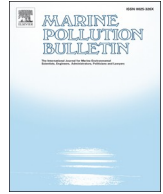




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Promoting sustainable and inclusive oceans management in Pacific islands through women and science

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ABSTRACT

The question of how to efficiently and effectively manage ocean resources in a sustainable way has reached the forefront of discussion at an international level, but women's contributions to this process have been underestimated or unrecognized. Inclusive management plays a major role in the effective creation, use and adoption of environmental governance, necessitating efforts to measure, monitor and advance inclusivity. In many Pacific island states, there is a lack of disaggregated data collection and management to assist reliable and liable gender-responsive decision-making by national and regional authorities. This lack of information leads to unquantified female contributions and unexplored potential for women to actively contribute to sustainable ocean management as traditional leaders, researchers or science-based managers and in accordance with traditional customs, cultures and processes. This paper examines the contribution of gender-disaggregated data in both (1) effective management of natural resources and (2) measurement and monitoring of the active involvement of women in ocean management. We seek to shift the question from simply "*(How) are oceans used by women?*" to "*How can we build a clear path towards inclusive oceans management using science?*", drawing data mainly from gender and ocean management practices in Pacific Small Island Developing States. This work also seeks to ground in reality the increasing national and international evocations about social equity and avoidance of gender discrimination. Given the existing relationships of Pacific peoples with the ocean and the emerging status of ocean science-based governance, wider integration of science and women in marine management can make an interesting and positive impact in this region.

1. Introduction

Resilient ocean management relies on effective information and engagement by a broad range of users and decision-makers. However, there are structures and systemically embedded hurdles that perpetuate biased or non-inclusive decision-making for oceans, including gendered decision-making (Gissi et al., 2018). Inclusive approaches result in more effective environmental management with greater uptake of information and consensus (Lane and McNaught, 2009; Matthews et al., 2014; Phillips, 2014) and are fundamental to the Small Islands Developing States (SIDS) Accelerated Modalities of Action (SAMOA) Pathway (UN General Assembly, 2014). Inclusivity can refer to the meaningful acknowledgment and incorporation of representatives from potentially

excluded or marginalized groups, such as groups defined by ethnicity, age, sex, gender, and other factors.

In the context of ocean management for Pacific islands, the priority areas for inclusivity are arguably sex, gender, age, and local and indigenous communities with their local and traditional knowledge (Govan, 2017). In this work, we focus on the importance and status of inclusion of women in Pacific islands ocean management.

1.1. Situational analysis

The Pacific islands region, represented by the broad groupings of Melanesia, Micronesia and Polynesia, consists of only 550,000 km² of land with over 11 million people spread across 33 million km² of ocean

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(Bidesi, 2008) (PRISM¹). Both subsistence and commercial fisheries are essential to Pacific livelihoods.

The participation and leadership of women in fisheries is increasingly recognized, yet formal qualitative and quantitative evidence from the Pacific islands region is still limited (e.g. a recent important UN Food and Agriculture Organization [FAO] publication only used one Pacific example, from the Solomon Islands) (Alonso-Problacion and Susana, 2018). The Asia-Pacific region accounts for 84% of the global workers in fisheries and aquaculture. Of these workers, 66% of the workers in large-scale marine fisheries and 54% in small-scale inland fisheries are women (UN (ESCAP), 2017). In the Pacific Small Island Developing States (PSIDS),² the “catch is big”, producing approximately two million metric tons from fisheries and aquaculture annually, worth an estimated US\$3.2 billion (Gillett, 2016). Women harvest over half of small-scale fisheries catches in this region (Harper et al., 2013).

In countries with rich ocean resources, women as well as men rely on the ocean for subsistence, livelihoods, cultural identity, and a broad range of ecosystem services. Equally, women hold knowledge, skills and traditions relevant for ocean resource management. However, despite the seemingly valuable contribution that women make to this sector, this contribution often remains uncounted and the nature of their work can be treated as inconsequential (Harper et al., 2013; Kleiber et al., 2015; Ogden, 2017). Women's activities in marine environments use different gear or locations, focus on different species, and in some cases are not considered “fishing” (Kronen, 2004). In fact, essential data that demonstrate the roles, needs and capacities of different social groups are missing (Harper et al., 2013; Kleiber et al., 2015; Charan et al., 2016; Ogden, 2017). The importance of subsistence fisheries and other traditional or subsistence marine resource use (e.g. mangrove mud dyes) in contrast to employment of public record is related to but does not fully explain the lack of attention to women's marine knowledge and marine resource use (Kronen, 2004). This lack of data regarding inclusivity, together with action plans to respond to the identified inclusivity information, is unfortunate as, following global trends, the Pacific regional attention now turns to ocean management in the context of a changing climate (Pratt and Govan, 2010).

Linking science to policy making to achieve more efficient management and/or cross-sectoral cooperation is a growing topic in the region, appearing in discussions in PSIDS since 2011 (Robin South et al., 2011). Inclusivity is a key component of that link and can facilitate the uptake of scientific information and engagement in traditional contexts and place-based communities (Lui et al., 2017), where factors such as language, social structure, and perceptions of knowledge ownership can create or remove barriers to sustainable environmental management and community resilience. Especially in regions which are challenged by natural hazards and where the need for building resilience is high, women and women's roles and needs should be formally represented at high-level decision-making posts. Female scientists and researchers can lead resilience-building from the grassroots level to more elaborate systems using scientific tools and assessment models. In parallel, official offices and staff positions that include women can provide stronger engagement of field-level technical groups and communities in order to meet their challenges and expand their economic activities while minimizing social, economic and environmental impacts (Lane and McNaught, 2009; Kleiber et al., 2015).

