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Epistemic Justice and the Integration of Local Ecological Knowledge for Marine

Conservation: Lessons from the Seychelles

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1. Introduction

The importance of knowledge held by local communities in resource management is a key theme of cultural ecology [1-4]. This article uses the term 'local and ecological knowledge' (LEK), understood as a 'cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment' [4]. LEK contains both a component of practice, marking the ways people carry out their resource activities, while also forming part of a community's culture, and a set of beliefs regarding how knowledge and practices relate to ecosystems [4]. This knowledge recognises the multiple levels of interconnections that exist between nature and culture, a concept that science is grappling with in its own research [3]. This paper focuses on the knowledge held by artisanal fishers about their marine environment and its use in the governance of marine biodiversity, which relates to ensuring the abundance and species richness of fish.

Fishers LEK can be very sophisticated and fine-grained, and offer snapshots of population health, species abundance or composition, and ecosystem dynamics and interactions [5]. Through its incremental accumulation and transmission over generations, it can produce spatial-temporal insights into the ecological role of intermittent or rare processes of importance for biodiversity conservation [6]. Fishers LEK can provide insights for the governance of fisheries, conservation management and planning, and in support of the sustainable use of marine biodiversity [7], that is reflective of local conditions. Information

about traditional sustainable harvesting practices has proved particularly useful [8]. In southern Brazil, fishers described fishing spawning aggregations of the Atlantic goliath grouper (*Epinephelus itajara*) that occur during the austral summer, and mapped prominent nursery and aggregation sites highlighting their importance for species recovery [9]. Similar, studies of subsistence fisheries demonstrated extensive knowledge of fish behaviour whereby population declines were traditionally managed by relocating whitefish fisheries, also allowing for periods of recovery [10]. This helps establish thresholds to trigger different levels of management interventions to counter biodiversity decline and set targets for the rate of recovery [11].

More recently, attention has been given to the incorporation of LEK into co-management approaches [12, 13]. This builds upon on new post-positive recognition that all knowledge is contextual and contingent, dismantling the privilege given to scientific forms [14].

Instrumentally, co-management facilitates early identification of conflicts, enabling compromise over planning decisions [15, 16], and can empower stakeholders in subsequent implementation [17]. Partnerships forged between fishers, scientists, NGOs and regulating agencies in the Hawaiian Islands have developed monitoring systems to assess the seasonal spawning peaks, lunar spawning cycles, and size at maturity of reef fish, leading to changes in fishing practices and a realisation of the need for revised regulations [18]. Further along the policy chain, participation also helps with subsequent monitoring and contributes to enhanced awareness and education [19]. LEK can also help support more adaptable and flexible management systems that are better able to deal with uncertainty and surprise [20].

To these multiple claims, however, this paper adds a word of caution. In the natural resource management literature communities are often idealised as harmonious units [21]. We point to the importance of guarding against romanticisation that postulates a 'mythic community' comprised of integrated groups with developed norms for managing resources in equitable and sustainable ways [22]. In practice, local priorities are not always geared towards the promotion of sustainable practices, in fisheries or otherwise [23]. Community heterogeneity impacts upon whether natural resource management policies are successful or not [24] and acknowledging divergent interests is crucial [21]. This is particularly the case when biodiversity conservation encounters trade-offs with local livelihoods. In addition, such knowledge is controlled by indigenous peoples and local communities through formal and

informal institutions, and is not always available to outside authorities [25]. Cultural insensitivity increases the likelihood of community groups not being willing to engage in collaborative, knowledge sharing processes [26]. Therefore, mobilising and using LEK is fraught with difficulties.

Aside from the instrumental value in creating better incentives for compliance [27], arguments about the importance of utilising good governance practices for marine conservation, such as equitable knowledge sharing through participatory practice, have also been coupled with those drawn from the ethical principles of fairness. In other words, in a democracy one ought to have a say in shaping policies that affects one's life [15]. From a governance perspective, recognising the importance of LEK and engaging fishers across all stages of the policy process help make resource management initiatives more legitimate. However, the issue remains under-theorised in relation to understanding how the interests of others, particularly dominant groups, can limit or exclude knowledge production and transmission by other, marginalised groups [28]. The literature has paid less attention to theorising the links between knowledge use and democratic governance, particularly at the institutional level. In this paper, we draw upon feminist epistemological theory to highlight those conditions that permit and constrain knowledge generation and transmission and to theoretically ground our understanding of the practice of epistemic exclusion. Epistemic exclusion is found when the contribution of some groups in society to the production of knowledge, and thus related public policy, is hindered. We are also concerned to identify how epistemic justice can be promoted through better practices. A deeper understanding of the dynamics involved in the construction of epistemic injustice is an important first step in addressing the problem of epistemic exclusion and thus in allowing all the epistemic resources of a society to contribute to resolving public policy problems.

The literature on epistemic justice explores the relations between power and knowledge and thus how ignorance and disapproval of LEK is often tied to colonial, imperial and other discriminatory attitudes and institutions of science towards non-western knowledge systems [29]. However, while recognising that inequitable social relations shape what counts as knowledge, there is need to guard against the tendency to see epistemic exclusion as a mere by-product of wider social and political oppression. Thus attention has turned to the features of epistemological systems themselves that lead to such exclusion [30, 31].

Coined by Fricker, the term epistemic injustice has two components. The first, testimonial injustice occurs when prejudice causes a hearer to give a deflated level of credibility to another speaker's words [32]. In this practice, the use of certain criteria or standards of credibility serves to create privileged groups, alongside others that are routinely viewed as less credible when attempting to offer testimony of their knowledge, experience and/or reflections [30]. This injustice harms the targeted group in their capacity as knowers. The second form of injustice, hermeneutical injustice, refers to the injustice of having some significant area of one's social experience obscured from collective understanding owing to some structural prejudices [32]. This can arise from the asymmetrical ability of some groups to affect the ways in which we collectively make sense of the world. Some social groups thus find that their experiences or knowledge are systematically neglected [28]. Those that claim interpretive authority can also seek to validate the knowledge or experience of others on their terms of reference.

Trust in epistemic matters is particularly important. The significance of trust between science and society is also recognised and if science is to provide public benefits it must be both trustworthy and credible [33]. Trust means deferring with comfort and confidence to others, about something beyond our knowledge or power, in ways that can potentially hurt us [34]. Trust is lost when, for example, scientists discredit local knowledge holders because of their lack of recognised credentials, leading scientists to overlook relevant types of experience and knowledge. Such practices can, in turn, lead local community groups and stakeholders not to trust scientists, because they see that the scientists' conception of expertise is so narrow as to exclude obviously important input from them as citizens [34]. Thus, failure to include local knowledge holders' breeds distrust in the competence of the scientists.

