

TILAPIA FISH FARMING IN THE PACIFIC - A RESPONSIBLE WAY FORWARD

In many islands of the Pacific, the environmental costs from past introductions of tilapia have already been paid. How can people in these places now responsibly obtain the expected social benefits?

This question emerged as the main theme of a meeting of regional and international experts hosted by the Secretariat of the Pacific Community (SPC) in Noumea, New Caledonia in December 2009. On one hand, tilapia farming is one of the readily available options to regional food security concerns. On the other hand, tilapia is an introduced species, which raises concerns about its impacts on the biodiversity of indigenous freshwater fish.

The SPC meeting — “Future directions for tilapia in the Pacific” — found that tilapia farming is already making a useful contribution in the region, and has much more still to offer. But careful planning will be needed to obtain the anticipated economic and social benefits while avoiding further environmental costs.

Pacific Island countries will face an increasing shortage of fish for domestic consumption. Recent results of environmental and demographic studies presented by SPC show that the region’s growing populations will need an additional 100,000 tonnes of fish by 2030 if present per capita fish consumption (essential for dietary health) is to be maintained¹. Even with good management, the region’s

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coastal fisheries will not be able to supply the increased quantity of fish needed to meet the projected future demand. Without good management, and combined with threats to coral reefs by climate change, the supply of fish from coastal reef fisheries is in fact likely to decrease.

To cope with future demands for fish, the time to start planning is now. Governmental and regional agencies have identified two main options to make up the projected shortfall in fish supply: 1) allocate more of the region’s tuna catch to domestic food security needs, and 2) develop small-pond aquaculture. The aquaculture option is a good one for providing fresh fish to rapidly-growing urban centres, and to inland populations, in countries with adequate land and freshwater resources for fish farming.

Tilapia — An obvious choice

Small-scale fish farming requires simple production methods. The type of fish chosen for farming must be one that is simple to breed and feed. There are presently no obvious candidates among the indigenous fish in the Pacific Islands region. To identify and develop any local species with potential for aquaculture takes time. Typically, 10 or 15 years of scientific research

is needed before a new fish species reaches commercialisation, even if it has the attributes needed for mass production.

Tilapia was introduced in much of the region in the 1950s and 1960s. It is one of only a handful of fish species available worldwide that is ideal for successful low-cost farming. It is easy to breed and grow without needing high technology, eats a range of low-cost foods, and tolerates a wide range of pond conditions. Originally from Africa, tilapia is now so domesticated for farming in Asia and the Americas that it has been dubbed “the aquatic chicken”.

Internationally, farmed tilapia is a commodity. The SPC meeting heard from US Tilapia Association past-president Professor Kevin Fitzsimmons that tilapia has now reached the top five preferred “sea foods” in the USA, overtaking salmon for the first time during 2009. “The amazing thing about tilapia is how rapidly sales continue to grow: in 2000, global consumption was worth USD 1.75 billion, in 2005, this had reached USD 2.5 billion, and in 2010 it will be USD 5 billion”. Secretary-General of the Network of Aquaculture Centres in Asia and the Pacific (NACA), Professor Sena De Silva concurred, informing regional representatives about the huge contribution to rural food security and livelihoods now being made by tilapia farming in Asia. “If we ask whether tilapia, as an introduced alien species in Asia, is a ‘friend’ or a ‘foe’, the answer is overwhelmingly that it is now a ‘friend’ to millions of our people”.

Farming tilapia for food security is not a new idea in the Pacific. Fiji and Papua New Guinea (PNG) both have long-standing policies of government support

for tilapia farming in rural areas. PNG's representative at the meeting, Peter Minimulu (National Fisheries Authority), reported that somewhere between 10,000 and 20,000 household-scale tilapia farms now exist in PNG's remote highlands and northern coastal provinces. This level of activity makes PNG the Pacific region's leader in tilapia farming. Fiji's Department of Fisheries similarly encourages and supports rural small-scale tilapia farming, by providing farmer training, hatchery services and marketing assistance.

Household-scale, versus medium-scale enterprises

The SPC meeting heard from WorldFish Center representative Dr Randall Brummett, based in Cameroun, about central Africa's past experiences in small-scale tilapia farming development targeting poor households. "As an approach to food security, such projects are better than giving out food relief. But without a deliberate and accepted policy to provide ongoing subsidies, such as giving out fingerlings for free, they are not usually self-sustaining businesses", he said.

The more promising approach now being taken in Africa is one of medium-scale enterprises. These larger fish farms have economies of scale to support infrastructure such as fish hatcheries or feed mills. Smaller-scale operators can then also access these services. Most importantly, jobs are created — on the farms themselves and in supporting industries. "In the last 10 years, African aquaculture has finally started to grow," said Dr Brummett. "The difference has been a switch to a business-like approach with a focus on markets and profits. To earn enough to keep their fish farms running,

people have to be able to get their product out of the village because their neighbours have little spare cash to buy fish."

