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Defining and bridging the barriers to more effective conservation of island ecosystems: A practitioner's perspective

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Abstract

The failure to meet global biodiversity targets clearly indicates the need for biodiversity management and conservation efforts to be more effective, and this in turn requires better understanding of the current barriers to success. Islands are known as biodiversity hotspots but nowhere has biodiversity loss been so acute as in island ecosystems. To identify the barriers to effective island ecosystem conservation, we conducted 32 semistructured interviews with conservation and management practitioners from island nations in the Western Indian Ocean region. Practitioners described 33 barriers to meeting their objectives under 12 overarching topics and suggested 14 solutions to these. Most barriers described by interviewees existed at organization level (55%), followed by national (24%) and site/project level (21%). Of the 33 barriers described by practitioners, the most commonly associated cause was limited capacity (23.5%), followed by lack of government coordination and limited resources (both 21.6%), lack of incentives (11.8%), poor leadership (11.7%), and finally interpersonal issues interfering with progress (9.8%). Most solutions centered around bridging capacity gaps. By defining these barriers, we can bring them forward for discussion and allocate resources and efforts to bridging them. Only by doing so can we increase the effectiveness of our management efforts and maximize our chances of achieving global biodiversity targets.

KEYWORDS
conservation management, island ecosystems, National Coordination, Seychelles, Small Island Developing States, social survey, Western Indian Ocean

1 | INTRODUCTION

Despite efforts to halt the accelerating loss of biodiversity (Ceballos et al., 2015), the Aichi Biodiversity Targets for 2010 and 2020 were not met at a global level (CBD, 2010, 2020). The reports outlining these failures do not detail why

they have occurred except to say that "*national targets are generally poorly aligned with the Aichi Biodiversity Targets, in terms of scope and the level of ambition*" (CBD, 2020). If future failures are to be avoided, a better understanding of current barriers to biodiversity management and conservation success is needed (Xu et al., 2021), especially at sites

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with disproportionally high levels of biodiversity loss, such as islands (Tershy et al., 2015). This will be key to implementing more ambitious and effective national level biodiversity management efforts.

Two major barriers to achieving global biodiversity targets are well addressed in the literature. The first is financial limitations (e.g., Coad et al., 2019; McCarthy et al., 2012). It is estimated that to protect and effectively manage sites of global conservation significance will require conservation funding to increase by at least an order of magnitude (McCarthy et al., 2012). The second is the documented lack of evidence-based decision-making in conservation management (Cvitanovic et al., 2016; Legge, 2015; Rose et al., 2018; Walsh et al., 2019). Practitioners manage species and ecosystems through a combination of active management (Sutherland et al., 2019) (e.g., enforcing site protection, habitat restoration, invasive alien species eradications), research (Fazey et al., 2005), and monitoring (Lindenmayer & Likens, 2009), with the latter two generating the evidence on which decisions can be made about the former. Therefore, if monitoring and research are well conducted, the information generated can play a vital role in achieving effective management and meeting biodiversity conservation objectives (Lindenmayer, Gibbons, et al., 2012; Lindenmayer, Wood, et al., 2012; Lindenmayer & Likens, 2010). However, such programs often do not deliver (Lindenmayer et al., 2013; Lindenmayer & Likens, 2009). While financial limitations and lack of evidence-based decision-making undoubtedly contribute to missed targets, there are likely a raft of other barriers operating at multiple levels across the management landscape that are not so clearly defined or addressed.

The ability of a country to meet national targets (and so contribute to global targets) depends on the combined efforts of a diverse group of practitioners working across sectors and scales. While this diversity offers an opportunity to capture the breadth and depth of different considerations, knowledge and experience, spatial, and temporal mismatches and barriers to collaboration are likely to hinder conservation success (Guerrero et al., 2013; Kark et al., 2015). For example, the scale of management ranges from single sites and species to national governance of whole ecosystems and natural resources. Practitioners include those working within and for government, who enact land/sea use designation, develop appropriate policy, and implement and enforce legislation. Outside government, practitioners include those working in nongovernmental organizations (e.g., Clifton et al., 2019) and private companies, as well as researchers and consultants who work with these organizations to generate information useful for management. Management at local level usually aims to achieve site- or taxon-specific conservation goals and collectively these site-level successes or failures influence national targets. Ideally, there should be synergies between national and local level; whereby government departments define and coordinate national targets linked to local organization/project objectives and, in turn, government decisions are guided or prompted by the information generated from these smaller management bodies. However, significant barriers often prevent these important interactions between national and local level from happening (Cook et al., 2013).

There is little detailed understanding of the day-to-day barriers to success and where precisely they occur: for example, whether at project/site, organizational or national level, and whether they result from institutional issues (such as lack of expertise and staffing), poor governance, lack of societal support, and social complexities (Nuno et al., 2014), or other factors. Although several studies have described barriers to effective biodiversity conservation, these have mostly focused on specific barriers and have not fully considered practitioners, or have focused on the perspectives of senior practitioners in upper management (Forster et al., 2011; Sanders et al., 2019). To obtain a more complete picture, we need to understand the views of practitioners across seniority levels and sectors, especially those at the very frontline of tackling biodiversity loss.

Nowhere has biodiversity loss been so acute as in island ecosystems (Brooks et al., 2002), where invasive alien species (Harper & Bunbury, 2015; Prior et al., 2018), habitat loss (Brooks et al., 2002) and climate change (Courchamp et al., 2014) have all had major impacts, causing extinctions and reducing surviving populations to critical levels. Despite major conservation progress and the development of pioneering techniques, such as invasive alien species management (Bunbury et al., 2019; Jones et al., 2016), translocations (Burt et al., 2016; Jones & Kress, 2012) and in situ species management (Samways et al., 2010), these pressures are compounded in island nations—especially Small Island Developing States (SIDS)—which are highly dependent on biodiversity for their economic and social wellbeing (Mouillot et al., 2020). However, capacity and resource constraints (human, institutional, and financial) can often hinder national and regional responses (Cherian, 2007).

Identifying barriers based on past experience is an important step toward achieving success (e.g., Samaniego et al., 2021). Therefore, here we focus on Western Indian Ocean (WIO) islands (where the lead and senior authors are based), including the SIDS of Seychelles and Mauritius. We interviewed practitioners across sectors and seniority levels who are involved in island ecosystem management and compiled the first in-depth case-study on the barriers to more effective management of island ecosystems from

a practitioner's perspective. Our aims are to: (1) identify the barriers practitioners face in meeting management objectives and their causes; and (2) generate ideas to strengthen and support island ecosystem management and discuss ideas for follow-up actions.