Unwarranted devaluations of the credibility of others and the creation of identities that are epistemologically disadvantaged are seen as practices of epistemic oppression – the routine and harmful exclusion of some domain of knowledge production [35]. Epistemic oppression infringes the epistemic agency of knowers, which damages the individual knowers, given that their social experiences do not become properly integrated into the collective understanding of the social world [36]. While epistemic injustice can harm the knower, preventing some social group from influencing social understanding or participating in practices where these meanings are generated and utilised [32], it also harms the social production of knowledge

more generally. Using this understanding, analysis would therefore ask a key question: are voices interacting with equal agency and power? [37]. Such investigation has paid particular attention to the experiences of women and including women of colour. However, despite its strong application within feminist theory, utilisation of the concept of epistemic justice to explore issues in relation to public policy is limited, as is its use to explore the utilisation of LEK, especially in the area of environmental policy. Furthermore, as far as we are aware, there is as yet no use of the concept to explore the specific area of marine conservation policy. In this paper, we therefore use the concept to ask: who voice is listened to, being acknowledged and engaged with in the making of marine conservation policy? Epistemic injustice also reduces the state of social knowledge and the shared epistemic resources that are available within society. We therefore ask a wider social question: whose interests are being served, in this case, through the practice of epistemic oppression?

This paper fills a conceptual and empirical gap in the literature by examining LEK of fishers in the Seychelles through the lens of epistemic justice, revealing the challenges and opportunities for an ethically just knowledge integration into conservation practice and planning processes for marine protection. The paper begins with a brief background of the methods, and outlines current challenges facing marine conservation in the Seychelles, including in artisanal fisheries. It then explores the system of governance, focusing upon its openness to community and stakeholder interests and the importance of current macroeconomic, structural adjustment reforms. Attention is then turned to detailing the knowledge held by artisanal fishers and its value for addressing current conservation challenges. The paper concludes with reflections on the importance of epistemic justice for both social and ecological sustainability and how just practice can begin to be realised.

2. Material and Methods

The contribution of a social science perspective toward understanding the human dimensions of conservation is valuable for providing insight into the complexity of human attitudes towards public policy decision making, including their governance processes; in detailing how these are shaped by power relations; and contextualising local understandings and individual experiences [38-41]. The social sciences have been applied in the study of marine conservation including, but not limited to investigating how perceptions and belief systems influence support for protected areas and the role of fisher's knowledge in conservation

practice [40, 42-45]. Furthermore, practitioners advocate for enhanced transdisciplinary work that builds upon the contribution of social sciences and integrates qualitative research approaches into fisheries management [43, 46]. This is important to take account of community perspectives in marine protected areas, to help tackle issues related to governance and interest group mediation, and to better understand the social and economic outcomes of policy decisions [43, 46]. It is against this background that we situate this paper and justify its social science perspective and data collection process. Our study adopts a social science approach based on the analysis of primary and secondary, qualitative data.

In relation to the secondary data, we first conducted a content analysis of the grey and policy literature from public authorities and bodies operating across a range of governance scales. This including policy documents on marine protected area planning, finance and partnership frameworks from relevant international bodies, including the UNDP, World Bank Group and Indian Ocean Commission; planning documents and fisheries management plans from the Government of the Seychelles and relevant Ministries; fish status reports from the Seychelles statistical office; and report, policy documents and public information material on marine conservation from NGOs operating in the country. This analysis was conducted to provide background information on (i) the role of international agencies in shaping fisheries policy; (ii) developments in governance arrangements, finance and planning for marine conservation; (iii) how the process of consultation with stakeholder groups, including fishers and conservation groups, was undertaken; and (iv) the challenges facing marine conservation and artisanal fisheries in the Seychelles, as seen through the lens of stakeholder responses.

Primarily data was then collected through mixed, qualitative methods, namely a stakeholder workshop, focus group discussions (FGDs) and key informant interviews, collected during July 2017. Qualitative research generate 'data in the form of spoken words, observations of behaviour, visual representations, and/or written text and analyse in light of theories about society' [46]. Qualitative approaches are important for providing insights into distinct subgroups, such as artisanal fishers and the underlying processes, values, dilemmas, conflicts and relationships that influence human behaviours [47]. Qualitative methods are also important because they are less structured, more open and flexible than quantitative approaches and enable greater opportunities for reflexivity of responses, in-depth analysis and the generation of novel findings [47]. Our research approach also adopted FGDs and semi-structured

interviews to give informants the opportunity to explain their experiences in their own words; allowing for the emergence of novel themes for analysis. Qualitative methods are also well suited for researching complex, and sensitive concepts, and accounting for inequalities, power relations and diverging interests [47]. This method has also proved useful for exploring social, economic and policy questions, as well as the likely consequences of policies before they are applied [48]. In our study, people persist in holding different systems of knowledge, and express multiple salient and often contested truths. Some groups of people do not accept the scientific view, leading to conflicts against policies that consider only biodiversity conservation outcomes [49]. Therefore, qualitative research methods can offer more informal settings to explore differences in perspectives and knowledge systems among stakeholders in decision-making processes, as well as those factors that contribute to consensus and the identification of common grounds for participatory governance [50]. Thus, our secondary data was first supplemented with information conducted from a one-day stakeholder workshop, 'Environment/Security Nexus at Sea: Reaching United Nations (UN) Sustainable Development Goals through Ocean Governance', held at the University of Seychelles and the Blue Economy Research Institute (18th July 2017) with 20 workshop participants¹. We employed a purposive sampling strategy where we selected workshop participants with the assistance of our partners at the Blue Economy Research Institute and through desk based research to identify individuals who had different roles within the marine conservation sector, such as government, NGOs, conservation agencies and academics. The workshop began with a series of presentations from participants to reflect on the threats and trade-offs in achieving marine conservation, and food and marine security in the Seychelles. The second half of the workshop involved a series of group discussions from participants who were asked to reflect on the priorities and potential solutions for achieving more integrated policy actions for marine conservation. This approach gave access to in-depth qualitative data and important contextual information on marine governance in the Seychelles. This information helped, in turn, to inform both the protocol for the FGDs as well as the questions for the semi-structured interviews that were subsequently conducted with key informants.

FGDs were conducted at the Seychelles Fishing Authority (SFA) (20th July 2017), in collaboration with the Blue Research Economy, with representatives of the Fishing Boat-

Owners Association (FBOA) and artisanal fishers (total of 10 people). FGDs centre on engaging with selected groups of people to discuss local perspectives on a specific topic, to share local understandings of this topic, and to identify the influence of different voices in the group with a view to consensus. In the light of tensions between artisanal fishers and government around the issue of marine spatial planning, as identified in the analysis of the grey literature and through the earlier stakeholder workshop, the use of an independent FGDs with fishers allowed a neutral space where artisanal fishers were free to voice their opinions. This was important as it was also evident that some artisanal fishers stated they would be willing to publicly share information on their LEK, particularly of the locations of spawning aggregations and key fishing areas, in the presence of government officials. The aim of the FGDs was to give voice to the embedded knowledge of artisanal fishers, with discussions focused on exploring their views of the (i) impacts of marine policies upon fishers' abilities to access marine resources and support local livelihoods, and (ii) perceptions of the opportunities and challenges of integrating LEK into current marine conservation planning. The FGDs were conducted in English, however, a representative from the FBOA acted as a cultural broker to facilitate the discussions and help with translations to enable some Creole speakers to actively participate in the discussions.