This work seeks to demonstrate the benefits of gender-inclusive

¹ <https://prism.spc.int/regional-data-and-tools/population-statistics/169-pacific-island-populations>

² We use the term PSIDS here to refer to the independent Pacific island states of Federated States of Micronesia, Fiji, Kiribati, Nauru, Palau, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Many of these concepts are also relevant for the protectorates and territories also present in this region: American Samoa, Commonwealth of the Northern Mariana Islands, Cook Islands, French Polynesia, Guam, New Caledonia, Niue, Tokelau, and Wallis & Futuna.

ocean science and science-based management and illustrate gaps in data-based monitoring. We particularly focused on the hypothesis, that in the case of PSIDS, there cognition and inclusion of women in ocean-related management and science can efficiently support sustainable ocean management and livelihoods.

1.2. Related work and approach

To the knowledge of the authors, there is no previous comprehensive literature related to the nexus of women and ocean sustainability in PSIDS. In this work, researchers who are active in intergovernmental (UN Environment) and academic institutions (University of Fiji and The University of the South Pacific) in the South Pacific region have worked together to form a knowledge baseline from which a more engaged dialogue can emerge. This dialogue requires a shift from perceiving women as solely users of the ocean and its resources to a more inclusive and multifaceted role of women in ocean sustainability.

Although the ramifications of interactions between women and the ocean extend beyond fisheries, the emphasis of this work will be on the fisheries sector with examples mainly retrieved from Fiji because this is where the majority of Pacific data can be found to date. It is noteworthy that information on gender impacts and participation of women in other aspects of ocean management and in other Pacific countries is poorly known. The Pacific gender spectrum also includes performed roles beyond the “man/woman” binary. The goal of inclusivity does not concern simply the “advancement” of women, but rather the inclusion of affected stakeholders in management decisions to stimulate effective, sustainable resource management for all. While the target groups for inclusivity may vary among locations and the changing cultural dynamics regarding roles across the gender spectrum are beyond the scope of this paper, the disaggregated data collection we call for here will inform the consideration of inclusiveness more broadly.

This work is structured as follows: Section 2 discusses the situation of gender relations in PSIDS and the constraints to inclusivity. Section 3 considers Pacific women as scientists and focuses on the post-graduation loss of young female scientists in the marine sector. Section 4 calls for improved disaggregated data collection in order to target more inclusive approaches, and finally, Section 5 considers how to join global and regional policy rhetoric to practical action within the Pacific islands.

2. Contributions of women to ocean sustainability

It is argued that inclusive approaches result in greater engagement by ocean users and decision-makers as well as greater uptake of information and community consensus (Lane and McNaught, 2009; Matthews et al., 2014; Phillips, 2014). International and national reports state that countries need to understand—and respond to—gender-based realities (including inequalities, misconceptions and disparities) if the agenda of sustainable development is to advance in the Asia-Pacific region (UN (ESCAP), 2017). Pacific countries are responding; for example, the Fijian Government has a National Gender Policy (Government of Fiji, 2014), which refers to official targets of institutionalized social justice and gender equity, as well as a Roadmap for Democracy and Sustainable Socio-Economic Development, 2009–2014 (Government of Fiji, 2009).

These policies have contributed to increasing the numbers of women in governmental posts, although Oceania has the lowest proportion of women in national parliaments in the world (UN Women, 2018). The presence of women as professionals in the Pacific marine economic sector, including national ministries of environment or marine affairs, has also become more prominent and dynamics are changing in the fisheries sector, from women catching and processing fish to women acting as fish merchants and managers in urban centers (Whippy-Morris, 2015). Globally, in all economic sectors, governance has begun to gradually shift towards more inclusive and participatory

modes (Nikitina et al., 2009) similar to the tourism industry where wider social and economic changes reshape travel patterns and tourist development (Coccossis, 2008) towards more sustainable themes (such as eco-tourism, health and spa tourism, and cultural tourism). In these themes and others, women are highly capable of taking lead roles in presently male-dominated fields.

Practical needs related to climate change also ask for strong contributions of women to management and markets because climate change effects are expected to affect women and men differently (Lane and McNaught, 2009; Thomas et al., 2018). Multiple factors, including limited mobility, especially in rural areas, as one example, places women in a position where they are disproportionately affected by climate change or natural disaster impacts on fisheries (UN, 2017; Thomas et al., 2018). Women are expected to face loss of harvests, often their sole sources of food (protein) and income. Related increases in food prices will make food less accessible, in particular to women and girls, whose health has been found to decline more than male health in times of food shortages (Lane and McNaught, 2009). This connection to food security means that the strong contribution of women to both domestic consumption and selling markets in fisheries underlines the need for gender equality in fisheries resource management (Charan et al., 2016).

Women can also contribute strongly to marine resource and resilient environmental management because female members of communities hold and manage unique knowledge of natural resources (Aalbersberg et al., 2005; Ram-Bidesi, 2015) and information on their society and economy (Musinguzi et al., 2017; Charan et al., 2016; UN WOMEN, 2014; Dennehy and Dasgupta, 2016; Gauthier et al., 2017). An example is the fish farming activities in Fiji which are having an impact on the empowerment of women with respect to more decision-making opportunities (outside the household) and are leading to their greater recognition in formal structures within communities (Pacific Community, Women in Fisheries Network - Fiji and Ministry of Fisheries, 2018). Gender-inclusive science and management can facilitate commercial uptake and progress towards resource-output maximization, profit maximization and resilience at a community level (Noland et al., 2016). Community-based management plans that are gender-responsive, including those conceived by female researchers or operated by female community members, can help lead towards environmental resilience and can be more effective than legislated, top-down, androcentric approaches (Morioka, 2016; De la Torre-Castro et al., 2017). Thus, there is a critical need not only to ensure that data related to dynamics of the roles and knowledge of Pacific women regarding ocean management are robust but also to create conditions for the rapidly growing marine sector which will include career opportunities for women as part of ensuring diverse teams; this inclusiveness has been suggested to be linked with increased organizational effectiveness (Noland et al., 2016).