2 | METHODS

2.1 | Study area

The study focuses on island ecosystem management and conservation practitioners in the WIO, which is a global biodiversity hotspot (Myers et al., 2000) and identified as a key area to prioritize for the conservation of global marine biodiversity (Ramírez et al., 2017). This region is characterized by islands which vary greatly in size, culture, socioeconomic context, and political status (Bouchard et al., 2019). The islands have unique environmental origins (volcanic, granitic, or coralline) as well as cultural (settlers from various origins; African, Arabic, European, Indian, and Chinese). The cultural heritage of the islands is heavily defined by their colonial history (especially French) and the slavery which accompanied that. Despite these differences, the islands within this region share natural heritage, including the rich terrestrial biodiversity unique to the islands and extensive marine biodiversity which forms the basis of the region's economy (Selig et al., 2019). This natural heritage is threatened by overexploitation, destruction of habitat, invasive alien species, and pollution.

Most interviews were conducted with practitioners from the Republic of Seychelles (where the lead and senior authors work), an archipelago of 115 islands stretching across an exclusive economic zone of 1.4 million km^2 with about 98,000 citizens (UN Department of Economics and Social Affairs, 2019), three-quarters of whom live on the main island of Mahé. Other interviewees were based in Mauritius, La Réunion (France) and Madagascar.

2.2 | Interviewee selection

We recognize that there are many roles associated with island ecosystem management. We therefore included not only staff working within conservation organizations but also conservation practitioners working on privately managed islands, government staff, consultants within the region who have many years of experience working with different organizations, and academics and researchers who have worked with conservation organizations to implement and achieve conservation and management objectives. Within organizations, where appropriate, we requested to interview staff from across seniority levels, for example,

CEOs, managers, and field staff. A criteria for participation was that practitioners, as part of their work, aimed to manage, conserve, or restore biodiversity to the island ecosystems within their jurisdiction, including playing a role in data collection and/or processing (either directly or through partnerships) to obtain information that would inform their management decisions or those of higher-level entities, such as government. All interviewees also needed to have a minimum of 2 years' experience in their current or a related role in island ecosystem management to participate.

Prospective interviewees were identified firstly by listing all island management and conservation bodies for the islands in the study region, either through consultation with people working there or through informal internet searches. Then perspective interviewees (or organizations where individual contact details were not available) were contacted via email to explain the project and request an interview. To enroll an appropriate number of interviewees representing a wide range of experiences while avoiding potential sampling biases due to researchers' personal networks and perceptions about the issues (Newing, 2010), we also employed respondent-driven sampling; this approach involves requesting those directly contacted to recruit additional participants among colleagues, peers and other organizations. A total of 68 individuals were contacted via email and asked for an interview (Table 1).

2.3 | Survey design and data collection

Interviews were conducted whenever possible in person (34%) and, when this was not feasible or preferred, via Skype (32%) or written (34%) via email exchange and took place between April and December 2019. Consent for participation was obtained before each interview. Interviews used a semistructured approach, following discussion guidelines that combined open-ended questions, more direct questions and "organic questions" that arose from interviewee responses (see Figure 1 for overall structure and supplementary material section 4 for the full interview outline); this is particularly useful to gather more indepth personal perspectives on challenges faced by specific respondents (Newing, 2010). The predetermined topics were generated based on the authors' personal experiences of working in island conservation management and a review of literature around the current understanding of factors that drive and influence effective management of biodiversity (e.g., Bottrill et al., 2011; Cook et al., 2014; Legge, 2015; Lindenmayer & Likens, 2010; Lindenmayer, Wood, et al., 2012; Reynolds et al., 2016; United Nations General Assembly, 2015; Walsh et al., 2015). The topics, however, remained broad to prevent biasing interviewees. The interview

TABLE 1 Information about the 32 interview respondents: (a) the number of interviews conducted for each of the countries in the Western Indian Ocean region included in this study, (b) the number of interviewees per role description, and (c) the number of participants per place of work

(a)	Island/archipelago (country)	# Interviewed
	Madagascar	1
	Mauritius and Rodrigues (Republic of Mauritius)	6
	La Réunion (France)	2
	Seychelles (Republic of Seychelles)	23
	Total	32
(b)	Role of participant	
	Conservation officer/coordinator/ site manager	12
	Researcher/academic	9
	CEO/director	5
	Field assistant/warden/ranger	4
	Local consultant	3
(c)	Place of work	# Interviewed
	NGO	14
	Academic institute	6
	Public trust/parastatal	4
	Government	3
	Private island	3
	Consultant/self-employed	2

started by asking the interviewee "Tell me about your role in island ecosystem management" and continued as outlined in Figure 1, prompting the interviewee for additional information or particulars where necessary and adding follow-up questions to new ideas the interviewees introduced. Toward the end of the interview, interviewees were asked to make suggestions for what would be most impactful in improving their ability to fulfill management objectives.

2.4 | Data analysis

The interviewee responses were transcribed directly during interviews, which prevented interviewee wariness that could arise during recorded interviews when discussing other organizations or using specific examples. The downside of this method was that consequently, some of the transcripts were abridged in sections, though the main points and their meanings were all documented. Each transcript was then reviewed to develop a conceptual framework from qualitative data using a hybrid approach of inductive and deductive coding (Hsieh & Shannon, 2005). All coding was done initially by researcher A. J. B.

