



WorldFish

POLICY BRIEF | 2011-08

Aquaculture and Food Security in Solomon Islands

MAJOR FINDINGS - ACIAR PROJECT FIS/2009/061

- Future scenarios for fish supply and demand project significant investment in aquaculture is required to ensure food security in Solomon Islands.
- Tilapia (*Oreochromis mossambicus*), introduced in the 1950's, is the only food fish farmed in Solomon Islands. There is a market demand for tilapia, that is expected to continue to grow as urban populations expand and acceptability of the species increases.
- Existing tilapia species and farming systems are insufficient to meet future fish demand. While some small yield improvements to present farming systems and practices may be possible, this species of tilapia does not have the characteristics to make it suitable to supply food security demand.
- It is necessary to explore alternative options if aquaculture is to meet predicted future demands. Farming of a native fish species is an option. Milkfish (*Chanos chanos*) is the most obvious candidate.
- Another option requires the introduction of a new species to the country. Inland pond farming of Nile tilapia (*Oreochromis niloticus*) is technically feasible and environmentally suitable sites exist within Solomon Islands.
- Both milkfish and tilapia farming options require further research. For Solomon Islands government to make a decision on importing an improved strain of Nile tilapia a formal analysis to assess risk, and identify risk management measures is required. Milkfish is a species that is native to Solomon Islands and requires no such import risk analysis.
- Investment in farming of more productive fish species appears to provide opportunities for viable businesses from household to larger scale commercial enterprises. Low cost fish production systems will be needed for the product to remain competitive in markets and benefit poorer consumers.
- Investment in a combination of smallholder household enterprises, school ponds, and small to medium enterprises (SME), plus supporting infrastructure, institutions and policy, could benefit consumers and households in rural and urban areas.
- An annual production of 2,500 tonnes of food fish will require investment in infrastructure and operating capital. Preliminary estimates suggest at least US\$ 1.2 million in farm construction and infrastructure and US\$2.6 million/year in operational funds will be necessary, but could generate over US\$3.7 million/year in farm gate sales, employment and improved food security.
- Some elements for inland aquaculture in Solomon Islands are in place, but are incomplete. Further investment in research, strengthening of institutional and regulatory capacity and partnership building is required to develop systems and bring together the skills and resources necessary for responsible growth of inland aquaculture.

BACKGROUND

Pacific Island Countries and Territories (PICTs) are amongst the nations most vulnerable to climate change. Growing populations, combined with climate change and overfishing on inshore reef fisheries, will compound food security problems arising from an increasing gap between fish demand and supply. Solomon Islands, amongst other PICTs, recognize the need for new sources of fish to meet future food security requirements. Options include fish imports, an expensive and increasingly unreliable source in the future, increasing access to offshore tuna fisheries with inshore Fish Aggregating Devices and aquaculture development. The Government of Solomon Islands has identified inland aquaculture as one means of addressing the gap between fish supply and demand.

ACIAR project FIS/2009/061 **“Aquaculture and Food Security in the Solomon Islands”** was formulated to assist the Government of Solomon Islands in better understanding the future demand for aquaculture and particularly *“to develop a strategy to guide future development of sustainable inland aquaculture to support food security and secure livelihoods for the Solomon Islands in response to rising populations and climate change”*. The project was implemented through a partnership of three agencies: The WorldFish Center, the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR) and the Secretariat for the Pacific Community (SPC).



One of the communities where the household questionnaires were conducted

FUTURE FISH

Predictions of current and future demand for fish in Solomon Islands under different scenarios of productivity of capture fisheries strongly indicate that development and growth of aquaculture are required in order to meet projected domestic supply gaps. Fish consumption from 2015 to 2030 estimated according to four projected future scenarios [Box 1] indicates essentially that strong and positive developments in aquaculture output are required to support the nutritional requirements of the people.¹ A key implication of the scenario development is that Solomon Islands should already be engaged in aquaculture to supply food fish. Fish supply-

Box 1: Target outputs for aquaculture (tonnes) under different scenarios, 2015 to 2030, assuming no change in per capita fish consumption.