Data was also generated by interviews with key informants that focus on the opinions and experiences of groups with specialised conservation expertise, conducted in English with representatives from the main NGOs operating in the Seychelles: Anse Forbans, Marine Conservation Society, Sustainability for Seychelles, and the Green Islands Foundation. Interviews focused on the collection of qualitative data (explorations of local meanings, asking why and how questions) through a series of open-ended questioning with conversation specific prompts, encouraging narratives and descriptions to elaborate on informants' viewpoints. Questions were designed to elicit information on how NGOs engage with coastal communities, the environmental and social challenges faced by coastal communities, and the challenges associated with the integration of LEK in community-based initiatives and conservation projects on the ground.

Both the FGDs and interviews gave opportunities for respondents to elaborate on their thoughts and to reveal the importance of particular issues, used later for the identification of research themes. These approaches also enabled the researchers to identify spheres of

ambiguity and uncertainty. The use of multi-methods allowed the researchers to triangulate the findings from different sources, by making comparisons of statements with other findings across the different datasets. During the stakeholder workshop, FGDs, and semi-structured interviews, participants were asked to read an information sheet highlighting the aims and objectives of the research activities, risks of the research and intended outcomes, and asked to sign a participant consent form which was approved by the lead author's University Ethics Committee. The workshops, FGDs and semi-structured interviews were audio-recorded and transcribed and deductively coded for dominant narratives that encompass fishers' storylines, arguments that fishers use to describe the impacts of marine policies on access to marine resources and impacts on local livelihoods, and local understandings of the opportunities and challenges of integrating LEK into marine conservation planning.

3. Marine Conservation and Planning in the Seychelles

3.1. Background

The Seychelles consists of 115 islands, divided into the granitic islands (the Inner Islands) and the outer coralline islands (the Outer Islands) (Figure 1) and an Exclusive Economic Zone (EEZ) covering 1.374 million km².

Insert Figure 1 about here

Figure 1: Map of the Seychelles protected area networks within the Inner Islands

The population mostly live in the Inner Islands (Mahé, Praslin, and La Digue). The country ranks second in Africa in terms of income and it displays fairly high levels of human development [51]. However, economic inequality is significant, and is increasing in recent years [52]. The country is also heavily dependent upon foreign imports, and 90% of its food is imported [53].

The Seychelles forms part of the designated Biodiversity Hotspot of Madagascar and the Indian Ocean Islands. There are several threats to biodiversity in the Outer Islands region, including from invasive alien species, vulnerability to climate change, especially from sealevel rises, changes in rainfall pattern, coastal flooding and extreme weather events, with particular concern about impacts on coral reef biodiversity [54, 55]. As a Small Island Development (SID) state, climate change risks food insecurity, particularly as more extreme weather events and coral bleaching impact upon coastal fisheries [56, 57]. Climate change is expected to increase the severity of water shortages, further exacerbated by the water

demands of tourism – with a planned doubling of tourism activities in the next three decades, [58].

Fisheries is the second most important economic sector after tourism, with annual contribution to GDP varying between 8-20% [59]. Large scale developments for tourism have resulted in negative environmental impacts, including through dredging and removal of mangrove forests within marine protected areas and other designated sites [60, 61]. The large scale Raffles Praslin hotel and villa complex, opened in 2011, saw construction impacts including enhanced runoff, erosion and sediment deposition over corals, and the ongoing contamination of the reef as a result of desalination for the delivery of fresh water to the resort [62].

3.2 Artisanal Fishing in the Seychelles

The fisheries sector is made up of artisanal fisheries targeting demersal and semi-pelagic species, semi-industrial fisheries targeting swordfish, tuna, and other larger pelagic species, and industrial fisheries, targeting tuna and tuna-like species [63]. Fisheries contribute about 80% of export revenues [64] and account for about 90% of its exports [65]. The per capita consumption of fish in Seychelles is one of the highest in the world [66]. Around 5,500 people are employed directly or indirectly in the fisheries sector, which constitutes 12% of total employment for the country [67]. The artisanal fisheries industry employs mainly Seychellois fishers who utilise a range of vessel and gear types (Supplementary Information, Table 1). The dominant gear types include hand lines, fish traps, drop lines, beach seines and gillnets (see Table 1 below). There are, additionally, artisanal net and seine fishery, octopus, lobster, crab fisheries, sea cucumber and shark fisheries. In addition to the artisanal fishery industry, semi-industrial and industrial fishing is also carried out by local and foreign owned vessels. This captures swordfish, Bluefin and Bigeye tuna that is mostly exported [68]. The sport and recreational sectors also target demersal fish species [68].

Table 1: Characteristics of the Small-Scale Fishing Industry in the Seychelles

Fishing Sector Targeted fish species Fishing industry and equipment

(Source: adapted from Agulhas and Somali Current Large Marine Ecosystems (ASCLME) Report on Coastal Livelihoods in the Republic of the Seychelles: pp.1-83).

Spear guns and shark gill nets are prohibited, as is the use of trawl nets to target demersal

resources [66]. Severe reductions in fisheries catch have been noted for recent years, especially in the Mahé Plateau, but fisheries catch in inshore areas have also declined [68]. This is having knock-on impacts on biodiversity, including phase shifts on reefs from coral to algal communities, arising from selective removal of herbivorous reef fish by trap fishers [61]. This points to the need to augment the existing management systems with new management approaches, allowing fishery *refugia* to be protected, and thus biodiversity [61].

3.3 Fisheries Governance and Planning

Historically, the establishment of protected areas and policy integration across the land/seascape has been the principal means of protecting biodiversity [69]. However, some concern has also been expressed that MPAs are not always located in the right areas, but are positioned near tourism areas in order to charge for entry, and not because of the biodiversity value of the site [61]. The Fisheries Act 1987 and the more recent 2014 Act are designed to promote a sustainable and responsible fisheries sector, including through restrictions on the harvesting of specific sensitive species and the regulation of marine habitat damage.

However, the capacity of the system of public administration to manage both its fisheries and its biodiversity under its PA system has historically been limited and policy implementation, especially legislative enforcement is weak. Administrative capacity has been further weakened by the country's recent macroeconomic crisis, when in 2008 the country was forced to default on its debt payments and requested International Monetary Fund (IMF) assistance for debt restructuring. The loan conditionality tied to the IMF structural adjustment programme brings strict curbs on public expenditure and liberalisation of trade [52]. The currency was also devalued, increasingly the price of imports, which put further pressure on artisanal fishers to address family food needs through inshore fishing. In addition, loan conditionality saw the opening of the economy to foreign investment.

