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Gender differences in the perceived impacts of coastal management and conservation



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Gender influences the ways that people are involved in and rely on coastal resources and spaces. However, a limited understanding of gender differences in this context hinders the equity and effectiveness of coastal management and conservation. Drawing on data collected through purposive sampling from 3063 people in Fiji, Papua New Guinea, Solomon Islands, Indonesia, Kenya, and Madagascar, we explored how men and women perceived the effects of coastal management and conservation on human well-being. We found significant gender differences in perceptions of the presence of impacts, whereby 37% of women and 46% of men perceived individual-level impacts, while 47% of women and 54% of men perceived community-level impacts. When asked about the degree and direction of impacts, the responses were not significantly different by gender. When describing the types of impacts, women and men articulated these differently, particularly impacts related to economic, governance, and health aspects of well-being. These findings highlight pathways for developing more equitable and gender-responsive coastal management and conservation initiatives aimed at safeguarding biodiversity, sustaining fisheries, and supporting the well-being of all those who depend on the marine environment.

Coastal management and conservation interventions aiming to support nature and people are often confronted with trade-offs between social and ecological objectives, yet opportunities also exist for multiple objectives to be advanced simultaneously^{1,2}. There is increasing evidence from around the world that equitable and inclusive management of natural resources and spaces leads to better social and ecological outcomes, while also supporting human rights and gender equality^{3–7}.

Gender and coastal management

Gender influences the ways that people (women, men, and non-binary gender identities) are involved in and rely on coastal spaces and resources^{8–13} (Box 1). Despite this recognition, there has been limited attention to the ways that coastal management and conservation might lead to different outcomes based on gender—in terms of the distribution of costs and benefits of management actions—and how gender equality (equal rights,

opportunities, and treatment of all people) interacts with and influences outcomes^{14–16}. This understanding is needed to support an increasing emphasis on social equity (fairness and responsiveness to needs) and, more specifically, gender equity within global biodiversity conservation efforts and beyond.

Coastal management and conservation approaches differ around the world but often include closed areas and other restrictions to fishing in order to support habitat protection; promote sustainable resource use; increase food security; or reinforce customs, among other objectives¹⁷. Traditional management practices in some places include gendered harvest restrictions and protocols, such as taboos and other rituals that shape how women and men interact with coastal spaces and resources^{18–20}. However, few management approaches explicitly address gender equity issues within their establishment or evaluation frameworks²¹. Understanding gender differences in perceptions of coastal management and conservation outcomes is

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Box 1 | Definition of terms

Gender is defined here as the socially constructed attributes and opportunities associated with being a woman, man, or non-binary person. This has to do with how society defines masculinity and femininity based on what is considered appropriate behavior for women, men, or non-binary people in any given context³⁰.

Gender equality defined here means equal rights, opportunities, and treatment of all people in all spheres of life. Equality does not mean that all people are the same but that their rights, opportunities, and life chances are not governed or limited by gender⁶⁴.

Gender equity defined here means fairness in the treatment of women, men, and gender minorities with respect to their rights, benefits, obligations, and opportunities. To achieve fairness, treatment is adjusted according to respective needs, which at times requires special treatment/affirmative action/positive discrimination based on gender³⁰.

Social safeguards are a set of processes designed to respect and protect the rights of people that may be disproportionately impacted by development or conservation efforts. These have emerged as a mechanism for identifying and mitigating negative social impacts that could result from conservation policy and practice^{25,26}.

important for improving the perceived legitimacy of these efforts as a necessary ingredient to the overall success of coastal management and conservation efforts^{22–24}. Identifying impacts of management that are more pronounced for women, particularly in contexts where women are already marginalized, could inform targeted approaches and interventions that support gender equity. These insights could support social safeguard policies and programs that are increasingly being integrated into conservation programs and practices^{25,26}. For example, previous work has shown that increasing women's engagement in natural resource management can lead to improved outcomes through increased innovations and problem-solving³. This matters for women, first and foremost, but also has society-wide ripple effects as gender equity is not just about women; it is about improving the lives of everyone, removing barriers to advance collective and individual human well-being while also supporting the health of the planet²⁷.