Deductive coding was used firstly by grouping barriers mentioned by practitioners based on the predetermined topics developed when designing the interview, resulting in the following initial codes of barrier themes expected in the interviewee responses: data management and analysis;
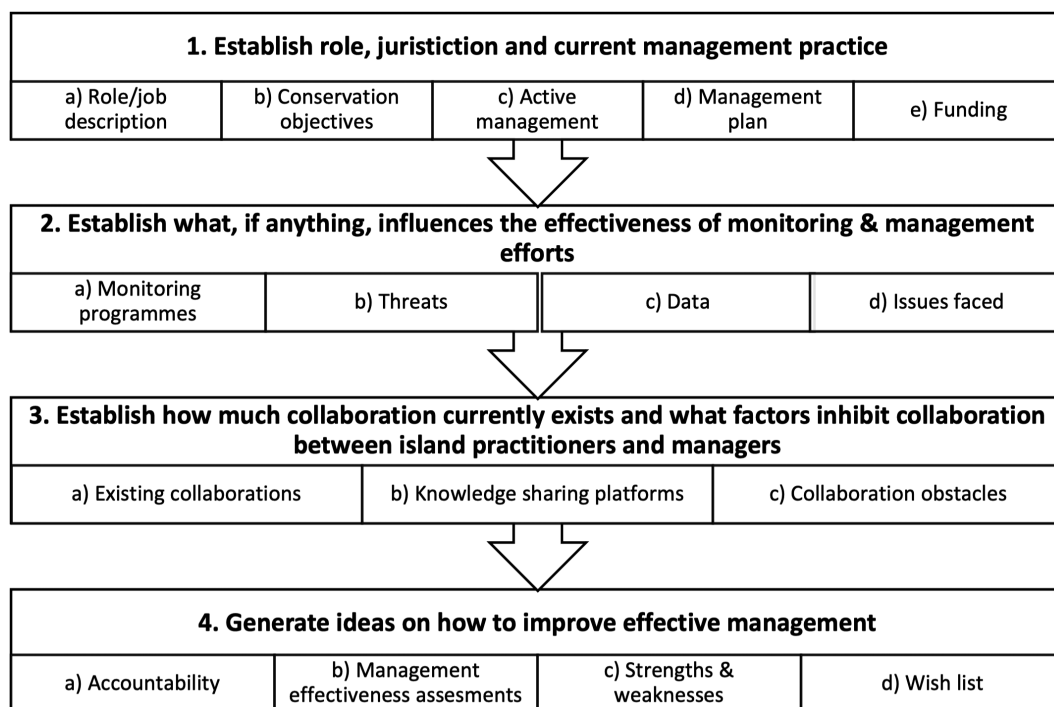
FIGURE 1 Schematic representation of the semistructured interview employed

collaborations and communication; and management objectives and resources. Inductive coding was used when a barrier was discussed that did not belong to a pre-determined topic and was therefore assigned/coded to a new topic. New topics added to the coding framework were: education; government capacity and coordination; policy and legislation; national research strategy; staffing; organization leadership; knowledge exchange and communication forums; and site/project management and leadership. This resulted in 12 topics (Figure 2(a)), four which were pre-determined, and eight which arose organically.

While coding the barriers under main topics, it became clear that the topics could also be categorized based on their provenance (i.e., at which level they arose within the management system), for example, if a practitioner described "lack of coordination by government" then it was clear that this barrier needed to be addressed not by individual organizations or projects but at national level. Conversely, if a practitioner described "no time for data analysis" this was clearly a barrier operating at individual site/project level. Each topic with its associated barriers was therefore coded most logically to: (a) national level (e.g., policy and legislation); (b) organization level (e.g., staffing/resources); and (c) site or project level (e.g., data management; Figure 2, Table S1).

Based on participants' comments about specific barriers we could also assign one or more causes to the barriers (Table S2). We therefore listed causes for each barrier, for example, poor database design could be attributed to lack of data management skills/capacity. Other barriers were self-explanatory, for example, low capacity in data analysis. From this exercise, six major causal links emerged: (1) limited capacity; (2) poor leadership; (3) lack of government coordination; (4) interpersonal issues; (5) lack of incentives; and (6) limited resources. Within the scope of this study, we refer to the term "capacity" strictly in relation to skill capabilities rather than the broader term which may also encompass resources. The networkD3 package in R Core Team (2020) was used to map these causes in a Sankey network diagram (Figure 3) to show the underlying causes of the barriers raised by practitioners at each level (national, organizational and project/site).

