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Limits of Tilapia Aquaculture for Rural Livelihoods in Solomon Islands

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Abstract: Increasing pressure on coastal fisheries poses serious threats to local livelihoods and the food security of Pacific Islanders. In response, governments and development agencies have explored tilapia pond aquaculture as an alternative fish production source. Yet, evidence to date on the impact of tilapia aquaculture on rural livelihoods has been inconclusive. Drawing on the sustainable livelihood framework, we analysed the contribution of Mozambique tilapia (*Oreochromis mossambicus*) aquaculture to the livelihood assets and outcomes of 40 rural farmers in Solomon Islands. First, results showed that 53% of tilapia farmers were satisfied with tilapia aquaculture's contribution to their human and social assets, while only 28% and 13% were satisfied with its contribution to their physical and financial assets, respectively. Tilapia aquaculture's contribution to farmers' natural assets was also limited. Second, and most importantly, there was an insignificant contribution of tilapia aquaculture to food and income security. Our results demonstrate that tilapia farmers rarely consumed tilapia, with only two of the 40 households having consumed tilapia in the seven days prior the interview. Moreover, only eight tilapia farmers sold their tilapia, which contributed 0.002–0.5% of their total weekly revenue. We argue the limited contribution of tilapia aquaculture to food and income stems from the low productivity of the available tilapia species and the low local demand for tilapia at rural markets. Given the current context of declining coastal fisheries and food insecurity concerns in rural Pacific Islands, it is unlikely that the current form of Mozambique tilapia aquaculture will be able to achieve its objective of addressing food and income security as a complement to coastal fisheries.

Keywords: tilapia; aquaculture; Pacific Islands; sustainable livelihood framework; Solomon Islands; food security; income security

1. Introduction

In many Pacific Island Countries (PICs), growing pressure on coastal fisheries is leading to a decline in reef fish populations [1,2]. Because reef fish provide a vital source of protein and key livelihood for many coastal communities in PICs, its decline has contributed to food insecurity and widespread poverty [3]. This translates into growing malnutrition in rural contexts–particularly among vulnerable groups, such as pregnant women and children [4,5]. Pervasive food insecurity and malnutrition have prompted local governments and development agencies to explore small-scale aquaculture (SSA) as a complement to coastal fisheries.

Small-scale aquaculture often involves farming fish in simple earthen ponds that are low-cost, require minimal maintenance, and are usually family-operated [6,7]. In Asia and Africa, where most

research on SSA has been conducted, SSA is widely practiced by rural farmers as a livelihood activity that can contribute to food, income security and rural development [6,8]. As an alternative or supplementary fish production source, SSA has been shown to contribute to food and nutrition security via three mechanisms: income, employment and consumption [7,9,10]. For most poor farmers with limited livelihood activities, SSA is often a main livelihood activity, while for others it can be one of a diverse portfolio of livelihood activities [11]. A substantial number of studies have demonstrated the positive contributions of SSA to livelihoods of the poor in developing contexts see [12–19].

Yet, empirical evidence on the impact of SSA for rural livelihoods stems largely from research in Africa and Asia, while research on the contributions of SSA in PICs remains relatively scarce [20,21]. We argue that the potential contributions of SSA to rural livelihoods may be highly contextual, where success stories in one context may not translate into other contexts in easily anticipated ways.

To this end, we investigated the contributions of small-scale tilapia aquaculture to rural livelihoods in a Pacific Islands context. Specifically, we asked: *to what extent is small-scale tilapia aquaculture contributing to livelihoods assets and outcomes in rural Solomon Islands?* In the subsequent section, we introduce the analytical framework for the study – namely, the sustainable livelihood framework (SLF) [22,23]. In the methods section, we outline the context for tilapia aquaculture in Solomon Islands, data collection and analysis. In section three, we present the study results. Next, we discuss the implications of our findings and conclude with two recommendations for governments and non-governmental organizations (NGOs) looking to contribute to rural income and food security through tilapia aquaculture.