Women usually have social and intellectual capital that can enable knowledge sharing throughout a wide social network. It is argued that women's engagement can boost productivity and economic return (Lee et al., 2015). As one example, women hold dominant responsibility for household purchasing, including of fish to eat, and women spend over 70% of consumer dollars worldwide (Boston Consulting Group, 2019). Data indicate that if women had equal opportunities of access and control to resources as men, their contributions would increase food production by as little as 2.5% and by as much as 4%: enough to move 150 million people out of hunger and poverty across the developing world (UN (ESCAP), 2017). Pacific women play different roles during disaster response, and providing information (e.g. advanced disaster event warning) to only men does not result in that information reaching women (Lane and McNaught, 2009) while conversely including women in disaster response planning ensures a broader range of actions are included within existing social structures (Charan et al., 2016). Pacific women also use social relationships to bring up management concerns (Lane and McNaught, 2009).

There are a number of factors which can aid inclusivity of women in the Pacific. First, Pacific women are opinionated. At the World Wide Views, in Fiji, 93% of the women expressed major concern about climate change, and almost 58% agreed that measures to alleviate climate change impacts can provide an opportunity to improve women's quality of life (Singh P., *World Wide Views on Climate and Energy (Fiji) Report*, 2015). Second, women can mobilize and structure networks effectively. A rapid market survey of over 40 fisher women in Fiji indicated self-generated structures, networks, and marketing activities the women used to manage competition and innovate marketing strategies (Vunisea, 2014). In fact, experience shows that sometimes fisher women performed better than their counterpart Fijian males. For example, in a community-based mangrove reforestation project implemented by the University of Fiji, more village women were observed to be actively engaged in reforestation activities as compared to the men (Singh pers. obs.). Third, PSIDS are increasingly creating enabling opportunity and conditions for promoting inclusivity (see above). For example, at a lecture in Kiribati on entrepreneurship related to an advanced energy technology, women were the ones who were asking questions about policy and technical aspects of this energy system (Michalena, 2017).

Although the text of the Pacific Islands Regional Ocean Policy of 2005 is gender-blind, the Office of the Pacific Ocean Commissioner has stated that women are to be a part of the capacity building and response actions.³ Given the cultural heritage of Pacific women and their roles in passing environmental beliefs and practices along to the next generation, intentional inclusion of women through policy benefits the whole society (Ram-Bidesi, 2015). This inclusion cannot be realized without directed policy interventions.

3. Enduring constraints to inclusiveness of women

While current international voices call for inclusivity, and economic and political approaches such as Green and Blue Economy build on the synergies between economic growth, social inclusion and preservation of the environment (PIDF, 2017), the model of growth and development pursued in the last decades in PSIDS has not delivered the inclusive growth and sustainable development desired (PIDF, 2017; Bryar and Naupa, 2017). The reality differs from political evocations, and the risk of "tokenism", or "mentioning gender equality in a policy but not changing any practices" (Bunce and Ford, 2015), remains.

In the professional arena of the Pacific, female-focused organizations or assistance interventions are generally focused on technical skills, processing and marketing rather than management (Ogden, 2017; Harper et al., 2013). In the Solomon Islands, Marshall Islands and Tonga, women form 60% of the administrative and clerical staff in government fisheries departments, but only 18% of total staff in the science and management roles (Tuara and Passfield, 2011). Much marine and environmental management is still androcentric (De la Torre-Castro et al., 2017; IUCN, 2019). In general, women's positions in fisheries management are lagging, even if recognition of the contribution of women to the fisheries sector is growing (Harper et al., 2013; Whippy-Morris, 2015). Some cultural beliefs contribute to the belief in Oceania that, for example, "fisheries" are the domain of men, not women (Tuara et al., 2008). For example, in the Fijian freshwater mussel fishery, women harvest and sell, but the resource is exclusively under control of male customary resource owners (Veitayaki et al., 2014).

Significant differences are also found between men and women in terms of work time and household income (UN WOMEN, 2013).

³ Cristelle Pratt, Deputy Director General of the Pacific Islands Forum Secretariat, www.forumsec.org/pages.cfm/newsroom/speeches/2017/dsg-cristelle-pratt-remarks-to-healers-of-ocean-event-at-un-oceans-conference-june-2017.html

Women spend more time than men on work overall, have fewer hours in paid work, and in general have less discretionary time than men (UNDP, 2008). Women often work as low-skilled, low-paid laborers and have irregular seasonal employment in processing, packaging and marketing (UN (ESCAP), 2017). Data from Fiji reveal strong gender discrimination; for example, among economically active women, 64% earned below the conservative poverty line for workers of FJ\$4000 per annum, compared with 38–40% of men (ADB, 2014). At the household level, women represent 74% of unpaid home workers, and there is unequal sharing of reproductive and household work (Narsey Lal et al., 2009; ADB, 2014). A 2005 analysis showed that women worked fewer hours than men in paid employment, but women worked 26–31% more hours in total than men because of their disproportionate share of household responsibilities (Narsey, 2007; Government of Fiji, 2017). In addition, an analysis of time use in four districts in Ba revealed that women had 0–8 h of leisure time compared to 14–24 h leisure time for men (Nagatalevu - Seniloli, 2016). Only approximately 1 in 5 countries have achieved gender parity in the Oceania area⁴ as defined by UN Women (UN Women, 2018).