3 | RESULTS

Of the 68 (30 females, 38 males) practitioners invited for an interview, 32 interviews were conducted (20 females [67% response rate], 12 males [32%
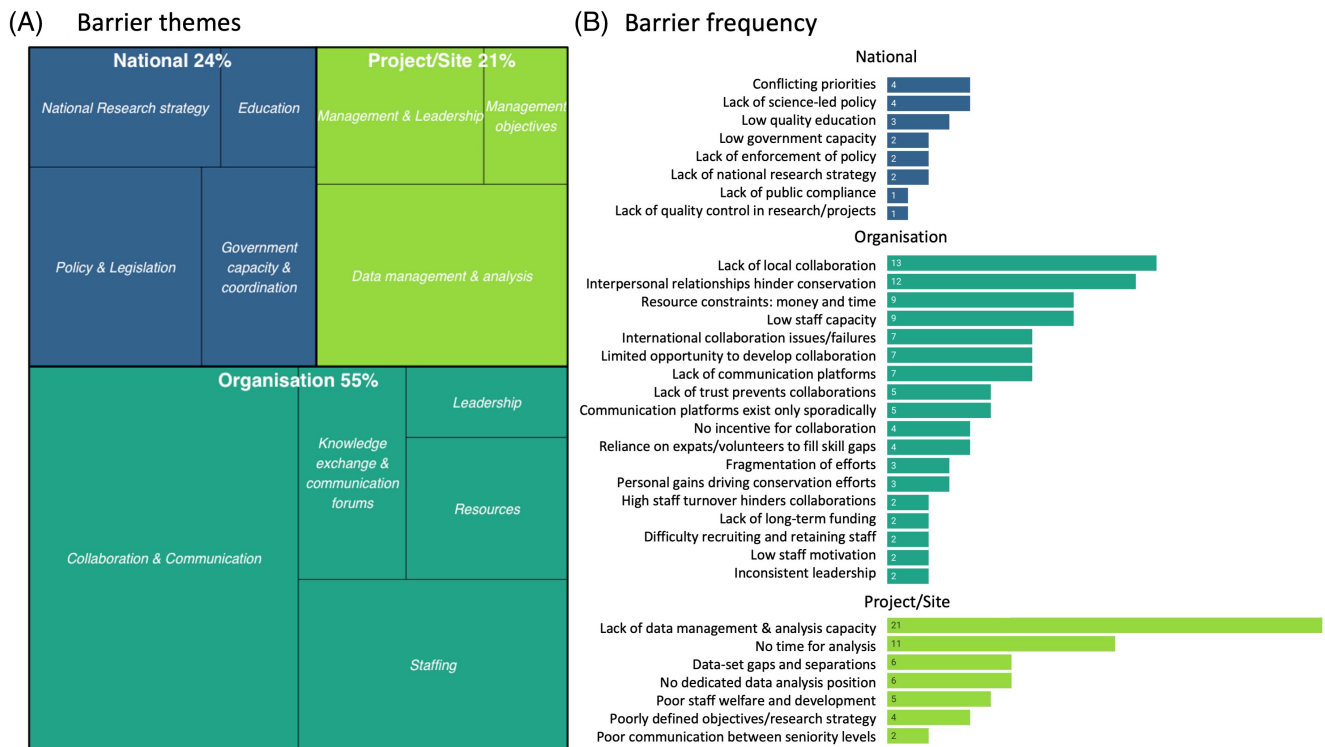
FIGURE 2 (a) Treemap plot presenting the proportion of barriers for each of the 12 main topics discussed during interviews, organized by the provenance level associated with each of the barriers showing the percentage of barriers that fall into each level. Each block size is proportionate to the number of barriers that topic represents. (b) Bar chart showing the number of practitioners who mentioned each barrier from the 32 interviews
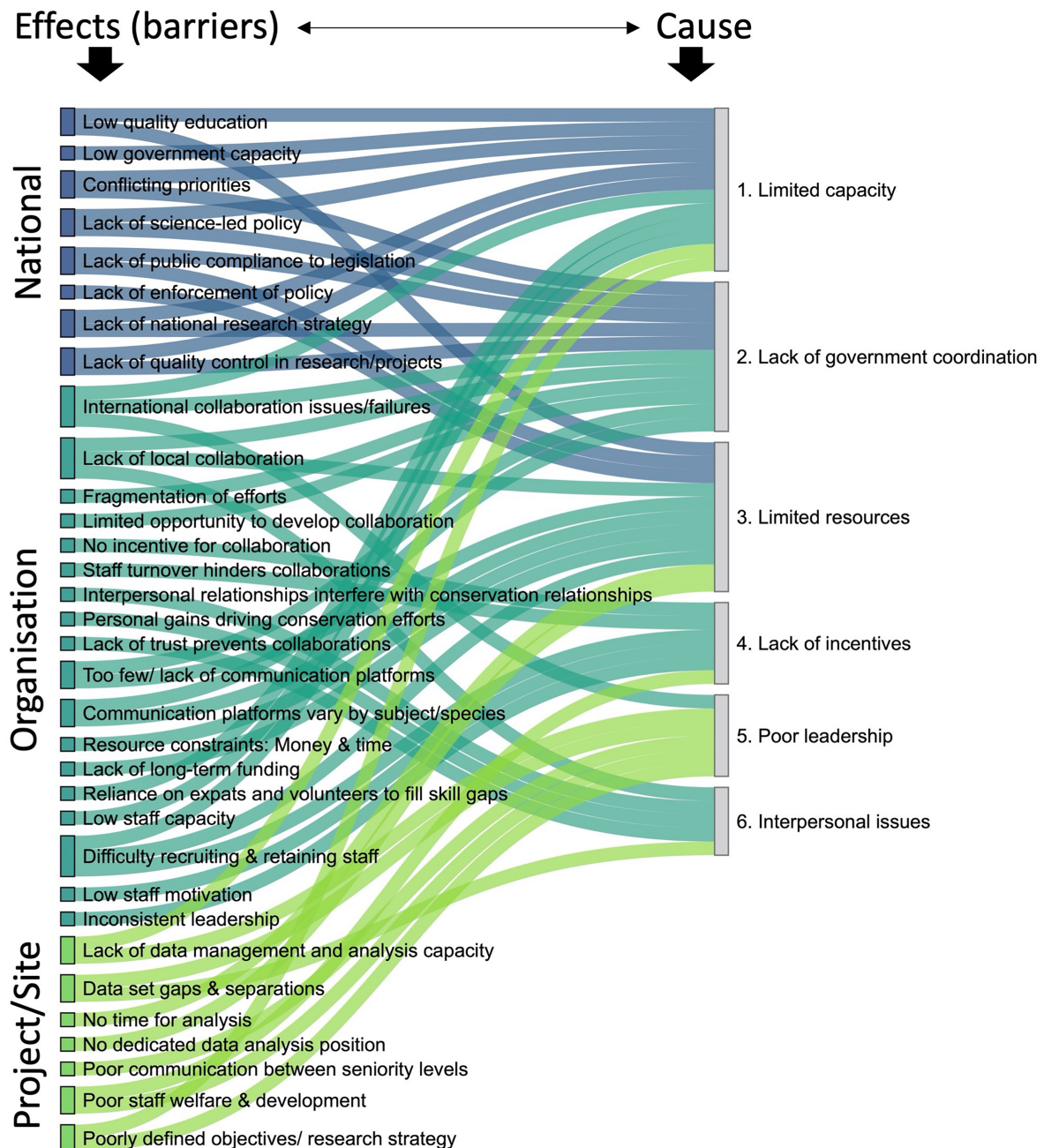
FIGURE 3 A Sankey diagram linking barriers from each provenance level (National, Organization, Project/Site) to the main causes. One barrier may stem from one or more causes

response rate]) from four countries and four islands in the WIO region (Table 1(a)), an overall response rate of 47%. Interviews lasted from 35 min to 2 hr with mean interview length of about 1 h. The seniority level of interviewees varied from high-level management positions and government officials to on-site field staff (Table 1(b)). The organizations to which interviewees belonged included: privately-owned islands; NGOs that manage one or more islands or parts of islands; government employees in Ministry for the Environment roles; and researchers from educational institutes that work

closely with organizations on conservation and management projects (Table 1(c)).

3.1 | Barriers to effective management

We identified 33 barriers under 12 topics that practitioners raised during the interviews in regard to meeting conservation and management objectives. Table S1 lists these specific barriers and key illustrative quotes lifted from the interviews. The majority of barriers described by

interviewees existed at organization level (55%; Figure 2(a)), followed by national level (24%) and site/project level (21%). The themes under which practitioners described the most barriers were "collaboration", "staffing" and "data management and analysis" (Figure 2(a)). The number of barriers grouped in each topic reflects the variety of barriers, not the frequency with which they were mentioned. The most frequently mentioned barriers were lack of data analysis and management capacity (21 of 32 practitioners mentioned this; Figure 2(b)), lack of local collaboration (13), interpersonal relationships interfering with conservation/working relationships (12) and no time for data analysis (11).

