

Sustainable development outcomes of livelihood diversification in small-scale fisheries

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Abstract

Livelihood diversification is increasingly central to policy advice and investments in rural development and fisheries management. For small-scale fishing communities in low- to middle-income countries, more diverse livelihoods are generally hypothesized to reduce fishing pressure and vulnerabilities to external shocks and adverse trends while enabling people to construct routes out of poverty. Yet, evidence of impacts from livelihood diversification in small-scale fisheries remains sparse. Our examination of the peer-reviewed literature found substantial differences in how livelihood diversification is pursued, and in the realized outcomes from the process of diversification. Studies describing diversified livelihoods were almost as likely to report that livelihoods were not improved or that outcomes were mixed (54% combined) as they were to report improved livelihood outcomes (45%). Furthermore, one of the main theoretical drivers behind the support for diversified livelihoods—ecological conservation benefits—was unexplored in over 70% of studies. Of the minority of studies that did explore ecological outcomes, most reported that ecological conditions had not improved. These findings indicate conceptual ambiguity around livelihood diversification and a lack of empirical evidence supporting its theoretical underpinnings. There remain important questions about the impacts of diversification on multidimensional poverty and ecological conservation. Future research on and investment in diversification should be both more deliberate of what diversification means and more rigorous in the evaluation of its impacts.

KEYWORDS

aquatic food systems, diversity, poverty, rural development, social-ecological systems, sustainability

1 | INTRODUCTION

In low- to middle-income countries, rural people often employ a diverse portfolio of livelihood activities across multiple sectors in

a complex and dynamic way (Barrett et al., 2001; Scoones, 2009). Rural livelihoods scholarship commonly finds that people with diverse livelihood activities are less vulnerable or more resilient than those with a greater reliance on fewer sources of food and income

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(Adger et al., 2005; Ellis, 1998, 2000). This proposition also features prominently in the small-scale fisheries literature, where diverse livelihoods are also promoted as a way to reduce pressure on over-exploited coastal fishery resources (Allison & Ellis, 2001; Brugère et al., 2008; Gillett et al., 2008). Consequently, the thesis that more diverse livelihoods reduce vulnerability, food insecurity, pressure on natural resources, as well as enable people to construct their own routes out of poverty, has become central to much policy advice and investments in both rural development (Ellis, 2000; Haider et al., 2018) and fisheries management (FAO, 2015; SPC, 2015).

Emphasis on livelihood diversification as a micro-economic development strategy gained momentum with the emergence of the sustainable livelihoods framework in the 1990s (Chambers & Conway, 1992; Scoones, 1998). Broadly, a livelihood consists of the portfolio of activities, material and nonmaterial assets, and access to these that together support people's lives (Ellis, 2000). A livelihood may be sustainable if assets and well-being can be maintained, vulnerability to external shocks and adverse trends can be reduced, and livelihood activities do not overexploit natural resources and environments (Allison & Horemans, 2006). Over the past few decades, the number and scope of research applying the sustainable livelihoods framework and more specifically looking at diversification for rural development and resource sustainability in small-scale fishery contexts has grown continuously (e.g. Allison & Horemans, 2006; Ferrol-Schulte et al., 2013; Stacey et al., 2021).

There is an interesting and sometimes muddled inter-relationship between livelihood diversity and diversification (Eriksson et al., 2020). Livelihood diversification is defined as "... the process by which families construct diverse portfolios of activities and social support capabilities in their struggle for survival and in order to improve their standard of living" (Ellis, 1998: 4, emphasis ours). Livelihood diversification is differentiated from the narrower concept of income diversification by having a wider focus on social processes and outcomes as they evolve over time (Ellis, 1998). This process can be encouraged exogenously through a planned intervention or a resource management regulation, or come about endogenously through opportunity or as a response to social-ecological change such as shifting market conditions and climatic patterns. Ideally, the process of diversification leads to a *pattern* of livelihood diversity where there is an increased quantity of activities in livelihood portfolios. Diversity *per se* is prominent in theoretical framings of sustainable development that focus on resilience and well-being (e.g. Biggs et al., 2012).

Nonetheless, the broad usage of the word 'diversity' has led to livelihood diversification being interpreted in many different ways. This ambiguity has contributed significantly to conceptual confusion about intentions to diversify livelihoods, including those in small-scale fisheries contexts (Brugère et al., 2008; Eriksson et al., 2020; Stacey et al., 2021; Steenbergen et al., 2017). Both in theory and in practice, a collection of divergent pathways to achieve diversified portfolios are haphazardly grouped together under the headline of livelihood diversification. For a rural fisher, for example, a diversified livelihood might be achieved by technologically enhancing existing

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activities, adopting new fish-based activities or transforming out of the fishery into alternative or supplemental livelihood activities (Roscher et al., 2022). Individuals within a household engaged in fishing-related activities could pursue multiple enterprises within and outside fisheries, or different members of a household could specialize in different enterprises or sectors to the exclusion of others (Allison & Ellis, 2001). The resulting patterns of livelihood activities employed through these diversification pathways would also differ in their ability to support a sustainable livelihood for different people in different contexts.

The hypothesis underpinning many policies and investments prescribing livelihood diversification, that through the process someone can achieve a pattern of livelihood diversity which reduces poverty, vulnerability and pressure on natural resources, appears to have been taken for granted. Externally driven efforts to diversify livelihoods are often plagued by flawed assumptions (Hanh, 2021; Sievanen et al., 2005; Wright et al., 2015), and for resource users the process carries a chance of adverse trade-offs and unintended consequences such as increasing risks or pressure on coastal resources (Allison et al., 2011). While there are examples of country-specific

syntheses of exogenous livelihood projects (e.g. Pomeroy et al., 2017; Stacey et al., 2021), surprisingly there remains no global synthesis of evidence on impacts from livelihood diversification emerging from endogenous (self-initiated) and exogenous (prompted by an external agent) processes in small-scale fisheries. Embedded in this gap are the key social and ecological factors and contexts that influence diversification outcomes (Steenbergen et al., 2017).

We address this gap by examining the body of evidence in the peer-reviewed literature for livelihood diversification to reduce poverty and vulnerability and contribute to ecological conservation outcomes. We work within commonly articulated theories of change proposed in fish-based diversification projects, notably Ellis and Allison (2004), Ireland et al. (2004), Torell et al. (2010), Pant et al. (2014) and Fröcklin et al. (2018). Based on this literature, livelihood diversification projects typically seek to improve lives in two ways:

1. Livelihood diversification provides a means to rise out of income poverty and reduces vulnerability to shocks and adverse trends.
 - The addition of more income-generating activities helps to increase income and assets.
 - A mixture of both natural resource and non-natural resource-based livelihood activities increases food security and confers a greater capacity to adapt to or cope with (political, natural and economic) shocks and adverse trends (e.g. climate change).
 - New activities can directly or indirectly assist the inclusion and empowerment of marginalized groups in land-based society and the wider economy.
2. Livelihood diversification leads to improved ecological outcomes.
 - Fishing effort is reduced by people leaving the fishery partially or completely.
 - Exploitation pressure on highly commoditized fishery resources is reduced as effort is shifted to more diverse species and environments. This may also enable the recovery of over-exploited fish stocks or ecosystems.
 - Those remaining in the fishery part-time may consider conservation measures that restrict fishing, as they have income streams outside of the fishery.