Scenarios for capture fisheries	Scenario 1 Trends continue	Scenario 2 Increase in fisheries productivity results in higher output (5%) due to improved technology and/or higher fishing effort from deep and coastal fisheries	Scenario 3 Decline in fisheries productivity results in lower output (5%) due to lack of technology and/or reduction in fish stocks, or lower fishing effort	Scenario 4 Decline in productivity results in lower output (50%) due to a major reduction in fish stocks or lower fishing effort
Year	Baseline	Scenario 1	Scenario 2	Scenario 3
2015	2,159	1,315	3,010	11,089
2020	3,515	2,567	4,470	13,461
2025	5,293	4,234	6,358	16,322
2030	7,636	6,463	8,816	19,788

¹ Nireka Weeratunge, D. Pemsil, P. Rodriguez, O.L. Chen, M.C. Badjeck, A.M. Schwarz, C. Paul, J. Prange, I. Kelling (2010) Planning the use of fish for food security in Solomon Islands. WFC, Penang, Malaysia

demand gaps suggest aquaculture output in 2010 should have been between 1,113 (Scenario 1) to 9,112 (Scenario 3) tonnes [Box 1]. Moreover, the target output of aquaculture required to meet future needs is predicted to grow to a range of 7,636 (Scenario 1) to 19,788 (Scenario 3) tonnes by 2030.



Small “household” tilapia pond of near Honiara - Mr Moses Peter (owner)

AQUACULTURE

Aquaculture is limited at present in Solomon Islands, with some seaweed culture, and a few households producing giant clams and corals for the aquarium trade. Some aquaculture was evident in the 1980s and 1990s (*Macrobrachium* and penaeid prawn) but production was small and the farms are currently inactive. Notably, none of these aquaculture operations contributed or contribute directly to food security.

Mozambique tilapia (*Oreochromis mossambicus*) is an exotic species that was introduced during the 1950s and feral populations are now well established in many fresh and brackish waters around the nation. It is harvested for food and income by households, particularly the poor in urban and peri-urban areas, where prices for reef fish have risen beyond the means of poor households and those without ready access to nearshore marine resources. Whilst small “backyard” ponds and tanks can be found on several islands, the largest concentrations are on Guadalcanal and Malaita. There are estimated to be around 50 household ponds in total across the islands, all characterised by low yields, and with total supply estimated at less than 1 tonne of tilapia annually. Nearly

all farmed tilapia are used for household consumption, including by women and children. Although pond yields are low, households are enthusiastic about culturing fish, and around 60% of 178 households surveyed in Guadalcanal and Malaita during the ACIAR project expressed an interest in culturing fish. Although some small yield improvements may be possible with existing systems of Mozambique tilapia farming, such improvements give modest returns on investment and will only marginally increase benefits to households. There will remain a significant shortfall in production required to meet future food security targets and it is clear that new approaches are necessary.

SUITABILITY AND DEMAND FOR AQUACULTURE

Inland aquaculture development depends on a number of technical, social, economic and environmental factors, as well as supporting policy and institutions. GIS modeling and analysis conducted through the ACIAR project shows that the peri-urban areas of Honiara and Auki have suitable sites with potential for successful inland pond farming on the islands of Guadalcanal and Malaita. The analysis also reveals potential in areas of population concentration elsewhere in rural areas, especially in Malaita where population densities are generally higher. Interest in investing in inland aquaculture exists among households, schools and palm oil plantations.