3.2 | Cross-cutting causes

Of the 33 barriers described by practitioners, the most frequently associated cause was limited capacity (23.5%; Figure 3) followed by lack of government coordination (21.6%), limited resources (21.6%), lack of incentives (11.8%), poor leadership (11.7%), and finally interpersonal issues interfering with progress (9.8%). The contribution of causes to barriers varied between levels (Figure 3). The majority of national-level barriers were caused by limited capacity (43%) and lack of government coordination (36%). The organization-level barriers had a wider set of causes, dominated by lack of government coordination (23%), limited resources (23%), lack of incentives (19%), limited capacity and interpersonal issues (each with 15%). Finally, at project and site level, the majority of barriers were caused by poor leadership (45%), followed by limited capacity and limited resources (each with 18%), lack of incentives (9%), and interpersonal issues (9%). Note: some of the actual barriers listed became causal links, for example, capacity was listed in several barriers and became a causal link.

3.3 | Improving effective management

Practitioners suggested 14 solutions (Table S3) that would most enhance their ability to achieve more effective island ecosystem management and conservation, and we have linked their suggestions (where possible) to the most closely linked cause (Figure 4). Interestingly, there were no proposed solutions for dealing with interpersonal issues. The most frequently suggested solution centered around the need for more funding (Figure 4), though few of these suggested how funding streams could be enhanced, other than to extend project funding beyond the standard 2–3 years. Following this was the suggestion that there should be enhanced transparency and accountability around the outcomes of actions and funding.

As 12 of the 33 barriers were entirely or partially attributed to limited capacity, 5 of these solutions were centered around recruiting and retaining a high-capacity staff team. This included the recruitment of additional personnel, such as a database manager or an internal researcher to ensure standardized data collection that was analyzed properly and used to inform management. Another suggestion was to ensure long-term inducement in the form of pay increments and giving staff chances to progress via training opportunities and career development.

To enhance coordination of efforts, one practitioner suggested that an annual, government-coordinated symposium become a compulsory event for appropriate ministers, practitioners, and researchers; each organization could present their work, which would be open to scrutiny by peers, facilitating a more transparent model for conservation at the national level. In addition, it was proposed that each organization have a clear set of management objectives incorporated into a plan and that this is linked with a national research strategy.

4 | DISCUSSION

Organizations, government departments, private companies, and research institutes are channeling vast resources (McCarthy et al., 2012) into the conservation and management of biodiversity. If these efforts are effective, this would collectively translate into national level conservation and management achievements and subsequently contribute toward meeting global biodiversity targets. Our research has uncovered a raft of barriers operating across management levels, stemming from six main causal links, which interfere with the ability of practitioners to achieve local and national conservation objectives in the WIO.

4.1 | Causal link 1: Limited capacity

The term "limited capacity" is frequently described as an issue within environmental conservation (Bawa, 2006; Lee & Jetz, 2008), but often without reference to what specific type of "capacity" is lacking. In our study, staff capacity limitations were identified as a key barrier but also a cause of several other barriers described by practitioners.

Many skill-sets are required by an organization to meet conservation targets, as outlined by Salafsky et al. (2002). Our survey has identified which skills are lacking in conservation and management of island ecosystems in the WIO region. At the national level, practitioners perceived capacity gaps in the skills/abilities to:
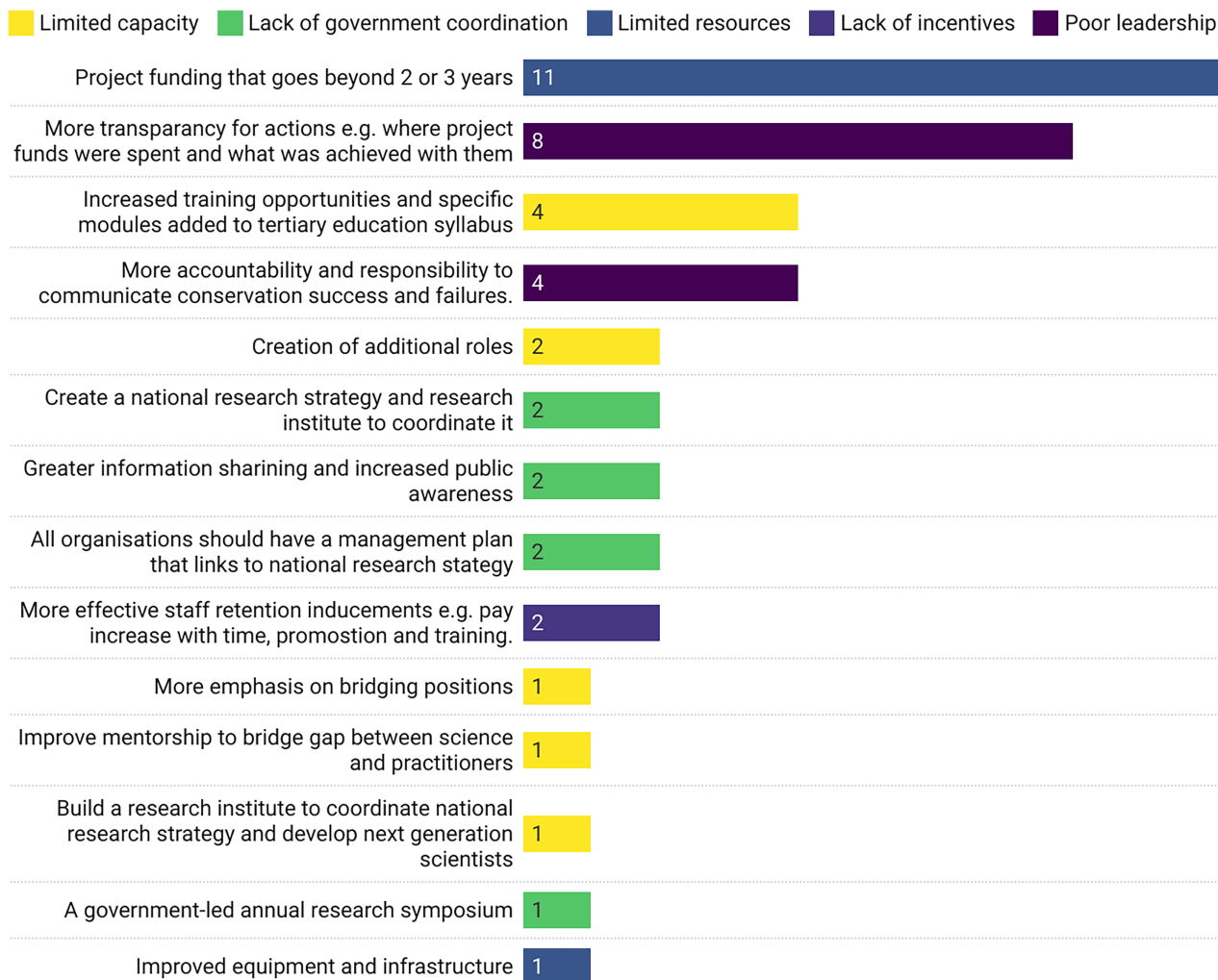
FIGURE 4 The frequency with which each solution was proposed by practitioners, grouped based on the main barrier cause they most relate to