We test these often-implicit theories of change by asking the following overarching question: What is the evidence that livelihood diversification in fisheries has contributed to reduced poverty, vulnerability and improved ecological outcomes? Within this question, we explore the efficacy of different diversification pathways from both endogenous and exogenous catalysts to facilitate diversified livelihoods and improved outcomes. Our findings can help inform the theoretical conceptualizations of future livelihood diversification interventions by providing much needed clarity on the concept to enable sustainable livelihoods. Given the importance of aquatic foods to rural economies and food and nutrition security, there is also significant practical application in clarifying what is meant under the headline of livelihood diversification for small-scale fisheries, and in what contexts it can reduce poverty, vulnerability and pressure on natural resources.

2 | METHODS

Our study took an 'aggregative systematic review' approach, in which empirical data were collected to describe and test predefined concepts through an exhaustive search (Gough et al., 2012). Following the guidance by Dixon-Woods et al. (2005), both quantitative and qualitative research were included. We explored theories of change that were either explicit or implicit in the captured studies, and gathered and assessed the validity of the evidence to test our theory of change assumptions. Analysis was performed through a multistep screening and evaluation procedure that resulted in a list of primary global literature describing livelihood diversification in coastal or inland capture fisheries and aquaculture. This includes diversification processes, patterns and resulting livelihood and ecological outcomes. Here, we summarize our methodology and preliminary results up to the final list of eligible articles.

2.1 | Data sources and search strategy

Initial scoping to test the search strategies was conducted through a process where potential search strings using keywords were used in the Thomson Reuters Web of Science and Scopus databases. The resulting data sets were compared for proportion of relevant vs. irrelevant articles as well as the presence of known key papers that had already been identified. Eventually, a broad search term was selected to ensure all relevant studies were captured. The final search term was: (livelihood* NEAR (diversi* OR alternat*)) and the search was limited to publications from 2000 to present. Searches were augmented with manual searches of citations in the following key papers and reviews: Allison and Ellis (2001), Barrett et al. (2001), Salayo et al. (2012), Ferrol-Schulte et al. (2013), Cinner (2014) and Purcell et al. (2021). We did not include grey literature and unpublished project reports but contend the ca. 2,500 unique studies that were captured in the peer-reviewed literature searches provides an adequate sample to conduct the analysis.

2.2 | Screening

Titles, abstracts and full texts of the captured studies were screened in a two-step process. First, titles and abstracts were screened and articles that were not in English or not related to fisheries or aquaculture were excluded. Approximately 85% of the studies were subsequently removed from further screening (Appendix S1).

The full texts of the remaining 410 studies were screened using a more narrowly focused set of inclusion criteria. Studies were excluded if they were a) inaccessible; b) reviews, syntheses or policy discussion papers; c) hypothetical scenarios or discussed diversification as a potential solution; d) contained no primary data; e) did not report at the individual, household or community scale; or f) not relevant to the study question. This second screening step removed

62% of the remaining studies, leaving a list of 155 unique studies to be coded into our data set.

2.3 | Analysis of evidence (coding)

From each unique study, we extracted information on general attributes of the studies, including the year of publication, unit of analysis (e.g. household), methodological approach (e.g. quantitative), funding source and study location. Due to the noted absence of gender in fishery livelihoods literature and the importance of gender analysis for fisheries management (e.g. Stacey et al., 2019; de la Torre-Castro et al., 2017), we noted if studies incorporated gender dimensions into their study designs, sampling and reporting. Furthermore, we also paid attention to how studies were framed around Indigenous peoples, traditional ecological knowledge and multiple knowledge system approaches based on the understanding they contribute precise observation and insight into ecological contexts and resource use practices (e.g. McMillen et al., 2014). However, we did not stratify our analyses based on these factors as they were sparsely reported and constituted a small proportion of our literature sample.

Thereafter, we extracted information on how diversification was described in the study including processes and (intended) patterns. If possible, we then extracted the reported portfolio, livelihood and ecological outcomes from diversification. The following sections provide brief explanations of these variables of interest; see Appendix S2 for the full set.

2.3.1 | Processes

The coding term 'processes' refers to the catalyst for changing livelihoods. Studies where the changes to livelihoods are described as occurring autonomously as opportunities or capabilities allow or as a response to change (e.g. social circumstances or climate change) were coded as *endogenous*. Alternatively, studies where the changes to livelihoods are described as occurring because of external influence from government regulations (e.g. marine reserves) or projects and interventions were coded as *exogenous*. If the reported process was an undeterminable mixture of the two categories, or if it was not reported, it was coded as *unclear*. Within the exogenous category, studies that specifically described an intervention with explicit livelihood diversification objectives were also distinguished. For this subset of studies, additional contextual information was extracted including intervention details, if the reporting was independent, and if a control group was used for comparative analysis.

Studies were assigned to a process category as reported by the study author(s). While seemingly straightforward, sometimes this meant going against logic. For example, some of the activities described in the included studies unequivocally originate from outside influence and would, therefore, be coded as exogenous. However, if a study describes the uptake of this activity in the study population occurring as a result of peer-to-peer learning, this describes an

endogenous process. The categorical line between the exogenous introduction of a livelihood activity and the dissemination of that activity leading to endogenous uptake elsewhere was sometimes blurred.

2.3.2 | Patterns

How studies framed patterns of diversity was captured in two ways. The first step related to the category (i.e. sector) of activity or activities the study population was described as moving into at the reported unit of analysis. Sectors include 'agriculture', 'aquaculture', 'fishing sector (other)', 'non-natural resource' (e.g. tourism) and 'moving into fishing'. However, there may be several equally weighted activities across multiple sectors being described in a study. In these instances, the diversification sector was coded as a 'broad portfolio'. Studies where the activities being moved into are not described were coded as 'not reported'.

Studies were also classified by the intended or targeted pathway that diversification was described to be pursued through. To help organize the inter-relationship between pathways and patterns, we used Stirling's (2007) common diversity framework, which distinguishes between balance, variety and disparity as three properties of diversity. Each of these properties depicted in Stirling's framework correspond to a distinct pathway to pursue livelihood diversification through (Roscher et al., 2022; Figure 1).

The pathway 'balance' refers to the extent to which each livelihood activity is currently practiced. Studies describing diversification through an increased contribution of an *existing activity* intended to change the balance of activities in livelihood portfolios. The pathway 'variety' refers to the number of activities available. Studies describing diversification through the introduction of a *new activity* intended to change the variety of activities in livelihood portfolios. Last, the pathway 'disparity' refers to the degree of difference between the activities. Studies describing an activity or activities being moved into in a *new and previously unemployed sector* intended to change the disparity of activities in livelihood portfolios. If multiple pathways were targeted, the study was coded as a 'mixture'. Studies that did not provide clear evidence or were ambiguous were coded as 'unclear' and studies that made no attempt to detail the activities being diversified into were coded as 'not reported'. Increasing the balance, variety and/or the disparity of activities employed in the overall livelihood portfolio can result in a diversified livelihood portfolio and theoretically contribute to sustainable livelihoods in different ways.