An analytical framework for exploring the contributions of aquaculture to rural livelihoods in the Pacific context

Sustainable livelihoods are characterized by two key concepts (Figure 1). First, *livelihoods* are defined as the capabilities, activities and assets needed to make a living [22,23]. Second, a livelihood is considered *sustainable* when it can cope with, and recover from, stress or shocks without jeopardizing the resource base [22,23]. The SLF is an analytical framework that provides a heuristic for examining the interacting components that influence livelihoods into rural communities. The framework helps to identify the connections between people and their enabling environment, which inevitably influence their livelihood strategies and outcomes.

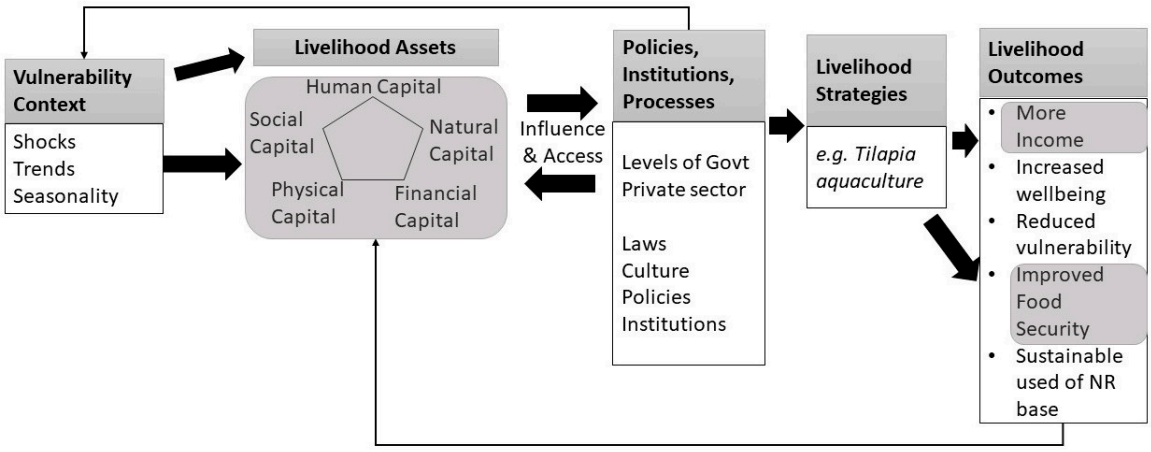

Figure 1. The sustainable livelihood framework. The components shaded in grey (livelihood assets and outcomes) were those used to analyze the impact of tilapia aquaculture on rural livelihoods in this study (This figure was modified from [23]).

Central to the SLF is the notion of the five livelihood *assets* (human, natural, social, physical, and financial). Assets are defined as the resources people require to pursue their livelihood strategies [23]. Vulnerability contexts and policies, institutions, and processes, such as governance and policy norms, are understood to influence and mediate access to livelihood assets. People employ a multitude of

livelihood strategies (e.g., adoption of aquaculture) to achieve desired livelihood goals. Livelihood *outcomes*, such as food security and income, are then shaped by the interactions among these different components of the framework and can also feedback and influence livelihood assets–either building up or reducing assets. For this study, we focused on two key components of the SLF to explore the contributions of Mozambique tilapia aquaculture to rural livelihoods in Solomon Islands: *livelihood assets* and *livelihood outcomes*.

2. Materials and Methods

2.1. The Context of Tilapia Aquaculture in Solomon Islands

Currently, Mozambique tilapia (*Oreochromis mossambicus*) is the only tilapia species found in Solomon Islands waterways. The species was introduced into the country in the 1950–60s, to enhance local fish stocks [24]. Due to its hardiness and invasive nature, it spread into most water systems around the country and soon established itself among the endemic flora and fauna. According to the International Union for Conservation of Nature (IUCN), Mozambique tilapia is considered an invasive species so, in some PICs, efforts are underway to completely eradicate it from their waters [25]. Yet, in some rural communities of the larger provinces of Solomon Islands, where the species has established itself (e.g., Lees Lake on Guadalcanal and Lake Tegano on Renbel Province), Mozambique tilapia form an important part of local diets in communities where access to marine fish is limited [26].

Mozambique tilapia aquaculture is one of the most recent developments in the history of aquaculture development in Solomon Islands (see Table 1). Its domestication coincided with the national government's recognition that the country was facing declines in its coastal fisheries production, as a result of the increased human population, unsustainable fishing, agricultural and coastal developments leading to run-off in coastal waters, and climate change [27]. Declining coastal fisheries production, and the anticipated shortfall of marine fish, motivated the government, with assistance from development agencies, to begin exploring the potential of Mozambique tilapia for small-scale aquaculture in various places throughout the country [3,27,28].