Disproportionate intra-household resource allocation as well as inadequate participation in decision making and consultation mechanisms (Charan et al., 2016; Kohlin et al., 2011; UN WOMEN, 2014) is often a result of tradition and cultural regulations and practices, or of a clash between traditional practice and the logistics of consultations planned by cultural outsiders (Bidesi, 2008). In some Pacific societies, it is culturally inappropriate for women to engage in specific fishing activities such as diving, netting, trapping and fishing from a boat. In others, women are considered to bring bad luck and poor catch if they are on a boat or in the vicinity of fishing activity of men. Female fisheries observers have reported being ignored or refused information aboard vessels, with crew obeying only male instruction (Women in Fisheries Network - Fiji, 2019). The acceptance of a change, such as the introduction of an advanced technology which would improve fish harvest and storage in Fiji, has historically only been successful when suggested by a male (C. Morris pers. obs.). Only few females can be influential when it comes to changes on commercial approaches and this influence is sporadic; for example, females who belong to a chief's family in Fiji can be sometimes positioned in an influential way (C. Morris pers. obs.).

Patterns of gender roles and relationships differ sharply throughout the Pacific region. In 2017, for example, 74.4% of women in Solomon Islands participated in the labor force, while in Samoa only 31.2% did (UN Women, 2018). Further, in Tonga, women can be considered more vocal than men during some community consultations regarding resource management (A. Matoto,⁵ 2017, pers. comm.). More remote islands of Fiji displayed more cases of girls involved in fin-fisheries, which traditionally is a male pursuit (Kronen, 2004). Under extreme socioeconomic conditions also, there is high interest and permission for the exposure of women even to very advanced technologies. Experience has shown that this phenomenon is more visible in some countries, potentially those facing a certain type of crisis. For example, in Kiribati, a large number of women participated at an academic lecture on an Ocean Thermal Energy Conversion system to be built in the island state. Those women showed more interest than their male counterparts in asking questions and being actively involved in the teaching (Michalena, 2017), which was indicative of the fact that women are more responsive (than men) towards advanced technologies and especially in the face of crises. This may be because the country is in such a perceived emergency for survival that all national human resources need to be motivated and solutions need to be sought.

4. Pacific women in ocean science

The severe and pressing problems of the Pacific Ocean and its peoples require improved understanding and decision-making at a local, national and regional level. Ocean science has a significant and increasing role to play in this, and the need for inclusion of women in science is thus an imperative for the Pacific. Pacific women have specialized and, in documented cases, unique knowledge of the ocean (e.g. Ram-Bidesi, 2015), and their contribution to ocean science is valuable. In global science, only 28% of researchers are women despite the near-parity of numbers of men and women graduating with science degrees (UNESCO, 2016; UNESCO, 2017a). Ocean science is somewhat more balanced: female scientists represented on average 38% of the global ocean researchers in 2013 (UNESCO, 2017b).

In the case of PSIDS, overall ocean science capacity is minimal though together they govern over 30 million square kilometers, or 10% of the world's ocean (UNESCO, 2015). Whilst the Pacific Ocean is of global importance, only 5% of long-term marine sampling stations are in the Oceania region, and less than 6% of ocean science publications come from the region (UNESCO, 2017b). In terms of the balance of male and female scientists, there is low representation of women in the field (UNESCO, 2017b) despite the existence of internationally recognized female marine science experts. The majority of Pacific women who are working in marine science mainly focus on training communities working on fisheries (such as the training offered by the Women in Fisheries Network-Fiji; Morris pers. obs.) or examining research samples as technicians (Tuara and Passfield, 2011). Although these roles are not problematic per se, women's contributions could reach beyond such established norms, including in existing marine management positions and the growing potential within ocean science and management careers.

Science has also often been the catalyst for game-changing innovative practices, and technological (r)evolutions have often been conceived as solutions to crises (Zarotiadis and Michalena, 2010). The role of women as stewards of natural and household resources within changing environmental realities (Lane and McNaught, 2009) calls for the targeted engagement of women to move from training and tutoring to more sophisticated scientific engagement for sustainable ocean management including traditional knowledge, language, and practices (Lui et al., 2017). Science and research can therefore help in shifting the narrow focus on the “participation” of women to the recognition and inclusion of women's skills in the management of environmental resources. An example of the benefits of scientific support of management practices comes from the village of Ucunivanua in Verata, Fiji, where after implementing scientific monitoring of fish and bivalves and adjusting harvests when counts were low, the women collected twice as many bivalves in the same amount of time as they did before the monitoring began. This demonstrable benefit has ensured that the environmental monitoring program continues (Tawake, 2017).

In Fiji, data from the three Fijian Universities on enrolment show that out of more than 31,000 students pursuing a tertiary education in 2014, 53% were women (Asian Development Bank (ADB), 2016). Marine/fisheries/environmental studies are tagged as a special area of high priority by some national Pacific governments (Pratt and Govan, 2010). At The University of the South Pacific (USP; a regional institution covering 12 island states), women represented over 50% of the graduates, for both Bachelor's and Master's degrees, from the USP marine science programs (P. Bijay pers. comm., 2017).⁶ In 2016, the University of Fiji produced approximately 52% female graduates (Krishna, 2016), and there were more female science graduates than males (P. Singh, 2017, pers. comm.). Anecdotal evidence, however, indicates that more women than men drop out because of family and economic reasons (ADB, 2014). Also, equal proportions of university

⁴ Excluding Australia and New Zealand

⁵ A. Matoto is Director for Environment, Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change & Communications (MEIDECC).