Categorization of pathways was necessary to exemplify the broad ways diversification has been framed and pursued through. However, incomplete or inconclusive evidence in many studies made it uncomfortably subjective to determine changes to patterns of diversity at the pathway level. To demonstrate, an exogenous project would typically report that a new activity being promoted has or has not been adopted in a study population. But they often do not explicitly report on how this new activity

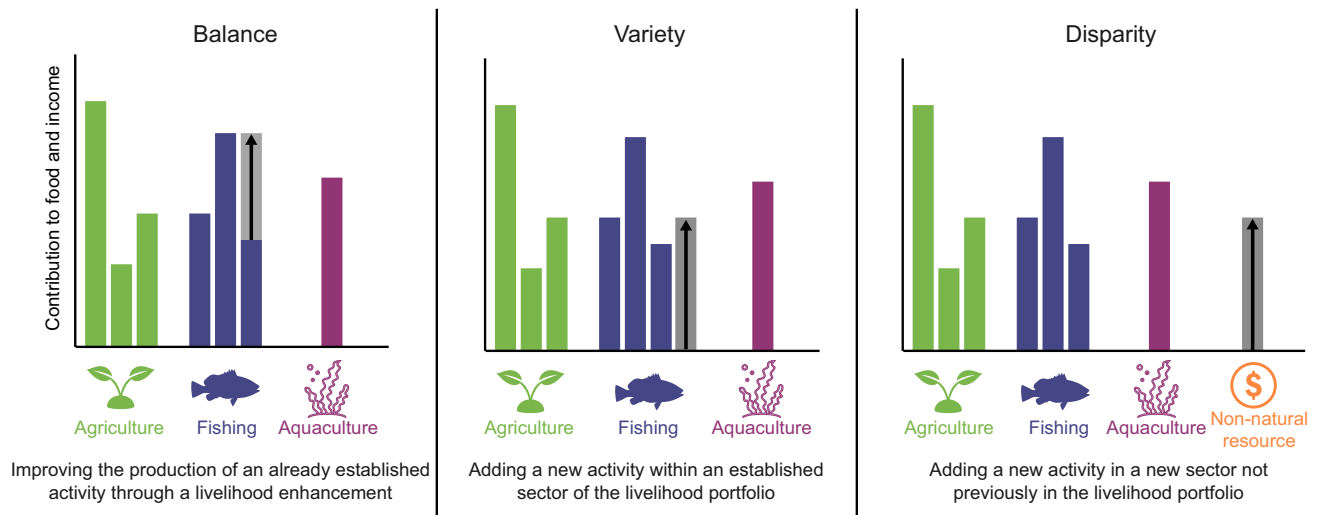


FIGURE 1 The three diversification pathways adapted from the common diversity framework (Stirling, 2007). The review classified studies according to the intended or targeted pathway that diversification was described to be pursued through. Figure adapted from Roscher et al. (2022)

impacts the suite of other activities that compose livelihood portfolios in the population. Objectively determining changes to the balance, variety and disparity of livelihood portfolios would require this information. Therefore, while we use these pathways to report on how diversification is framed and pursued, and explore the relationships between the intended pathways and livelihood and ecological outcomes, we recombine the pathways and report on changes to patterns of diversity at the aggregated portfolio level.

2.3.3 | Outcomes

We report on the activities described in the livelihood portfolio at the aggregated level. Interpretations for livelihood portfolio outcomes were based on livelihoods as defined by Ellis (2000) to include a grouping of the assets, activities and access to these that together compose the living gained. Portfolio outcomes were coded as 'diversified', 'less diversified', 'not diversified' or 'not reported' depending upon the evidence of change given in a study. A study reporting that the increased uptake of an existing activity (balance—to a certain qualitative degree), a new livelihood activity (variety) or a new activity in a new and different sector (disparity) had been added to overall portfolios would all be coded as *diversified*. For studies reporting in multiple time periods, only the beginning and the conclusion were considered. For example, if a new and lucrative activity is briefly employed in the study community but becomes untenable and abandoned because of market conditions, then livelihoods are comparatively *not diversified* between the start and the finish of the study.

Livelihood outcome coding was interpreted through a multidimensional poverty lens to account for both material and nonmaterial impacts from livelihood diversification. The three overlapping and

reinforcing dimensions include income and asset poverty, risk and vulnerability, and marginalization (see Table 1 for working definitions). Thus, an 'improved' livelihood outcome equalled any one or more of: increased income or asset base, or reduced vulnerability, or reduced marginalization. A 'mixed' livelihood outcome included a combination of positive and negative impacts across the three dimensions of poverty, and a 'not improved' livelihood outcome was where no aspect of multidimensional poverty was improved through the diversification process.

We also coded studies as 'improved', 'mixed', 'not improved' or 'not reported' if they qualitatively or quantitatively reported ecological outcomes in connection with diversification processes. Our interpretation for ecological outcomes is purposively broad to encapsulate any impact to natural resources that can be clearly linked to livelihood diversification, as described by the study author(s). Specific ecological outcomes included the impacts of livelihood diversification on fishing effort, target fish stocks, catch per unit effort, indicators of ecological health and well-being as well as management. Studies would be coded as *improved* if—as a result of the activity or activities being diversified into—fishing effort had reportedly been reduced. Alternatively, scenarios where fishing effort had reduced but the new activity led to the destruction of other coastal environments would be coded as *mixed*. If there was no observed change to fishing effort, or if the new activity had harmful ecological consequences, then the ecological outcome would be coded as *not improved*.

2.3.4 | Quality of reporting

All studies were evaluated for the quality and clarity of reporting. The specific clarity checks included: whether explicit claims linking evidence to outcomes were clearly reported; and if the

TABLE 1 Working definitions of the multiple dimensions of poverty applied to the coding of eligible studies for the analysis of impacts from livelihood diversification

Dimension	How each dimension is understood	Example of typical processes investigated by the studies
Income poverty	Poverty in fishing communities is often related to an insufficient asset base. Assets include not only obvious financial, natural resource and physical categories but also closely related human and social capital. In this sense, poverty is determined by the ability to secure either cash or in-kind income from the assets controlled or accessed by the household.	Enterprise development Education and skills development Loans and savings Infrastructure development Technology transfer
Vulnerability	Fisherfolk's vulnerability is determined by their exposure to hazards and to how those hazards affect their livelihoods as a whole. Both short-term events (e.g. extreme weather or an oil spill) and long-term trends (e.g. climate change or macro-economic structural adjustment) might limit fisherfolk's ability to prepare for and withstand shocks, and reorganize their livelihoods for improved resilience.	Climate change adaptation Food security Health services improvement Insurance and related savings Social protection schemes Disaster preparation and response
Marginalization	Social exclusion or discrimination might be based on gender, ethnicity or other social and cultural features. As a result, marginalized groups are often locked in exploitative labour relations, have restricted access to resources and severely limited ability to overcome those conditions.	Local government accountability Legal system development Gender equity Human rights Land tenure and aquatic use rights

Note: Conceptualization based on Allison et al. (2011). Dimensions and respective lists of typical processes are an approximation for analytical purposes only.

methods were described in a manner that allows the reader to objectively evaluate the validity of findings. Studies with low quality of reporting, or where livelihood and ecological outcomes were not reported were subsequently marked as unclear and removed from analysis of outcomes. This method allowed us to include studies that discussed processes and patterns of diversification in our data set, even if reporting on outcomes from diversification was outside the scope of the study. A common example of this is where livelihoods were described as diversifying in response to climate change yet impacts from these livelihood changes were not explored. Approximately 40% ($n = 63$) of the initially accepted studies were coded as having unclear outcomes, leaving 92 studies with outcomes from diversification that were clearly reported (Appendix S1).

