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REVIEW

Emerging human dimensions research in coastal and nearshore Oceania

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Article impact statement: Marine social science offers a comprehensive and just perspective on the well-being of coastal peoples and their seascapes.

Abstract

Calls for incorporating human dimensions into marine conservation have increased and begun to coalesce as marine social science. However, it is unclear what types of research and foci have been centered in this new interdisciplinary field and what gaps remain. Seeking to clarify the state of marine social science's emerging discourses and methods, we conducted a systematic mapping review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022. We reviewed 684 studies, most of which appeared in interdisciplinary marine science journals. We deductively coded studies using previously established human dimensions categories. Australia, Aotearoa New Zealand, Hawai'i, and Fiji were the focus of 65% of studies despite comprising only a fraction of the total region. Emerging themes of the study included Indigenous worldviews, complex and nuanced drivers of human behavior, diverse human–ocean relationships, and social equity and justice. Some of the studies notably complicated common assumptions about human behavior in marine domains. Over half of the studies used mixed methods, engaging multiple perspectives and allowing for a more comprehensive understanding of research domains that may set marine social science apart in its ability to incorporate understudied human dimensions into marine conservation. Participatory methods, although not yet common, provide a valuable suite of approaches to understanding issues of social equity in marine management and studies of sensory and affective dimensions, also uncommon, could be of high value in filling gaps in understanding of people's complex relationships with marine places. Expanding interdisciplinary training for the next generation of marine stewards and transdisciplinary collaborations will provide opportunities to further mainstream marine social science for a richer, more comprehensive, and just understanding of the world's peopled seas.

KEYWORDS
human dimensions, marine social science, Oceania, peopled seas

INTRODUCTION

Timeliness of human dimensions research

The oceans' seascapes and coasts are profoundly peopled. Today, more than a third of the world's population lives within 100 km of coastlines (Reimann et al., 2023), and more than 775 million live in areas that are highly dependent on marine ecosystems for their livelihoods (Selig et al., 2019). At the same time, overlapping local and global pressures on marine and coastal habitats, including pollution, overexploitation of fish stocks, urbanization and development, and climate change, threaten the multidimensional well-being of linked human and ecological systems (Betley et al., 2021). Attention to the blue economy has further increased global focus on the world's oceans. At the intersection of diverse hazards and perceived economic opportunities, calls for marine conservation and management have also become more urgent, including initiatives

such as 30×30, which aims to protect and sustainably manage 30% of the world's oceans by 2030 (Gjerde et al., 2016). The need to rearticulate and advance the effective impact of the marine sciences is evident in transformative campaigns, such as the United Nation's Decade of Ocean Science for Sustainable Development (https://oceandecade.org/).

Methods and insights from the natural sciences, which value some forms of knowledge over others (e.g., quantitative, empirically reproducible), have historically guided biodiversity conservation initiatives (Mace, 2014). In reality, however, marine systems are thoroughly entangled with diverse human activities at all scales (Bennett, 2019). Recent decades have seen recognition among scholars, policy makers, and sustainability practitioners that incorporating human dimensions is critical for equitable, just, and lasting outcomes (Bennett et al., 2021; Kittinger et al., 2012; Mascia et al., 2003). At the same time, enhancing the depth and nuance of marine sciences' understanding of linked human-natural systems is recognized as a frequently underestimated dynamic (Liu et al., 2007; Ostrom, 2009) that requires engagement with social scientists' relevant methodological, epistemological, and disciplinary expertise. Attempts to manage ecosystems that ignore social, cultural, or historically embedded political dimensions frequently fail, are less effective, or lead to perverse and unintended consequences, including negative consequences for human rights, people's livelihoods, and their well-being (Cross, 2016; Jupiter, 2017; Sowman & Sunde, 2018). This shift toward needing to balance multiple perspectives in ocean planning, management, and governance has advanced to the point that it constitutes a significant sea change in the literature, resulting in the new scholarly field of marine social science.

Human dimensions defined

The sea change is not limited to the marine sciences and is motivated by transformations within various disciplines, national and supranational fora, diverse natural resource management and conservation actors in marine and terrestrial systems, and current wicked environmental crises. This transformative moment has resulted in different manners of understanding humans and their role in nature, including interdisciplinarity (such as social–ecological systems and coupled human-natural systems) (Liu et al., 2007; Ostrom, 2009), valuing ecosystem services (Turner & Daily, 2008), decolonizing and Indigenous methodologies (Kovach, 2021; Smith, 2022), biocultural approaches (Caillon et al., 2017; Gavin et al., 2015), and relational thinking (Jax et al., 2018; West et al., 2020). We urge a broad understanding of human dimensions as inclusive of the plurality of human beings' individual and collective ways of being, acting, perceiving, conceiving, or feeling within particular social, cultural, political, or otherwise human contexts that play a role in mediating their relationships with natural systems.

While some human dimensions have become well established, developing a sufficient understanding of the range, qualities, and dynamics of human dimensions in an emerging marine social science may throw open the "floodgates of the wonderworld" (Melville & Schaeffer, 1922) to understanding peoples' complex entanglements with the sea—that is, stimulate marine scientists to engage in diverse new research opportunities. Human dimensions research involves the application of social science and interdisciplinary research methods and approaches to a diversity of environmental management issues at local, national, or global scales (Bennett, Roth, Klain, Chan, Clark, et al., 2017). Recognition of the challenge of commensuration, or what the sociologist of knowledge (Abbott, 2001) called the "chaos of the disciplines," is of critical importance for entering into and engaging with human dimensions research. A foundational observation is that the social sciences, which emerged in the 19th and 20th centuries, are rooted in distinct and often competing understandings of the nature of the human condition (Abbott, 2001). Significant debates within particular social sciences about the nature of humanity, much less between disciplines, can easily be overlooked by transdisciplinary scholars drawing on particular frameworks with insufficient familiarity with the scholarly traditions or disciplinary contexts in which they are rooted. Presumably, if a marine social science field has emerged, as we and others (Aswani, 2020; Bavinck & Verrips, 2020; McKinley et al., 2020) suggest it has, it takes as one of its goals the examination of the question: What is the nature of human relationships with marine domains?

The complexities of addressing such a profound question are not difficult to identify. How human relationships to marine domains or entities change over time, how they are mediated by scale or boundaries, if they should be approached individually or collectively, how they differ between distinct coastal cultural contexts or even within particular coastal communities, are, among others, questions that will continue to require significant attention. We did not seek to answer the question of which human dimensions are most significant. Instead, we considered the status of the marine social science field to date in one geocultural region, Oceania, and paid particular attention to the human dimensions investigated in this region, methods used, and potential opportunities for further advancing the state of the conversation paid particular attention to the human dimensions investigated in this region, methods used, and identifying potential opportunities for further advancing the state of the conversation regionally and farther afield.

Oceania and the marine sciences

We focused on the Pacific Islands region, conventionally referred to as Oceania, as exemplary for investigating the emergence of a marine social science. Oceania is well situated as a focus of our study because the vast majority of Oceania's peoples live along coastlines; their diverse communities have maintained myriad relationships with marine domains and entities over millennia (Fache et al., 2022), including, for the region's Indigenous communities, a striking range of resource management practices (Friedlander, 2018; Veitayaki, 1997); the region's marine systems experience diverse hazards and are on the foreshore of global climate change (Klöck & Nunn,

2019; Thomas et al., 2020); and there has been active scholarly marine social science engagement in the region. Across Oceania, peoples' cultural and historical connections to ocean and coastal environments extend from deep time to the present and influence contemporary behaviors and responses to changing environmental and sociopolitical contexts. Complex relationships between communities and their marine environments in this region are also notable because of their persistence despite significant colonial impositions and sociocultural transformations over the 19th and 20th centuries and, today, in communities' continuing commitment to decolonizing projects and sustainable futures (Fabre et al., 2021; Parsons et al., 2021; Winter et al., 2023).