With the need to service its foreign debt, the country is currently developing its ocean-based economy, under the umbrella of a Blue Economy initiative [66]. A *Blue Economy Strategic Framework and Roadmap* was approved by the Government in 2018 [70]. At the core of this are two planning strategies: a Marine Spatial Plan (MSP) and an array of specific fisheries management plans [71]. A key part of the MSP is the establishment of new, or the expansion of existing MPAs, with a new Seychelles Protected Areas Policy (2013) developed under guidance of the UNDP-GEF [72] (Figure 2). The development of an aquaculture sector has

been prioritised [73]. A Mariculture Master Plan (MMP) is currently being developed, along with revisions to the Fisheries Act, expected in 2020 [66].

Within the new MSP, there is an ambitious marine conservation pledge to protect 30% of the EEZ by 2020 [68] The EEZ delineation indicates the proposed target area for the MSP covering 1.35 million km² (Figure 2). The Government has been able to link its marine spatial planning to its debt servicing, re-directing a portion of its debt payments to establish two new MPAs [66]. This is expected to use a multi-stakeholder, participatory planning and management process [66].

Insert Figure 2 about here

Figure 2: Map of the Seychelles Outer Islands and EEZ delineation

In parallel, are the fisheries management plans for nearshore fisheries, based on a view that the existing system of open-access impedes actions to ensure sustainability [74]. The Praslin Artisanal Trap and Line Fishery Co-Management Plan 2013 (revised in 2015) has been developed and the Mahé Plateau Demersal Trap and Line Fishery Co-Management Plan is currently being prepared, with a view to progressively transition from an open-access fishery to more controlled fishery [75]. A sea-cucumber fisheries management plan, and a domestic tuna fisheries management plans are also being developed [68].

The implementation of the both the MSP and the fisheries management plans will limit the traditional open access system [76]. For example, the Mahé Plateau Plan includes a fishing license requirement, minimum size limits for key species and a maximum number of active traps [75]. Access controls could be spatial or temporal, and range in scope from short-term closures of certain locations to fishing, to longer-term or even permanent prohibitions on fishing in certain areas [75]. Other measures include licencing of boats, prohibition on certain types of fishing gear currently used by fishers, including purse seiners, restrictions on fuel concessions and the development of a national action plan against IUU fishing [76].

Likewise, the proposed zoning types for EEZ under the MSP will see highly restrictive fishers' uses in the high biodiversity zones and moderate restrictions in the medium biodiversity zones [77]. Stakeholder groups, especially fisher associations, are expected to play a key role in implementing these new plans. There is thus very high potential for conflict over the current MSP, new fish management planning and the implementation of the Blue Economy initiative, as they will limit access to marine resources for fishers and for local

communities. It is within this policy context that the role of fishers' knowledge is investigated.

4. The Use of Fishers Knowledge

The relationship between fishers LEK and fisheries management and conservation in the Seychelles is well understood. Studies of fisher's knowledge and behaviour have revealed extensive knowledge of the locality and temporal patterns of the spawning aggregations of 26 demersal and semi-pelagic species in the Seychelles [78]. More recently, fisher's knowledge of siganid and serranid aggregations has been used to inform key sites and vulnerable species in the Seychelles [79]. Fishers knowledge has also led to the identification of 12 aggregations of the Camouflage Grouper (*Epinephelus polyphkadion*), Brown Marbled Grouper (*E. Fuscoguttatus*), Marbled Coral Grouper (*Plectropomus punctatus*), and Shoemaker Spinefoot Rabbitfish (*Siganus sutor*); and enhanced understanding of the temporal patterns of spawning aggregations of *E. polyphkadion* and *E. Fuscoguttatus* [79]. Understanding the locality of spawning aggregations has assisted in developing a better understanding of the decline of White Blotch Grouper (*E. multinotatus*) and of several serranid aggregations [79]. Similar studies in the region have explored fisher's effort to assess the status of Siganid species to inform sustainable fishing practices [80]. In turn, LEK of purse seine fishermen has been employed to understand behavioural information on the attraction, retention and departure behaviours of tuna schools around Drifting Fish Aggregation Devices (any object floating at the surface that can attract pelagic fish, such as natural logs or human-made structures, such as buoys and rafts) [81]. Engagement of fishers in developing conservation actions for fisheries has often resulted in increased support for conservation and enhanced awareness of unsustainable fishing practices [78].

The Seychelles has long established practices of using stakeholder engagement to overcome the challenges presented by its vast and scattered territories, and the limited resources and financial capacity of its system of public administration. Partnerships with national and international stakeholders is recognised as essential for biodiversity conservation [82]. The Mahé Plan, for example, is committed to 'sustainable demersal fishery that delivers best possible ecological, economic and social benefits for the Seychelles through effective, transparent and participatory management'[75]. A key aspiration here is to integrate the LEK of artisanal fishers into the Plan, drawing upon their knowledge of historical and current

presence and abundance of threatened species, the sustainability of fishing catches, by-catch and the identification of important locations and habitats [83]. Furthermore, The *National Development Plan of Seychelles 2008-2020* includes objectives to engage with artisanal fishers, to take account of their livelihood and food security needs [84].

Civil society and economic stakeholder groups are well organised and include the Nature Protection Trust, Birdlife Seychelles and the Green Island Foundation. The Marine Conservation Society has strengthened support for marine conservation, including through public education and through restoration initiatives. Seychellois fishers are also mobilised, and grouped under several fishers' associations, organised by fishery and geography. There is also the Fishing Boat-Owners Association (FBOA), formed to advocate for better working conditions for fishers and to promote the sustainable management of marine resources. In addition, the SFA has experience of empowering resource users as co-managers through established eco-labelling initiatives [57]. Eco-labelling initiatives have been initiated in collaboration with hook-and-line fishermen where a label accompanies each fish that is caught and sold to inform consumers about who caught the fish, how, and where. This allows fish to be sold at a value above market price (up to 25%) [85]. There are also strong links with the academic community, and with the private sector, especially hotel developers who have invested in coastal restoration and employ environmental officers to manage and monitor their resort's environment. These partnerships have been crucial for enhancing capacity to manage biodiversity and to deliver on international commitments. This bodes well for the use of collaborative approaches to address issues arising in current MSP and fisheries management initiatives.

International governance regimes, and their funding bodies also played a critical role. The UNDP, for example, has worked in the Seychelles to strengthen the capacity of artisanal fishermen to engage in a collaborative partnership for MPA management [86]. The debt-forclimate swap also involves a parallel project financed by the GEF and the UNDP for capacity-building, including among fishers. The government has confirmed that its MSP are 'to be achieved by engaging all stakeholders' [66]. To this end, a private consultancy company has been tasked with producing a report on the status of the demersal fishery and the development of a fleet capacity management plan 'in collaboration with stakeholders through workshops using scenarios and participatory techniques' [87]. Similarly, to ensure

compliance with the World Bank Operational Policy, the government is currently using a participatory planning process that requires consultation with all 'project affected persons' and communities, and that any negative impacts are avoided or adequately mitigated [66]. In short, the historic traditions of civil society and stakeholder engagement in conservation management, and the strong co-management component of current loan conditionality both set the context for the inclusion of LEK and offer promising avenues to co-design and complement the Blue Economy policy.