2.4 | Independent coders and justifications

To assess the objectivity of our coding process, two randomly selected studies from the final data set were coded by five independent coders selected by the co-authors. Across both studies, there was uniform agreement (100%) with the coding for diversification processes, sectors and ecological outcomes. There was also 80% uniformity in the coding for intended pathways, 80% uniformity in the coding for portfolio outcomes and 70% uniformity in the coding for livelihood outcomes. This test showed that the academic discipline of each coder influenced the interpretation and coding of each study. We acknowledge this limitation in the study design by providing a paragraph justifying the rationale behind the way each paper was coded in Appendix S3.

2.5 | Data analysis

The scoping, screening and full-text coding processes were annotated in a (Microsoft Excel) spreadsheet. Each relevant study was arranged into a unique row, which was later exported as a CSV file. Analysis and data visualization were conducted primarily using RStudio (RStudio Team, 2020). The data visualization package Circlize (Gu et al., 2014) was used to illustrate the connections between portfolio outcomes and both livelihood and ecological outcomes.

2.6 | Limitations of study

We used the indicators of impact as they were reported in each of the included studies, and as a result our synthesis reflects their respective frames of reference. Consequently, there may have been a bias to report comparatively diversified livelihoods because that is how the studies were often framed. Given that many exogenous diversification projects are implemented by development organizations rather than research organizations, there is also likely a bias to report instances where the activity or activities being promoted are taken up in the community and contribute to improved outcomes (i.e. publication bias).

Additionally, generalizing conclusions regarding livelihood and ecological outcomes is naturally inhibited by the nonstandardized use of units in the studies we assessed. An improved livelihood outcome was reported when income or assets increased, exposure or sensitivity to risk decreased, adaptive capacity increased, or empowerment or social inclusion increased. An improved ecological outcome

pertained to circumstances where specific ecological conditions had improved, or fishing effort had reduced. Studies reported on any of these indicators at the individual, household or even community level. Overall, these indicators refer to complex concepts and assigning livelihood or ecological outcomes specifically to diversification dismisses many of the larger processes at play. While we confined synthesis of studies with clear reporting of these outcomes, we also acknowledge the limitations of oversimplifying these complex concepts and using a data set consisting of nonuniform indicators and units. However, due to this heterogeneity in how data contained in studies we assessed was compiled, analysed and reported, we follow Evans et al. (2011) and do not attempt a statistical analysis to examine the significance of differences between diversification outcomes and various processes and patterns.

3 | RESULTS

3.1 | Descriptive information

The full set of eligible studies report on research carried out in 56 countries (Figure 2); most of which were in Asia (46%, $n = 72$) or Africa (25%, $n = 38$). Single country studies made up nearly 95% of the eligible set ($n = 146$), with nine cases of multicountry research designs. Research was concentrated in eight countries (58% of the eligible set): Indonesia ($n = 17$), the Philippines ($n = 16$), Bangladesh ($n = 16$), Tanzania ($n = 13$), Kenya ($n = 8$), Vietnam ($n = 8$), Solomon Islands ($n = 6$) and Brazil ($n = 6$).

Units of analysis were predominantly reported at either the individual (40%, $n = 62$) or household (35%, $n = 55$) level. Some studies reported on a mixture of units (20%, $n = 31$), while a few reported at the community level (3%, $n = 4$) or were unclear (2%, $n = 3$). Methodologically, most studies employed a mixed method approach (67%, $n = 104$). The remaining studies were relatively evenly split between quantitative (19%) and qualitative (14%) approaches. Nearly 45% ($n = 69$) of the studies specifically mentioned the sampling of both women and men in their methods. However, only 25% ($n = 40$) of all studies included some form of gender disaggregated result and less than 10% ($n = 13$) had a gender-specific study objective. Furthermore, 31% ($n = 49$) of studies incorporated Indigenous people, traditional ecological knowledge and/or multiple knowledge systems into their study designs or interpretation of results.

3.2 | Processes

Studies were assigned to a process category according to the way the diversification process was catalysed. Approximately half (51%, $n = 79$) of the eligible studies described diversification occurring endogenously while 37% ($n = 58$) described exogenous processes (Figure 3). Of the exogenous studies, 15 described a specific livelihood diversification intervention. However, only eight of these studies reported independently from the intervening organization(s), while only six used a control group in their analysis. The remaining 12% ($n = 18$) of all coded studies described

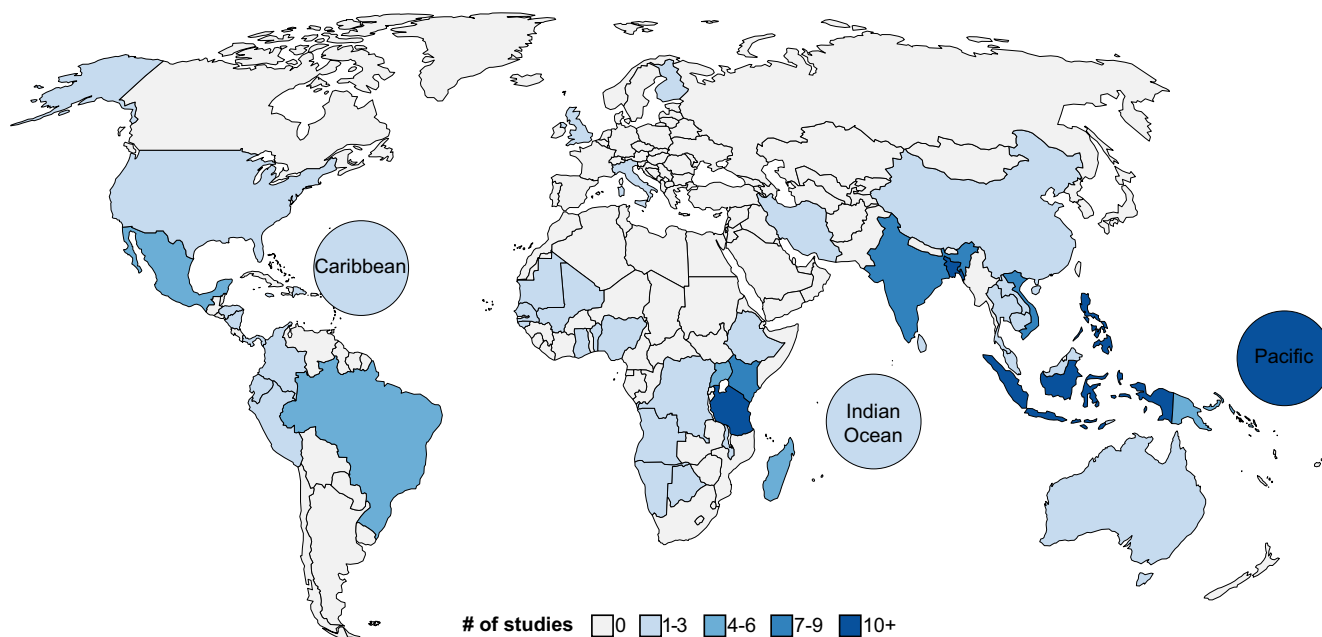


FIGURE 2 Geographical representation of the full set of accepted studies for this review ($n = 155$). Bubbles represent ocean regions with countries whose landmass is not visible on the map. Bubble symbolizing the Pacific region includes Fiji, Kiribati, Federated States of Micronesia, New Caledonia, Samoa, Timor-Leste and Tonga. Indian Ocean region includes Mauritius and Seychelles. Caribbean region includes Jamaica, Anguilla and Dominican Republic

an unclear process where the catalyst for changing livelihoods was not discussed or explored.