Table 1. History of aquaculture development in Solomon Islands from the 1960s–2018.

Year	Aquaculture Development
1950–60	Pearl oyster aquaculture in Wagina (Choiseul Province)
1980s	*Macrobrachium rosenbergii* aquaculture started on West Guadalcanal. International Center of Living Aquatic Resource Management (ICLARM) (now WorldFish) research station was established, and seaweed aquaculture was introduced into Solomon Islands
1990s	Shrimp aquaculture was established on Guadalcanal. Pearl aquaculture was encouraged in parts of Kia (Isabel Province) and Wagina (Choiseul Province)
2000–2008	An aquaculture division was established in the Ministry of Fisheries and Marine Resources. In Gizo (Western Province) a clam hatchery was developed, while coral farming, commercialization of seaweeds, and pearl aquaculture were being explored
2009–2018	Tilapia initiatives (*O. mossambicus*) commenced, with the government establishing a community aquaculture program. Seaweed aquaculture was expanded to other provinces. Potential of *P. monodon* was investigated. The national Aquaculture Policy was formulated

Sourced from [29].

2.2. Study Site

This study was undertaken in Malaita Province, Solomon Islands. Malaita has the highest population of all Solomon Islands' provinces. In 2009, its population reached 137,596 and represented 27% of the country's total population with a growth rate of 2.1% from 1999–2009 [30]. Poverty is

becoming widespread, with 6.9% of the people below the basic needs poverty line [ibid]. Poverty in Solomon Islands (and other PICs) is defined by a lack of basic needs for a meaningful life, and not necessarily absolute poverty [31,32].

This study took place across five wards in Malaita (see Figure 2). These wards included West Baegu/Fataleka, Fauabu, Buma, Keaimela/Radefasu and Waneagu Silana Sina, which together have 30,911 inhabitants and account for 23% of the total rural population of Malaita Province in 2009 [30]. Wards are the smallest electoral divisions that constitute the nine administrative areas run by the Provincial Government [33]. The wards in this study were selected because they hosts one of the only established networks of tilapia farmers in the province. Furthermore, Malaita Province holds the largest group of tilapia farmers across all provinces of Solomon Islands. Although Mozambique tilapia can be found in Lees Lake on Guadalcanal Province and Lake Tegano on Renbel Province [26], there were no reported Mozambique tilapia aquaculture activities in these provinces at the time of this study.