Global commitments and emphasis on gender in conservation policy and practice

Various high-level policy instruments that are guiding conservation and management into the coming decades articulate commitments to gender equality. For example, the United Nations Decade on Ecosystem Restoration proclamation emphasizes the importance of “Recognizing the crucial role that women play in ecosystem conservation and restoration and stressing the need for the full participation of women at all levels of policy-making and implementation for ecosystem conservation and restoration” (General Assembly resolution 73/284²⁸). Equally relevant in the context of coastal ecosystems and livelihoods are the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication²⁹. These guidelines provide a clear framework for the governance of small-scale fisheries underpinned by a human rights-based approach with gender equality and the empowerment of women as key priorities³⁰.

Of particular note is the emphasis on gender equality within the recently adopted Kunming-Montreal Global Biodiversity Framework (GBF), a pivotal component under the world's most influential conservation agreement, the Convention on Biological Diversity. The GBF is unprecedented for its emphasis on prioritizing social equity within the conservation sector, including gender considerations³¹. The framework incorporates two targets focused on gender, stating that “successful implementation of the framework will depend on ensuring gender equality and empowerment of women and girls and reducing inequalities”, and has developed a Gender Action Plan to aid implementation³². This framework uses ‘gender-responsiveness’, which calls for conservation policy, planning, and programming to equally address the perspectives, interests, needs, and human rights of all people, especially women and girls that are, in many contexts, underrepresented. Furthermore, it underscores the need to collect and understand information and data on how gender contributes to different human well-being outcomes. As countries adopt the GBF and other policy instruments, that emphasize gender equality, into national policymaking (or aspire to do so), environmental organizations will also be motivated and encouraged to ensure that their work aligns with these instruments.

However, the lack of established guidelines or clear practices on how to understand and support gender equity and equality within coastal management and conservation programming, and the capacity to do so, means that considerable gaps continue to exist in delineating what exactly gender-responsiveness looks like across contexts from around the world. To this end, we explore how women and men perceive the impacts of coastal management and conservation. Using data from 3063 respondents in six countries (Fiji, Papua New Guinea, Solomon Islands, Indonesia, Kenya, and Madagascar), we asked: (i) Are there gender differences in whether people perceive impacts of coastal management and conservation at the individual and community levels? (ii) Does the degree of perceived impact of coastal management and conservation differ by gender? (iii) How do women and men describe the impacts of management and conservation on human well-being?

Results

Approximately half of the 3063 survey respondents ($n = 1579$) across the six-country contexts indicated that management had an impact, with all of these (51%, $n = 1579$) mentioning community-level impacts and 42% ($n = 1308$) mentioning individual-level impacts, with many people mentioning both (Supplementary Table A3). At the aggregate (or global) scale, there were significant differences by gender in these responses for impacts at both the individual [$\chi^2(1, n = 3063) = 26.601, p = 2.5e-7$] and the community [$\chi^2(1, n = 3063) = 12.764, p = 0.0003$] levels. Approximately 37% of women who responded said that management did affect them personally, whilst 46% of men who responded perceived individual-level impacts. At the community level, 47% of women perceived impacts, whilst for men, the majority (54%) of respondents perceived community-level impacts.

Meanwhile, in response to questions about the degree of impact (Likert-style question), across the total sample, individual- and community-level impacts were not significantly different by gender (Fig. 1 and Supplementary Table A4 for p values). At the country level, gender was not significantly related to perceived impacts at the individual and community levels, except for Fiji for community-level impacts (Supplementary Table A4).

From the subset of respondents who described the impacts of management, there were similarities and differences by gender in terms of the type of impacts, visible at both global and country scales. Grouped into six human well-being domains, the costs and benefits mentioned at the individual level related most to the economic domain, and this was consistent across genders (Fig. 2). At the community level for both men and women, the most mentioned domain for benefits was the environment, and for costs, it was governance. The least commonly mentioned domain was culture, and this was consistent across gender and societal levels. The most apparent differences between genders were in relation to health benefits, with more women mentioning health benefits at both the individual and community levels. The specific types of impacts experienced by women and men differed for some, but not all aspects of human well-being (Fig. 2). In the following section, we present the themes that emerged from the data within each of the

Fig. 1 | Perceived degree of impact of management at the community (top panel) and individual (bottom panel) level by gender.