5. Seychelles Fisher's Knowledge

This section begins by revealing the experiential knowledge and practices of artisanal fishers, before discussing their experiences of the consultation process that was put in place as part of the development of current marine spatial planning. It highlights both the potential opportunities and challenges of integrating LEK into marine conservation planning.

5.1 Knowledge and Practices

Seychellois fishers demonstrated detailed knowledge of sustainable fishing practices associated with the application of traditional bamboo traps and hook-and-line fishing techniques. Fishers use traps made from bamboo, named *Kayse*, that differ in terms of the depth of placement, period of time placed in the water, and presence of bait. *Kayse peze* are unbaited traps, that are placed on shallow reef flats for 3 days; *Kayse dormi* are baited traps positioned at depths of 60m on reefs for 3 days; and *Kayse lavol* have a lighter construction are baited and placed in a variety of depths for a few hours [88]. The construction of the bamboo traps allows fishers to monitor unwanted by-catch so that only adult fish are retained, and juveniles are returned to the sea without damage:

The traps are made from bamboo, they have a small hole that allows the fish to come in and out. The traps are good because they don't kill anything, and we can then easily lift the trap to check the sizes. We release the juveniles, so they continue to reproduce (Artisanal Fisher, E).

Several fishers also described the process of hook-and-line fishing techniques that target red snapper (*Lutjanus seba*), humphead red snapper (*Lutjanus gibbus*), green jobfish (*Aprion virescens*), and multi-coloured groupers (*Serranidae*). Hook-and-line fishing was also described as 'sustainable' for harvesting specific adult fish species and reducing high levels of bycatch. The specificity of the method was linked the size of the hook that was used to

target specific species, and the type of bait used, which was usually mackerel. Several FBOA informants described the process of hook-and-line fishing:

The size of the hook is especially important for catching adult fish [only] and we use a J hook to catch the bourgeois fish [Bourgeois Red Snapper] (Artisanal Fisher, C).

In addition, several fishers also described how in the past fishing activities were regulated through seasonal closures during the monsoon period, lasting from June-September.

Monsoon weather prevented fishermen from travelling further offshore, allowing the seas to experience what one fisher described as:

Nature assisting us. This is 'a biological rest' for the fish (Artisanal Fisher, C)

Local observations of fishers also reveal an understanding of ecological dynamics that carry insights for the design and implementation of conservation strategies. This includes knowledge about the locations of spawning aggregations of the White Blotched Grouper (*Epinephelus multinotatus*) and White Streaked Grouper (*Epinephelus ongus*) that warranted further protection:

We know where the fish are spawning, we have for years, this knowledge is kept with us, we use these areas for fishing, but they must also be protected (Artisanal Fisher, E).

Fishers described several important spawning aggregations that have been negatively affected by overfishing and land reclamation works. The *Epinephelus ongus* (*vyey avril*) was known to spawn during the month of April and has experienced localised extinctions due to land reclamation:

Vyey Avril spawning grounds are no more since the sand and coral were mined for land reclamation projects, it caused a lot of environmental damage (Artisanal Fisher, C).

Seychellois fishing activities are seasonal and dependent upon fishing grounds and gear, allowing opportunities for LEK to inform site designation and fishing activity in the MSP.

Firstly, the adoption of sustainable fishing practices through gear selection, bait use, location choice and seasonal (temporal) adjustments has the potential for aligning with several objectives of both the MSP and associated co-management plans that aims to provide minimum size limits for key species' catches. The use of traditional bamboo traps allows effective monitoring of the size of target fish. Similarly, the selectivity of the hook-and-line

fishing also offers opportunities for targeting key fish species in relation to their size and for limiting by-catch. Secondly, the hook-and-line fishermen have also realised the potentials of their fishing practice for enhancing foreign exchange earnings and supporting fishing livelihoods through the development of an eco-labelling programme, as mentioned above, that promotes sustainable fishing practices, establishes traceability and allows for fish to be sold at a high market price. Similar initiatives could also be used in support of traditional bamboo traps if monitored effectively. Thirdly, the intentions of the MSP and the Mahé Plateau Co-Management Plan to provide temporal fishing closures could also align with the re-establishment of traditional fishing closures during the monsoon period. Fourthly, Seychellois fishers have extensive place-specific knowledge of the temporal and geographical nature of spawning aggregations and the abundance and distribution of threatened species that can inform the locality of closure sites and use designations. Finally, knowledge of the environmental impact of development activities on marine biodiversity may also assist in improved land use planning, including for land reclamation.

Our informants identified several barriers that have limited the uptake of LEK in conservation planning. Fishers are often seen as contributing to overfishing problems across the Mahé Plateau and this has led to negative perceptions of the sustainability of local fishing practices among some conservation groups. Discussions during the stakeholder workshop identified illegal unreported and unregulated (IUU) fishing as one of many major threats to fishing stocks in the Seychelles, not only from foreign vessels but also artisanal fishers. In turn, there were concerns about the high levels of overfishing on the inner shores of the Mahé Plateau from the artisanal fisheries, as evidenced by a decline of the occurrence, diversity and abundance of key species such as Serranidae on the plateau and further declines of the emperor red snapper (*Lutjanus sebae*) and the brown spotted grouper (*Epinephelus chlorostigma*) [68].

Discussions with the fishers themselves and with conservation groups highlighted that, even in cases where LEK exists, certain practices are not always environmentally favourable. Local practices may not be based on ecological criteria relevant to successful resource conservation in the context of current resource depletion and adaptations to new fishing technologies. An employee from the Green Islands Foundation, for example, observed a tendency for some fishers to catch juveniles and use illegal fishing gear that provoked anger

among others who were concerned about the sustainability of their practices:

When I talk to a lot of fishermen, I mean, a lot of them don't want these small fish rendered, they get angry at each other (Representative, Green Islands Foundation).

Furthermore, new adaptations in fishing practices, in part facilitated by government loans, have interrupted traditional rest periods for fishing during the monsoon season. Trap fishermen and Seychellois islanders use *kayases* on the inshore fishing areas of the Mahé Plateau during this period to allow continued exploitation of fishing stocks for subsistence. This was perceived by fishers as a contributing factor to the decline in fishing stocks in inshore waters:

These days, people fish in the inshore areas, the monsoon season doesn't always prevent people from fishing, here the fish continue to decrease (Artisanal Fisherman, C).

New fishing technologies and new boats have also allowed fishermen to fish further offshore during the monsoon season:

The *kayases* aren't picking up enough fish so they are having to rely on the fisherman to bring them fish. The problem with that is because there is less fish ... they are going further and further out (Representative, Anse Forbans).