3.3 | Patterns

Almost 40% ($n = 60$) of studies discussed diversification occurring into a broad portfolio of activities in multiple sectors (Figure 3). This was followed by diversification within the fishery sector (18%, $n = 28$) and diversification outside of natural resource sectors into tourism or wage work (14%, $n = 21$). A minority of studies discussed diversification into aquaculture (11%, $n = 17$), agriculture (6%, $n = 10$), as well as moving into fishing (3%, $n = 4$). The remaining studies did not attempt to elaborate on the livelihood activities being diversified into (10%, $n = 15$).

The described intended pathways for diversification were highly variable. More than half of the studies either discussed

diversification through multiple pathways (26%, $n = 41$), for example, into a broad portfolio of activities in multiple sectors, or were unclear about previously employed livelihood activities and sectors (26%, $n = 40$). Of the studies clearly reporting on a single pathway, most intended to diversify from capture fisheries through the disparity pathway by adding new activities in new sectors such as aquaculture and tourism (23%, $n = 36$). This was followed by the intention to diversify through the variety pathway by adding new activities in previously established sectors, commonly fishing and agriculture (19%, $n = 30$). Some studies specifically discussed diversification through the balance pathway by increasing the efficiency of a previously established activity (e.g. fishery postharvest technologies) in the existing livelihood portfolio (5%, $n = 8$). The inconsistent pursuit of diversification through these pathways was also reflected in the studies reporting on livelihood diversification interventions. Of the 15 studies, four discussed livelihood diversification through multiple pathways, five focused solely on

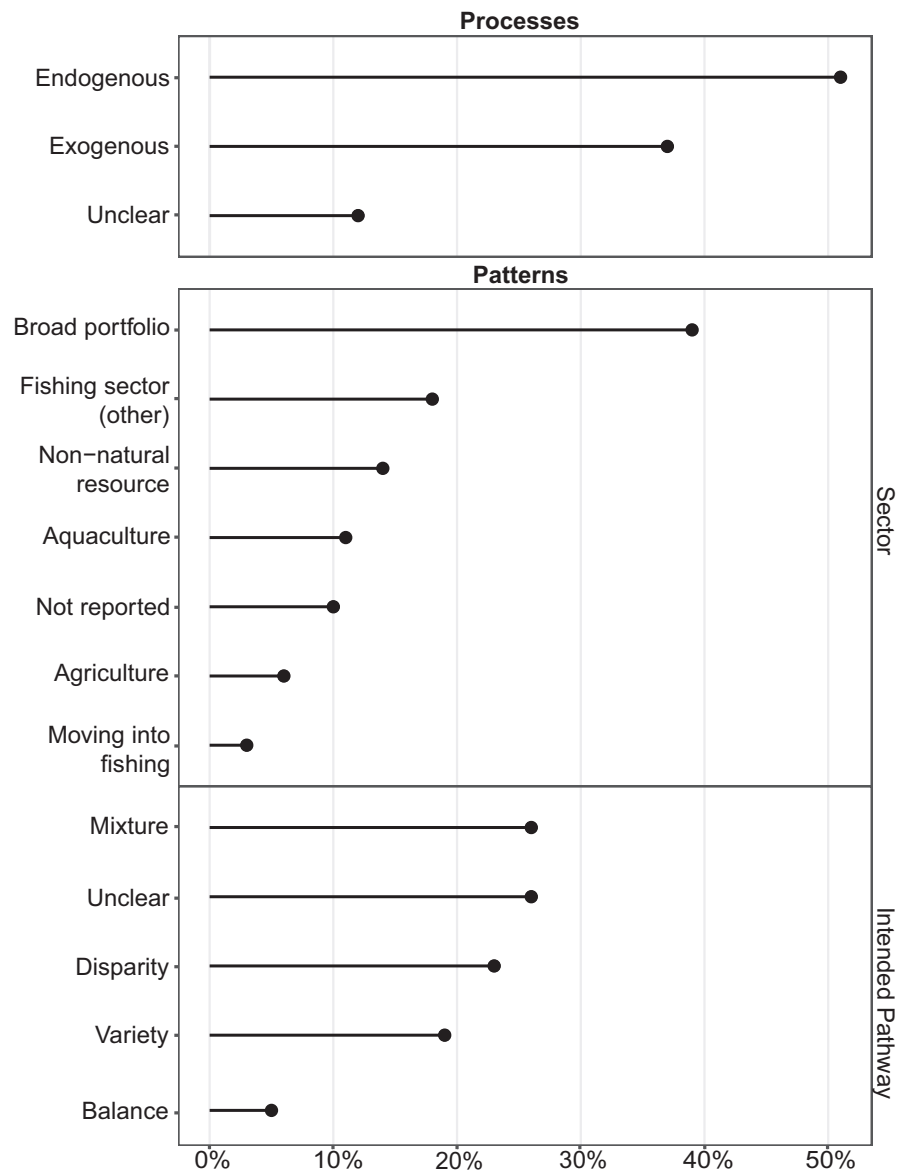


FIGURE 3 Percentage of reported diversification processes and patterns including both sectors being diversified into, and the intended pathways being influenced. The summed percentage for each of the three illustrated components equals 100% of the full set of studies in the data set ($n = 155$)

disparity, four on variety and one each on balance and an undeterminable mixture.

Many income diversity studies were characterized by limited evidence on diversification outcomes. Such studies were frequently restricted to measurement of occupational diversity. These studies, as well as studies that did not meet the quality of reporting guidelines detailed in the methods section were subject to data extraction. Yet, the uncertain, unclear or absent reporting on outcomes of diversification led to their exclusion of the in-depth assessments presented in the subsequent sections relating to diversification outcomes. The excluded subset of 'unclear' studies also includes four livelihood diversification intervention studies, leaving a total of 11 to be explored further.

3.4 | Outcomes

Our data set consisted of 92 studies that reported clear portfolio outcomes for diversification, as well as one or both of livelihood and ecological outcomes (e.g. increased income and/or reduced fishing effort). The majority of these reported diversified livelihood outcomes (84%, $n = 77$). The remaining studies either reported that livelihood activities had not diversified (8%, $n = 7$), or were comparatively less diverse (9%, $n = 8$).

There was little difference in the aggregated portfolio, livelihood and ecological outcomes between diversification processes and patterns (Figure 4). Approximately 88% ($n = 42$) of studies detailing an endogenous diversification process led to diversified livelihood portfolios compared to 79% ($n = 34$) of studies detailing an exogenous diversification process, including 8 of the 11 diversification intervention studies. Similarly, nearly 40% ($n = 17$) of exogenous studies resulted in improved livelihood outcomes compared to 38% ($n = 18$) of endogenous studies. Most studies detailing endogenous (75%, $n = 36$) and exogenous (67%, $n = 29$) processes did not report any ecological outcomes. Those that did reported improved ecological outcomes for 4% ($n = 2$) of endogenous processes and 7% ($n = 3$) for exogenous processes.