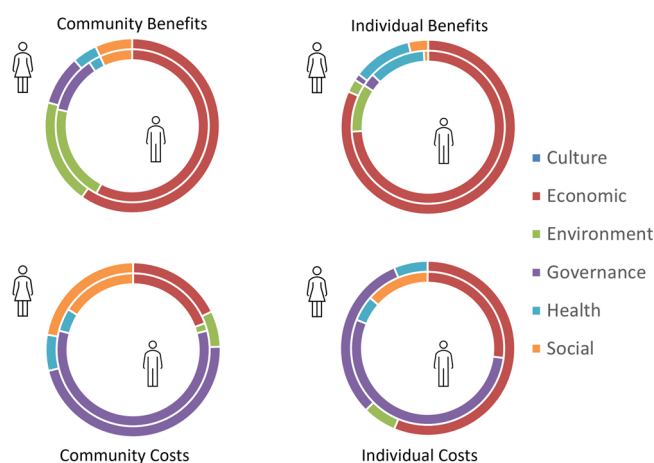
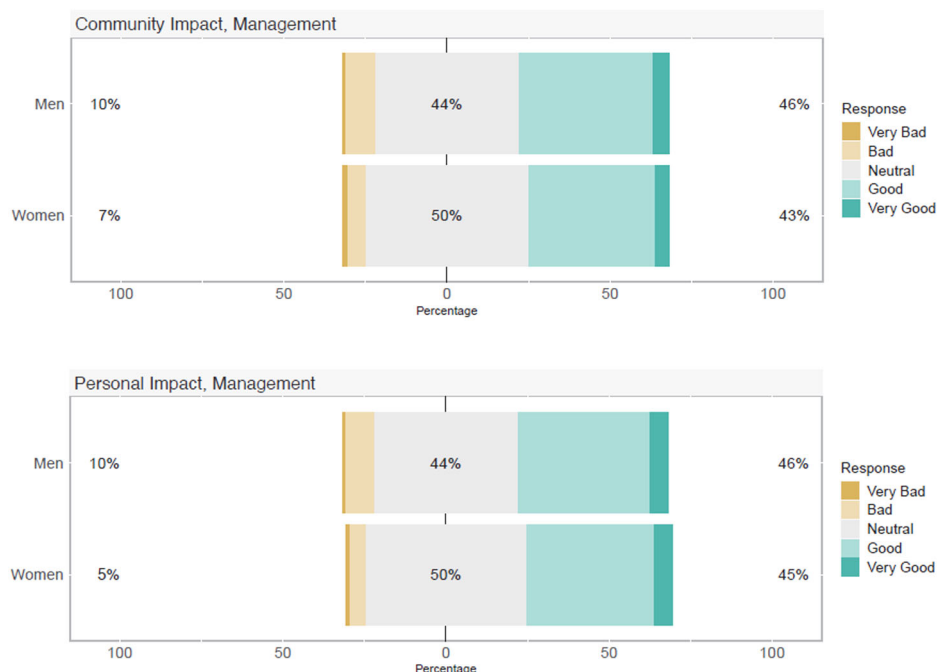


Fig. 2 | Proportion of responses about perceived positive and negative impacts of management grouped by human well-being domain at the individual and community levels for men (inside circles) and women (outside circles).

six domains of human well-being. We highlight the key themes within each domain and whether there were similarities or differences in the frequency of responses by gender (Fig. 3).