(1) coordinate national efforts and develop a national research strategy ("*It's the blind leading the blind*"); (2) critically review projects and their scientific rigor; and (3) implement scientifically sound conservation and management of island ecosystems. At organization and project levels, skills perceived to be lacking were: (4) leadership and management; (5) data management and analysis; and (6) the ability to define research and monitoring objectives that effectively inform management. The lack of these skills was attributed to in-country tertiary education standards ("*Most students are not getting the core skills needed or to a standard that's required to progress in any conservation research or management role*") and a lack of internal training opportunities and skill development through skill exchange and/or mentorship. With relatively few graduates and even fewer with postgraduate education (who remain in-country), there is little basis for in-country capacity to fulfill the attribute list for successful conservation, which has created a reliance on international staff and volunteers. One practitioner described how their organization have combated this issue by developing strong links with external researchers and institutions whereby their overall capacity and outputs were enhanced. Another practitioner pointed out that while overall capacity was lacking, certain organizations have developed very strong capacity (in some cases world-leading) in certain niche areas, such as invasive species eradication and species translocations.

One capacity-driven barrier described by practitioners was the perception of poorly defined objectives, whereby practitioners spend resources (time, money) collecting data of little apparent value ("*...[Feels like we are] collecting data forever without a reason why or any end goal*"). Monitoring programs must be motivated by a clear management question or problem, with well-defined objectives on how the program will answer this question or provide critical information. Without this fundamental step, design and implementation problems are likely, and

consequently the data is unlikely to achieve anything meaningful (Lindenmayer & Likens, 2010). The conception, design, and implementation of a successful monitoring program requires critical thinking, sound scientific understanding, good knowledge of past work, and consideration of a broad range of factors, as well as regular assessment of the data collected (Reynolds et al., 2016). In our survey, practitioners described how data is not analyzed frequently enough to detect such problems, which can mean that data are collected for years or even decades before problems are uncovered and addressed ("*the major bottleneck is one of time*" or analysis is "*very basic and incomplete*"). Such delays seriously impinge the effectiveness, relevance and value of monitoring programs and prevent their use in adaptive management (Leverington et al., 2010). Previous studies suggested that building technical capacity is not insurmountable, especially if funders drive this requirement through selection of projects which demonstrate clear outcome-focused objectives coupled with transparency and accountability (Legge, 2015). But the need to strengthen capacity has long been recognized in the region (Berg et al., 2002), and "capacity building" is therefore already often a requirement for funding consideration. Whether or not these funder-driven capacity-building initiatives are effective requires further investigation; other studies highlight the need for dedicated funding to support knowledge exchange *beyond* the lifetime of such projects to develop real and lasting *institutional* capacity (Cvitanovic et al., 2016).

Our interviewees suggested several solutions to these capacity-driven barriers, including establishing new roles such as data manager and, specifically, acknowledging the need for and development of "bridging" positions within organizations ("*Having a resident researcher at each site would be hugely beneficial*"). These bridging positions could be created for high-capacity postgraduates or practitioners who partner more closely with scientists to clarify conservation objectives, develop research strategy, design projects/programs, and ultimately ensure the information being generated feeds back into management—and research and monitoring objectives are driven by management needs—through rigorous analysis and interpretation. Other suggestions centered around the education system, for example, introducing specific modules to existing courses that better equip students for work in the conservation management sector, or the need for an overall shift at government level to develop a research culture through the allocation of resources, for example, "*Build a research institute whose mandate is just to do research to inform management*" and by "*Investing in schemes to develop next generation conservation scientists.*"

Our study shows that, despite some perceived improvement in capacity, there is still a vacuum whereby the value of practitioners' efforts is compromised due to limited capacity. Bridging these gaps in core skills will require further assessment of specific capacity needs at national, organizational, and project/site level, coupled with a long-term collaborative investment in people development across government and organizations to develop the next generation of conservation practitioners capable of *increasing* effective management.

4.2 | Causal link 2: Lack of government coordination

Lack of government-led coordination of conservation and management efforts was the second major causal link across barriers at all levels. This lack of coordination results in a "*fragmentation of efforts*," whereby practitioners have "*no idea what is happening on other islands*," and are "*all doing the same thing, in slightly different ways but not sharing lessons learned*." This lack of connection and collaboration makes it difficult to track and synthesize project outcomes, compile national data, identify successful (and unsuccessful) actions and ultimately to maximize resource use and effective management: "[There is a] *lack of platforms for 'cross-pollination'… Stronger leadership is needed to outline what data is needed and where funds should be allocated vs where they are going to waste.*" This view was shared by practitioners both outside and within government: "*There are workshops and occasional symposiums, as much as possible ministry staff attend these, but there is no annual forum.*"

Government ministries/departments were perceived to be in the best position to harness the collective power of nongovernmental organizations and thereby create synergies between national and local level efforts. The solutions suggested by practitioners align with this need for government-led coordination of efforts, for example, by creating a national research strategy and mandating that conservation management of island ecosystems is transparent and accountable, that is, by clearly stating their core aims at regular intervals, how they are achieving these aims, and crucially, how these aims support the national research and conservation strategy ("*Regular self-reporting should be mandatory for all to report on management plans - how is management being conducted and is it successful? We should be held to account and prove ourselves to Cabinet once a year, for both government and the public*"). A key suggestion, and one that could be relatively easy and cost-effective to implement, was a government-led annual research symposium. This would help to strengthen synergies across levels, reduce

fragmentation of efforts, encourage knowledge exchange, and potentially lead to increased collaboration. More than one practitioner mentioned instances where non-governmental organizations often step into the breach to ensure knowledge exchange and communication between practitioners. One example provided was of an NGO who coordinates annual meetings for focus groups on seabirds and one of the long-term endemic land bird species recovery programs, despite no-longer receiving project funds to do this.