⁶ Data concerning the period 2012–2017

graduates do not necessarily mean equal opportunities for work. In Fiji, although female citizens make up half the population of Fiji (Fiji Government Bureau of Statistics, 2007), and despite the growing number of women enrolling in university programs, women represent only 36% of the economically active population and 33% of wage employees in the non-agricultural sector (ADB, 2014). Published data are limited regarding women's professional status in Pacific marine employment, but in a 2011 study, women accounted for only 18% of fishery science and management staff (Tuara and Passfield, 2011); the female representation in governmental structures is also low but growing (Whitfield, 2012).

Thus, while a gender balance is achieved in Fiji science graduates and within marine science graduates (at USP), there is a rapid degradation of this balance and increasingly male domination in leadership roles. The shortage of career progression in women in “demanding” sciences may be traced to pressure to conform to traditional gender roles (Dybas, *Women in water sciences*, 2017), lack of confidence (Crawford, 2012), or lack of career opportunity or awareness of such opportunity. For example, a female Pasifika marine professional said, “*I don't believe we are given the right information or tools to know there is much of a career within the environmental field. [...] I had not met another female Marine Biologist who is from Samoa*” (S. Langton 2017 pers. comm., “Healers” profile⁷). This rapid-decay loss of early career female ocean science graduates is not confined to the Pacific. In an assessment of progress of inclusion of women in oceanography in the USA (Kappel, 2014a), it was concluded that increased retention of women required two essential aspects: (i) improved mentoring schemes and (ii) creation of supportive work environments. Although the relative importance of these factors compared to other elements that might drive retention in Pacific contexts awaits research, these factors providing a starting point corroborated by Pacific opinion and evidence from other regions (Dennehy and Dasgupta, 2016, Kappel, 2014a).

5. The need for disaggregated gender data

The work presented here has portrayed the role of women in Pacific Ocean management and science; however, there is a need for more systematic collection of disaggregated gender information regarding ocean management. With gender-blind policies and interventions, no knowledge is generated regarding differences in the roles and work effects between women and men (Morioka, 2016). Moreover, reported statistics often combine agriculture and fishing data, or forestry and fishing data, making it impossible to analyze the separate characteristics of each. Current international classification standards for agriculture and fisheries do not adequately reflect the economic structure of a typical Pacific Island country (Lambeth et al., 2014). Proactive collection of gender-disaggregated data broken down by relevant sector can inform about gendered roles but does not inherently seek to change those traditional roles (Morioka, 2016); in fact, rather than ‘un-gendering’ the ocean (Gissi et al., 2018), many Pacific thought leaders seek to recognize and increase respect for different roles. Monitoring patterns of changes to the roles, needs and impacts of men and women can prove valuable to decision-makers and develop paths of openness, transparency and inclusiveness with development partners (Bennett, 2005; Morioka, 2016). Gender-based data disaggregation can also be used to quantify patterns such as time in staff roles and progression in job posts, key to identifying inclusivity in professional organizations and management more broadly. To date, very few research studies include gender metrics, limiting the substantiated evidence for gender impacts (Bunce and Ford, 2015); a 2013 desktop literature review found that less than 1% of peer-reviewed conservation studies addressed gender (WWF, 2013).

The scientific collection and use of gender-disaggregated data can lead to more efficient policies (UN (ESCAP), 2017). Data disaggregation can inform quantifications of the economic and social contribution of marine activities and provide elaborated outcomes in numbers that, for example, concern Gross Domestic Product, employment, rural development, regional stabilization and fish production; all key aspects of national development plans. Although measuring only the representation by number of females in a specific task is an insufficient proxy for inclusion, those basic measurements are still lacking. In the past, surveys of fisherwomen in Fiji have been conducted but with very small sample sizes as a result of limited funding and lack of gender-responsive study design, although a nationwide survey has recently been completed (WCS, unpubl. data). While effective fisheries can be readily informed by the enumeration and documentation of women's fishing activities (Whippy-Morris, 2015), the exclusion of women from decision-making on natural resources (Vunisea, 2014; Gillett, 2016) requires more detailed analysis to identify inclusive futures.

Disaggregated data can inform metrics that are important for building resilience, lowering risk and reducing misconceptions. Based on gender-disaggregated data, it is known that women in Samoa form around 18% of the total village fishers and contribute around 20% of the seafood consumed (Lambeth et al., 2014). Disaggregated data helps with quantifying women's role in fisheries and helps in the assessment of resource management, poverty alleviation and future development. In Fiji, the majority of women's involvement is in the informal sector with only 109,000 females in the formal labor force, and 121,000 doing ‘household work’ which is defined as ‘economically inactive’ because it is in the household (and unpaid) (Narsey Lal et al., 2009). Disaggregated data are necessary to track gender dynamics, to allow it to be mainstreamed across policy development as well as to provide a clearer lens on inclusivity within the socio-cultural context of the Pacific. Efforts need to be made to ensure regular collection of data for gender-specific indicators, including those within the Sustainable Development Goals, and to ensure quality and comparability within and between national statistical systems of the region (UN Women, 2018).

6. Promoting inclusion for Pacific Ocean sustainability

The impacts of SDGs on the study, life and policy related to oceans has already been discussed and research clearly shows the relation of the ocean goal (SDG14) to all other SDGs (Singh et al., 2018). Ocean management is gaining political momentum and increased investment. The United Nations has announced a Decade of Ocean Science for Sustainable Development (2021 – 2030) “to gather ocean stakeholders worldwide behind a common framework that will ensure ocean science can fully support countries in the achievement of the Sustainable Development Goal 14 on the ocean” (UNESCO, 2017C). Sustainable Development Goal (SDG) 14 refers to “conservation and sustainable use of oceans, seas and marine resources for sustainable development”. However, SDG 14 has no gender-specific indicators although “addressing the specific constraints faced by women engaged in fisheries and the fishing industry should be an integral component of strategies to achieve SDG 14” (UN Women, 2018).