Vanuatu already boasts one such medium-scale enterprise. Vate Ocean Gardens is operated by Paul Ryan in Lake Manuro on Efate Island, using floating-cages to culture an attractive red-colour variety of hybrid tilapia sourced from Thailand. "It's become a nice little business", says Mr Ryan, whose regular harvests of fresh "perche cerise" ("cherry perch") are usually sold out in Port Vila within two hours. "I grow the fish in a small lake already degraded by previous fish introductions and by the dumping of tree rubbish from land-clearing, so our tilapia farm is not only economically viable, it has little additional negative environmental impact." At the meeting, representatives from Guam, Saipan and American Samoa reported that they too have successful commercial operators growing and selling tilapia, mainly in backyard operations that rear the fish intensively in swimming pools or cement tanks.

The Pacific was given the "wrong" tilapia

The species of tilapia introduced to the Pacific was the Mozambique tilapia (*Oreochromis mossambicus*), whereas 90% of the tilapia farmed globally today is Nile tilapia (*Oreochromis niloticus*). Distinctions between the two species are not always clear-cut because they hybridise easily. However, the Mozambique tilapia is generally much slower growing (in culture) and potentially more invasive because it is more tolerant of salt water.

To make matters even worse, the particular Mozambique tilapia distributed throughout

the Pacific are reputedly the inbred descendants of less than a dozen fish found at a place in Indonesia in 1939. As a result, according to a recent study supervised by geneticist Professor Peter Mather of Queensland University of Technology: "... the Mozambique tilapia in the Pacific are so lacking in genetic variation that improvement by selective breeding will be almost impossible", he said.

For Nile tilapia, however, improved varieties are now available, which have been selected to give better growth performance when domesticated in pond conditions using formulated pellet feeds. Some countries in the region such as Fiji and PNG are already using these varieties for farming. Other countries in the region wishing to establish successful tilapia farms will need to ignore the feral Mozambique tilapia already present in their rivers and use a domesticated variety of Nile tilapia. "Domesticated varieties do better in culture with good feeding", advised Prof. De Silva, "but they don't do so well as feral types if they escape into rivers. This is especially so with red hybrids, whose bright colour makes them more easily caught by fishers or by hunting birds like herons and cormorants".



Mozambique tilapia were stocked into many inland water bodies of the Pacific region during the 1950s and 1960s, as part of efforts to increase freshwater fisheries production. It is unsuitable for aquaculture. (Photo: Tim Pickering).

Managing environmental risks of tilapia

The SPC meeting was briefed about threats to biodiversity among the region's freshwater fishes by Suva-based Dr Aaron Jenkins of Wetlands International – Oceania. Dr Jenkins includes feral tilapia among several threats to indigenous river fishes in the Pacific. "In Fijian streams, we've found that the presence of tilapia along with deforestation is associated with the absence of as many as 10 of the indigenous fish species." Pacific Island river fishes are more vulnerable to these multiple threats than those in Australia or Asia, he says, because more of our species have early life history stages that spend time in the ocean, and so cross several habitats during their lives.

Prof De Silva commented on Asia's experience that tilapia do not easily invade pristine clear-running forested streams, but prefer slower-moving muddy rivers in open sunlit countryside. "If deforestation occurs, tilapia will move in. They can often be found at the scene of the crime, but are not necessarily the criminal." Dr Jenkins counters that the unusually high level of connectivity between all sections of Pacific Island rivers and the ocean itself means that ecosystem-based approaches are needed for protection of our indigenous fishes, many of which are "endemic" (not found anywhere else). "Resource owners and managers will need to take into account all likely threats throughout the entire river, to avoid loss of species or further reductions in useful indigenous food fishes such as the Fijian *vo*.

"It's increasingly important to protect the invasive-free status of those river catchments that are still pristine". Dr Jenkins



An experimental tilapia pond constructed on the initiative of Mr Fred Manu in 2002 in North Malaita, as a village-level development project. The growth rate of the tilapia was so slow that the project was suspended. This is because only Mozambique tilapia is presently available in the Solomon Islands. (Photo: Tim Pickering).

recommends that the distributions of indigenous species, and of tilapia, be mapped and used as guides for aquaculture planning. "We definitely need policies in place to avoid introducing tilapia into remaining areas of high conservation value", he said.

The way ahead for tilapia farming

It is obvious that the demand for fresh fish in the region will increasingly drive new initiatives to farm tilapia. Already the region is witnessing an expansion from household-scale fish farming projects to economically viable medium-scale enterprises based on aquaculture of this versatile fish. Participants at the SPC-hosted meeting "Future directions for tilapia in the Pacific" have helped to clarify the main issues still to be addressed if this industry is to expand in a responsible and environmentally sustainable way.

The success of new entrants to tilapia farming will depend on

being able to work with suitable domesticated varieties. This means having the capacity to manage aquatic-species quarantine protocols at the national level. It also means carrying out an import risk assessment for the proposed new variety, to ensure that no characteristics (such as higher salt tolerance) are added to the local feral tilapia gene pool that may increase invasive properties any further. Zoning approaches to aquaculture planning can be developed to protect areas of high conservation value from the introduction of tilapia. The need for, and viability of, a tilapia farming industry should be assessed country by country and province by province, before any decision is made to go ahead with it. SPC plans to work with its member countries and territories, and other stakeholders, to further develop these and other ideas in support of sustainable and profitable tilapia farming in the Pacific Islands region.

1. See *Pacific Island Business*, October 2007: "Fish – cornerstone of future food security"