Economic domain

Themes mentioned that relate to the economic domain of human well-being included: impacts on livelihoods, employment, and income; access to markets, fishing gear, and/or capital; and changes to fishing effort or costs (Fig. 3). Women mentioned income from the sea as a benefit of management more often than men (Fig. 3; e.g., “fishing areas have more fish hence more to sell for income”—woman from Chubikopi, Solomon Islands). This was especially the case in Indonesia, Kenya, Madagascar, and the Solomon Islands. Overall, women also expressed, fishing is harder; however, at the country level, there was considerable variation with this being expressed more frequently by women in Indonesia, Kenya, and Solomon Islands, whereas this came up more frequently by men in Fiji and Papua New Guinea. Meanwhile, decreased income from the sea was also cited more

often by women than by men as a cost of management (Fig. 3). For example, a woman from Karimunjawa, Indonesia indicated that it is “hard to find a location for fishing”. However, at the country level, there was considerable variation.

Men indicated access to markets, gear, and infrastructure as a benefit more often than women, mainly in Kenya and Indonesia. For example, a man from Batu Putih, Gita Nada, Indonesia, described the impact of management as being able to “get the help of a canoe and nets”. Men also described that assistance is uneven or lacking as a negative impact of management more often than women surveyed (e.g., “but the help is not evenly distributed”—a man from Dara Kunci, Raki Lipan, and Indonesia). However, a difference by gender for this impact was only substantial for Indonesia.

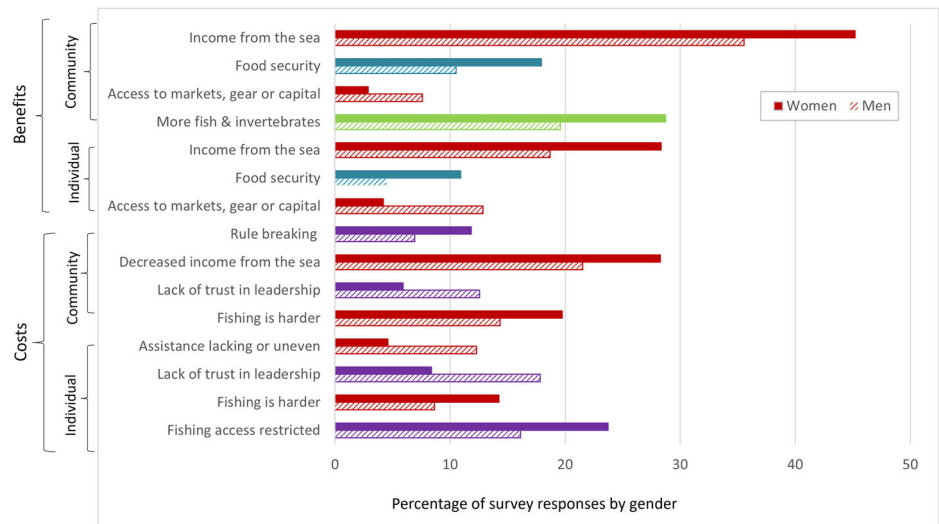
Environmental domain

Respondents expressed that there were impacts related to ecosystem health, species abundance, and biodiversity, which we considered within the environment domain of human well-being. The most pronounced difference by gender in this domain was that women mentioned an increase in fish and invertebrates as a positive impact of management on the community more often than men, mainly in Melanesia. For example, a woman from Nonovaul in Papua New Guinea said, “with the tambu area [fisheries closure] the number of fish has increased”. A woman from Peava, Solomon Islands, explained that “people listen and agree to manage fishing areas; as a result, there is an increase in fish and biodiversity is healthy.” Most of the other responses that related to the environment domain had similar proportions by gender.

Governance domain

Governance-related impacts were expressed by respondents as changes in access to fishing grounds; lack of trust in leadership and management; compliance and adherence to rules; and ability to monitor and enforce rules. Men indicated a lack of trust in leadership and management more often than women surveyed (e.g., “there is inequity between the management committee leaders and members”—man from Imorona Center, Madagascar). Overall, women indicated restricted fishing access as a negative impact of management more often than men (e.g., there are “too many prohibited locations”—woman from Karimunjawa, Indonesia). However,

Fig. 3 | Themes mentioned with the largest gender differences, with the x-axis representing the proportion of respondents by gender group that mentioned a particular cost or benefit of management at the community or individual level. The y-axis is the cost or benefit mentioned. Colors of the bars relate to the well-being domains, where red relates to the economic domain, light blue to health, green to environment, and purple to governance.



there was considerable variation across country contexts, with women mentioning this more than men in Indonesia and Solomon Islands, while the opposite was true in Kenya and Madagascar, where men mentioned this more than women.