International agreements, national policy documents and international research have begun to incorporate considerations of gender equity and social justice, explicitly emphasizing the role of women in new instruments such as green growth, blue economy and disaster risk reduction (Fiji Government, 2014). SDG5 specifically targets gender equality and empowerment. Target 5.5 aims to “Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life”. All Pacific SIDS have adopted the SDGs, and gender inclusiveness is increasingly a component of their national strategies.⁸ Voluntary measures are also

⁷ www.sprep.org/pacific-voyage-un-ocean-conference-2017/women-ocean-leaders

⁸ <http://genderandenvironment.org/resource/the-environment-gender-index/>

taking hold and examples are increasingly available for specific sectors; for example, FAO's 'Small-scale fisheries guidelines 2015' has a gender equality section under Part 2 'Responsible fisheries and sustainable development'. Yet, in the PSIDS region, "gender-based discrimination — deeply rooted and present across all countries — threatens to undermine the transformative potential of the 2030 Agenda in real and measurable ways" (UN Women, 2018).

Building management tools for women who are actively involved in the management of marine resources and that acknowledge female needs and roles, alongside stronger involvement of female scholars in marine scientific fields, can help decision makers to elaborate more informed and inclusive decisions. This change can strengthen women's engagement in ocean management, facilitate monitoring of female inclusiveness into planning mechanisms, frame more accurate risk assessments, and facilitate preparedness and resilience building. This is very important for climate change mitigation and adaptation purposes and already suggested in regional policies (e.g. the Framework for Pacific Regionalism, Framework for a Pacific Oceanscape, Framework for Resilient Development in the Pacific and so on). At local to global levels, uplifting the profile of Pacific women in ocean management and science can help to create opportunities and alleviate gender discrimination (Dennehy and Dasgupta, 2016; Gauthier et al., 2017).

Beyond high-level policy and rhetoric, there is a need for practical progress to be taken in gender inclusivity within the oceans sector, and more broadly. Management approaches jointly informed by social science, social justice and environmental science are essential for the long-term resilience of human–marine systems (Bennett, 2018) need for collection of disaggregated gender data has already been identified in order to build increased acknowledgement and recognition of roles and track progressive inclusion of women in novel work/roles. The Women in Fisheries Network-Fiji has recently stated the need to mine and analyze the data held by government and NGOs to compile the sex-disaggregated data that currently exists and quantify the role of women in the sector (Pacific Community, Women in Fisheries Network - Fiji and Ministry of Fisheries, 2018). Such information allows for targeted and effective positive inclusion of women in modern ocean management and does not necessarily involve changes in the traditional context or segregation of roles. Practical steps are also needed to ensure improved retention of female marine science graduates in the region to ensure persistence of a gender balance through all stages of a professional marine career, including as academics or in technical/advisory services. This gender-responsive professionalization of marine careers must start at least at the higher-education establishments but also become increasingly pervasive in the recipient employers in the Pacific region, be they academia, government or international organizations.

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Author contributions statement

EM and TS conceptualized and designed the work. EM, TS, and JH wrote the manuscript. All authors contributed to manuscript revision, read and approved the submitted version.

Disclaimer

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Declaration of competing interest

The authors declare no conflict of interests.