We also focused on Oceania because of striking Pacific Islander leadership in marine governance and sustainability discourses. As the heads of state of the Pacific region articulated in the foreword to the *2050 Blue Pacific Strategy*, "As Pacific Leaders, we are strongly committed to ensuring the health and well-being of our people, and to human rights and equity for all. We place great value on our ocean and land, and celebrate a deep connection to our community, natural environment, resources, livelihoods, faiths, cultural values and traditional knowledge… As large oceanic countries and territories, we are the custodians of nearly 20% of Earth's surface, and we place great cultural and spiritual value on our ocean and land, as our common heritage" (Pacific Islands Forum Secretariat, 2022). Such commitments and the centering of the future of oceans encompass concerns about unsustainable fishing practices, protected sovereignty areas, deep sea mining, the well-being of the region's nearshore coral reef systems, food security, ethical tourism sustainable development, and more. As should be evident in this "sea of islands" (Hau'ofa, 1994), there is a significant challenge and scholarly risk in generalizing the dynamics of human dimensions across a vast and diverse region inclusive of myriad Indigenous and local communities with intersecting and divergent colonial and postcolonial histories and legacies and contemporary sociopolitical currents. That these dynamics cannot always be understood through a single theoretical or disciplinary lens highlights the actual and potential role of an interdisciplinary marine social science.

Review aims

Seeking to understand the rising tide of marine social science in Oceania, we conducted a systematic mapping review to document advances in the field made since 2016, when calls for more qualitative research to understand human–ocean relationships increased (Aswani, 2020; Bavinck & Verrips, 2020; McKinley et al., 2020). Specifically, we sought to present an overview of the kinds of human dimensions being assessed, identify regional trends in these studies, and explore the methods and approaches being used in this research. We also sought to provide easily visualized summaries of the human dimensions addressed and methods used that may be particularly useful for students and other researchers or practitioners looking for applied examples of the diverse ways in which human dimensions are studied. Further, we identified emerging themes, methods, and fields that could advance marine social science by contributing to gaps in understanding of human–ocean relationships.

METHODS

We were generally guided by the ROSES (reporting standards for systematic evidence syntheses) protocol, which was developed to guide researchers in conducting transparent and robust systematic reviews and maps in the fields of conservation and environmental management (Figure 1). (Haddaway et al., 2018). We conducted a systematic mapping review because our guiding questions were broad and our goal was not to catalog the details of every existing study. Rather, we sought to gain an understanding of the types of studies and methods being conducted in the marine social science field and whether these studies from Oceania align with established descriptions of human dimensions research. Specifically, we were interested in the following questions: what approaches/methods are being used, where is this work occurring in the region, what human dimensions are being studied, and are there research themes that are particularly active topics of study?

Before we conducted our searches, we compiled a benchmark list of 28 regional studies to represent research across the breadth of the social sciences (Appendix S1). We refined our search keywords and tried a variety of literature databases until we located all studies on the list. The keywords used for the searches were a combination of social science disciplines (e.g., anthropology, economics), human dimensions (e.g., knowledge, perception), zone (e.g., nearshore, reef), and location (e.g., Oceania, Fiji) (Appendix S2). We found that a combination of Web of Science, EBSCOhost, and Google Scholar effectively identified our benchmark list. To download our Google Scholar search results, we used Publish or Perish software (Harzing, 2016), which can be used to download the first 1000 results of a Google Scholar search. Because of this limitation, we conducted 3 Google Scholar searches for different periods (1891–2009, 2010–2015, 2016–2022). These periods were determined based on results from EBSCO search. The number of publications in each temporal series was nearly equal. Searches were conducted on 24 and 25 August 2022.

Studies from each of the 3 search tools were uploaded into EPPI Reviewer Online (EPPI Centre Software, 2010) and duplicates were removed (based on an EPPI similarity score of 0.85 and above). In the first round of screening, titles and abstracts were reviewed for the inclusion criteria (Table 1).

The priority screening machine learning automation tool in EPPI Reviewer was used during the screening of titles and abstracts. This tool learns as screening is conducted and prioritizes studies for review that are more likely to be included based on previous studies screened. Screening ran until we reached an inclusion rate of <5% for every 300 studies (Cheng et al., 2022). After the initial screening of titles and abstracts, we reviewed 8042 studies of which we included 3217. At this point, we decided to limit the studies for full-text screening to those from the 2016–2022 period. This was done in part to make the number manageable but more so to specifically track the latest developments in the period identified as having almost