The intended pathway of diversification also had little impact on the ability to achieve a diversified portfolio outcome or improved livelihood and ecological outcomes. Studies describing diversification through a mixture of pathways (92%, $n = 23$) or through the pathway of disparity (85%, $n = 23$) were the most successful to achieve diversified portfolios. Variety was the worst performing pathway, with only 75% ($n = 16$) of studies reporting comparatively diversified portfolio outcomes. However, in terms of ability to lead to improved livelihood outcomes, variety was the most successful pathway (52%, $n = 11$), followed by studies describing diversification

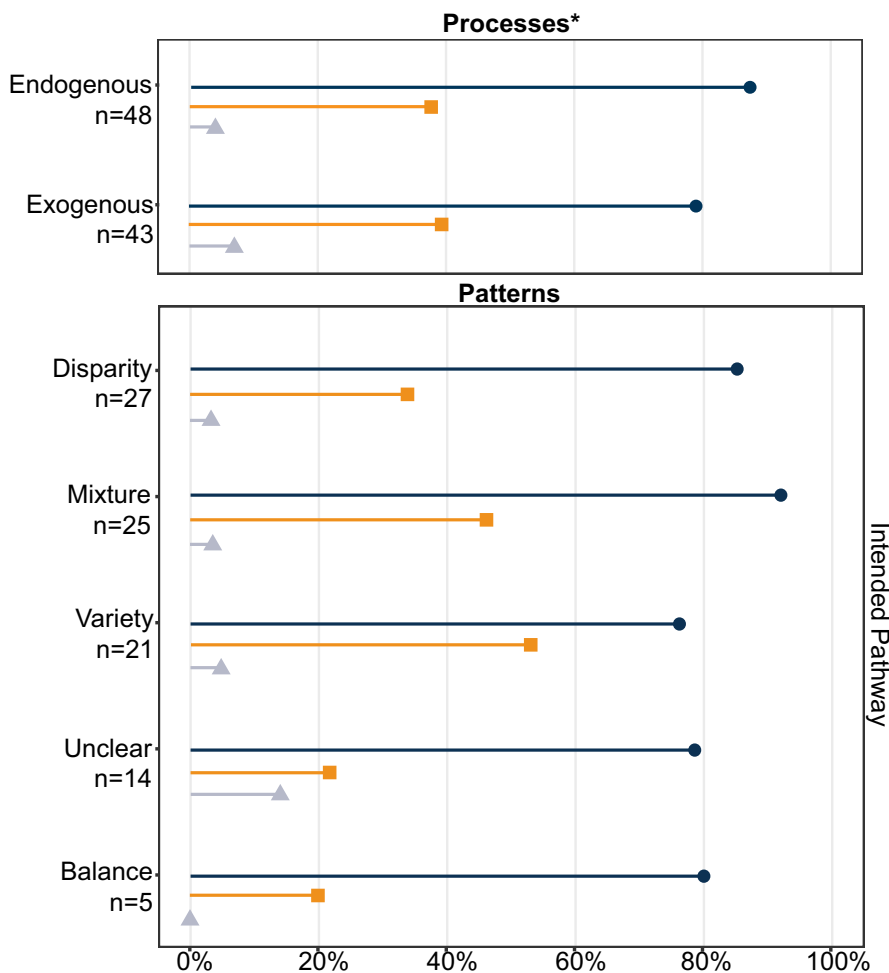


FIGURE 4 The percentage of reported processes and intended pathways that led to comparatively diversified portfolios at the aggregated level (blue circles), improved livelihood outcomes (orange squares) or improved ecological outcomes (grey triangles). Percentages represent the proportion of each unique sample size. Summed sample sizes in each of the two components equal the total clearly reported outcome studies ($n = 92$). *Not pictured: $n = 1$ study that had clearly reported outcomes, but detailing an unclear process

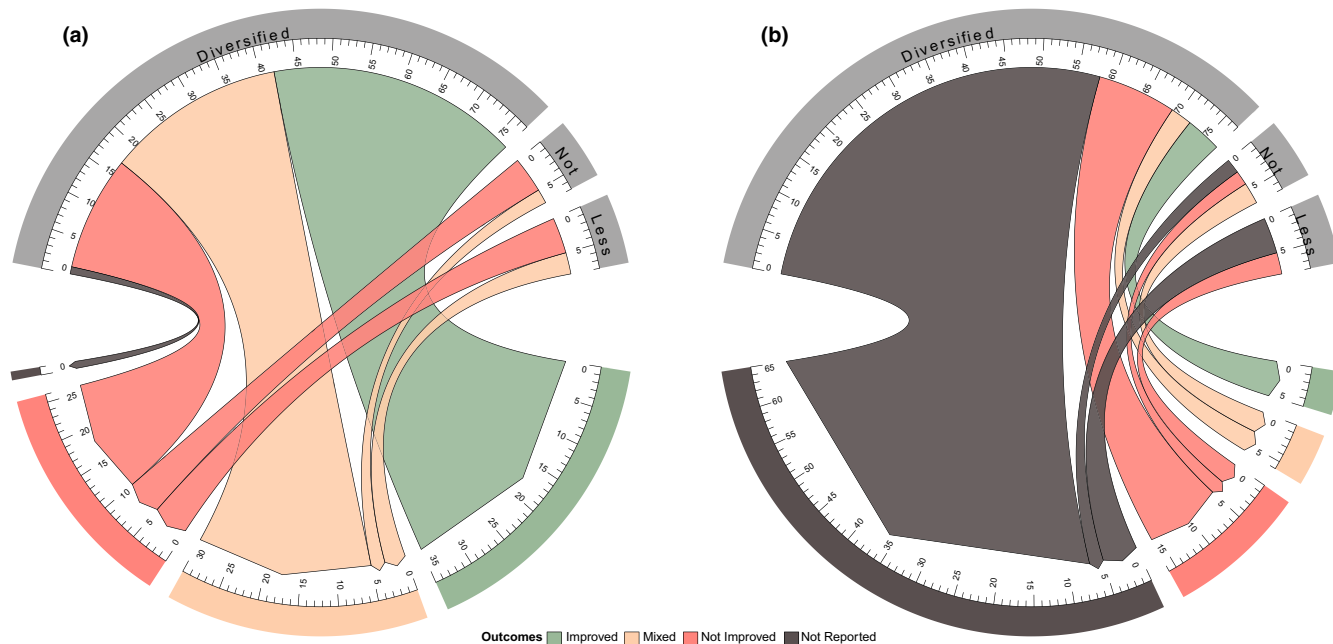


FIGURE 5 For the clearly reported studies ($n = 92$), circular visualization of how diversified, not (diversified) or less (diversified) portfolios lead to various (a) livelihood and (b) ecological outcomes. Numbers indicated on the inner edge of each variable represent frequencies. Each semi-circle sums to equal the sample size

through multiple pathways (44%, $n = 11$). For all pathways, most studies made no attempt to explore ecological outcomes. For those that did, an ‘unclear’ mixture of pathways was the most successful at just 14% ($n = 2$).

Studies reporting diversified livelihood portfolios led to a range of livelihood outcomes (Figure 5a). Of the 77 studies that reported diversified portfolios, nearly half (45%, $n = 35$) also reported improved livelihood outcomes. This includes six intervention cases that reported livelihood outcomes and diversified portfolios. Approximately a third (32%, $n = 25$) of the studies that reported diversified portfolios reported mixed livelihood outcomes, and 16 of the remaining 17 studies that reported diversified portfolios reported not improved livelihood outcomes. There were no studies reporting either not diversified portfolios or less diversified portfolios that resulted in improved livelihood outcomes.