Health domain

Health-related impacts described by respondents included food security, and mental and physical health. Surveyed women mentioned food security as a benefit of management more often than men. For example, in Solomon Islands more women than men surveyed mentioned food and nutrition security benefits of management (e.g., the “number of fish increases, family consumption of fish is more”—woman from Chubikopi, Solomon Islands). This was also the case for Kenya, whereas we see the opposite in Papua New Guinea with men mentioning this more often than women. Mental and physical health-related impacts were mentioned much less frequently but in similar proportions by women and men surveyed.

Social domain

The themes mentioned related to the social domain of human well-being included social capital; infrastructure; education, training, and skills; and considerations for future generations. Where social impacts were mentioned, some gender differences were visible at the country level, mainly in Kenya and Melanesian countries. For example, in Kenya men indicated positive social impacts of management more often than women, mentioning education, training, and skills as benefits of management (e.g., “the community didn’t have the knowledge of the destructive gears but now they are aware”—man from Mwaembe, Kenya). Men mentioned safety concerns more than women, especially in Indonesia, Kenya, and Papua New Guinea. In Fiji, women mentioned benefits to future generations more often than men, whereas in Papua New Guinea, this response came up more frequently among the men surveyed. For example, a woman from Dalomo, Fiji said, “happy to know that there will be fish available for the future generation”, while similarly, a man in Kavirongon, Papua New Guinea, said that management “will help future generations.”

Cultural domain

Themes expressed in the cultural domain of human well-being overlapped with other domains of human well-being, such as health. For example, respondents shared as an impact of management increased availability of food for village functions, occasions, and ceremonies. This was interpreted as contributing to food security and supporting cultural practices. However, among the six countries, cultural impacts were the least frequently cited domain and only appeared in the survey responses from the three Melanesian countries, mentioned most in Fiji, in similar proportions by women

and men surveyed. Responses included, for example, the ability to harvest for cultural practice (e.g., “the tabu area [fisheries closure] allows the community to have an abundance of fish during village occasions [when the tabu gets lifted]”—a woman from Levuka, Fiji; “Nakali tabu is fished three times a year or more to support church and village functions through fundraising and catering”—a man from Navatu, Fiji).

Discussion

Research examining gender differences in the outcomes of conservation and management is limited, and examples tend to focus on a single country or sub-national contexts^{14,24,33}. Here, we looked across six countries to understand gender differences in the perceived impacts of management. We found significant gender differences in impacts being perceived; however, the degree and direction of impact indicated was not significantly different by gender, while the types of impacts described were articulated differently by women and men, particularly those relating to economic, governance, and health domains of well-being. In identifying the domains of human well-being where differences were most pronounced, we discuss how this information can support the development of gender-responsive coastal management and conservation policies and programs.

The different perceptions observed here reinforce the need to engage both women and men, and perhaps in different ways, to identify the risks and co-design conservation and management. The key finding that there are significant differences by gender in whether impacts are perceived in the first place, with more women perceiving community-level impacts than individual ones and more men overall perceiving impacts, suggests that management efforts may focus more on those activities that men are involved in, as has been shown in other local studies¹⁶. This is further reflected in the types of impacts described. To understand how management approaches might lead to or reinforce gender inequalities in management outcomes^{33,34}, there needs to be more engagement with the increasing body of knowledge that dispels the widespread assumption that fishing in many contexts is an activity that only men engage in refs. 35–40. For example, women surveyed in this study reflected on the perceptions that fishing is harder or access to fishing is restricted due to management more so than men. Gender risk assessments are one way to get at this, whereby women and men identify perceived risks associated with management and conservation at the outset, and then actions to mitigate these risks are then built into project design and planning with those communities^{26,41}. This is currently being done as part of a broader set of social safeguards (i.e., efforts to identify and mitigate negative social impacts that could result from conservation policy and practice) being incorporated into project planning stages in coastal management initiatives²⁶ and could be reinforced broadly if funders were to ask at the proposal stage for these types of risks to be identified. While some

programs/projects might already employ gender risk assessments, others simply do not have the expertise or capacity to do so. Thus, funders and grantmakers can also advocate for gender risk assessments to be a requirement in the process of applying for conservation funding—either in addition to or as part of existing Environmental and Social Impact Assessments^{42,43}—and financially support them.