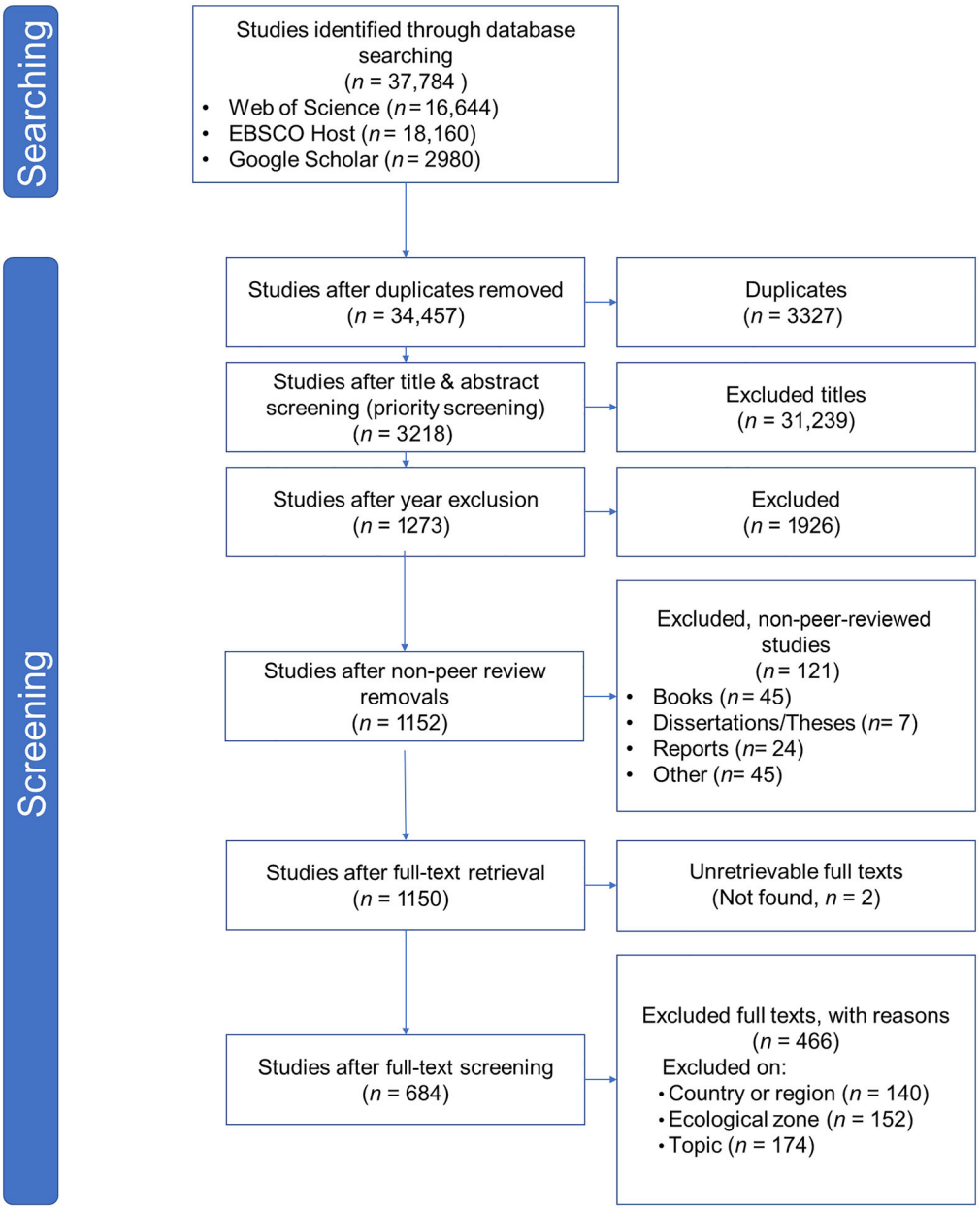

FIGURE 1 The ROSES 1.0 (reporting standards for systematic evidence syntheses) flow diagram for systematic reviews (Haddaway et al., 2018) used in a review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022.

exponential growth in published studies in this field (Partelow et al., 2023; Pelke & Simonn, 2023) (Appendix S3). This period also corresponds to the period in which approximately one third of all EBSCOhost search results were published (Appendix S3). We excluded studies that were not peer reviewed.

We uploaded full texts to EPPI Reviewer and screened the full text based on our established criteria (Table 1). Finally, we deductively coded for country, habitat or ecosystem, type of study, methods, and human dimension. Method codes were based on Bennett, Roth, Klain, Chan, Christie, et al. (2017) (Appendix S4), although we acknowledge the existence of overlaps and potential hierarchies in the 8 methods categories. For example, most of the methods in Bennett, Roth, Klain, Chan, Christie, et al.'s (2017) typology could be categorized as qualitative, quantitative, and mixed. Methods and human dimension codes were based on Bennett (2019) (Appendix S5). As in the initial screening, we could mark studies for a second opinion during full-text screening. R.D. and S.Y. screened the studies and met regularly to discuss second opinions. They reached an agreement on whether studies directly engaged with human dimensions or whether they were presented as implications (e.g., fish biomass models based on theoretical management were excluded). We also excluded disaster risk management and climate change studies that did not have a clear and specific human–marine focus.

TABLE 1 Criteria for inclusion in the systematic mapping review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022.

Criteria	Included
Subjects and populations (site)	Studies conducted in Pacific Islands, Oceania, Polynesia, Micronesia, Melanesia, American Samoa, Australia, Cook Islands, Fiji, Federated States of Micronesia, French Polynesia, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Hawai'i, New Caledonia, New Zealand (Aotearoa), East Timor (Timor Leste), Bougainville, Pitcairn, Rapa Nui (Easter Island), Guam, and Northern Mariana Islands. Inclusive of comparative studies in which not all study sites are in the region (described above) Studies took place in or focused on a location or resource in a coastal, nearshore, inshore, intertidal, lagoon, bay, estuaries, beaches, sand dunes, salt marsh, or atoll location, in territorial waters (12 nm from shore)
Intervention	Used social science methods or focused on the study of a human dimension (as defined by Bennett [2019])
Study type	Original research, review (if focused in the region), case study, methodologies or methods (if place specific or give an example of how they have been used in a study location listed above), policy analysis, opinion, or perspective
Primary outcome	Can guide ocean or coastal policy for better outcomes for the social–ecological system as a whole

Note: Criteria types are consistent with the ROSES (reporting standards for systematic evidence syntheses) protocol for systematic reviews.

TABLE 2 Ten journals with largest number of studies included in a review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022.

Journal	Number of studies
Marine Policy	101
Ocean & Coastal Management	43
Frontiers in Marine Science	36
Ecology & Society	17
Ecosystem Services	16
Journal of Environmental Management	16
PLoS One	16
ICES Journal of Marine Science	14
Fisheries Research	13
Biological Conservation	12

RESULTS

From the 37,784 studies that resulted from our searches, 684 were included after screening and were coded based on our protocol (Figure 1) (list in Appendix S11). There were no distinguishable trends in the number of studies published over the years of this review (Appendix S6).

Included studies were published in 198 unique journals (128 of these journals had only one resulting study). Twenty-seven percent of the studies came from just 3 journals: *Marine Policy*, *Ocean & Coastal Management*, and *Frontiers in Marine Science*. Of the 10 journals with the most studies (ranked based on the number of studies by journal from this review) (Table 2), half were marine focused and none were regionally focused. None of the top 10 journals were strictly social science journals.

Study sites

We reviewed research from 21 countries or territories in Oceania. Forty-four percent of studies were conducted in Australia, the country with the longest coastline in the region (Table 3). Studies conducted in Aotearoa New Zealand (10%), Hawai'i (6%), Fiji (6%), French Polynesia (4%), and at multiple sites (6%) made up the remaining 32% of all studies reviewed (Table 3). Twenty-one studies were conducted in Papua New Guinea, a country with ~9000 km of coastline and ~5% of the world's coral reefs. The 4 most researched countries were places where English is the official language.

Types of studies and regional trends

The overwhelming majority of studies reviewed were published as original research articles (n = 576; 84%), including case studies and policy analyses. Nine percent of studies (n = 60) were reviews and 4% (n = 27) were methodology focused. The remaining 3% of studies were opinion or perspective pieces. We excluded 121 studies because they were not in the peer-reviewed literature (e.g., books, reports, theses, or dissertations).

Research methods employed

Qualitative (28.4%) and quantitative (18.5%) approaches were most commonly used. In 53.1% of publications, researchers used mixed or other methods. Although participatory and spatial approaches were the least commonly used as single methods (n = 6 and n = 4, respectively), they were more often used in combination with other methods (Appendix S7). Sixty-four percent of studies used a single methodological approach (qualitative, quantitative, evaluative, etc.), and 31% used a combination of 2 methods. Four percent of studies used ≥3 methods (Appendices S7 & S8).

Human dimensions assessed

Fifty-two percent of studies were coded with a single human dimension category: 23.8% (n = 163) documenting the social context, 16.8% (n = 115) characterizing or evaluating the efficacy of management, 8.1% (n = 56) assessing the impacts of conservation, management, or development on human well-being, and 3.2% identifying the social and institutional factors that influence people's behaviors, actions, or responses

TABLE 3 Studies included in a review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022 by country and length of country coastlines (sources: https://www.cia.gov/the-world-factbook/field/coastline/, https://coast.noaa.gov/data/docs/states/shorelines.pdf, Bird [2010], and H. Ainsa, personal communication).