References

- Aalbersberg, B., Tawake, A., Parras, T., 2005. Village by village: recovering Fiji's coastal fisheries. In: World Resources, pp. 144–151.
- ADB, 2014. Gender Analysis - Summary.
- Alonso-Problacion, E., Susana, V., 2018. Women's participation and leadership in fish-erfolk organizations and collective action in fisheries: A review of evidence on enablers, drivers and barriers. In: FAO Fisheries and Aquaculture Circular No. 1159.
- Asian Development Bank (ADB), 2016. Fiji Country Gender Assessment 2015. ADB, Philippines.
- Bennett, E., 2005. Gender, fisheries and development. *Mar. Policy* 29 (5), 451–459.
- Bennett, N.-J., 2018. Navigating a just and inclusive path towards sustainable oceans. *Mar. Policy* 97, 139–146.
- Bidesi, V., 2008. Development of Marine Resources, Fisheries Policies and Women's Rights in the Pacific Islands. SPC.
- Boston Consulting Group, 2019. A Gender Perspective on Securing Livelihoods and Nutrition in Fish-Dependent Coastal Communities. The Rockefeller Foundation from Wildlife Conservation Society, New York.
- Bryar, T., Naupa, A., 2017. The shifting tides of Pacific regionalism. *The Round Table* 106, 155–164.
- Bunce, A., Ford, J., 2015. How is adaptation, resilience and vulnerability research engaging with gender? *Environ. Res. Lett.* 10.
- Charan, D., Kaur, M., Singh, P., 2016. Indigenous Fijian women's role in disaster risk management and climate change adaptation. *Pacific Asia Inquiry* 7 (1), 106–122.
- Coccosis, H., 2008. Cultural heritage, local resources and sustainable tourism. *Int. J. Serv. Technol. Manag.* 10 (1), 8–14.
- Crawford, M., 2012. Engineering Still Needs More Women.
- De la Torre-Castro, M., Frocklin, S., Borjesson, S., Okupnik, J., Jiddawi, N., 2017. Gender analysis for better coastal management - increasing our understanding of social-ecological seascapes. *Mar. Policy* 83, 62–74.
- Dennehy, T., Dasgupta, N., 2016. Female peer mentors early in college increase women's positive academic experiences and retention in engineering. In: Proceedings of the National Academy of Sciences (PNAS), pp. 114.
- Dybas, C., 2017. Women in Water Sciences. Retrieved December 2017, 2017, from. <http://www.waterencyclopedia.com/Tw-Z/Women-in-Water-Sciences.html>.
- FAO. (n.d.). Women and Food Security - FAO FOCUS.
- Fiji Government, 2014. Fiji National Gender Policy. Government of Fiji, Suva, Fiji.
- Fiji Government Bureau of Statistics, 2007. Census of Population and Housing.
- Gauthier, G., Wonch Hill, P., McQuillan, J., Spiegel, A., Diamond, J., 2017. The potential scientist's dilemma: how the masculine framing of science shapes friendships and science job aspirations. *Soc. Sci.* 6 (1), 14.
- Gillett, R., 2016. Fisheries in the Economies of Pacific Island Countries and Territories. SPC, Noumea, New Caledonia.
- Gissi, E., Portman, M., Hornidge, A., 2018. Un-gendering the ocean: why women matter in ocean governance for sustainability. *Mar. Policy* 94, 215–219.
- Govan, H., 2017. In: K., R. (Ed.), *Ocean governance - Our Sea of Islands*. (Vol. A Sustainable Future for Small Island States: Pacific 2050 (Forthcoming)). Commonwealth Secretariat, London.
- Government of Fiji, 2009. Roadmap for Democracy and Sustainable Socio-Economic Development 2009–2014. Ministry of National Planning.
- Government of Fiji, 2014. The National Women's Action Plan 2010–2019; National Gender Policy 2014. Ministry of Social Welfare, Women and Poverty Alleviation, Suva.
- Government of Fiji, 2017. 2015–2016 employment and unemployment survey. Fiji Bureau of Statistics.
- Harper, S., Zeller, D., Hauzer, M., Pauly, D., Sumaila, U., 2013. Women and fisheries: contribution to food security and local economies. *Mar. Policy* 39, 59–63.
- IUCN, 2019. The Environment Gender Index. Retrieved August 21, 2019, from. <https://genderandenvironment.org/resource/the-environment-gender-index/>.
- Kappel, E., 2014a. Introduction to women in oceanography: a decade later. *Oceanography* 27 (4).
- Kleiber, D., Harris, L., Vincent, A., 2015. Gender and small-scale fisheries: a case for counting women and beyond. *Fish Fish.* 16, 547–562.
- Kohlin, G., Sills, E., Pattanayak, S., Wilfong, C., 2011. Energy, gender and development. In: *What Are the Linkages? Where Is the Evidence? Paper No. 125*.
- Krishna, K., 2016. 323 Graduate from University of Fiji. Retrieved December 16, 2017, from Fiji Sun Online. <http://fijisun.com.fj/2016/04/23/323-graduate-from-university-of-fiji-lautoka/>.
- Kronen, M., 2004. Fun or Duty: School children's Involvement in Subsistence Fisheries in Tonga and Fiji. SPC Women in Fisheries Information Bulletin, Noumea, New Caledonia.
- Lambeth, L., Hanchard, B., Aslin, H., Fay-Sauni, L., Tuara, P., Rochers, K., et al., 2014. An Overview of the Involvement of Women in Fisheries Activities. SPC.
- Lane, R., McNaught, R., 2009. Building gendered approaches to adaptation in the Pacific. *Gen. Dev.* 17 (1), 67–80.
- Lee, L., Marshall, R., Rallis, D., Moscardi, M., 2015. Women on boards: global trends in gender diversity on corporate boards. In: MSCI ESG Research.
- Lui, S., Mitiepo, R., Sanau, N., Tofaono, T., Malsale, P., Plotz, R., et al., 2017. Combining traditional knowledge and meteorological forecasts in the Pacific to increase community resilience to extreme climatic events. In: *Research Dialogue (RD 9)*. Subsidiary