Our findings highlighted gender considerations associated with various domains of human well-being that could be used as a basis for identifying potential risks. These can also highlight important areas for targeted interventions to better support gender equity and human well-being in the context of coastal management and conservation. Gender influences how people engage with coastal spaces and how they participate in and are affected by management. Although gender is increasingly recognized as an important organizing category for understanding what is taking place along the seascape¹⁶, there is still limited recognition of (and data collected on) gendered fishing patterns (habitats, species, gears⁴⁴) and roles across coastal seascapes⁴⁵. This information is critical, for example, in understanding gendered fishing access and/or changes to it as an important governance-related impacts⁷. Our finding that women were more likely to say that fishing is harder under the management restrictions suggests that perhaps the locations where they fish may not have been adequately considered while designing areas that would be restricted to fishing. Understanding gender dynamics is important from an instrumental point of view (i.e., in terms of influence on management effectiveness), as perceived impacts of management affect incentives for and support of management and conservation⁴⁶, while also providing key insights for developing effective interventions in support of gender equity and human rights⁵.

As an action to support gender-responsive coastal management, mapping fisheries (seascapes and value chains) is an important first step that involves identifying relevant actors, activities, and use of spaces by gender and other important demographic characteristics^{7,47,48}. Such mapping can address the economic dimension of well-being, the most mentioned domain in our study. Mapping fisheries can help to identify opportunities for supporting women's livelihood activities, where in a particular context, existing interventions, such as access to fishing gear, may only benefit some fishers (mostly men). Taking a gender-sensitive value chain perspective can help identify appropriate interventions, such as supporting women fish traders through access to cell phones or other technology that connects them to buyers and market information⁴⁹. Fisheries mapping is thus a critical step in developing gender-responsive interventions that support women's coastal livelihoods and other economic dimensions of well-being.

In contexts where gender norms strongly dictate the activities that women can engage in outside of the home, management, and conservation interventions such as alternative livelihood programs must be developed with input from women, so that women fishers and/or women in fisher families are also able to access these⁵⁰. Designing gender-responsive interventions requires understanding socio-historical change and drivers of gender norms⁵⁰. And where gender norms prevent such access, working with women, men, and gender minorities to shift these norms could create more equitable outcomes⁵¹. This may require a phased approach with short-versus long-term goals in a shift towards more inclusive, more participatory engagement of women and gender minorities. Understanding gendered roles and responsibilities within the communities and contexts surveyed may also help identify the reasons why women indicated community-level impacts, while more men indicated individual-level impacts of management.

Future research directions

Our analysis used data collected as part of a large-scale monitoring and evaluation effort that has multiple aims. Leveraging an existing dataset allowed us a unique opportunity to conduct a multi-country gender-differentiated analysis on the outcomes of conservation and management but limited our ability to investigate these issues in greater depth, including with regard to identifying the underlying drivers of the gender similarities and differences we observed. For a more detailed understanding, we

recommend future research using a case study approach and additional qualitative methods such as focus groups to ask targeted questions about how gender and other intersecting identity characteristics influence the outcomes of management and conservation⁴⁷. Our finding that some women indicated *increased income from the sea* while others indicated decreased income from the sea as an impact of management may reflect varying economic realities across contexts. A more in-depth look at demographic characteristics may reveal additional factors driving these responses. This underscores the importance of an intersectional analysis to get a more fulsome understanding of how the many aspects of a person's identity can amplify the costs and/or benefits of coastal management and conservation, including going beyond a binary interpretation to include all genders⁴⁷. And in addition to identifying impacts, seeking input on solutions requires further work into participatory approaches that are gender inclusive and sensitive to social-cultural contexts. Finally, the large percentage of respondents (both women and men) that indicated management had no impact at all, invites further investigation into the alignment between community needs/interests and management activities across all genders and reinforces the importance of co-designing management objectives with communities more generally.

