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The socio-economic context for improving food security through land based aquaculture in Solomon Islands: A peri-urban case study ☆

Nathan Cleasby [a], Anne-Maree Schwarz [a,*], Michael Phillips [b], Chris Paul [a], Jharendu Pant [b], Janet Oeta [a], Tim Pickering [c], Alex Meloty [d], Michael Laumani [d], Max Kori [e]

[a] WorldFish, P.O. Box 438, Honiara, Solomon Islands
[b] WorldFish, P.O. Box 500, GPO, 10670 Penang, Malaysia
[c] Secretariat of the Pacific Community SPC, Private Mail Bag, Suva, Fiji
[d] MFMR, P.O. Box G13, Honiara, Solomon Islands
[e] Malaita Provincial Fisheries Division, Malaita Province, Auki, Solomon Islands

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ABSTRACT

Future fish demand-supply scenarios project that investment in aquaculture will be needed to ensure fish for food security in Solomon Islands. In 2010 a study of two peri-urban areas of Solomon Islands analysed the demand and potential for inland aquaculture, and the role of the introduced Mozambique tilapia (*Oreochromis mossambicus*) in household livelihoods and existing value chains. Of 178 households interviewed, marine reef fish were the preferred fish for consumption, although tinned fish was also common. At the study sites, Mozambique tilapia was accessible and contributed to food security, particularly for inland households. Sixty five percent of the people actively fished for tilapia at least monthly; 13% of these fished on almost a daily basis. Fish were consumed by men, women and children and sold by both men and women in local village markets. Mozambique tilapia is considered to perform poorly in aquaculture. While other species like Nile tilapia or milkfish (*Chanos chanos*) are being considered for aquaculture by the Solomon Islands Government, Mozambique tilapia is currently the only cost-effective and widely available alternative for farming fish for household food security. This study lends weight to the premise that peri-urban households that are cash poor are likely to benefit nutritionally from easier access to tilapia or other freshwater fish.

1. Introduction

In the Pacific Islands Countries and Territories (PICTs), coastal capture based fisheries contribute substantially to local subsistence and market economies [1,2], while the offshore tuna fisheries are particularly valuable national assets [1,3]. Marine capture fisheries typically dominate the fisheries of PICTs [4] although production in recent decades has seen a gradual decline, similar to global fishery trends [5–7]. The industrialisation of fisheries since the 1950s has led to the well documented overexploitation of marine resources with a number of fisheries collapsing [8–15]. There is overwhelming evidence that human activities are profoundly altering marine ecosystems on a global scale [16–18]. Of particular concern are the environmental changes that human activity is causing to the functioning of coral reef ecosystems that support fisheries upon which millions of people, including all of the PICTs, depend [19].

One of the responses to declining capture fisheries has been a dramatic rise in aquaculture production. With a global reduction in wild capture of more than 0.5 million tonnes per year from 2004 to 2010, aquaculture has been increasing in production at approximately 2.5 million tonnes per year over the same period [20]. Globally, aquaculture contributed 63.6 million tonnes of the total 154 million tonnes of fish produced in 2011 [20]. Aquaculture is currently the fastest growing food production system for developing, low income and food deficit countries (LIFDCs), which boast the highest annual aquaculture growth rate (10% per year) since the 1970s, compared to the 3.7% per year rate for developed countries [21,22]. There are marked geographical differences in aquaculture production, however, and PICTs have experienced significantly slower growth rates than most other areas [23–25]. Sustainable aquaculture as a tool for development, incorporating environmental, economic, nutritional and social considerations, is increasingly considered to have great potential to help meet the global requirements of fish for the future, and contribute to future food and nutrition security [25–27].

While improved management of coastal fisheries in the coral reef ecosystems of the Pacific is widely recognised as being essential to secure the benefits of capture fisheries [1,4,28], it has also been recognised that increased production from

* Corresponding author. Tel.: +677 25090.
E-mail address: a.schwarz@cgiar.org (A.-M. Schwarz).

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aquaculture will be necessary to meet the fish food needs of the region in the future [1,28]. Demand for fish from aquaculture will increase as supplies from capture fisheries, particularly from inshore reefs, become increasingly unreliable, as seen, for example, in recent fish-supply demand scenarios in Solomon Islands [28].

Imbalances between supply and demand for fish in many PICTs are expected to be exacerbated by the external drivers, such as fuel prices and climate change, to which these nations are particularly vulnerable [29]. Solomon Islands is one of the PICTs where future shortfalls in food fish production are projected, with contributing factors including population growth and development, degrading coral reef fisheries, long travel times to and from fishing grounds and fishing access rights [1]. Recent calculations suggest coastal fisheries will not supply the fish required for future food security, with all projected shortfalls, greater than 4000 t per annum by 2030 [1,28], raising critical questions about the future supplies of the most significant animal food source.

The Solomon Islands Government, through the Ministry of Fisheries and Marine Resources (MFMR), is responding to predictions of shortfalls in fish to meet food security needs through three principal policy endeavours: (1) improved coastal resource management; (2) increased tuna allocation to the domestic market, and (3) development of aquaculture opportunities [30,31].