Government coordination of island ecosystem management inevitably varies in approach across the countries represented in our interviews, and although the majority of interviewees were from a single country, we suggest that the issues outlined are likely to be representative or common to many such nations, and perhaps especially to SIDS.

4.3 | Causal link 3: Limited resources

Resource constraints are well documented for both conservation of biodiversity (McCarthy et al., 2012) and for SIDS such as Seychelles (Betzold, 2015; Cherian, 2007), so it is unsurprising that resource limitations were identified as a major cause of the barriers described in this study and that "more funding" was the most frequently suggested solution. Overall, limited resources were a direct cause of 11 of the 33 barriers described by practitioners. Even within government, lack of resources (human, institutional, and financial) was identified as limiting what was possible and the effectiveness of actions: "*[The ministry] do what is possible with the low resources.*" Outside government departments, financial support for many of the conservation organizations comes directly from ecotourism. These tourism revenues often support the basic running of operations (staffing costs and monitoring activities), and additional conservation actions normally rely on external project funding through grants. One practitioner described how one of the strengths to national conservation efforts had been the high level of international funding which had facilitated some of the country's biggest conservation successes. However overall, practitioners felt that project funding, although crucial, does not support long-term objectives and often does not allow specific funds for staffing projects appropriately: "*Conservation of threatened species and the associated habitat rehabilitation is not a sprint; it is a marathon that requires years of work, not 2–3 years which is the general length of project funding.*"

Innovative ways of funding conservation and management of island ecosystems in the region have been developed; for example, in the Seychelles, the world's first sovereign blue bond was introduced in 2015—a pioneering financial instrument designed to support sustainable marine and fisheries projects. Proceeds from the bond supports grants and loans issued through the Blue Grants Fund and Blue Investment Fund. This initiative is shaping the research and conservation landscape in Seychelles by exclusively funding projects that are of national importance to the blue economy and climate adaptation. Now, with the impacts of Covid-19 de-stabilizing conservation worldwide (Phua et al., 2021; Thurstan et al., 2021), it is more important than ever to ensure that the available resources are being used in the most efficient and effective way. Bridging these barriers is therefore essential for success.

4.4 | Causal link 4: Lack of incentives

Then, 6 of the 33 barriers described in this study were linked to a lack of incentive for staff. Practitioners described how high staff turnover was a major barrier to achieving effective conservation due to the loss of long-term perspective, resulting in each new staff member "*reinventing the wheel*" by altering methods, shifting research focus, starting new databases, and so forth. Staff turnover was a cause of other barriers, such as data management and consistency issues, loss of collaborations and poor management. As one practitioner put it, the solution to many of the barriers faced would be to "*ensure you have the A-team in place.*" The specific incentive issues described in this study included low pay, lack of career development opportunities, in some cases no formal contract or financial incentive for contract renewal or reward for loyalty (e.g., "*I have lots of responsibilities as project leader but no contract*").

The lack of employment contract mentioned by a couple of the interviewees, while not illegal, is unlikely to reassure employees or lead to long-term retainment. The issue of pay is not so easy to address because while "better pay" and financial rewards to continued employment in a role are almost certainly likely to lead to increased staff retention, there simply may not be the money to do this. But arguably, it is better to do less but do it better by investing more in staff than ineffective efforts toward achieving management objectives. Clearly, funding is a major factor in the development of incentive schemes but serious considerations should go into balancing resource allocations to enable incentives, given the clear evidence for their success in other sectors (Feng & Sass, 2018; Willis-Shattuck et al., 2008). There are also other inducements for staff than financial ones, such as increasing holiday allowance,

facilitating skill and career development, promotion, and work/life flexibility. For example, one practitioner described how their organization had become more flexible to staff needs to retain key staff, which has enabled the core management team to have remained stable for the past 10 years.

4.5 | Causal link 5: Poor leadership

Practitioners identified several barriers that were attributed to poor leadership. Ultimately it is effective leadership that most supports effective management; effective leaders need the knowledge, skills, and attitudes to boost organizational capability and performance to tackle environmental and institutional challenges (Couttee, 2020). Leaders are therefore pivotal in making or breaking efforts to achieve management objectives but the specific skills needed to be a good leader are broad and available training does not necessarily cover the key skills required for effective leadership (e.g., "*[For managers] day-to-day they are dealing with anything from staff sickness/HR issues to planning and science, these people need to be great drivers, diplomatic, and have strong communication and management skills*").

In a study of effective leadership skills, the skills deemed essential were not those targeted in academic and professional development (Couttee, 2020), that is, postgraduate degrees do not provide leadership skills. Some practitioners acquire these "soft skills" through learning from others (good/bad mentorship) but a lack of specific training within academia and at organization level greatly reduces leadership potential and therefore the effective management of ecosystems. The huge disparity between the emphasis on improving leadership within the business/financial sectors versus the environmental sector is acknowledged (Dietz et al., 2004), but it is imperative that environmental conservation leadership catches up if we are to address the biodiversity crisis.

4.6 | Causal link 6: Interpersonal issues

Among the most frequently cited recommendations in the scientific literature for protecting biodiversity is improving regional coordination among practitioners (Heller & Zavaleta, 2009), that is, collaboration. The overall response of practitioners interviewed in this study to collaborations (local and international) was recognition of their value (all 32 respondents), a general feeling that there is "*more collaboration these days*" but acknowledgement of numerous barriers to collaboration: nine of the 33 barriers identified were grouped under the collaboration theme. Among those

barriers to local collaborations most frequently mentioned (12 of 32 practitioners) was the issue of interpersonal relationships between managers impacting the likelihood and success of collaborations. Despite recognizing that collaborations have the potential to increase conservation effectiveness ("*one person could do all datasets to save time and resources*"), egos, interpersonal conflicts within high level management and a lack of trust were frequently perceived as problems ("*People politics comes before conservation*" and "*Historic 'egos' govern organisations from a top-down approach*"). These barriers manifest themselves through blocking of data-sharing agreements, unwillingness to support or participate in knowledge or skill exchange activities, competitiveness, or sense of ownership over a species, dataset or site (as described by one practitioner, "*some people will keep data to the grave*"). Despite no explicit solutions proposed by practitioners to bridge these type of barriers, the frequency with which they arose during our interviews suggests that they have a larger influence on management effectiveness than has been previously recognized; these issues are only briefly touched on in a handful of studies (Dietz et al., 2004; Sanders et al., 2019) and so further investigation could be important for defining and implementing solutions.