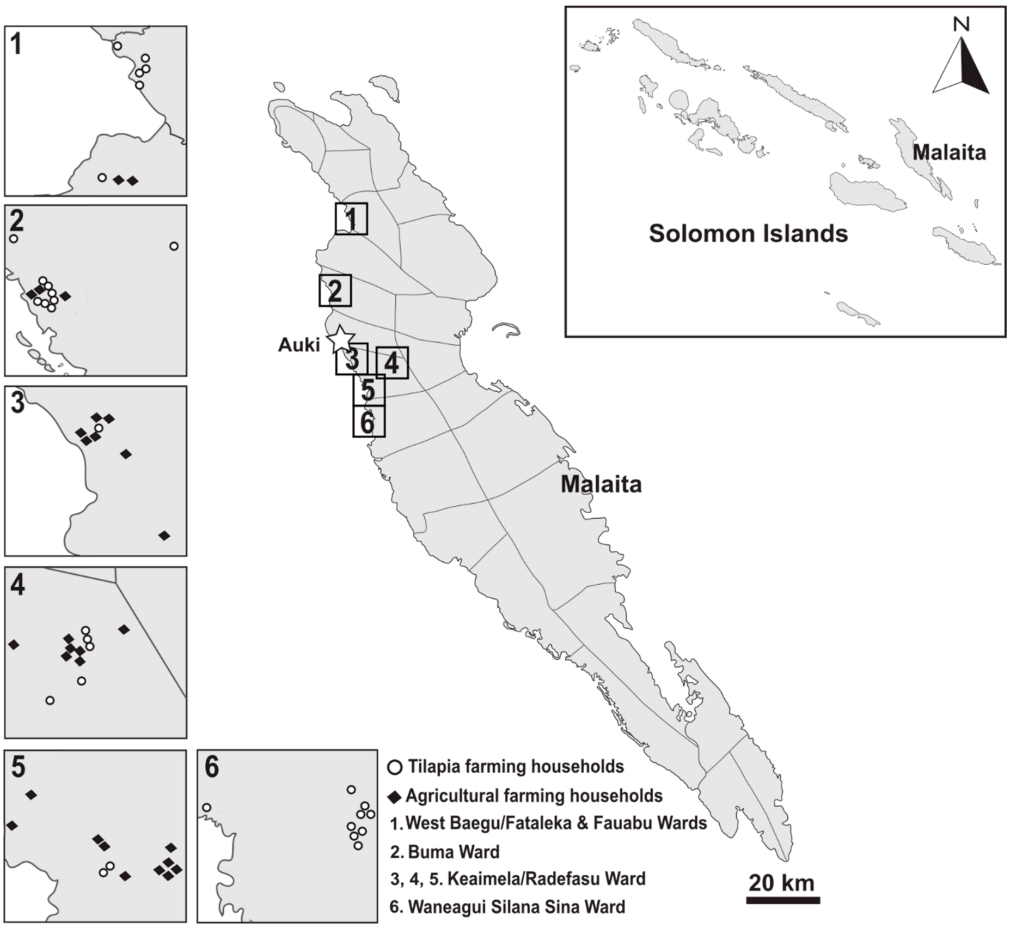

Figure 2. Map of the five wards on Malaita Province, Solomon Islands that make up the study sites. These wards are within proximity of Auki (administrative center of Malaita Province) and are accessible by road.

In the study sites, common livelihood activities include gardening or agriculture-related activities, fishing, marketing of local produce/goods and casual employment [30,33,34]. With the current population growth rate of 2.1% and declining coastal fisheries, there is a need to diversify livelihood activities to tackle the increased food and nutrition insecurity in the rural areas of the province. This makes the prospect of adopting tilapia aquaculture, as a complement to other livelihood activities, potentially attractive to rural farmers.

2.3. Participants Selection and Data Collection

Purposive sampling was used to select participants for this study. Prior data collection, researchers knew prospective participants for the study [35]. These connections were made by the lead investigator, during his experience working as a non-governmental extension officer with some of the tilapia farmers across the wards. A total of 58 farmers were involved in tilapia aquaculture in the study location of central Malaita at the time of the study [36]. We selected 40 tilapia farmers for our study, which represented 69% of all active tilapia farmers in the study region. Participation in this study was open to any farmer in the study area currently active with their tilapia pond aquaculture farms.

Before conducting fieldwork, interview schedules and logistics were organized via mobile phone and word of mouth, as these are the common modes of communication in Malaita and Solomon Islands in general. The research team consisted of the lead investigator and a trained field assistant, both locals (Malaitans) who are well versed with the local socio-cultural context across the five wards. Interviews were conducted in *pidgin* (the common language in Solomon Islands) but written in English for later analysis.

Data were collected over two time periods with the same group of respondents. The first round was in November to December 2017, and individual face-to-face interviews were focused on tilapia aquaculture's contribution to assets and outcomes. In November to December 2018, a second round of household-level interviews was conducted to record household food consumption using 24-h and 7-days food recall methods for details of these methods see [37–39]. Interviews were carried out at a time and location preferable to the respondents. This study was approved under human research ethics application (ID H6870) of James Cook University on 1/03/2017. Table 2 shows the list of variables used for this study.

Table 2. Study variables.

