a participatory proposal that involved the population.</i> (Decision-maker, 02)</p> <p>42: <i>The beach is very important for everyone in Boa Vista. People don't have access to other beaches, and it's very expensive. It's important for tourists too, and it helps my business.</i> (Fruit vendor, market)</p> <p>45: <i>It's important for the animals and for us.</i> (Hotel cook)</p> <p>47: <i>Because it touches everyone, it's part of the community, and no one wants the space to be unreserved. With the development of the Bay, it will no longer belong to the people and will belong to the "whites."</i> (Hotel manager)</p> |

| | |
|---|---|
| <p>Aesthetic and Recreational Value</p> | <p>22: <i>It is important to protect the Bay because of its beauty and the animals there, but plastic ends up being the biggest problem.</i> (Artisanal fisherman 04)</p> <p>24: <i>I think it's important because things would be safer in the Bay.</i> (Retired fisherman)</p> <p>25: <i>Because it is a treasure, an unimaginable heritage. For 12 years, I've brought friends, and everyone loves it. People have unique life experiences in this Bay.</i> (Tourist)</p> <p>34: <i>Maintaining the attractiveness.</i> (Resort manager)</p> |
| <p>Concerns About Degradation</p> | <p>3: <i>Otherwise, it will get ruined. Especially with quad bikes—there must be laws and documents.</i> (Kite surf touristic operator)</p> <p>9: <i>It has to be protected. They care more about tourism. The whites care more than Cape Verdeans, but we wait for the government. Only hotels will be built.</i> (Beach bar cook)</p> <p>12: <i>Big boats come to the beach to take all the bait.</i> (Artisanal fisherman)</p> <p>13: <i>To not ruin the Bay.</i> (Museum employee)</p> <p>19: <i>Yes, because of the importance of the Bay and the degradation that has been happening.</i> (Artisan and ex-fisherman)</p> <p>24: <i>I think it's important because things would be safer in the Bay.</i> (Retired fisherman)</p> <p>32: <i>It's the only way to protect the Bay; things have progressed too much not to have protection—at least partial protection.</i> (Government worker)</p> <p>35: <i>It must be protected urgently because it may already be too late.</i> (Tour operator)</p> <p>40: <i>Because we dive and like to see the fish. With nets, they catch everything, even the small fish.</i> (Barber)</p> |

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| | <p>41: <i>Because in 15 years, we won't have a Bay.</i> (Hotel employee)</p> <p>48: <i>It helps in conserving marine life. Less coral is being destroyed; without coral, there's nothing, and the fish leave. We need to create conditions and alternatives.</i> (Dive centre 03)</p> |
| <p>Question 5.4 “Why is it important for local community to be involved in the protection of the Bay?”</p> | <p>Interview answers</p> |
| <p>Community Responsibility and Stewardship</p> | <p>6: <i>Because otherwise there will be no result. It is an extension of the people's home. If they are involved from the start and participate, many harmful behaviours can be avoided.</i> (Government employee 01)</p> <p>9: <i>It has to come from the community to protect the island; it is our home.</i> (Beach bar cook)</p> <p>13: <i>Because it is good to protect the island.</i> (Museum employee)</p> <p>15: <i>Because it is ours; if we do not protect it, who will protect the government?! No!</i> (Kite surf school owner)</p> <p>16: <i>To protect the nursery so it can grow and provide more income to those who live here.</i> (Restaurant bar 01)</p> <p>22: <i>Because it is mainly the tourists and foreigners who use it; it is important to reconnect the population with the Bay.</i> (Fisherman and musician)</p> <p>23: <i>For future generations to find something better.</i> (Retired fisherman)</p> <p>26: <i>It has economic and emotional interests in this area; in addition, it has local knowledge.</i> (Decision-making entity 01)</p> <p>27: <i>It is an area with so much use that it will be difficult not to include everyone. It is very important.</i> (Conservationist 01)</p> <p>28: <i>We will hold people accountable, and with that, pay more attention to the Bay.</i> (Decision-making entity 02)</p> <p>29: <i>Any decision that impacts the average citizen should be heard. This is to avoid measures that do not meet their needs later.</i> (Government employee 02)</p> |

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| | <p>30: <i>They know it well; they can help, and it is fair; moreover, they know the Bay very well.</i> (Tourist operator)</p> <p>32: <i>We all live here; we benefit from it; it brings tourism and money to the island, which is important for everyone and will dynamize the island.</i> (Dive centre tourist operator)</p> <p>33: <i>They are the most interested party in the Bay; if they destroy it, they could lose a lot indirectly.</i> (Hotel manager 01)</p> <p>34: <i>I think it is important to start with the fishing children because everyone benefits directly or indirectly.</i> (Tourist operator)</p> <p>36: <i>There is no way to enforce without community participation; there must be involvement for a change in mentality to occur.</i> (Conservationist 01)</p> <p>40: <i>Because the Bay is used by them.</i> (Resort employee)</p> <p>44: <i>Because community businesses depend on the Bay for there to be a balance between community and conservation.</i> (Conservationist 02)</p> <p>46: <i>It is essential; the community needs to collaborate for things to happen; otherwise, nothing will happen.</i> (Dive centre 03)</p> |
| <p>Improving Management Outcomes</p> | <p>4: <i>Because without community participation, the community will not be educated or informed, and thus the mission of managing the Bay will not be fulfilled.</i> (Local Accommodation)</p> <p>6: <i>Because otherwise there will be no result. It is an extension of the people's home. If they are involved from the start and participate, many harmful behaviours can be avoided.</i> (Government employee 01)</p> <p>12: <i>Because with everyone united, it will work better.</i> (Artisanal fisherman 01)</p> <p>18: <i>Unity is strength; if we unite for this cause, it will have an impact. Otherwise, the next generation will find nothing, which is very sad.</i> (Artisan fisherman 02)</p> <p>24: <i>It is the only way for things to work; otherwise, it would not work. The turtles are a good example; it is the population that defends them and the areas where they live.</i> (Tourist)</p> <p>28: <i>We will hold people accountable, and with that, pay more attention to the Bay.</i> (Decision-making entity 02)</p> <p>36: <i>There is no way to enforce without community participation; there must be involvement for a change in mentality to occur.</i> (Conservationist 01)</p> |