Strikingly, 71% ($n = 65$) of studies did not explore ecological outcomes from the process of diversification (Figure 5b), including 75% ($n = 58$) of the studies that reported diversified portfolios and eight of the 11 intervention studies. For the total studies that did report on ecological outcomes ($n = 27$), most reported that they had not improved through the (attempted) diversification process (17% of all clearly reported studies, $n = 16$). Studies reporting improved ecological outcomes were the least numerous (5%, $n = 5$). All the studies reporting improved ecological outcomes also reported diversified portfolios.

4 | DISCUSSION

The body of evidence in the global peer-reviewed literature demonstrates inconsistency for livelihood diversification to facilitate

poverty and vulnerability reduction in coastal and inland small-scale fishing communities. It also exposes the enduring knowledge gap regarding fishery resource impacts from livelihood diversification. These findings challenge the hypothesis underpinning many policies and investments prescribing livelihood diversification, and emphasize the need for further inquiry into the contexts where this strategy can enable sustainable livelihoods.

In a previous review of livelihood diversification programs in fishing communities, Brugère et al. (2008) linked the limited success of diversification programs to conceptual ambiguity in the diversification paradigm itself. Our findings support this interpretation by demonstrating significant variability in how diversification is pursued in small-scale fisheries. Except for ‘balance’ (which has clearer analogues to the strategy of livelihood intensification), there was an almost uniform distribution across the remaining intended pathway categories for how the pursuit and analysis of diversification was framed, including studies detailing specific livelihood diversification interventions. But the ability of these divergent pathways to lead to comparatively diversified portfolios or better/worse livelihood and ecological outcomes did not differ substantially.

4.1 | Livelihood diversification impacts on multidimensional poverty

Our findings support the conclusion that diversification, although potentially beneficial, might also lead to mixed or negative livelihood outcomes (e.g. Allison et al., 2011; Salayo et al., 2012). Some exogenously driven diversification processes were able to grow incomes and assets, as well as empower women through an increase in household decision-making authority (e.g. for women engaged

in shell-handicraft enterprises in Zanzibar, Tanzania; Fröcklin et al., 2018). Others perpetuated poverty and created new vulnerabilities in already marginalized communities through maladapted fishery resource regulations that restricted access to vital livelihood options, as happened with the Indigenous Garifuna population in Honduras' Cayos Cochinos marine protected area (Brondo & Woods, 2007). Similarly, there were instances where endogenous diversification processes helped accumulate wealth and build adaptive capacities to shocks and adverse trends (e.g. for two Cambodian fishing communities; Marschke & Berkes, 2006); and instances where endogenous processes resulted in not only increased income but also increased vulnerability through diminished food security, such as for inland Brazilian Amazonian Caboclos in the Médio Juruá Extractive Reserve (Morsello et al., 2014).

Outcomes across the collection of peer-reviewed studies indicate that livelihood diversification is not a panacea. There are numerous risks and intrinsic limitations associated with the process, and the potential for diversified portfolios to reduce multidimensional poverty varies between contexts (Roscher et al., 2022). To demonstrate, although Sahelian floodplain fishers in Mali diversified the ways in which they catch fish, livelihood outcomes did not improve as these livelihood options are covariant in the sense they are vulnerable to the same climate-related threats (Morand et al., 2012). Comparatively, tsunami impacted household in Aceh, Indonesia, were able to reduce vulnerabilities (i.e. improve livelihood outcomes) by diversifying into livelihood options that were not reliant on the same ecosystem services (Mills et al., 2011). But reducing vulnerabilities to climate-related threats by diversifying outside of natural resource-dependent activities is inherently dependent on having the assets to do so (e.g. as was reported in two Ugandan lakeshore villages; Goulden et al., 2013).

Livelihoods projects often engage with communities where households have broadly varied assets, abilities and benefits from natural resources, which greatly influences their ability to engage and participate (Eriksson et al., 2020; Wright et al., 2015). The tendency for unequal capacity to participate in, and, therefore, derive the benefits from changing livelihood strategies has also been a recurring theme in the literature (e.g. Barrett et al., 2001; Blythe et al., 2017). So has the tendency for benefits from new livelihood activities to only reach the already wealthy and reinforce existing inequalities (i.e. 'elite capture'; Fabinyi, 2010; Scheyvens, 1999). These trends were well represented here by both exogenous and endogenous studies, and often resulted in 'mixed' livelihood outcomes stratified along socio-economic lines. For example, in a study of exogenous ecotourism operations in the Sundarbans of India, Ghosh and Ghosh (2019) reported the siphoning of financial benefits to remotely located capital investors. Comparably, multiple studies depicted endogenous processes where improved outcomes hinged on who had adequate (access to) assets, while those less endowed were marginalized, as studies from both Mexico and Brazil showed (Emdad Haque et al., 2015; Robles-Zavala, 2014).

As has been articulated elsewhere, the successful integration of new livelihood activities often hinged upon their suitability within

social and cultural contexts, and whether they build on existing strengths and capabilities (e.g. O'Garra, 2007). Successful interventions that continued to generate benefits beyond external funding and project timelines were characterized by their consideration of local contexts during initial feasibility assessments, including identifying both what constitutes a successful livelihood in the local context and to whom efforts to promote diversification should be targeted (Govan et al., 2019; SPC, 2020; Wright et al., 2015). They were also characterized by their inclusion of social protection measures such as microfinancing or other asset-building schemes (Pomeroy et al., 2017). Social protection measures seek to enable vulnerable community members to participate in (exogenous or endogenous) diversification (Goulden et al., 2013). We found three studies detailing diversification interventions that integrated these characteristics and reported improved livelihood outcomes across all three dimensions of poverty (see Pant et al., 2014; Torell et al., 2010, 2017).

Understanding how to enable positive livelihood outcomes through diversification is also contingent upon acknowledging the social and cultural barriers (e.g. pre-existing gender relations) that may inhibit diversification from occurring (Forsyth & Evans, 2013). Yet, despite the growing wealth of literature detailing important distinctions between women's and men's livelihood contributions in small-scale fishery contexts (e.g. Kleiber et al., 2015; Tilley et al., 2020; de la Torre-Castro et al., 2017; Weeratunge et al., 2014), gendered considerations were frequently absent from the studies we assessed. Although roughly half of total eligible studies incorporated the sampling of both women and men, further inspection revealed just a fraction of these presented some form of disaggregated results, incorporated a gender-specific component into study designs or analysis, or attempted to interpret the interaction between gender and livelihood diversification outcomes. The scarcity of reporting on gendered roles in fish-based livelihoods and the broader aquatic food systems literature has been noted before (Simmance et al., 2021; Stacey et al., 2019), and demonstrates limited engagement with societal contexts that influence the outcomes from diversification processes.

Condensing the reported outcomes from livelihood diversification processes across societal contexts may lead to misinterpreting results and represent a missed opportunity to start unpacking the inconsistencies observed thus far. To illustrate, the unit of a household can be female-headed vs. male-headed, many children vs. no children, or other socio-economically differentiating factors. Within a single household, outcomes for different individuals may also differ. Runk et al. (2007) reported that female-headed households within Indigenous Wounaan communities in Panama earned substantially less income from fishing and more from art sales compared to male-headed households. Dolan (2004) found that cultural norms in central and eastern Uganda inhibited access to more lucrative livelihood options for female-headed households. Within a household, Lawless et al. (2019) accounted gendered differences of livelihood outcomes where women in Solomon Islands experienced intensified time and labour burdens in comparison to male counterparts. These examples

highlight the ongoing need for greater integration of gender considerations in livelihoods analysis to enhance the understanding of the role gender plays in reducing poverty and increasing well-being (Koralagama et al., 2017; Stacey et al., 2019).