Component of Sustainable Livelihoods Framework [1]	Variables	Measurement Scale/Component Calculation
Livelihood assets		
Human assets include the knowledge, skills, labor and good health necessary to engage in diverse livelihood strategies.	▪ Satisfaction with tilapia aquaculture's contribution to skills and knowledge on fish farming. ▪ Satisfaction with tilapia aquaculture's contribution to household food consumption.	Likert scale (0–10) "Human assets" = mean of both scales
Financial assets are savings, credits and debts needed to achieve livelihood goals.	▪ Satisfaction with the income generated from tilapia aquaculture.	Likert scale (0–10)
Social assets are social resources (social network, trust, connectedness) people drawn upon in pursuit of their livelihood goals.	▪ Satisfaction with tilapia aquaculture's contribution to social network (e.g., expand current network).	Likert scale (0–10)
Physical assets are the infrastructures (e.g., roads, tools, etc.) and goods required to support livelihoods.	▪ Satisfaction with the tools and equipment available as a result of tilapia aquaculture.	Likert scale (0–10)
Natural assets include intangible assets (e.g., air, nutrient cycle) and tangible ones (e.g., water, trees, land).	▪ Contribution of tilapia aquaculture to natural assets (e.g., tilapia for fish meal or pond water utilized for other purposes).	Coded qualitative & binary
Livelihood outcomes		
Food security	▪ Frequency of tilapia consumption per year ▪ 24-h & 7-days recall of food and meat consumption by households (kg)	Scale
Income	▪ If tilapia farmers sold their tilapia or not	Binary
	▪ How much income was obtained from tilapia sold?	Scale

[1] Definitions of the SLF components were sourced from [23].

2.4. Data Analysis

We used descriptive statistics to interpret our quantitative data. Inductive coding was conducted on qualitative responses to identify common emergent themes. In some instances, re-occurring themes were weighted according to their frequencies across the sample size and then presented graphically. Data analysis was performed using Microsoft Excel.

3. Results

3.1. Tilapia Aquaculture's Contribution to Livelihood Assets

The Likert scores indicated that the largest proportion (>50%) of tilapia farmers were satisfied with the tilapia aquaculture's contribution to their human assets (Figure 3). Farmers valued the activity's contribution to their knowledge and skills of fish farming, and also to household food consumption. This included 20% and 23% of tilapia farmers who were "strongly satisfied" with the activity's contribution to their knowledge and skills, and household food, respectively. Similarly, 53% were also satisfied with the expansion of their social connections and network due to tilapia aquaculture. A relatively high proportion of these tilapia farmers (20%) were "strongly satisfied" with the activity's role in the expansion of their existing social assets.