Despite awareness of fish declines due to overfishing and changes in fishing practices, the need to re-pay government loans for new gear and boats forces fishermen to increase their fishing efforts to meet their financial obligations. To add to these pressures, hotel development along the inshore waters was perceived as having negatively impacted upon local fishing grounds, necessitating the need to exploit offshore regions:

There is destruction in the way of development: reclamation along the east coast and these were rich fishing grounds and before that the transit time to get to the fishing ground was short. But, now with the reclamation, we have to go further and further out (Artisanal Fisher, C).

Trade-offs influence fisher's decisions to travel further offshore, including fuel costs and the cost and availability of on-board ice storage facilities, relative to the expected value of the fish haul. Hook-and-line fishermen take longer fishing trips, from 3-4 days to 4-10 days, with larger vessels increase their ability to exploit offshore fishing territories:

There is adaptation now, building bigger vessels. You can't go out now and back in

the same day, the fuel costs are too high; so, you need to stay out longer (Artisanal Fisher, C).

In the past, fish was salted and cured on board for preservation. However, new advances in ice storage facilities have allowed fishers to use new strategies for preserving fish over longer periods of time:

25-30 years ago, ice happened, and that meant that there was a change from small fishing [out-boats], to multi day vessels [2-3 days on the ocean] (Artisanal Fisher, C).

Although fishers' knowledge may offer insights for adaptation or conservation, changing practices, often forced upon fishers as a result of government funded fisheries expansion and development schemes, may have unintended negative consequences for biodiversity, as evidenced here. This returns us to our opening discussion, which pointed out that LEK needs to be considered as part of a complex but also dynamic system or worldview that adapts and changes. The data also reinforces the need to guard against treating local communities as homogenous in terms of perceptions, interests and actions. This heterogeneity adds to the complexity of the challenges associated with the integration of LEK into marine conservation policy.

Other causal factors linked to overfishing were associated with a lack of enforcement capacity, including financial resources, by public officials charged with ensuring compliance with fishing regulations, especially within the Seychelles vast marine protected areas:

And they don't have money [government] to ensure that they have sufficient staff and so you might have one or two rangers who are responsible for a whole marine park and so they can't go beyond the limits of operation because they're understaffed and also they might not be effectively using their abilities because of the limits

(Conservation actor participant in Stakeholder Workshop).

Finally, changes in fishing behaviour to exploit offshore waters for pelagic fish have posed additional challenges for the effective monitoring and enforcement of illegal fishing in these areas.

5.2 Epistemic Inclusion

Conservation priorities and solutions identified by government and supported by environmental NGOs brought mixed reactions from artisanal fishers. A dominant theme that emerges from the FGDs was the lack of trust between artisanal fishers and the agents of the

state charged with the formulation of the MSP. This mistrust has its roots in the historical, top-down approach utilised by the state during the earlier establishment of MPAs, which lacked consultation with stakeholders, yet placed restrictions on fishers' practices and thus livelihoods:

A lot of them are sceptical because, again, related to the social political context because things are being done a different way and once you start talking about fish size and so on, the first question they ask is, 'what are you going to propose to be banned now?' so there is a bit of mistrust between the civilian society and government, there is this mistrust and it does exist, especially in fishery (Representative, Green Islands Foundation).

Similarly,

The MPAs were just put there in the past, they were enforced on us, without consultation with anyone, we suffer in this way because we can't fish. It's been like that a lot (Artisanal Fisherman, D).

In an effort to address this legacy, several NGOs expressed interest in engaging fishers' LEK into current marine conservation efforts through citizen science:

You know one thing I've noticed some of the older ones because I live in this fishing community and I know a lot of the fishermen...they actually have a lot of knowledge about climate for example the sea birds...and fish catches, which may or may not be related to climate change, it may just be overfishing or other issues like that but they definitely notice a lot and they know. As we have been thinking about it and maybe trying it out, how to engage them [fishermen] in a sort of citizen science. Some of those fishers they're really interested in helping with that to keep track of you know catch size and it has to be easy for them because it's pretty easy when they're catching fish (Representative, Nature Seychelles).

However, engaging fishers in citizen science falls short of full epistemic inclusion. This is not least because it does not engage fishers' knowledge on their own terms, but instead sets them to work on terms set out in mainstream science, the latter seen as having validation authority. In this case, this includes the use of mainstream methods for the collection of data for subsequent use in scientific assessment.

Historical patterns of epistemic exclusion are continued in the contemporary context with the

development of the fish co-management plans. These plans were developed through partnerships between the Green Islands Foundation, the Seychelles Fisheries Authority (SFA) and artisanal fishers. However, here too LEK is viewed with scepticism, and LEK contributions deemed in need of scientific testing in order to be considered valid and to justify their integration into the marine planning processes. Thus the Green Islands Foundation have been attempting to establish the scientific credibility of fishing knowledge and the sustainability of their practices through mainstream measurements of key fish species targeted, size of fish, selectivity of fishing practices and levels of by-catch.

I mean we have an ongoing discussion but what is also important is that before you can go to the fishermen, before you can go to the authorities, you have to have data so in fisheries it is all anecdotal. So like, a fish that long or a fish this long, so we are now monitoring artisanal catch for one whole year, we started in January, in fact we just analysed our first four months of data because we had a review team over and we presented some of this data so you could see that the catch size and the size of fish length and the artisanal catch is well below the natural size, so I mean these things are coming up and in terms of the gear that they use. They are catching juveniles, obviously because of the gear they use and a lot of this gear is illegal and what we also are doing is establishing a baseline. So we are doing interviews with the old fishers, current fishers, because you have to have a baseline to explain the decline and to explain the change (Representative, Green Islands Foundation).

Credibility problems therefore continue to plague co-operation between state agents and fisher groups, despite the fact co-management plans are presented as having been informed by fishers' knowledge and in ways that integrate their knowledge of the historical and current presence and abundance of threatened species, the sustainability of fishing catches, by-catch and identification of important locations and habitats. As in the past, the continuation of such epistemologically oppressive practices can serve to reinforce the privileging of science over experiential knowledge, and close the space for full knowledge co-operation based on credibility and trust.

Some groups even suggested that one way to address the problem of marine biodiversity protection was to reduce artisanal fisheries:

We need to tell fishermen to fish less, and earn more subsidies, this is a sensitive

issue, where communication with fishermen is key (Conservation actor, participant from Stakeholder Workshop).

Numerous mechanisms were proposed during the stakeholder workshop to achieve this end, including the removal of the state fuel subsidies, and incentive schemes for encouraging alternative forms of employment, such as in aquaculture. This attitude bodes ill for the development of mutual respect between fishers and conservation groups.