Country or territory	Studies reviewed	Coastline (km)
Australia	297	25,760
Aotearoa New Zealand	66	15,134
Hawai'i	43	1693
Fiji	41	1129
Multi-sited	39	–
French Polynesia	30	2525
Solomon Islands	30	5313
Region-wide	27	–
Papua New Guinea	21	>9000
Vanuatu	15	2528
East Timor (Timor Leste)	14	706
Tonga	9	419
Palau	8	1519
Rapa Nui (Easter Island)	8	60
New Caledonia	5	2254
Federated States of Micronesia	4	6112
Guam	4	125.5
Samoa	4	403
American Samoa	2	203
Kiribati	2	1143
Bougainville	1	600
Marshall Islands	1	370.4
Palmyra	1	14.5
Tokelau	1	101

(Appendix S9). Because these human dimensions are not discrete, we commonly coded with more than one human dimension when relevant (Appendices S9 & S10). For example, documenting the social context, the most commonly addressed human dimension, was broken down into several subcategories (Table 5) due to the diverse range of studies that fell into this single theme. In contrast, studies focused on characterizing the efficacy of governance or management were fewer in number and often easier to categorize. As such, the absolute numbers are not as important here as the overall trends. Table 5 contains examples of studies for each human dimension and briefly summarizes the kinds of questions they address.

DISCUSSION

In tracking the research that fit into predefined human dimensions categories, we found that many studies addressed more than one category and that some studies were more comprehensive than others in their scope. This variation in human dimensions coverage may result from the differential disciplinary backgrounds and experiences of authors involved in the studies. For instance, some collaborative studies may have had a single social science author, among a group of natural scientists, whose contributions may not have been central to the major underpinnings of the study; some social scientists are trained in approaches that are more holistic than others (e.g., case studies, ethnographies); some authors are Indigenous persons from the region who have knowledge and expertise that may differently configure the epistemological or ontological grounds on which the human dimensions categories rest; and some authors have academic training in the natural sciences but have pivoted to incorporate social sciences in ways that avoid or ignore disciplinary complexities in particular fields or discourses. Martin (2020) highlights that social science research conducted by natural scientists has 4 common problems: "1) oversight of the literature; 2) inexperience with social scientific methods; 3) lack of training in analytical methods; and 4) inadequate reporting of results." However, Martin (2020) does not acknowledge that much of social science theory and standard social science methods are largely based on Western perspectives. As such, lived experience and the use of decolonizing methodologies (Kovach, 2021; Smith, 2022) are also of high value in conducting human dimensions research in Indigenous and local Pacific Island contexts.

In relation to the methods encountered, 52% of studies used mixed methods or methods classified as other. The qualitative–quantitative pairing, often referred to as mixed methods research, was most common among studies that used 2 methods. In each of these approaches, several specific methods were used, in varying contexts (Table 4). These methods span many disciplines and require different types of training. By employing mixed methods, multiple perspectives are encountered, allowing for a more comprehensive understanding of a research question. Mixed methods research allows the strengths and limitations of individual methods to be balanced. For example, qualitative interviews with a few individuals may allow for an in-depth understanding of an issue, whereas quantitative surveys that may only be able to assess a few variables are feasible with a larger proportion of a population. Qualitative methods may also be useful for developing quantitative methods (e.g., questions for a survey) and for providing context to quantitative results.

We also encountered literature that did not cleanly fit into any of the human dimensions categories. Below, we explore these studies in more detail to identify opportunities for this growing field.

Indigenous knowledges in marine social science

Unlike many Indigenous worldviews across Oceania that acknowledge people as part of ecosystems, marine management tends to be designed according to Western ecological concepts that do not consider complex human dimensions as components of ecosystem dynamics. This is illustrated in Fache and

TABLE 4 Approaches and examples of methods used in studies included in a review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022.

Approach	Method (example study)
Qualitative	Case studies (Chabot et al., 2016; Gould et al., 2021; Harvey & Smithers, 2018; Hepburn et al., 2019; Murphy-Gregory, 2018; Vaughan et al., 2017; Wongbusarakum et al., 2019), case analysis (Veitayaki et al., 2018; Wodak, 2012), institutional analysis (Jacobsen, 2020; Rist et al., 2019; Song et al., 2018), ethnographies (Andersson-Tunivanua, 2020; Donaldson, 2018; Fache & Pauwels, 2020; Gesing, 2021; Nardini, 2019; Pascht, 2022), comparative analyses (Kerr & Wardana, 2020; Valdez, 2022), content analysis (Fogarty et al., 2020; Haas et al., 2020; Karcher et al., 2020), discourse analysis (McCormack, 2017; Newton et al., 2020), comparative case study (Hopkins et al., 2016; Valmonte-Santos et al., 2016), document analysis (Abbott et al., 2018; Christie et al., 2016; Nursey-Bray et al., 2016), oral histories (Whaanga et al., 2018)
Quantitative	Surveys and questionnaires (Aswani, Albert, and Love 2017; Clara et al., 2018; Dominguez-Tejo et al., 2018; French et al., 2019; Golden et al., 2022; Gonson et al., 2018; Hofman & Hughes, 2018; Lapointe et al., 2021; Mangubhai et al., 2020; Marre et al., 2016; Mustika et al., 2016; Purcell et al., 2020; TuckerWilliams et al., 2018; Tuohy et al., 2022), choice experiments (Oleson et al., 2020; Pascoe, 2019); modeling approaches (e.g., Bayesian belief network models [Hafezi et al., 2021]; regression models [Thomas et al., 2019; Windle et al., 2017]; structural equation models [Ritchie et al., 2022]; economic and bioeconomic models [Bode et al., 2016; Oyafuso et al., 2020]), cluster analysis (Martin et al., 2020), cost–benefit analysis (Atkinson et al., 2016; Schaar & Cox, 2021), economic valuation (Jänes et al., 2022; Qu et al., 2021)
Evaluative	Case analysis (Caputi et al., 2018; Hersoug, 2018), literature review (Fa'otusia 'Amelia et al., 2018; Le Cornu et al., 2018), framework evaluation (Hornborg et al., 2020), governance analysis (Cockerell et al., 2020; Jones, 2021), policy analysis (Bell-James, 2020; Fisk, 2021; Hassan & Alam, 2019), policy comparisons (Fassina et al., 2022), institutional analysis (Ayers et al., 2018; Dutra et al., 2019), other (Hume et al., 2019; Spooner et al., 2021; Zheng, 2018)
Historical	Ethnographies (Weisler & McNiven, 2016), excavations (Ditchfield et al., 2018; Dixon et al., 2022; Hawkins et al., 2017; Kahn, 2022), radiocarbon dating (Kahn et al., 2016), meta-analysis (Lambrides et al., 2019), stable isotope analysis (Swift et al., 2017), historical review (Novaglio et al., 2018)
Meta-analytical	Reviews (Aswani et al., 2018; Ataria et al., 2018; Gaylard et al., 2020; Kitolelei et al., 2021), systematic literature reviews (Charlton et al., 2016; Niner et al., 2017), synthesis (Martin et al., 2022), comparative analysis (Tucker et al., 2018)
Participatory	Participatory action research (Aburto et al., 2017), workshops (Barclay et al., 2019; Hoey et al., 2016; Ogier et al., 2020; Van Putten et al., 2016), structured decision-making processes (Meynecke et al., 2017; Noble et al., 2021; Robinson et al., 2020), group facilitation (e.g., Delphi approach in Hemming et al. [2018]; the territory game in Littaye et al. [2016]), participatory GIS (Brown et al., 2016; Munro et al., 2017)
Planning and forward thinking	Bioeconomic modeling (Gourguet et al., 2016; Hardy et al., 2016), willingness to pay (Spencer-Cotton et al., 2018), cost–benefit analysis (Creighton et al., 2019), economic modeling (Bell et al., 2018), modeling of ecosystem service values (Sandhu et al., 2018; Stoeckl et al., 2021), scenario planning (Boschetti et al., 2020; Robinson et al., 2020), simulation models (Cheok et al., 2018; Davies et al., 2016), trade-off analysis (Finkbeiner et al., 2018)
Spatial	Participatory mapping and GIS (Brown et al., 2017; Kobryn et al., 2018; Strickland-Munro et al., 2016), fuzzy-set spatial modeling (Noble et al., 2020), scenario mapping (Atkinson et al., 2016; Ma et al., 2022), random utility modeling (Navarro et al., 2022), values mapping (Moore et al., 2017)
Other	Framework development (Maxwell, Awatere, et al., 2020; Winter et al., 2020), method evaluation (Hartill et al., 2020), device design and testing (Flint et al., 2017)