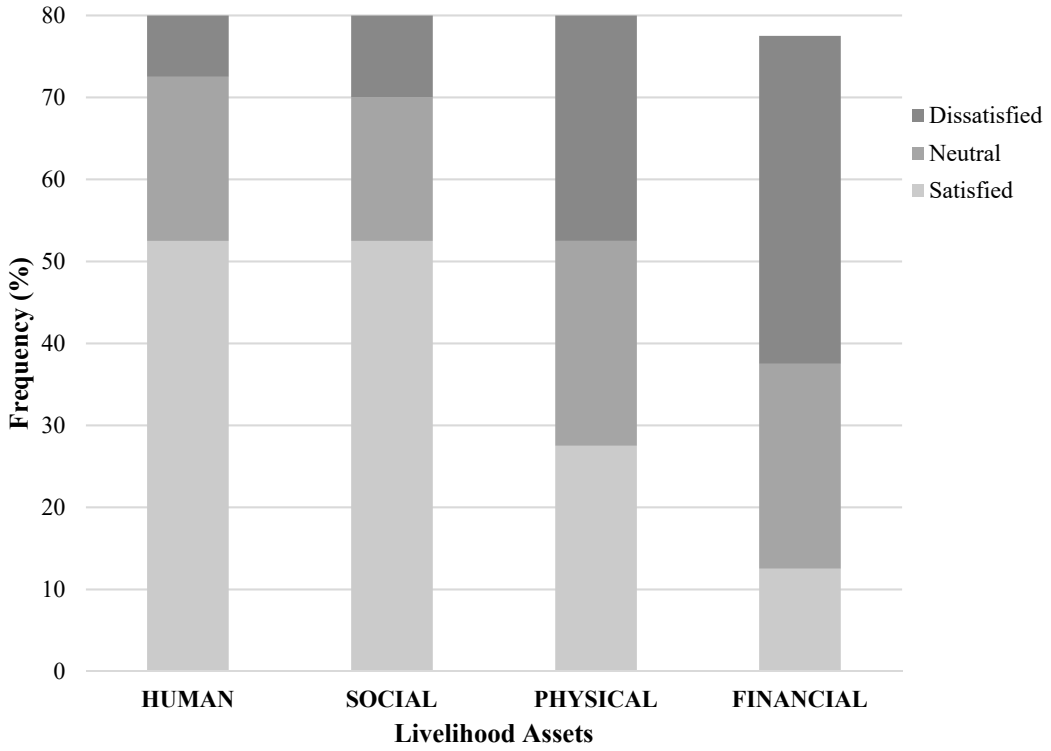

Figure 3. Tilapia farmer's level of satisfaction with tilapia aquaculture's contribution to their livelihood assets. Tilapia farmers, in general, had high levels of satisfaction with tilapia farming's contribution to their social and human assets. The highest level of dissatisfaction was with the activity's contribution to financial assets.

In contrast, 40% of tilapia farmers were dissatisfied with tilapia aquaculture's contribution to financial assets, of which 28% were "strongly dissatisfied". For physical assets, farmers reported equal levels of satisfaction and dissatisfaction (both 28%) with the activity's contribution to their physical assets.

Contribution of tilapia aquaculture to natural assets were recorded qualitatively. Farmers were asked what other purposes tilapia aquaculture has served their households (e.g., if pond water was

used for livestock or tilapia used as supplementary fish meal for piggery, etc.). For most farmers (40%), tilapia aquaculture did not serve any other purposes, and 26% explained that tilapia aquaculture's only contribution was towards food consumption.

3.2. Tilapia Aquaculture's Contribution to Livelihood Outcomes

Tilapia aquaculture contributed minimally to household food consumption. Almost half (43%) of respondents indicated that tilapia was only consumed once a year. Seventy-eight percent of the farmers that consumed tilapia annually, indicated that they consumed all the fish they harvested–implying that harvested tilapia was not shared among relatives.

The minimal contribution of tilapia to household food security was validated in follow-up household interviews that employed the 24-h and 7-days food/meat consumption recall methods. These interviews showed only two households had consumed tilapia in the previous 7-days, and none had consumed tilapia in the last 24-h. These two households consumed an estimated 0.014 kg and 0.210 kg of tilapia, respectively. For household A, this contribution of tilapia accounted for 0.3% of combined weight (kg) of all fish types (pelagic fish, reef fish, canned sardine, canned mackerel, canned tuna and freshwater fish) consumed in the last 7-days. For household B, tilapia was the only fish consumed in the last 7-days.

Tilapia aquaculture also contributed negligibly toward household income. In fact, only 20% of all tilapia farmers had sold their tilapia for income within the previous year. The weekly income of these farmers ranged from SBD$325.56 to SBD$8,925.19. Of this weekly income, tilapia aquaculture contributed only 0.002% to 0.5% of total income earned per week. The three most common reasons for not selling tilapia were: (1) tilapia was only for food at this stage, (2) tilapia was too small for sale, and (3) lack of consumer demand for tilapia.

4. Discussion

Coastal reef fisheries are declining across many PICs [33]. Given this context, small-scale aquaculture has been identified by local governments and development agencies as an alternative fish production source [1,29]. However, there is limited conclusive evidence about the contribution of tilapia aquaculture to rural Pacific Islands livelihoods. Through interviews with 40 tilapia farmers in Solomon Islands, our results showed just over half (>50%) of tilapia farmers were satisfied with tilapia aquaculture's contribution to their human and social assets. Tilapia's contribution towards financial, physical, and natural assets was limited. Importantly, our findings suggest that tilapia aquaculture is not contributing significantly to food and income of rural tilapia farmers in Solomon Islands.

These findings contradict the dominant narratives about the benefits of small-scale aquaculture for rural livelihoods. The differing results may be because most empirical evidence that supports these narratives stems from research in Asia and Africa, where small-scale aquaculture has contributed significantly to rural food security and income security [14,16–18,40–46]. We argue that the limited contribution of tilapia aquaculture to food and income security in Solomon Islands may result from two contextual aspects. First, the small-scale aquaculture sector in Solomon Islands lacks a tilapia species that is well suited for small-scale pond production. Second, local demand for tilapia in domestic markets is low. These two constraints are discussed here in turn.