For their part, fishers also demonstrated some reservations concerning the validity of scientific expertise. Several fishermen described the dominance of western consultants in the task of evaluating the sustainability of the demersal fishing industry. These consultants are seen as contributing to the continuation of the practice of top-down steering, and as more concerned with informing the fishers about policy decisions than eliciting their views and experiences to inform policy making. As a result, fishers hold that these evaluation processes have failed to adequately represent their priorities and community needs.

Furthermore, the knowledge of western consultants has been challenged by fishers who suggest that outsiders lack the nuanced understanding of fishing characteristics at finite scales:

Consultants don't see it necessary to list and report what we say ... they don't give us a copy of their reports as we can check it ... it often not given [in] our voice
(Artisanal Fisher, C).

But they [consultants] had no real onsite knowledge and data (Artisanal Fisher C).

Fishers also joked that one consultant could not even correctly identify local fish species (authors' field notes). The failure to adequately draw upon local knowledge and practices was also evidenced by fishers when they described one consultation event where they were presented with the MSP map highlighting the areas demarcated for different uses. The delineation of no-take zones on the maps conflicted with important fishing grounds:

[The consultants] come with a map of the Mahé Plateau - on a map of colours, with take/no take zones. But, the no-take zone was in our traditional fishing zone
(Artisanal Fisher, E).

'Our knowledge of how to catch fish – it is not used... 'But consultants are not listening to us – but telling us what to fish and how' (Artisanal Fisher, C).

One fisherman called into question consultants' efforts to identify areas of 'high biodiversity'

due to their poor understanding of 'shifting biodiversity,' such as temporal changes in the abundance and distribution of spawning aggregations and therefore, fish:

But high biodiversity areas on high seas does not make sense, as the area changes with the currents, as ocean currents change the area of zooplankton and phytoplankton and therefore fish (Artisanal Fisher E).

Targeting areas of high exploitation of fishing stocks were deemed more important than prohibiting fishing activities in areas of high biodiversity:

The need to control arises not from the upwelling, but the exploitation takes places that need to be controlled – the cause needs to be addressed. But they are not controlling the area where the fishers are fishing, but where the upwelling is taking place. This is the wrong place (Artisanal Fisher E).

Thus, as a result of the ways in which stakeholder partnerships were perceived, especially the failure of these partnerships arrangements to listen to, and thus make visible the knowledge of fishers, trust between actors was lost. At the root of this was the failure to give credibility to the knowledge held by fishers and thus the outcome has been a denial of their agency, that is, a failure to give a role to this knowledge in shaping marine conservation policy. Trust works both ways, and in this case, the failure to give credence to the knowledge of fishers resulted in a spiralling of loss of trust on both sides.

In addition, there was also a great deal of scepticism on the part of artisanal fishers about the appropriateness of adopting a regulatory approach to marine conservation, a core component of the new MSP. While the approach is favoured in international efforts to protect marine biodiversity, in the case of the Seychelles where state enforcement capacity is weak introducing more regulations on artisanal fishermen was seen to risk an increase in illegal fishing activities:

It will create opportunities for illegal fishing. Our fishers are the sentinels of the sea. We are the ones reporting illegal fishing by our men doing citizen arrest, phoning in etc and if they can't get out to fish, then illegal fishing can continue (Artisanal Fisher, E).

The proposed new legislation and policies for regulating the artisanal fishing industry were also viewed as redundant, owing to existing regulations on fishing catches. In contrast, fishers viewed the unregulated recreational vessels, servicing the tourism industry, to be of greater

concern:

Our fishermen are regulated and registered, and we have a vessel tracking system and they know where we are, and our catches are declared. But, not the charters and the occasional fishers, so instead of dealing with the issue they dump a new policy on us (Artisanal Fisher, F).

Distrust towards government conservation initiatives also results from a perceived failure to take into consideration the priorities of local fisher groups. Poor infrastructure facilities for the storage and processing of fish catches, and improving marketing opportunities to support fish sales were also major concern:

Harvesting is not our big problem, what is the problem is the lack of basic input; ice, shared facilities, [and] marketing (Artisanal Fisher, B).

The country's debt problem and loan conditionality were also seen to have pushed government towards favouring policies that comply with foreign and 'western' approaches to the management of marine natural resources, to the detriment of local community needs:

\$21m debt and a conservation swop, which would imply selling our natural and national heritage for bad management by some politicians (Artisanal Fisher, F).

Other aspects of the Blue Economy policy, in particular plans for the development of fish farming, were also seen to reflect this bias in favour of external, business interests:

Fish farming is connected to government self-interest: big investors; big shares; big profit. And the fishermen are gone, so, there is a hopeless narrative, and this also legitimises the mari culture (Artisanal Fisher, C).

Aquaculture was also met with suspicion as some saw it as a ruse to replace the fishing industry:

It is like a conspiracy ... If the fishery sector fails, this means that we can create aqua and mari fisheries. It legitimises and justifies it (Artisanal Fisher, C).

Indeed, fishers queried whether or not government was really interested in biodiversity protection at all, pointing to the development of aquaculture facilities on the island, with its potential to damage wild fisheries through the introduction of alien species and attracting predators into inshore fishing areas:

There is no harmonising between what the government preaches and what is done.

Fish farming means more sharks, predators, contamination of the sea floors (Artisanal

Fisher C).

Furthermore, fishers pointed to the environmental costs of development projects that have negatively impacted upon fishing activities, including land reclamation and hotel development. They saw a contradiction between the way the Seychelles is represented as a 'pristine paradise' to attract tourists, and policies that prioritise the development of new resorts through foreign investment that bring negative environmental impacts. The development of the Raffles Praslin Hotel, and its impacts upon the coral reefs, was subject to notable criticism:

We had meeting on the MSP with the Minister. There was outcry about the nature reserve, there was an environment plan and it had to be repealed. It was done to favour a rich Saudi, and it was done to favour him. There was a plan for a 5 Star hotel, and a desalination plant, but this would mean that there was brine outflow on the reef, and there would be nutrients taken from the water and into the desalination plant.

Therefore, there would have been an imbalance (Artisanal Fisher E).

The cumulative effect of the current approach to marine protection is that local fishers have come to see the creation of the MSP as favouring only the interests of certain groups, leading to strong local resistance:

We are totally against the MSP due to the poor consultation and the invasion of our area of work. We saw the plans, but the control area is on the bank where most of the fishers' fish ... It should not be a *fait accompli* (Artisanal Fisher F).

We need proper fisheries management plan (Artisanal Fisher D)

The adoption by the state of western approaches to the management of marine natural resources is largely viewed as destructive to the fishing industry, and to the environment. Furthermore, the imposition of foreign systems of rules has eclipsed fisher's knowledge, while simultaneously disregarding their interests. Such approaches undermine local epistemologies and ways, practices and traditions for engaging with the marine environment. Epistemic justice is not well served when policies fail to take account of this knowledge, all the more so when it results, as shown here, in negative consequences for local communities. One fisher explained the difficulties they face experience in getting their voices heard in policy making:

You are 'the small people' and that is the problem (Artisanal Fisher F).