In 2009 and 2010, a study was undertaken by WorldFish, MFMR and the Secretariat of the Pacific Community (SPC) to analyse the demand and potential for development of inland aquaculture in two provinces [32]. The study comprised three main components (1) understand the role of tilapia and other freshwater fish in household livelihoods and existing value chains; (2) assess scaling options for land based aquaculture and (3) use GIS based tools to assess and map suitable land based aquaculture areas. Component one is reported on here. While recognising the widespread rural demand for household food security throughout the country, this initial study was confined to two peri-urban areas on the premise that poor urban households are primarily being impacted by high urban fish prices, and that for an aquaculture industry to develop it will require sufficient local market demand to be economically viable. Empirical data were collected through household surveys and key informant discussions and findings are mentioned in the context of opportunities and constraints for land based aquaculture to contribute to improved food security in Solomon Islands.

2. Solomon Islands

Non-fish animal-source foods are rare in the diet of Solomon Islanders and fish make up about 90% of the animal-source food intake [33]. Although around half the rural population of women, and 90% of men, engage in fishing, the Solomon Islands inshore subsistence fishery is poorly quantified. The subsistence fishery was estimated at about 15,000 t in 2006 [34] and it has been described as meeting more than 60% of the nation's annual fish consumption [1]. The inshore subsistence fisheries are integral to nutrition, employment, cultural practices, cash trade and recreation [1].

The offshore fishery in Solomon Islands waters is part of the Asia-Pacific region, the most heavily exploited region in the world [35]. In 2007 121,642 t of fish were taken from offshore Solomon Islands waters, primarily consisting of yellow fin (*Thunnus albacares*) and skipjack (*Katsuwonis pelamis*) tunas [36]. Foreign fleets dominate commercial deep-sea fishing, with catches primarily targeted for export. With approximately 94% of fresh tuna transported to Asian markets, the opportunity to utilise this source for local food security is compromised [28]. The remaining 6% of tuna sold in Solomon Islands comprises the old, small or low quality tuna, deemed unfit for Asian markets.

The 515,000 people [33] currently living in Solomon Islands are distributed throughout the country's 990 islands, and distances between them are substantial. According to the 2009 census, 80% of the population is considered rural [33], although the population of the capital Honiara is increasing, and the town experienced an annual growth rate of 2.7% between the 1999 and the 2009 census [37]. An increasing number of informal settlements in Honiara are unplanned with a lack of basic services. Poverty and unemployment are often higher in the informal settlements, as most residents are dependent on gardening and informal economic activities such as street vending for their livelihoods [37]. For urban areas (including the capital Honiara), small scale artisanal fisheries contribute to meeting fresh fish demand. However, supplies of reef fish to the capital's fish market are increasingly drawn from more distant provincial waters [16]. Fish remains the major source of animal protein and micronutrients for the population [38]. Income from fish and other marine products sold primarily in local markets also provide indirect benefits, generating revenues to purchase other foods, goods and services [39]. However, there is growing evidence of over-exploitation of coral reef fisheries due to localised intensification of fishing [16,40], which has been positively correlated with proximity to urban markets [34,40]. Prices of reef fish in the capital Honiara have increased dramatically in recent years [40], anecdotally making it more difficult for many of the burgeoning urban dwellers to regularly afford fresh fish.

A fledgling aquaculture industry began in Solomon Islands in the late 1980s and 1990s. Production, made up primarily of invertebrates (clams, corals and prawns), and targeting export markets, peaked in 2000–2001 at approximately 15 metric tonnes (excluding seaweed production, which peaked in 2005 at 320 metric tonnes) [20]. In the late 1990s, civil unrest effectively terminated local aquaculture production. Investors across sectors abandoned their businesses due to extensive loss of infrastructure, and by 2002 the government was insolvent [41]. Revival of the aquaculture industry has been slow but by 2010, 8000 t of farmed marine production, composed primarily of seaweed (*Eucheuma* sp.), was exported from Solomon Islands [20]. Apart from suffering such a setback at the start of this century, Solomon Islands has no tradition of aquaculture and little domestic production from aquaculture is formally recognised. Traditionally, people have been able to rely on reef fishing, there has been lack of aquaculture education or extension and attempts to start large scale commercial aquaculture enterprises have suffered from political instability, traditional land rights deterring private investment, lack of infrastructure and lack of government policy prior to 2000 at which time an Aquaculture Department was first established [31,42].

As a country that is rich in water resources and has substantive populations of forest and farm dwelling people with limited day-to-day access to coasts, freshwater or inland aquaculture[1] potential is now codified in a national Aquaculture Development Plan [31]. The plan outlines goals for future inshore and freshwater aquaculture development, the resources and expertise required to attain these goals and backgrounds on viable species for aquaculture.

Within rural communities, interest in aquaculture is also high. In records kept by WorldFish and MFMR between 2012 and 2013, more than 160 enquiries were recorded of farmers looking for advice and information about starting inland aquaculture. A desire to farm fish in the absence of any extension or information

[1] We define inland aquaculture as the farming of aquatic animals and plants in ponds or water-bodies, regardless of proximity to the coast.