The aquaculture sector in Solomon Islands lacks a productive tilapia species. The attributes of low fecundity and stunting render Mozambique tilapia an unsuitable species for SSA that aims to alleviate rural poverty, contribute to rural development, and address food security [47]. In fact, the species has been referred to as a "wrong species" for SSA in the Pacific Islands, due to its biological and ecological attributes (early maturity, early reproduction, stunted and slow growth, etc.) [47,48]. This presents a problem when we consider that farmers' motivations for adopting aquaculture are usually to diversify both income and food generation [6,9]. These unattractive traits of the Mozambique tilapia for SSA, have prompted other Pacific Island Countries, including Papua New Guinea, Fiji and Vanuatu to shift their attention to Nile (*Oreochromis niloticus*) and the genetically improved farmed tilapia for

SSA [49–52]. In Solomon Islands, this potential of obtaining genetically improved seeds should be explored if tilapia aquaculture is to improve from its current production status and play a significant role in domestic food and income security [53]. Researchers contend that if the SSA sector in the Pacific Islands is to be successful, farming of appropriate fish species is necessary [47,54]. An appropriate species for rural SSA in the Pacific would be one that grows quickly, in order to provide a quick turn over for tilapia farmers, feeds low on the food chain, and is tolerant to a range of conditions that fits the limited resources and capacities of rural farmers. Studies on SSA in Africa (Rwanda and Zambia) also highlighted that the lack of quality seed resulted in local fish productions not meeting consumer demand, which posed a major challenge for the SSA sector [55,56].

Second, the tilapia aquaculture sector in Solomon Islands may be constrained by the lack of demand for tilapia in domestic markets. Our results indicate that Mozambique tilapia does not possess much value, reflected by its poor consumer demand. This is one factor limiting its potential and long-term sustainability among rural tilapia farmers and restricting its contribution to food and income security [6,52]. We contend there may be two reasons for the low demand for tilapia: (1) a current market for tilapia does not exist in Solomon Islands (also evident across most PICs), and (2) tilapia is relatively new to the Pacific Islands and will take time before it might compete with marine fish at domestic markets [57]. The limited local experience with, and demand for, pond cultured species remains a challenge for the region and has been identified as an area for support and investment in the coming years [51]. As Edwards [6] highlighted, the maximum impacts of SSA for rural livelihoods are only possible if farmers have a market for their products. A number of other studies have shown the positive effect of markets for SSA and rural livelihoods (see [9,14,44,58–60]).

Since Mozambique tilapia aquaculture showed little impact on food and income security, the sector may be unlikely to achieve its objective of addressing food and income security or contribute meaningfully to supplement coastal fisheries. At the moment, coastal fisheries still play the leading role in supplying fish for consumption and income generation across rural communities in Solomon Islands [34,61]. Recent evidence showed that demand for coastal fisheries is intensifying [62,63]. For instance, women who used to glean in the coastal tidal flats for shells and invertebrates have now moved offshore to fishing grounds previously dominated by men [62]. Local fishermen have increasingly diversified their target species using various harvest methods, in an effort to maximize catches [63]. These trends suggest that coastal fisheries will continue to play a key role in supplying fish for local consumption and livelihoods [64]. This begs important questions that need to be addressed in the Solomon Islands and other Pacific Island contexts such as: is investment in tilapia aquaculture a reasonable choice? Or should focus and efforts be diverted to developing other potential commodities (e.g., seaweed) for SSA instead? Or would it be more profitable to focus on improved management of wild fisheries, or alternative livelihood/food security solutions? Addressing these questions can ensure, if it is deemed to be viable, meaningful progress towards improving current outcomes of tilapia aquaculture and in understanding its role in food and income security, and the livelihoods of rural farmers.

Finally, this study also showed that Mozambique tilapia aquaculture is only contributing to social and human assets. Several studies that have supported SSA's contribution to farmers' social and human capital (e.g., increased skills) [16,65–67]. Yet, other studies have demonstrated that farmers with limited social capital are unable to benefit from SSA [14,68]. The contribution of SSA to human and social assets may be explained by the "newness" of the activity among rural farmers in the local context. Farmers may be keen to learn more about tilapia farming, hence creating new social connections and expanding existing social networks to maximize learning about tilapia aquaculture. Their direct participation in SSA also developed their knowledge and skills base related to tilapia aquaculture.