Pathways for gender-responsive coastal management and conservation

As we awaken to the immediacy of actions needed to safeguard planetary health, there is an opportunity to simultaneously address social equity by developing pathways to support all of humanity, not just those who are privileged by their inherited identity. In this study, we identify potential pathways for gender-responsive coastal management and conservation and conclude with the following three recommendations for practitioners, grantmakers, and environmental organizations to consider:

1. **Building capacity** is essential to being able to see and understand gender differences in interests, needs, knowledge, and values, and the contextual gender norms and relations that underpin these differences⁵². This should ideally be done by engaging local gender expertise to undertake this work and provide gender training to practitioners, with this expertise built into programs and engaged throughout the life cycle of projects through sustained investments, not just as add-ons or one-off efforts.
2. **Co-designing programs** with the perspectives of all genders elicited (e.g., via gender risk assessments) and integrated, is fundamental to a gender-responsive approach^{26,41}. This should be done at the earliest possible stage of project development to identify and mitigate harmful impacts on gender relations and, ideally, to address and shift gender norms that are limiting.
3. **Developing targeted interventions** based on context-specific understandings of the ways that gender and other intersecting identities (e.g., age, resource user type, ethnicity, etc.) influence how people engage with, participate in, and are impacted by coastal management and conservation³. This requires, for example, fisheries (or other coastal resources) mapping exercises to identify relevant actors, activities, and use of spaces, by gender and other important demographic characteristics. This can inform stakeholder identification and engagement, and project evaluation to assess progress towards gender equity targets such as those outlined within the Global Biodiversity Framework and beyond.

Conclusion

In summary, we found significant gender differences in perceptions of the presence of impacts of coastal management and conservation. For those that did perceive impact, the degree and direction of impact did not differ significantly by gender, but the type of impacts articulated by women and men did differ. These findings aim to inform ongoing conversations among environmental organizations, practitioners, and supporters about how to close the gap between commitments and action towards gender equity and equality in coastal contexts around the world. These conversations are

needed now more than ever as countries across the world develop action plans to meet the GBF's headline goal to protect 30% of the planet by 2030—action plans that must include the interests, perspectives, and knowledge of the people—of all genders and identities—that these actions will impact the most.

Methods

Study sites

We surveyed residents of 76 coastal communities dependent on coral reef fisheries in six countries: Fiji, Papua New Guinea, Solomon Islands, Indonesia, Kenya, and Madagascar. In addition to their proximity to and dependence on coral reef fisheries, communities were selected based on whether they were associated with, or were planning, locally, co-, or government-managed area-based management⁵³. The six countries surveyed span various social, cultural, and ecological contexts. And while there are some common characteristics in terms of management approaches and objectives⁵⁴ and gender dynamics in each country, there are also considerably different management contexts across these countries (Supplementary Table A1). For example, in Fiji, communities have established locally managed marine areas with fisheries management rules, including traditional closures (tabus) within customary fishing grounds that are recognized under law¹⁷. In Madagascar and Kenya there are similar community or co-management arrangements⁵³. In Indonesia, government agencies have formal authority over most legally declared marine protected areas (MPAs); however, community members, community groups, and, in some cases, traditional leaders, are being empowered to be more involved in management^{55,56}. The purpose of the survey was to evaluate subjective perceptions of local management irrespective of management approach.

Sampling

We collected data from 3063 individuals (1239 women and 1824 men) across 76 coastal communities using household surveys between 2017 and 2019 (Supplementary Table A2). Within each community, households were systematically sampled, whereby a sampling fraction of every *i*th household (e.g., second, third, and fourth household) was determined by dividing the total community population by the desired sample size^{53,57}. The desired sample size was determined based on the population of the community and the time available at each site. The number of surveys conducted per community ranged from 6 to 157. This sampling strategy ensured that the sample was both random and geographically representative. Purposive sampling targeted heads of households or an adult (woman or man) who could provide information on behalf of the household surveyed and drew on a stratified sampling approach to ensure key social subgroups (in particular, men and women) were well-represented in our sample. Due to strong socio-cultural norms shaping gender in each of the geographies, the research focused on women and men and, although we recognize that other gender identities exist in these contexts, we were not able to capture these here. Surveys were conducted by trained interviewers, in local languages and dialects. The survey- instruments were approved by the Wildlife Conservation Society's Institutional Review Board and all surveyors underwent training in human subjects' research to protect subjects' privacy and data confidentiality.