We are the victim of development' (Artisanal Fisher C).

Silenced and made epistemologically invisible, fishers concerns have moved from that of epistemic exclusion to a wider concern about the structural biases that denies them agency in the management of marine resources from the onset.

6. Conclusion

Current biodiversity and marine conservation initiatives offer promising avenues for local knowledge holders to engage in participatory management of the marine environment. In our study we demonstrate how concern about overfishing is shared across different agencies and actors, including international bodies, government agencies, NGOs and fishers' associations, and how this can potentially serve as common grounds for collaboration. This research has also revealed the potential of LEK to promote sustainable fishing practices, including, in this case, through informing temporal fishing closures, identifying the localities of spawning aggregations, detailing the abundance and distribution of threatened species, and the revealing the environmental impacts of development projects.

In the Seychelles, the thick, well developed networks between the government and civil society institutions, embedded in a history of stakeholder participation, provides space to engage in epistemic sharing. In addition, the high degree of organisation of fisher stakeholders, combined with current good governance principles operated by intentional agencies and actors active in Seychelles' development policies, also offer fruitful opportunities for the integration of fishers LEK. However, our research revealed the challenges of such integration. Although actors share in common their concerns about overfishing, they do not hold a common position on how to address this issue. While international agencies push for tighter management of marine resources, including through a closure of the marine commons, and local conservation groups suggest incentivising alternative forms of economic activity, local artisanal fishers hold that their traditional fishing practices can be used as a basis for sustaining the marine ecosystem and thus of local livelihoods. Our research revealed that these traditional practices have come under threat over time as fishers have become caught up in a system of debt that itself encourages overfishing. Focusing on the perceptions of this artisan fishers' community, the research also revealed that the new opportunity to utilise traditional knowledge and practices in the development of the Blue Economy initiative and its related MSP, has become lost. The tragedy is that this debt

for nature swap will not only make local communities more economically vulnerable, but may also hasten the decline of marine biodiversity as the state struggles to find the resources necessary to implement and enforce its plans, while simultaneously losing the ability and willingness of the local fishers' community to help police its marine resources.

The concept of epistemic injustice has been used to frame this paper. Returning to the dimensions of testimonial injustice, we see how the concept has allowed us to understand better the ways in which certain views of the world hinder the ability of some groups to participate in knowledge production as agents. Top-down consultation processes, driven by the privileging of western forms of knowledge and management approaches, has denied the validity of local knowledge. From the perception of LEK holders, knowledge exchange has been replaced by a consultation process that treats them as mere passive recipients of the knowledge has been produced by others and through other ways of seeing and knowing. Mistrust also emerges when conservationists express a need to test the scientific credibility of LEK to justify its integration into marine conservation practice. The denial of credibility has, in turn, fed into a lack of trust between actors across all levels. Thus, this article goes beyond the view prevalent in the literature that LEK is merely useful as a 'tool' that provides inputs for policy [89-91]. In contrast, the epistemic justice approach utilised here points to the importance of examining how to achieve respectful synthesis in knowledge sharing, one that requires institutional pathways, built on trust. Despite revealing thick networks between the state and civil society organisations, the research points to the difficulties of ensuring equitable knowledge sharing when trust is absent.

Returning to the hermeneutical dimension, this concept has also allowed us to theorise better how such epidemically unjust knowledge practices can prevail. The concept enables us to query whose interests are served by the practice of epistemic injustice and the marginalisation or neglect of the full range of epistemic resources available within a society [92]. The powerful are likely to have a particular epistemic advantage in silencing other voices. In the Seychelles case, contemporary planning decisions made about the marine environment seem, on the one hand, to be designed to restrict fishers' access to marine resources, while, on the other, are seen to advantage other economic interests (such as aquaculture and foreign owned tourism). This makes local fishers sceptical about government policy and unwilling to have further restrictions imposed upon them in the name

of biodiversity conservation. Therefore, when policy is being made certain interests are seen to be favoured over others, and some forms of knowledge are supported, whereas others are marginalised. Thus, examining the opportunities to engage in marine conservation in ways that respect, and value different epistemologies also requires that we investigate how power is exercised [93]. The uneven distribution of power, between public officials, international agencies, and between different fisheries organisations, as manifested in policy decisions that favour certain interests while marginalising others, has consequences for the engagement of LEK holders [94]. In the Seychelles, this is not just a matter of trust between planners and local communities, but also the transparency and accountability of state institutions. What is seen as the skewed making of rules reduces local confidence in the governance system and willingness to participate in knowledge sharing. There is a missed opportunity here.

Emerging democracies have difficulty in engaging civil society, yet this research points not only to the positive benefits that such engagement can bring for marine conservation, but also how epistemic justice can enhance trust in governance, thus supporting good governance not just of marine resources but more generally.

Hindering knowledge exchange and the agencies of certain groups compromises the ability of society to share epistemic resources and to utilise these resources to the full. In this case, marine protection policy is weakened by practices that are not properly informed by the social experience of all knowledge holders. In this light, we conclude by suggesting some ways in which to facilitate credibility and trust so as to enable the policy advantages that full epistemic inclusion brings.

We recognise that avoiding unwarranted epistemic exclusion is a difficult task. Epistemic power does not emerge in a vacuum, but is historically formed [30], making the task of overcoming epistemic oppression structurally complex. However, we can advocate for better, more responsible epistemic conduct [35]. To this end, Fricker advocates the development of a reflexive, critical testimonial sensibility, that would stimulate correction of judgements of credibility [32]. Developing epistemic responsible agency is also needed [95]. This invites participants in natural resource management to a long term process of mutually respectful learning [29]. Changing the credibility assessment of groups hitherto deemed less worthy could build on the acknowledgement that all epistemological systems are historical and social developments, as mentioned in the opening section of this paper.

This understanding of the socially rooted nature of all knowledge serves well to remove practices that privileging one form of knowing. There is a rich literature with insights into how credibility deficits can be bridged by re-thinking the nature of expertise, including through acknowledging the placed based knowledge that is held by local communities and by citizens [96]. While this would go some way to undoing the harm caused to the knowers, dealing with the structural problem of hermeneutical injustice requires addressing structurally prejudicial found in the ways society deals with knowledge resources [97]. In other words, this means that the very structures of knowledge sharing, not just their practices in particular conditions, which construct and maintain that asymmetry must be interrogated [95]. We hope that this paper has gone some way to starting this interrogation, by showing how knowledge sharing practices are shaped by wider context, including the desire to advance particular economic interests.

Our contribution lies in applying the concept of epistemic justice to stakeholder participation in natural resource management, in particular in relation to the marine environment. Using the concept of epistemic justice to theorise the use of LEK in marine conservation policy, we have cast new light on the multiple dimension of knowledge exclusion, including at both the epistemological and structural levels. We also suggest ways in which this exclusion may be overcome.

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Footnotes

1 Stakeholders were from University of Seychelles staff, Cardiff University staff, the British

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