The perceived contribution of tilapia aquaculture to social and human assets found here are essential for adaptation of this innovation into the communities, long-term sustainability of the activity, and for promoting the innovation and ensuring farmers can tangibly benefit from SSA [66,69]. This is because, too often the expectation is that such new livelihood activities–externally motivated and

introduced into rural communities as alternative livelihoods–must have an immediate impact on rural livelihoods. This expectation may undermine, to some extent, the potential success of the sector in the long-term [70]. Other studies on SSA have also shown that acquiring appropriate knowledge and skills of fish farming is vital for its adoption and success [71,72]. Therefore, policymakers, extension officers, and project officers must ensure practical short and long-term support is put in place for rural tilapia farmers, especially during the phase where they are continuously learning and making important decisions on their choice of livelihood strategies.

5. Limitation of this Study

This study provides important empirical evidence to counter narratives about the universal benefits of small-scale aquaculture for rural livelihoods, especially from a Pacific Islands perspective. However, there are several limitations to the study that we wish to highlight here. First, this study was conducted five years (and more) after the introduction of tilapia aquaculture in Malaita Province, Solomon Islands. Benefits arising after longer implementation (e.g., >10 years) time would not have, therefore, been captured by our study. In the future, longer-term studies of the impacts of tilapia farming may help clarify whether benefits accrue over time. Second, obtaining detailed and accurate information on tilapia consumption was a challenge, especially through the use of recalls on estimated number or weight of fish consumed. This may be indicative of the irregularity of tilapia harvesting and consumption by farmers, making it difficult for farmers to provide such information. Again, longer-term studies may be useful to capture detailed and accurate information on tilapia consumption rates.

6. Conclusions

This study addressed the question: *to what extent is small-scale tilapia aquaculture contributing to rural livelihoods in the Solomon Islands?* We found that over half of tilapia farmers were satisfied with the tilapia aquaculture's contribution to their human and social assets, yet the majority were dissatisfied with its contribution to physical and financial assets. Tilapia aquaculture's contribution to farmer's natural asset was also limited. Importantly, SSA contributed insignificantly to household food and income security. Our findings suggest the current Mozambique tilapia aquaculture sector may be unable to contribute to household food and income security and provide a meaningfully complement to coastal fisheries production. We conclude that coastal fisheries across PICs will continue to play a major role in fish production for rural communities [64].

Based on our findings, we propose the following recommendations to help the government and relevant stakeholders ensure the tilapia aquaculture sector maximizes its positive impact on rural livelihoods in Solomon Islands. First, it is imperative the government and relevant stakeholders consider an improved strain of tilapia to replace the current Mozambique tilapia. As discussed, the current tilapia species lacks the traits suitable for aquaculture, which among other benefits involves food and income generation for rural farmers. Moreover, we recommend that local farmers are involved in early trials with a more productive strain of tilapia in order to familiarize rural communities with the new species to potentially build value and local demand for the species. The authors are aware the Solomon Islands government is currently in the process of introducing the Nile tilapia, which includes establishing the necessary infrastructure for the arrival of the tilapia species [73,74]. The sooner local farmers are involved with a better performing tilapia species, the sooner the positive impacts of the sector on their livelihoods might be realized. Second, governments and other relevant stakeholders will need to increase their support for tilapia aquaculture to ensure sustainability of the sector going forward. Factors such as lack of effective government extension services and delivery, and the importance of farmers' social networks for learning about the activity emphasize the need for continuous institutional support in order to nurture the growth of the sector [75]. This can be achieved through short and long-term support for rural tilapia farmers, especially during the experimentation

phase, where farmers are trialing tilapia aquaculture and making important decisions that will impact their livelihood strategies.

For policymakers and decision-makers concerned with tilapia aquaculture development for food security in the Pacific Islands, vital questions remained to be answered. These include (but are not limited to): is investment in tilapia aquaculture a reasonable choice for Solomon Islands and other PICs? Should efforts be diverted to developing other potential commodities (e.g., seaweed) for SSA instead? Would it be more effective to focus on improved management of wild fisheries, or alternative livelihood/food security solutions? Future research that explores these questions, can generate empirical evidence of whether SSA (tilapia aquaculture, or other alternate SSA livelihood activities) might meaningfully complement coastal fisheries production.

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