The surveys were undertaken as part of a broader social-ecological systems monitoring program: the Marine and Coastal Monitoring framework⁵⁸. The framework underpinning the program is based on Ostrom's social-ecological systems framework⁵⁹ and was developed through a transdisciplinary process with the aim of supporting the Wildlife Conservation Society in identifying the social and ecological outcomes of their coral reef management programs. All social and ecological surveys were compliant with ethical standards as specified by the WCS Institutional Review Board. The survey elicited data on the processes and outcomes of management, as well as demographic data. For this study, we focused on a subset of questions related to the perceived impacts of management (see Supplementary Materials for survey questions).

Perceptions of impacts of coastal management and conservation

We elicited perceptions of the impacts of management and conservation at both community and individual levels. Given that previous work highlighted disparities in how resource users perceive the benefits of management to themselves versus to their communities, with implications for management compliance⁶³, we examined impacts at these two societal levels. We first asked participants whether they perceived the impacts of management. We then asked participants open-ended questions about what types of negative and positive impacts they perceived. Subsequently, we asked them to provide an overall assessment of the degree of impact on the community using a five-point Likert-type scale ("very bad", "bad", "neutral", "good", "very good"). We then repeated the questions for perceptions of impact at the individual level. We converted these responses to ordinal values and analyzed the ordinal data.

Data analysis

We assessed whether gender was related to whether respondents perceived the impacts of management using chi-square analyses. To assess whether gender was related to the perceived degree of impact of management, we used Cochran-Armitage tests, which accounted for the ordered nature of the data. All analyses were conducted in R Statistical Software (version 4.0.3). We focused the scale of our analysis at the global and country levels, while recognizing that there are variations in approaches to coastal management and conservation as well as differences in gender dynamics at the community-level.

We iteratively coded the responses to open-ended survey questions about the positive and negative impacts of coastal management and conservation to identify themes using the qualitative analysis software NVivo R1⁶⁰. We then organized these themes using the concept of human well-being^{23,61,62}, defined as "a state of being with others and the environment, which arises when human needs are met, when individuals and communities can act meaningfully to pursue their goals, and when individuals and communities enjoy a satisfactory quality of life"⁶². Human well-being is one of the key social objectives in the management of many marine social-ecological systems^{58,63}. We grouped themes into the six domains of human well-being, as described in Ban et al.⁶¹: cultural, economic, environmental, governance, health, and social. We then analyzed the data by gender to identify differences and similarities in responses by women and men. We engaged country teams in the interpretation of survey responses, especially team members who were involved in conducting the household surveys and are deeply familiar with the cultural contexts and nuances of the language used, to understand context-specific information and ensure it was properly coded.

Data availability

Data supporting the analyses and results of this study are available in the Supplementary information. Correspondence regarding this data should be addressed to S.J.H.

Code availability

Code for Likert-style data analysis and plotting is included in supplementary information.

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Author contributions

S.J.H., E.D., G.G.G., S.J., S.M., W.P.L., and N.C.B. contributed to the design and ongoing development of the study. R.S., S.S., S.J., S.M., and W.P.L. supported data collection. S.J.H., G.G.G., S.M., and E.D. contributed to the data analysis. All authors contributed to the interpretation of the results. W.P.L. supported language translation. S.J.H. was responsible for drafting the text, with S.M., S.J., N.C.B., G.G.G., and E.D. contributing to the writing. E.D. developed Fig. 1, S.J.H. developed Figs. 2, 3, and G.G.G. did the statistical calculations. All authors provided substantive feedback on the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

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