Pauwels (2020), who examined how the concept of overfishing, which frames current fisheries management in Fiji, does not speak to the relational dynamics and knowledge present in iTaukei worldviews, where human and fish behaviors are interconnected not only ecologically and economically but also socioculturally, spiritually, and politically. Relatedly, Bodwitch et al. (2022) showed how the New Zealand government's process for reestablishing Indigenous fishing rights has fallen short of achieving distributional, procedural, and recognition-based dimensions of environmental justice for Māori fishers, in part due to upstream land-use change, a lack of integrated governance across land–sea divides, and practices of decision-making that have privileged certain kinds of knowledge over others.

Consistent with work beyond the scope of this study (Berkes, 2017; Kimmerer, 2013), we encountered studies demonstrating how Indigenous values and worldviews can guide more integrated approaches that bridge multiple sectors and move beyond trying to solve societal problems in disciplinary isolation. Ogilvie et al. (2018) provide a case study of how a transdisciplinary approach pairing mātauranga Māori values with Western scientific approaches resulted in a technology transition in the New Zealand scampi (*Metanephrops challengeri*) fishery that enhanced its environmental performance but was fundamentally driven by the principles of kaitiakitanga (values and practices of stewardship or guardianship). Culturally grounded Māori values also guided *Kai Ika*, a project that redefined fish as surplus to be shared with food-insecure fish eaters, with potentially significant benefits for fisheries sustainability and food security (Sharp et al., 2022). Somewhat in contrast is a study by Farmery et al. (2020), who investigated the integration of the fisheries management and fish policy sectors in Timor-Leste, where food insecurity is high, but fish consumption rates are low for the region. Although the authors found evidence of moderate collaboration across the sectors and some level of integration of food security into fisheries management, cultural values were largely absent from these sectors. This finding is

TABLE 5 Examples of studies for each human dimension category considered in a review of human dimensions studies in coastal and nearshore Oceania published from 2016 to 2022. as a summary of the kinds of questions they addressed.

Human dimension Documenting the social context to inform planning and management	Explanation	Example study
Human use	Studies documenting and examining the sustainability of interactions between humans and their marine spaces, both contemporary and throughout history (e.g., archaeological studies, fisheries reconstructions); many focused on the harvest of fish, but other marine taxa, including invertebrates and algae, have also been the focus, for consumption and material culture; historical studies important for establishing baselines for management and restoration efforts; nonconsumptive uses, such as recreational use (beach going, camping, snorkeling or diving, and surfing), have also been documented	Examined fish bone remains to speculate on historic fishing techniques (Bouffandeau et al., 2018) Evidence that marine resource use was not a primary activity in all tropical Pacific Island communities (Weisler & McNiven, 2016) Explored the transformation from Indigenous to Western management of the Sydney rock oyster fishery, resulting in valuable information to inform current oyster bed restoration efforts (Thurstan et al., 2020) Found that previous estimates of fisheries catches in Vanuatu were greatly underestimated, with reconstructed small-scale fisheries catch being over 200% higher than previous reports (Léopold et al., 2017) Examined importance of noncommercial gifting of fish in high- and low-income countries (Dacks et al., 2020; Delaney et al., 2017; Vaughan & Vitousek, 2013) Examined surfing from an Indigenous perspective, including how surfing develops and maintains sense of place (Aramoana Waiti & Awatere, 2019; Fine, 2021; Nardini, 2019; Wheaton et al., 2021)
Relationships with the marine environment	Studies examining people's connection to places and to specific taxa and how the local and Indigenous knowledge associated with these interspecies relationships can inform resource management	Assessed how human–aquatic species relationships have changed in the period since European arrival in Aotearoa (Whaanga et al., 2018) Described Indigenous relationships with sharks in Polynesia (Puniwai, 2020; Torrente et al., 2018) Contrasted human–shark relations in recreational contexts in Fiji and Nouméa (Kon Kam King & Riera, 2022) Motivations of sea turtle conservation volunteers, with lessons on attracting and retaining volunteers in conservation programs (Shum et al., 2023)
Values, knowledges, practices, worldviews	Studies in which economic and noneconomic approaches were used to understand the wide breadth of values that exist across the region, and how these values drive behavior and are ultimately determined by cultural ontologies	Comparison of the economic value of the regulating services of mangroves and rock revetments to explore potential solutions to coastal flooding and erosion (Strain et al., 2022) Provisioning ecosystem services of coral reefs have the highest values in the US-affiliated Pacific and Papua New Guinea (Allen et al., 2021; Lau et al., 2019) Examined motivations of different stakeholders to determine the values that drive their behaviors; findings valuable for better engaging fishers in management and conservation (Magee et al., 2018; Young et al., 2016) Cultural ecosystem service values are often concentrated in coastal zones (Brown & Hausner, 2017) and are dependent on access and tenure arrangements (Kobryn et al., 2018) Knowledge of turtle migration may have been used for traditional navigation (Wilmé et al., 2016) Reviewed Indigenous fisher knowledge documentation in Fiji and other Pacific Islands (Kitolelei et al., 2021) Several studies involved different knowledge system representation in governance and management (e.g., Maxwell, Ratana, et al., 2020) Investigated how modern fisheries management framings focused on overfishing are at odds with the Indigenous worldview in Fiji (Fache & Pauwels, 2020)
Tenure and access	Studies documenting traditional tenure regimes and how changing contexts has resulted in changes to access of shorelines and the nearshore environment	Many studies of tenure focus on Indigenous or community-based management (Carlisle & Gruby, 2019; Rist et al., 2019) Examined how access to ecosystem services has changed as customary institutions evolve in modern times (Lau et al., 2020) Case study of how a local Hawaiian community has maintained access for surround net fishing (Vaughan & Ayers, 2016) Examined how coastal access can be a barrier to experiencing cultural ecosystem services (Gould et al., 2022)

(Continues)

TABLE 5 (Continued)