- Body for Scientific and Technological Advice (SBSTA). UNFCCC.
- Matthews, E., Painter, M., Wilkie, D., 2014. Equality for Women and Sustainable Development Go Hand in Hand.
- Michalena, E., 2017. Building green growth and entrepreneurship in the Pacific through knowledge and innovation. In: Stavros Sindakis, P.T. (Ed.), *Global Opportunities for Entrepreneurial Growth: Coopetition and Knowledge Dynamics within and across Firms*. Emerald Publishing Limited, pp. 475–506.
- Morioka, K., 2016. Time to Act on Gender, Climate Change and Disaster Risk Reduction. An Overview of Progress in the Pacific Region with Evidence from the Republic of Marshall Islands, Vanuatu and Samoa. UN Women.
- Musinguzi, L., Natugonza, V., Efitre, J., Ogutu-Ohwayo, R., 2017. The role of gender in improving adaptation to climate change among small-scale fishers. *Climate and development*. *Clim. Dev.* 1–11. Published online.
- Nagatalevu - Seniloli, M., 2016. Gender and Fisheries and Photo Voice Training Workshop Report. Women in Fisheries Network, Fiji.
- Narsey, W., 2007. Gender Issues in Employment, Underemployment and Incomes in Fiji. Vanuavu Publications, Suva, Fiji.
- Narsey Lal, P., Singh, R., Holland, P., 2009. Relationship Between Natural Disasters and Poverty: A Fiji Case Study. UNISDR.
- Nikitina, E., Ostrovskaya, E., Fomenko, M., 2009. Towards better water governance in river basins: some lessons learned from the Volga. *Reg. Environ. Chang.* 9 (2), 1–13.
- Noland, M., Moran, T., Kotschwar, B., 2016. Is Gender Diversity Profitable? Evidence from a Global Survey. Peterson Institute for International Economics, Washington DC.
- Ogden, L., 2017. Fisherwomen—the uncouted dimension in fisheries management: shedding light on the invisible gender. *BioScience* 67, 111–117.
- Pacific Community, Women in Fisheries Network - Fiji and Ministry of Fisheries, 2018. Gender Analysis of the Aquaculture Sector in Fiji: Community-based Tilapia Farms in Viti Levu.
- Phillips, C., 2014. How diversity makes us smarter. *Sci Am* 311 (4), 42–47. <https://doi.org/10.1038/scientificamerican1014-42>.
- PIDF, 2017. Why PIDF? Retrieved December 18, 2017, from. <http://pacificidf.org/why-pidf/>.
- Pratt, C., Govan, H., 2010. Our Sea of Islands, our Livelihoods, our Oceania. Framework for a Pacific Oceanscape: A Catalyst for Implementation of Ocean Policy. (Suva).
- Ram-Bidesi, V., 2015. Recognizing the role of women in supporting marine stewardship in the Pacific Islands. *Mar. Policy* 59, 1–8.
- Robin South, G., Bala, S., Chand, P., Limalevu, L., Morris, C., Veitayaki, J., Wilkinson, C., 2011. Global Change and Capacity Building in Coral Reef Management in the Pacific: Engaging Scientists and Policy-Makers in Fiji, Tonga, Samoa and Tuvalu. *APN Sci. Bull.* 1, 15–18. <http://www.apn-gcr.org/resources/items/show/1845>.
- Singh, P., 2015. World wide views on climate and energy (Fiji) report. Retrieved December 14, 2017, from. <http://www.unifiji.ac.fj/wp-content/uploads/2015/08/WWViews-Report-Fiji.pdf>.
- Singh, G., Cisneros-Montemayor, A., Swartz, W., Cheung, W., Guy, A., McOwen, C., et al., 2018. A rapid assessment of co-benefits and trade-offs among sustainable development goals. *Mar. Policy* 93, 223–231.
- Tawake, A., 2017. Human Impacts on Coastal Fisheries in Rural Communities and Their Conservation Approach: A Case Study on Kaikoso (Anadara spp) Fishery in Verata District, Fiji. (Thesis submitted to Unviersity of South Pacific).
- Thomas, A., Vandervord, C., Fox, M., Nand, Y., 2018. Impact of Tropical Cyclone Winston on Women Mud Crab Fishers in Fiji. Retrieved from. <https://www.tandfonline.com/doi/full/10.1080/17565529.2018.1547677?scroll=top&needAccess=true>.
- Tuara, P., Passfield, K., 2011. Gender in Oceanic and Coastal Fisheries Science and Management: Based on Case Studies in Solomon Islands, Marshall Islands and Tonga. Secretariat of the Pacific Community, Noumea, New Caledonia.
- Tuara, P., Passfield, K., Williams, M., Hilly, Z., Schwarz, A., Boso, D., et al., 2008. Issues on gender in oceanic and coastal fisheries science and management in the Pacific Islands: case studies from Solomon Islands, Marshall Islands and Tonga. *SPC Women in Fisheries Information Bulletin* 22, 3–16.
- UN, 2017. Fact Sheet Women, Gender Equality and Climate Change. UN Women.
- UN (ESCAP), 2017. Gender, the Environment and Sustainable Development in Asia and the Pacific. UNITED NATIONS (ESCAP), Thailand.
- UN General Assembly, 2014. SIDS Accelerated Modalities of Action (SAMOA) Pathway. *A/RES/69/15*.
- UN WOMEN, 2013. Why Is Climate Change a Gender Issue? Newsletter.
- UN WOMEN, 2014. Gender and Energy in the Pacific.
- UN Women, 2018, March 10. Turning Promises into Action: Gender Equality in the 2030 Agenda for Sustainable Development. Retrieved from. <http://www.unwomen.org/en/digital-library/publications/2018/2/gender-equality-in-the-2030-agenda-for-sustainable-development-2018#view>.
- UNDP, 2008. Making Invisible Work more Visible. Gender and Time Use Surveys with a Focus on the Pacific and Unpaid Care Work. UNDP Pacific Centre, Suva, Fiji.
- UNESCO, 2015. Global Science Report - Towards 2030.
- UNESCO, 2016. Gender Parity in Science Not Yet a Reality.
- UNESCO, 2017a. Women and science. Retrieved December 26, 2017, from. <http://www.unesco.org/new/en/natural-sciences/priority-areas/gender-and-science/>.
- UNESCO, 2017b. Global Ocean Science Report: The Current Status of Ocean Science.
- UNESCO, 2017c. United Nations Decade of Ocean Science for Sustainable Development (2021–2030). Retrieved December 18, 2017, from. <https://en.unesco.org/ocean-decade>.
- Veitayaki, J., Breckwoldt, A., Sigarua, T., Bulai, N., Rokomate, A., 2014. Living from the Sea: Culture and Marine Conservation in Fiji. iTaukei Trust Fund, pp. 117.
- Vunisea, A., 2014. The Role and Engagement of Women in Fisheries in Fiji.
- Whippy-Morris, C., 2015. Changing Roles and Challenges of Pacific Women in Natural Resource Use and Management: An Analysis on the Fisheries Sector in Fiji; the New Roles and Challenges of Women in Fisheries.
- Whitfield, S., 2012. Gender assessment of the Pacific adaptation to climate change project. The SPC Women in Fisheries Information Bulletin 23.
- Women in Fisheries Network - Fiji, 2019. Introducing Moana voices. Retrieved August 21, 2019, from. <https://womeninfisheriesfiji.org/introducing-moana-voices/>.
- WWF, 2013. Gender in Conservation: Does a Gender Aware Approach Lead to an Improvement in the Achievement of Conservation Outcomes.
- Zarotiadis, G., Michalena, E., 2010. Green technology: A European way-out of the crisis? In: International Conference on Economic Crisis and the Process of European Integration. University of Antwerp, Belgium, Brussels, Belgium.