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| | <p>37: <i>The only way to work is if people understand what is being done.</i> (Volunteer turtle foundation)</p> <p>45: <i>Things can be discredited due to a lack of information. It is essential to have community ambassadors to recruit people and support the protection of the Bay. When the effort comes from the community, the positive impact increases, without creating resistance to tourism.</i> (Hotel manager 02)</p> |
| <p>Local Knowledge and Expertise</p> | <p>13: <i>Because it is good to protect the island.</i> (Museum employee)</p> <p>26: <i>It has economic and emotional interests in this area; in addition, it has local knowledge.</i> (Decision-making entity 01)</p> <p>30: <i>They know it well; they can help, and it is fair; moreover, they know the Bay very well.</i> (Tourist operator)</p> <p>33: <i>They are the most interested party in the Bay; if they destroy it, they could lose a lot indirectly.</i> (Hotel manager 01)</p> <p>38: <i>Yes, from childhood, with awareness and education not only in the Bay but for the rest of the country.</i> (Tourist boat operator)</p> <p>40: <i>Because the Bay is used by them.</i> (Resort employee)</p> |
| <p>Ensuring Compliance and Enforcement</p> | <p>1: <i>Yes, it is necessary for the involvement of all local Cabo Verdeans and foreigners.</i> (Dive centre 01)</p> <p>3: <i>Yes, there used to be more people taking care of the Bay; now no one seems to care much about it.</i> (Kite tourist agent)</p> <p>4: <i>Because without community participation, the community will not be educated or informed, and thus the mission of managing the Bay will not be fulfilled.</i> (Local Accommodation)</p> <p>5: <i>It is important for everyone to be united to protect the Bay.</i> (Artisan street vendor)</p> <p>6: <i>Because otherwise there will be no result. It is an extension of the people's home. If they are involved from the start and participate, many harmful behaviours can be avoided.</i> (Government employee 01)</p> <p>11: <i>If it is to not leave trash and not mess with the turtles, yes.</i> (Beach barman)</p> <p>12: <i>Because with everyone united, it will work better.</i> (Artisanal fisherman 01)</p> <p>19: <i>It is important for everyone to participate and hear everyone's opinion; only then will it work.</i> (Barman)</p> |

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| | <p>24: <i>It is the only way for things to work; otherwise, it would not work. The turtles are a good example; it is the population that defends them and the areas where they live.</i> (Tourist)</p> <p>36: <i>There is no way to enforce without community participation; there must be involvement for a change in mentality to occur.</i> (Conservationist 01)</p> <p>37: <i>The only way to work is if people understand what is being done.</i> (Volunteer turtle foundation)</p> <p>41: <i>There are already people who protect the turtles.</i> (Local Fisherman)</p> <p>42: <i>Yes, it is important for everyone to participate.</i> (Security guard)</p> |
| <p>Economic Interests and Benefits</p> | <p>16: <i>To protect the nursery so it can grow and provide more income to those who live here.</i> (Restaurant bar)</p> <p>25: <i>The population should be the first to benefit and have a very close relationship with the Bay. They should be involved in these matters.</i> (Decision-making entity 03)</p> <p>26: <i>It has economic and emotional interests in this area; in addition, it has local knowledge.</i> (Decision-making entity 01)</p> <p>32: <i>We all live here; we benefit from it; it brings tourism and money to the island, which is important for everyone and will dynamize the island.</i> (Dive centre tourist operator)</p> <p>44: <i>Because community businesses depend on the Bay for there to be a balance between community and conservation.</i> (Conservationist 02)</p> |
| <p>Cultural and Social Connection to the Bay</p> | <p>15: <i>Because it is ours; if we do not protect it, who will protect the government?! No!</i> (Kite surf school owner)</p> <p>17: <i>I think it is important for people to change their mentality.</i> (Former cargo shipper)</p> <p>22: <i>Because it is mainly the tourists and foreigners who use it; it is important to reconnect the population with the Bay.</i> (Fisherman and musician)</p> <p>23: <i>For future generations to find something better.</i> (Retired fisherman)</p> <p>34: <i>I think it is important to start with the fishing children because everyone benefits directly or indirectly.</i> (Tourist operator)</p> <p>35: <i>20 years ago, I was an agent of Boa Vista; nowadays, there is a lot of emigration, and with the very rapid population growth, there has been the emergence of stalls with fewer conditions because the growth was so</i></p> |

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| | <p><i>rapid, and the city did not keep up. There is less sense of community!</i> (Local accommodation 02)</p> |
| <p>Challenges in Implementation and Mixed Opinions</p> | <p><i>2: I don't know if it would work to have the involvement of the entire community because there are too many interests. (Beach bar restaurant) 7: Rules need to be made, but there must be conditions for them to be followed so that people do not break the law. (Fisherman)</i></p> |