Human dimension **Documenting the social context to inform planning and management**	**Explanation**	**Example study**
Assessing the impacts of conservation, management, or development activities and human well-being	Studies examining how conservation or management affects ecosystem services, the costs and benefits associated with such projects, including their social, economic, or cultural impact, and equity implications	Conducted a cost-effectiveness analysis for mangrove management in Fiji, with implications for how policy makers prioritize and fund mangrove management based on their ecosystem services (Atkinson et al., 2016) To assess different management scenarios for coral reefs in Guam, study linked an ecological ecosystem model with human behavior model to show how watershed restoration could lead to significant long-term benefits for fisheries and tourism (Weijerman et al., 2016) Social–ecological framework to assess trade-offs among tourism, food security, and local conservation efforts on Palau's reefs highlights how reef fish consumption patterns can have significant flow-on impacts for reef health (Wabnitz et al., 2018) Used a bioeconomic model to assess how wantok system of collective management system in Solomon Islands can promote social–ecological resilience and food security (Hardy et al., 2016) Developed a Bayesian network model to discern the impacts of climate change and benefits of adaptation on community well-being at multiple spatial scales in Vanuatu (Sahin et al., 2021) Developed a multidimensional well-being framework to assess the social impacts of MPAs on people's well-being, highlighting the importance of considering local perspectives and intangible impacts in MPA design (Gollan & Barclay, 2020) Developed a system for the collection and analysis of economic, social, and cultural data to develop a report card to track the performance of a harbor area in Australia (Pascoe et al., 2016) Survey focused on understanding fisher mental health shows how traditional risks and modern uncertainties have differential impacts on fisher mental health based on their individual role and location in the fishery (King et al., 2021)
Identifying the social and institutional factors that influence people's behaviors and responses	Studies examining how knowledge, perceptions, motivations, norms, and behaviors interact, levels of support for management, and how contextual, institutional, and individual factors influence livelihoods	How people's connection to place, or perceived barriers to action, informed their environmental behaviors (e.g., on the Great Barrier Reef [Goldberg et al., 2018]) Examined how attitudes toward marine parks can change over time and found that pro-attitudes were often associated with people's familiarity with marine parks and conservation, their age, gender, and education level (Haensch et al., 2022) Understanding conceptions, perceptions, and expectations (CPE) of Indigenous and conservation and sustainability practitioners can decolonize and shape management practices (Fabre et al., 2021) Willingness to pay studies (for microplastic management [Borriello & Rose, 2022] and for marine reserves in Aotearoa [Rojas-Nazar et al., 2022]) Perceptions of trust and legitimacy in governance (MacKeracher et al., 2018; Turner et al., 2016)
Characterizing and evaluating the efficacy of governance and management	Studies examining how decisions are made (what data are considered and who is involved), documenting and evaluating governance processes and management effectiveness	Participatory processes to create space for different kinds of knowledge (Barrett et al., 2022; Davies et al., 2018) and centering Indigenous worldviews (Maxwell, Awatere, et al., 2020) Lexicometric analysis to track how the actions and priorities of national and regional ocean governance are related or differ (Hills et al., 2021) Examined mechanisms by which valuation intervenes in local political contexts for environmental justice and sustainability, with implications for how practitioners situate their objectives (Tadaki et al., 2021) Conducted an institutional analysis to identify the barriers to fisheries comanagement in Hawaii and actions that may help reduce them (Ayers et al., 2017) Examined how colonial legacies pose obstacles for successful hybridized governance by comparing 2 co-management programs in Samoa related to protection and fisheries management (Quimby & Levine, 2021) Compared 2 comanagement case studies from Timor-Leste to assess if and how they offer a viable model to govern small-scale fisheries (Tilley et al., 2019) Examined the evolution of polycentric governance on the Great Barrier Reef and its vulnerabilities and effectiveness (Morrison, 2017) Assessed how geofencing can minimize marine protected area noncompliance by providing an alert service to fishing vessels (Read et al., 2019)

significant given the cultural taboos that may restrict fish consumption. In this case, inclusion of local worldviews may not be necessary for collaboration across sectors per se but may be necessary for tackling interdisciplinary challenges (i.e., promoting higher levels of fish consumption for food security). If the relevance of Indigenous knowledges (inclusive of value and belief) to marine sciences is now accepted, the challenge of exploring and understanding the breadth of causal linkages and their directionalities, feedback loops, histories, adaptabilities, temporalities, and scalar characteristics will keep marine social science thoroughly engaged for the foreseeable future.

Human dimensions driving resource use and management

Natural resource management and conservation is about managing people, not resources. Early studies in the new wave of marine social science approached this by focusing on aspects of human populations that were relatively easy to measure, often using household surveys or existing data sets, including population density and distance to market (Cinner et al., 2009; Sandin et al., 2008). Many researchers conducting quantitative studies continue to use these types of measures. Distinct from these studies is novel research that has pushed back against problematic assumptions about human nature, often based on behavioral assumptions from other parts of the world (usually Europe or North America). For example, contrary to studies from elsewhere, including Africa, Busilacchi et al. (2018) found that a multidimensional measure of poverty did not generally predict household participation in illegal marine resource trade in the transboundary coastal villages in Papua New Guinea. Instead, various social, political, and economic factors, which vary by village, act in a complex system to drive illegal activities. The complex dynamics of human dimensions associated with marine spaces also characterized the drivers of reef fish exports from Guam. Although environmental factors had some influence on fishing capabilities, it was ultimately multilevel economic drivers that most influenced fishing exports from Chuuk. It was increased social welfare assistance, in the form of monthly nutritional disbursements, that drove an increase in demand for fresh fish from Chuuk until growing air transportation costs overtook profit margins, after which exports decreased (Cuetos-Bueno & Houk, 2018).

Understanding the economic, social, political, cultural, and environmental factors that drive human behavior at individual, familial, or collective scales can guide more effective and just conservation planning and interventions.

Marginalized mechanisms emerge from scholarly depths

Because of the often-layered nature of relationships that people have with marine species, their behaviors in exploiting or conserving these places and species are not straightforward (Fache et al., 2022). Throughout the region, studies have explored the rich relationships that many cultures and communities have with various taxa and with their environments (Puniwai, 2020; Torrente et al., 2018). These relationships go far beyond food sourcing. Grantham et al. (2020) found that, although the common narrative of women's gleaning activities is often focused on fulfilling subsistence needs, women in Timor-Leste also value gleaning for procuring their favorite foods and socializing, and these values shift seasonally. Vave (2022) documented the ceremonial role of protected areas associated with important life transition events. Similarly, beyond fish production, fish ponds in Australia are important sites for spiritual and ceremonial rituals (Bradley & McNiven, 2019; Roberts et al., 2016).

We place one of the most significant opportunities for an emerging marine social science in scholars' engagement with the dynamic linkages between particular cultural communities and their coastal and nearshore environments. Natural scientists' epistemic and ontological disciplinary commitments and comforts are challenged by documenting, sense making, and modeling the significance of diverse relations, which are inherently qualitative and run from the material to the metaphysical (McCormack & Mawyer, 2022; McGuire & Mawyer, 2023). As such, we see this as a highly charged area for advancing research in the future.

Psychological dimensions

A few studies explored the more sensory and affective dimensions of marine and coastal spaces and the ways in which ideas of place are created or changed through interactions with other-than-human beings. For example, Chen and Ryan (2018) used a multispecies sensory ethnographic methodology to examine how the "sensescape of Western Australia is remembered, imagined, and…shaped" by Chinese diasporic materialities, in particular those related to the embodied practices of harvesting abalone (*Haliotis* spp.) in Western Australia. This richly detailed study explored how harvesting abalone may be linked to memories of home and experiences in the present to generate "a mosaic of enmeshed memories, tactility, and tastes" that translates to cultures around gifting and eating and interpretations of belonging and identity. In doing this, they illustrated how abalone converts Chinese people's perceptions of the material environment in Perth and revealed the roles abalone plays in bridging and combining memories, histories, and traditions, as well as in creating a sense of belonging in a diasporic space. Similarly, Naidu (2018) draws from the field of semiotic and sensory anthropology to explore how sensory and experiential dimensions of pollution, such as having to sell or eat fish that "smell of death," among Mambai residents in Betano, Timor-Leste, shape their political engagement in the wake of infrastructure development. King et al. (2021) investigated drivers and levels of psychological distress in commercial fishers and made recommendations for reducing modern uncertainty stressors. In Gaynor and McCann (2017), oral histories of fishers and divers reveal deep connections and a sense of familiarity with the marine environment; they often imagined themselves "as part of the animals' world." This study articulates how oral history,

with its reliance on memory and narrative, can reveal deeply personal yet shared insights into relations between people and marine organisms and, in doing so, may improve understanding of how emotion and memory shape human relationships with and attitudes and behaviors toward the environment.