4.2 | Livelihood diversification impacts on ecological outcomes

Although it is one of the main theoretical drivers behind the support for diversified livelihoods, few studies attempted to explore any ecological effects (including changes to fishing effort) from diversification processes. This knowledge gap has been identified elsewhere; several studies have remarked on the largely scattered or absent documentation of evidence for diversification (or alternative livelihood) processes to improve ecological outcomes. This includes the paucity of evidence for diversification to improve biodiversity conservation (Roe et al., 2015), or more simply to reduce fishing pressure (Carter & Garaway, 2014; Hill et al., 2012; Sievanen et al., 2005). Perhaps this speaks to the difficulty of establishing a causal pathway from changes in livelihood portfolios to ecological impacts from these changes, or the mismatch between project funding timelines and the time it takes for observable ecological impacts to develop. But the limited evidence contained here also demonstrates inconsistencies with the widely supported theory of change for livelihood diversification to lead to improved ecological outcomes.

A few cases conveyed a positive impact on natural (fishery) resources from livelihood diversification processes. Gjertsen (2005) links the existence of alternative income projects around marine protected areas in the Philippines to reduced fishing effort and perceived positive changes in abundance of reef fish and coral cover. Also in the Philippines, Lowe and Tejada (2019) report that with the establishment of a community-based dive tourism business, reliance on dwindling coastal fishery resources for income has been reduced and conservation-oriented fishing restrictions on gears and vessels have been implemented with little opposition. Yet, most studies reporting ecological impacts described circumstances where ecological outcomes had not improved, such as the activity being diversified into having harmful ecological consequences (e.g. snake fishing within floating communities of Tonle Sap Lake in Cambodia; Brooks et al., 2008), increasing pressure on already heavily utilized near-shore environments (e.g. shrimp aquaculture in lagoon ecosystems of Nicaragua; Benessaiah & Sengupta, 2014), or increasing fishing effort (e.g. within the Calamianes Islands, Philippines; Fabinyi, 2010).

The ecological impact of diversification is most likely related to key social and cultural contexts, including the benefits generated from fishing and the opportunities to diversify outside of the fishery. How fish-based livelihood activities contribute to cultural identities (Russell et al., 2013), or the enjoyment of participating in them (Pollnac & Poggie, 2008) may influence the potential to reduce fishing effort. Additionally, in some rural economies there may be limited options to diversify outside of natural resource-dependent livelihoods (i.e. poverty of opportunity; Narsey, 2011).

Considering these contexts is critical to achieve desired ecological outcomes through diversification, particularly for exogenous processes that impose resource use regulations. Failing to do so risks further deterioration of ecosystems and could exacerbate vulnerabilities for the already vulnerable (as was described by Brondo & Woods, 2007).

Exogenous processes that seek to enable the most vulnerable community members to participate in alternative economic opportunities are thought to be most effective at achieving conservation oriented goals (Cinner et al., 2009; Wright et al., 2015). For example, in an impact study of a project-based diversification intervention across three countries spanning multiple continents (Thailand, Tanzania and Nicaragua), Torell et al. (2010) found that activities outside of the fishery had little impact on reducing fishing effort as additional revenues were used to reinvest in existing fish-based livelihood activities. A follow-up survey conducted six years later in Tanzania found that a higher percentage of intervention beneficiaries had either stopped or reduced fishing effort in comparison to both nonbeneficiaries and the previous survey (Torell et al., 2017). In part, the authors attribute this change to greater access to microcredit loans that enabled the most poor and vulnerable within project communities to participate in activities being promoted through the intervention. Increased participation also enabled beneficiaries to meet their immediate cash and nutritional needs from activities outside of the fishery. How fast monetary and nonmonetary (e.g. food security) benefits are realized from alternative livelihood activities can play an integral role in their lasting ability to reduce fishing effort (Muallil et al., 2013). Therefore, tailoring diversification efforts to meet these immediate needs may be an appropriate entry point for conservation-oriented diversification efforts.

Positive ecological outcomes from livelihood diversification also likely rely significantly on the strength of existing resource management institutions. In this regard, Govan (2009) suggests that the most effective diversification approach would be to simply enable better local management of resources. Indigenous institutions have helped manage relationships between people for centuries (Foale et al., 2011), and can organize communities to resist unwanted commoditization and subsequent overexploitation of coastal resources (e.g. Ferguson et al., 2022). Traditional knowledge systems can provide accurate observations on local ecological processes and practices of resource use, which are vital components for developing appropriate livelihood solutions to adapt to changing environmental conditions at local scales (Leonard et al., 2013; McMillen et al., 2014). It would, therefore, seem logical that they would also be an integral facet of research at the juncture of livelihoods and resource sustainability. Yet, none of the five studies reporting improved ecological outcomes, and only eight of the remaining 22 studies reporting any ecological outcome, explicitly incorporated Indigenous people, traditional ecological knowledge and/or multiple knowledge systems into their study designs or interpretation of results. This further demonstrates the limited engagement with societal contexts that influence outcomes from diversification processes. It also highlights the ongoing need for greater coordination with traditional resource

management institutions to understand how improved ecological outcomes can be achieved through diversification.

5 | CONCLUSION

In considering the evidence for positive impacts of livelihood diversifications, the question should not be whether it reduces multidimensional poverty and improves ecological outcomes, but under what circumstances, how and for whom. Disentangling the concept of livelihood diversification presents an entry point to encourage more targeted and deliberate research into livelihood diversification processes and outcomes. Being more deliberate in how livelihood diversification is pursued is critical to reduce the risk of exposing new vulnerabilities through ill-fitting livelihood solutions that result in adverse trade-offs or unintended consequences.

There is also a pressing need for more rigorous evaluation of both exogenous and endogenous diversification processes that assesses their effectiveness to enable sustainable livelihoods in a variety of contexts. This includes engaging with the social and cultural contexts that, as our analysis demonstrated, are often overlooked but inherently impact livelihood outcomes. It also includes developing and monitoring indicators to examine ecological outcomes. The lack of monitoring and evaluation on livelihood diversification projects in fisheries (e.g. Gillett et al., 2008; O'Garra, 2007; Stacey et al., 2021) and more broadly (e.g. Roe et al., 2015) has been previously highlighted. To this point, O'Garra (2007) warns that in the absence of information on the factors of success or failure, livelihood projects and programmes are likely to be tried, time and time again, and to keep failing or succeeding without any lessons learnt on the reasons why.

Livelihood diversification has been advanced as a prominent strategy to reduce vulnerability, income poverty and pressure on natural resources in both rural development and fisheries management for decades. Embedded within the concept is the potential for positive-sum or win-win outcomes that embody sustainable livelihoods. Although there was an overall tendency for positive effects of diversified portfolios, there remain important questions about the impacts of diversification on multidimensional poverty and ecological conservation. Specifically, when, how and for whom should livelihood diversification be promoted? Which diversification pathway unlocks the potential to achieve sustainable livelihoods in a given context? What are the specific objectives to be achieved through the process and how does this impact the immediate needs of participants in small-scale fisheries? These questions represent an opportunity to more critically investigate the theories of change that support the promotion of this micro-economic development strategy and to identify where future research on and investment in diversification should be directed.

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DATA AVAILABILITY STATEMENT

Data supporting findings are available as Supporting Information (Appendices S1–S3).

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