ACIAR project FIS/2009/061 identified two approaches for meeting future fish demand through inland aquaculture beyond existing



WorldFish staff conduct household questionnaires during phase I of the study



WorldFish staff having discussions with women from a community in Honiara who fish for tilapia

systems. Supply of sufficient food fish from land based aquaculture in Solomon Islands will not be feasible using the current species, *O. mossambicus*. Therefore, either a productive strain of Nile tilapia is required or an indigenous species must be developed, with milkfish (*Chanos chanos*) being one of the few candidate species with some potential. In any event, experience elsewhere suggests that sustainable uptake of aquaculture will not occur unless there is a viable business at the core of the operation and that input (fish feed and fingerlings) and output (demand and delivery mechanisms for the product) markets are sufficiently well developed. Initial studies have shown that market demand and support in principle from potential small and medium scale enterprises exists for tilapia and milkfish. Government policy is also generally favorable to aquaculture, with

both species identified in the Solomon Islands Aquaculture Development Plan 2009-2014. Investment is required if inland aquaculture is to grow, in aquaculture farm construction and operations, but also in the necessary supporting infrastructure, institutions and services if the sector is going to contribute fish for future food security.

Preliminary analysis suggests that a viable business case exists for private investment in pond aquaculture of tilapia or milkfish, but production costs will need to be kept low and competitive through locally sourced feeds, fertilisers and seed production. The ACIAR project projected that fish demand is unlikely to be met solely through a household pond aquaculture model; the working hypothesis is that a combination of households, household “clusters”, schools, palm oil plantations and medium-scale enterprises would provide an optimal combination of investment and synergies. Different enterprise scenarios were explored by the project, and the outcome of one scenario for an annual production of ~2,500 tonnes is provided in Box 2. Essentially, the key message is that commercial investments in medium enterprises will be required to provide sufficient supply to meet future demand, particularly for urban areas.

MOVING FORWARD

Aquaculture production of fish appears to be a necessary component of future food security in Solomon Islands, and market demand and opportunities exist for competitive inland aquaculture enterprises. Based on the findings of ACIAR project FIS/2009/061, an integrated

Box 2: One scenario for an enterprise/production combination to achieve ~ 2, 500 tonnes/year

Enterprise type	Annual fish production - kg/unit	Number of farm units	Infrastructure costs (US\$)	Annual operating costs (US\$)	Estimates of annual fish output (tonnes)
Households	120	500	30,000	60,000	60
Household “cluster”	6000	20	120,000	100,000	120
Schools	25,000	6	155,000	130,000	150
Palm oil	50,000	2	56,000	110,000	100
Medium enterprise	300,000	7	860,000	2,300,000	2100
Total			~1.2 million	~2.6 million	~2,500 tonnes



Large milkfish (*Chanos chanos*) in Honiara market

approach based on five major themes will be necessary to move forward. Implementation will require bringing complementary skills and investments together via partnerships, involving both public and private sectors.

1. Improving fish yields and productivity:

- Aquaculture for food security requires a species other than Mozambique tilapia; one that can deliver higher yields competitively under culture conditions. An indigenous species may be used or if tilapia is preferred an improved species such as Nile tilapia must be imported.
- Government has initiated a process of risk analysis on import of an improved strain of Nile tilapia, which is planned for completion during 2011. The process should assess risk, and identify risk management measures for introduction of an improved strain of Nile tilapia. Infrastructure, capacity building and management measures in suitable facilities for receiving and maintaining an improved Nile tilapia strain will be required should government make a decision to proceed with the importation.

- Milkfish on the other hand is a species that is native to Solomon Islands requiring no such import risk analysis. For this indigenous species the questions to be answered are around the availability and location of fry, the ecological sustainability of capturing and rearing wild fry and determining suitable and economically viable feed sources and grow-out systems under different farming conditions, including existing backyard household ponds.
- Inland aquaculture investments for food security must aim to produce a low cost product for domestic markets. To do so sustainably, aquaculture will need to be competitive in the production and pricing of products. Low cost pond input options need development (feed, fertilisers, use of by-products, management systems). Farming systems, management practices and business models require elaboration for different enterprise types.