5 | CONCLUSION

It is important to recognize that despite the barriers outlined in this study, there is a huge amount of crucial and successful conservation work being carried out by practitioners in the region. Many of which have already recognized certain barriers and are proactively dealing with them; for example, by creating data management positions or by developing collaborations with research institutes to facilitate data analysis. Despite such efforts, multiple barriers existed for all practitioners within this study and fixing any one of these barriers will not address the entire problem. For example, if practitioners in the field are struggling with data management and a solution is implemented, there are still more hurdles to navigate, that is, data analysis, data interpretation, and report writing. If practitioners fall at one of these hurdles, they have little chance of achieving their ultimate objectives further down the line (Figure 5). Some barriers have simple fixes, some require individual organizations to act, while others require national level action and coordination to tackle them. It will therefore be essential to identify the trade-offs between solutions that are the most achievable, the cheapest and the most effective. However, by identifying the main causes of barriers, and implementing solutions to *these*, we will have a better chance of bridging multiple barriers at once.
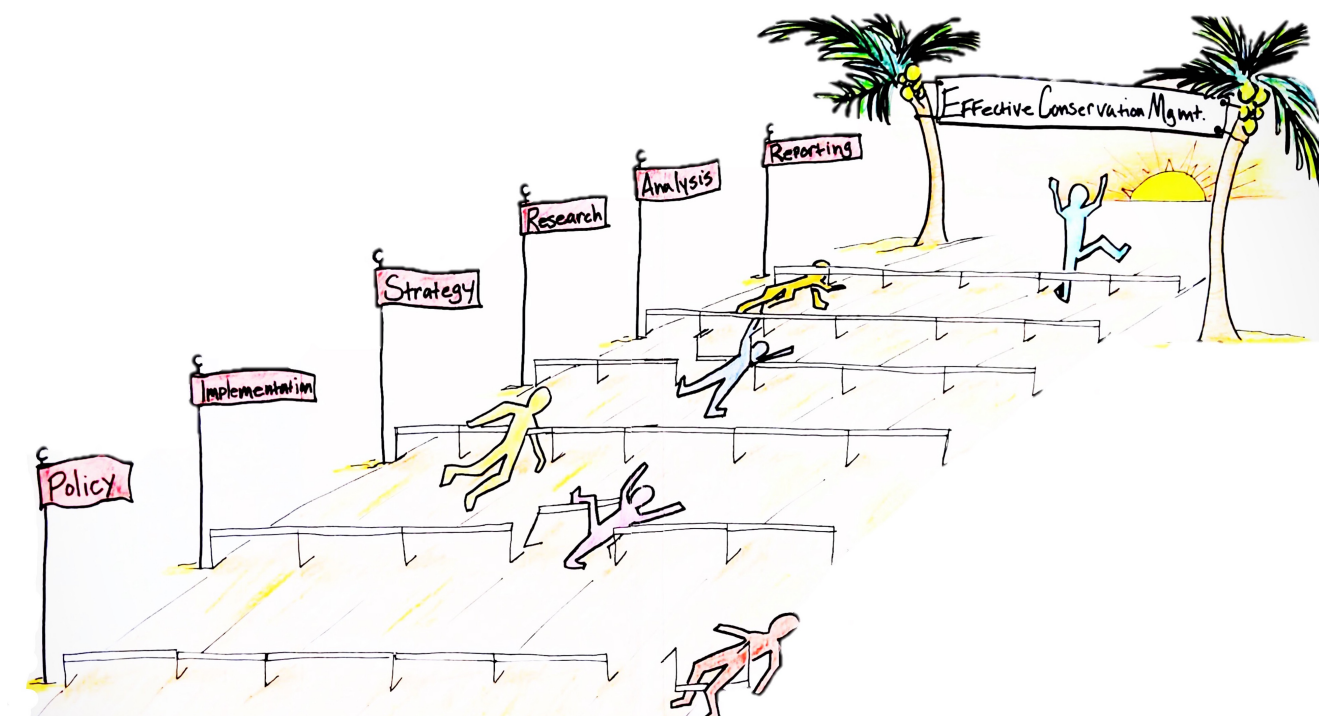
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FIGURE 5 A practitioner's hurdle race to achieving effective conservation management

While our study was focused on the WIO region and is restricted to practitioners mostly representing two SIDS, the barriers they described are likely to be representative of those operating in SIDS worldwide and perhaps even more broadly within biodiversity conservation and management. Further research to quantify which barriers are most prevalent and most decisive, and which solutions will most increase the effectiveness of island ecosystem management would be greatly beneficial. By defining these barriers through systematic research, they can be brought forward for discussion between practitioners across management levels. Finding meaningful solutions relies on us being honest, realistic, and self-critical of our work, but implementing these solutions will require national level investment. Only by doing so can we increase the effectiveness of our management efforts across local and national levels and maximize our chances of actually achieving global biodiversity targets.

CONFLICT OF INTEREST
The authors declare no potential conflict of interest.

AUTHOR CONTRIBUTIONS
April J. Burt and Nancy Bunbury: Conceived the study. **April J. Burt** and **Nancy Bunbury**: Developed the methodology. **April J. Burt**: Conducted the interviews, analyzed the data under guidance of **Ana Nuno**, prepared the figures and tables and wrote the first draft of the manuscript. **April J. Burt**, **Nancy Bunbury**, and **Ana Nuno**: Contributed substantially to refining further drafts of the manuscript.

DATA AVAILABILITY STATEMENT
The data used to make figures are available on request of the lead author.

ETHICS STATEMENT
The survey design was approved by the University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (Ref No: R62246/RE001).

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