In all of these studies, qualitative, interdisciplinary approaches revealed subjective experiences with, and among, marine life. The value of using interdisciplinary approaches to explore and understand a place is well illustrated in Hamylton et al. (2020). The authors follow their disciplinary traditions of coastal geomorphology, human geography, and the arts to compare their narratives of a walk around an island. By weaving together their individual narratives and revealing and comparing their disciplinary norms and practices, they found that diverse perspectives can widen the reach of a text, improve communication, and put perspectives in tension with each other to challenge readers—both of which may enable deeper engagement with place. Beyond noting how much of being human is embodied and fundamentally entangled in sense organs, neural and cognitive apparatus, and culturally mediated conceptual experience thereof, sense and affect provide a useful example of how existing human dimensions schemes must be expanded to capture the range of social science interventions increasingly common in the emerging marine sciences (Wiebe, 2019).

Communication studies and the public sphere

Communication studies, identifiable as the facet of everyday life of broadly circulating discourses in the public sphere (Habermas, 2020; Spitulnik, 1993), though challenging to categorize as a single human dimension, can nevertheless have significant governance, management, or policy implications to say nothing of how they might serve as drivers of individual or collective marine behaviors. For example, Couper and Walters (2021) analyzed government communications, policy documents, freedom of information requests, public submissions, and newspaper articles to show how the creation of a catch-and-kill policy to mitigate shark incidents in Western Australia misrepresented public beliefs. Public perception of sharks had generally remained positive, but shark attacks became the "foci for political and economic manipulation" that influenced the media and government decision-making. Weekly fishing columns in a popular newspaper were similarly analyzed by Gaynor et al. (2016) to examine changing gender relations in recreational fishing over 4 decades. Lester (2016) used the Great Barrier Reef as a case study to look at how environmental awareness and concern emerge, in part through spectacle, to affect environmental politics. Similarly, a case study of conflict over the construction of a boat ramp in a small, rural, Australian town highlights the role of hyperlocal news in intensifying divisions in the community when it made the decision to stop covering any boat ramp stories. The newspaper's silence on the issue hindered communication between community stewards concerned about the environmental consequences of building the boat ramp and those with business interests who supported the construction (Freeman & Hutchins, 2023).

In a more applied context, Prince et al. (2021), guided by concepts in behavioral science, developed highly visual, simple illustrations to communicate topics related to declining small-scale fisheries. By focusing on facilitating dialogue as opposed to raising awareness, these communication materials were highly effective at motivating participation in data collection, which supported coastal fisheries management reform at multiple levels. Similarly, "decolonial design" approaches, as explored in Taboada et al. (2020), were employed to communicate preliminary biophysical and socioeconomic research data to Fijian village members. As part of the process, community members had input into and guided future scientific research so that it would be respectful of multiple value systems and would be meaningful to the community.

Better incorporating information theory, communications studies, and related fields and scholarly currents from across various social science disciplines will continue to shed light on how publics feel, think about, act toward, or change their relationships with significant marine issues from tourism and development, to conservation and sustainability, to blue–green economies. This is a ripe area for more research.

Social equity and justice

We found a growing body of social equity research that appears to have emerged at least in part as a response to the failures of marine conservation initiatives to engage with the social and cultural contexts in which they work, leading to ineffective and unjust outcomes (Bennett, 2022). The topic of social justice was cross-cutting. We encountered an emerging and increasingly important subset of this work across all human dimensions categories. Studies highlighted different aspects of equity and justice, including recognitional, procedural, and distributional justice.

Recognitional justice issues arose, for example, when the values, beliefs, and needs of communities were not respected in marine management. In Rapa Nui, mainland Chilean institutions that govern marine fisheries used Western principles, which were at odds with Indigenous Rapa Nui values, beliefs, and needs (Aburto et al., 2017). Similar dynamics were described from other postcolonial contexts in which traditional tenure rights and Indigenous knowledge are not adequately represented in marine management (Alonso-Población et al., 2018; Ayers et al., 2018).

Procedural justice concerns were evident in cases where women's substantial contributions to fishing communities were not recognized, leading to their exclusion from decision-making processes and resulting in ineffective and socially unjust governance (Thomas et al., 2021). For example, in the Solomon Islands, Rohe et al. (2018) found that women made significant contributions to household food security and community socioeconomic sustainability through fishing (also documented by Rabbitt et al. [2019]) but had little to no influence on local

marine management and decision-making, which had eroded their trust in leadership.

Studies touching on distributional justice investigated the unequal benefits and harms of marine resources and management across different groups. For example, guided by access theory, Ferguson (2021) found that in the sea cucumber fishery in Palau, benefits and harms were experienced differently based on an individual's gender, marital status, and nationality. In Hawai'i, physical and social barriers to access, often associated with tourism, limit individuals who practice Hawaiian lifeways from experiencing benefits from the shoreline and engaging in acts of stewardship (Gould et al., 2022). Gurney et al. (2021) found that wealth and education affected stakeholders' perceptions of distributional fairness with regard to payment for ecosystem services of a comanaged marine area, challenging dominant understandings that equality and opportunity cost principles are the fairest. Through their work in Papua New Guinea, Lau et al. (2021) emphasized the importance of considering local contexts when assessing justice because predefined justice criteria may not align with the interconnected nature of justice perceptions in local communities. Many of these studies highlight how using an intersectional approach to account for various social, economic, and cultural characteristics, such as age, class, gender, religion, and education, can affect people's identity, roles, and behavior in any given context. They also underscore the importance of adopting context-specific and inclusive approaches in marine conservation and often used participatory approaches (discussed in more detail below) to codevelop solutions that were just and equitable.

Closely related to these equity and justice concerns is the issue of parachute science (Ahmadia et al., 2021; Stefanoudis et al., 2021), which skews the type of knowledge produced about a region, potentially missing crucial local context and perspectives, and can cause direct harm to communities and connected ecosystems. We bring up this issue because, although we did not officially track the identity of authors, we did observe that the majority of studies appeared to be led by non-Indigenous authors. We are not suggesting that all non-Indigenous researchers participate in parachute science, but we stress that parachute science can, and often does, reinforce colonial power dynamics, undermine local capacity, and lead to conservation efforts that fail to address the needs and values of local populations (De Vos & Schwartz, 2022). Future research that prioritizes the development of inclusive, context-specific approaches that integrate diverse knowledge systems, are attentive to intersectional dynamics and ethics, and actively work to build equitable partnerships through the research process will make important contributions to advancing this field.