Mozambique tilapia in Solomon Islands

2. Building of skills and organisational arrangements:

- Inland aquaculture will require people with the technical skills for farming, as well as necessary business, management and marketing skills, with actual requirements depending on scales of operation. Aquaculture extension and knowledge dissemination systems will need to be developed to impart skills to farmers and businesses. With dispersed populations across islands, workable and sustainable mechanisms need investigation to effectively reach existing and prospective aquaculture farmers.
- Assisting interested households to organise into more economically efficient “clusters” needs investigation, both in terms of its viability and to determine socially and culturally acceptable systems of cooperation among farmers to develop efficiencies.
- Possibilities for mutually beneficial links between households and medium and larger aquaculture enterprises and value chains should be further explored (e.g. contract nursing, farming, input/output markets).

3. Access to finance for infrastructure and operations:

- Inland aquaculture will require access to investment; in pond construction and associated water supply/drainage, possibly roads for larger enterprises and seed, feed, labour and other routine operational costs. Whilst further research on business models is necessary, preliminary estimates suggest investment of the order of US\$1.2 million in pond infrastructure will be necessary to achieve annual supply of ~2,500 tonnes of Nile tilapia or milkfish² [Box 2] plus as yet unquantified investments in supporting seed and feed supplies. Operational investments are estimated at US\$ 2.6 million/year.
- Nile tilapia at least, will require additional investment in hatchery infrastructure. One central publicly controlled Nile tilapia brood stock nucleus and quarantine facility will be required to receive and manage imported Nile tilapia, with trained people, and sustained financing. Such investment in milkfish may not be necessary initially, should trials confirm



Pond where mozambique tilapia are regularly fished by Honiara residents

that wild seed is available in sufficient quantities for farming, but may be necessary in the longer-term.

- An associated hatchery and nursery system will be required to deliver seed to farmers, and feed production facilities are also required, again requiring investment. Fish seed and feed costs must be kept low for inland aquaculture to remain competitive, the latter using locally available ingredients as far as possible.
- A business case appears to exist for investments in pond farming, providing opportunities for households and commercial investors. Business models and investment partners and financing mechanisms need further analysis and development.
- Significant growth of small household or community cluster farming will require microfinance packages specifically designed to support households or clusters of households. Suitable risk management procedures for all investments need to be investigated and developed with government and financing institutions.

4. Market access:

- Existing marketing systems and value chains could absorb some increased household production of tilapia, but more organised systems of marketing will be needed as tilapia or milkfish farm production grows.

² This calculation is tentative, and requires further research. It also does not include use of some existing facilities – eg “abandoned” prawn farm ponds near Honiara, and existing palm oil ponds and household ponds which would reduce capital infrastructure costs to some extent.



Milkfish at roadside stall in Honiara

- Marketing strategies that enable access of poorer consumers also need further investigation.
- Consumer and demand surveys and market campaigns should be conducted to improve understanding demand and develop markets and market chains.
- If household models of farming are pursued, then marketing systems for households or household clusters should be investigated and supported.

5. Public policy and institutions:

- A conducive public policy environment and the development of regulations will be needed to support the implementation of (1) to (4) above.
- Investments in institutional strengthening – such as staff training and operational budgets - will be needed for national and provincial government management of aquaculture.
- Guidelines (e.g. suitable locations for aquaculture, environmental norms) and other knowledge products (brochures, audio-visual *etc*) should be prepared and disseminated using appropriate fora and media.
- Land use, site selection criteria and spatial plans should be prepared to support medium scale investments in inland aquaculture. Particular attention will need to be given to the existing land use and ownership patterns, with reference to customary land use norms and conditions. Further GIS modeling would be useful to locate suitable sloping areas (currently only flat land has been assessed) as gravitational flow of water may be an advantage for potential aquaculture sites.

The key activities indicated in this policy brief will be scrutinised by partners in order to develop an appropriate strategy and investment plan for inland aquaculture development in Solomon Islands. A national advisory group containing representation from households, public and private sectors may be considered to facilitate progress.



Freshly caught mozambique tilapia from a Honiara pond

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