Participatory methods as an approach to complex engagements with marine domains

Participatory methods, although not yet common, are gaining increasing attention (Chevallier et al., 2024; Schwermer et al., 2020); 7% of studies included in our review mentioned or used a participatory approach. Authors may be selecting participatory approaches to further focalize justice and equity issues. Participatory methods can incorporate stakeholders in multiple aspects of research planning or enactment, frequently to further governance or management outcomes. For example, Brown (2016) performed a stakeholder analysis and participatory mapping exercise to assess coastal and marine values in the Kimberly region of Australia, operationalizing multiple definitions of stakeholder groups based on identity, interest, and value orientation to understand how these affected marine management preferences. Participatory mapping helped predict the potential for conflict among stakeholders by examining how place-based values and diverse social uses may differ as marine protected areas are created (Moore et al., 2017). Littaye et al. (2016) similarly adapted a participatory planning tool (the territory game in which drawing was used as a tool for expression) for marine spatial planning that effectively revealed social and cultural values and created a sense of ownership among participants. Šunde et al. (2018) critiqued value-articulating institutions (e.g., court proceedings, public feedback on proposed laws) that are commonly used to elicit and assess people's views and values and showed the negative effects it can have on people's willingness to participate in democratic institutions. They contrasted these with other more participatory and culturally meaningful approaches that can give voice to and legitimize those views or knowledge systems that might not be represented in more formal or litigious valuation processes.

The use of participatory methods is another enticing current in an emerging marine social science field. However, participatory approaches are not a silver bullet for addressing equity issues and may in fact perpetuate the injustices associated with research, planning, and conservation if applied in a manner that continues to disempower and marginalize those involved (Bennett et al., 2019). To overcome this potential problem, Le Heron et al. (2021) describe a process used to develop a rubric to guide the evaluation of participatory processes for inclusive and empowering ecosystem-based management in New Zealand. The rubric is for ongoing evaluation that focuses on varying notions of success and the coproduction of indicators of success.

Rising tides

We reviewed recent human dimensions work in nearshore Oceania that reflects or responds to increasing calls for marine social science to guide conservation and natural resource management (Bennett, Roth, Klain, Chan, Clark, et al., 2017). Alongside other recent work (Partelow et al., 2023), we suggest that recent trends in the literature strongly support the claim that a marine social science field has emerged as an interdisciplinary field and that this field of scholarly endeavor, along with its focal objects, methodological currents, and epistemic commitments, is experiencing a rising tide.

We found that existing human dimension category schemes, such as those we drew on, are useful for describing what human dimensions are; framing their relevance for various kinds of conservation, management, or policy issues; and making

visible the opportunities for inter- and transdisciplinary research needed to address diverse challenges. However, we found a tension between the diversity of human interconnectedness with marine nature and the necessarily reductionist modeling of human dimensions that runs the risk of confirming or reconfirming existing analytical tendencies and missing important alternate understandings of dynamics whose understanding is sought and greatly needed to confront ecological and social challenges.

Among our findings, the intersectional quality of human dimensions stands out. Although some of the studies in our review cleanly fit into single human dimension categories, many studies were interdisciplinary and featured interconnected, overlapping, often complexly interacting human dimensions. The interconnectedness of human dimensions, along with that of the natural and social realms, as well as marine and terrestrial environments, is consistent with many Indigenous worldviews in the region. As such, research guided by a single human dimension category may not correspond with the way human dimensions are perceived, experienced, known, valued, or acted on by the people of Oceania (or elsewhere). We are hopeful that the wave of interdisciplinary studies that take a biocultural approach to human dimensions work with equity and justice concerns in mind will continue to swell. However, if such work is to be mainstreamed, scholars need to be better trained in these perspectives. Two interventions that will be helpful in this endeavor are enhancing interdisciplinary and transdisciplinary training and exposure to multiple ways of knowing in the conservation and resource management fields and increasing graduate training and professional development opportunities for Indigenous and local scholars, whose epistemic foundations may support a more plural and holistic approach to understanding human dimensions relevant to marine conservation.

For example, we have all been involved in teaching a course, People and the Sea: Exploring Multiple Perspectives for Marine Systems. The course is an inventory of how oceans are studied and known across different disciplines and worldviews and is offered in a marine biology program. The majority of students were pursuing master's or doctoral degrees in marine biology. Others were from multiple disciplines, including geography, linguistics, Pacific studies, philosophy, and urban and regional planning. The aim of the course is to equip students with the skills needed to be good interdisciplinary collaborators who embrace different approaches used to understand marine spaces. Other courses taught at our institution that expose students to human dimensions of marine spaces involve student engagement with community organizations that conduct biocultural stewardship. Biocultural approaches to stewardship integrate diverse knowledge systems to care for people and place, for example, by restoring areas that are important for both biodiversity and food production (Bremer et al., 2018; Caillon et al., 2017). Further, Native Hawaiian and other faculty at our university have created professional development opportunities to recruit, retain, and support Native Hawaiian and Pacific Islander students in the ocean sciences. These opportunities focus on mentoring, embracing cultural values, and incorporating community members into research programs (Kane et al., 2023). We encourage our academic readers to reflect on how they are preparing students to embrace multiple ways of knowing in order to prevent the continuation of disciplinary silos and privileging of positivism and Western worldviews in addressing sustainability challenges in marine spaces.

In reflecting on the intersection of this review of the current literature and its potential application in the development of tomorrow's scholars and practitioners or in the continuing and emerging work of those already established, there are a number of persistent questions. What social science disciplines or subdisciplines and which of their particular methodological, epistemological, or topical affordances are unrepresented in marine social science work? Is there a singular, epistemologically centered field emerging—a marine social science? Or, has what has been documented been the emergence of a plural field—the marine social sciences? How might increased attention to epistemic communities and conflicts within and between disciplines support the maturation of a marine social science? Might more nuanced human dimension categories, if developed, offer further and deeper insight into significant human–nature linkages toward advancing or meeting conservation goals? What might more nuanced attention to the disciplinary relationships and epistemic, methodological, or ontological commitments of authors, particularly in multi-research and multi-author contexts, provide? Considering that anecdotal evidence and personal experience suggest that social science scholars are, perhaps too often, asked to join marine science research or writing teams late in the process or are not always part of the research developmental process, what insights and benefits might accrue should social scientists be robustly engaged in the earliest moments of research planning? In this interdisciplinary field space, is there potential for usefully incorporating the environmental humanities? Could the human dimensions framework we adopted be adapted to allow for further incorporating relevant human dimensions from humanities scholarship? Significant conceptual and empirical work by historians, literary theorists, and arts scholars, for instance, may offer additional paths forward as well as additional epistemic and methodological challenges. How a marine social science might work to productively bound and bridge its field space may be a particularly relevant question to some areas of inquiry (e.g., communication, affect, value).

Future studies of marine social science would also benefit from moving beyond some of the limitations we identified. Limiting our review to English-language studies may have biased our results. Publications in French or other languages could be included in a future study. Further, excluding studies that were not peer-reviewed publications may have biased our results. For example, the Pacific Community (SPC) publishes significant relevant reports and newsletters (e.g., *Fisheries Newsletter*, *Women in Fisheries Information Bulletin*). Theses and dissertations from the region may also include valuable local perspectives that have not been published in peer-reviewed journals.

Our review highlights the rich, comprehensive understandings that result when marine spaces are studied from a variety of worldviews and disciplines. If solutions to the wicked crises confronting islands, communities, regions, and the world were

going to emerge from the knowledge about marine systems afforded by 20th-century natural science approaches, humanity would not likely be confronted by the continuing fragmentation of marine habitats, biodiversity loss, and related sustainability challenges. Alongside remarkable 21st-century approaches (e.g., eDNA, metagenomics, remote sensing, and other scientific innovations), the areas where advances are likely to contribute the most to solving pressing problems are those that incorporate human dimensions from diverse areas of expertise. A complementary approach to incorporating complex, subtle, and significant human dimensions into foundational science is not only possible but also increasingly evident. As such, a space for necessary scholarly transformation is clear—a rising tide that lifts all boats.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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