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# Partnership for Aquaculture Development in Timor-Leste: Looking back, looking forward



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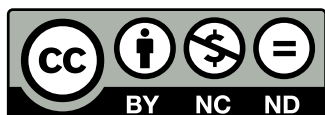
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## Background

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The Timor-Leste Government is committed to developing aquaculture to improve the country's food and nutrition security while improving income opportunities for coastal and inland farming communities. To realize this, in 2012 the National Directorate of Fisheries and Aquaculture (NDFA) of the Ministry of Agriculture and Fisheries (MAF) developed the [National Aquaculture Development Strategy \(NADS\) 2012–2030](#) with technical assistance from WorldFish. The strategy's goal is to help raise per capita fish consumption from 6.1 kg to 15 kg per year—and aquaculture is expected to contribute 40 percent (12,000 metric tons) of domestic fish supply with the remainder to come from capture fisheries and imports.

The [New Zealand Ministry of Foreign Affairs and Trade \(NZ MFAT\)](#) provided funding to support implementation of NADS through the [Partnership for Aquaculture Development in Timor-Leste \(PADTL\) project](#) (2015–2019). The five-year project, led by WorldFish and implemented with the National Directorate of Aquaculture, focused largely on pond culture of tilapia in Ermera, Baucau and Bobonaro municipalities.



Farmers eating fish in Timor-Leste.

# Context

Fish farming in Timor-Leste has been limited by several factors—low quality seed and feed, poor farmer knowledge of good aquaculture practices and limited extension services. To tackle these challenges, the project adopted a holistic, multi-pronged strategy to strengthen four interrelated aspects of the tilapia production chain (Figure 1). Research and development efforts focused on improving access to high-quality seed and feed and grow-out technology, thereby enabling farmers to increase fish production and productivity. At the same time, the project worked on building local capacity to boost uptake of tilapia farming by rural households.



**Figure1.** Holistic approach of the PADTL project.

# Key development areas

## Quality seed: GIFT arrived in Timor-Leste and is here to stay

### Achievements:

- The project introduced **genetically improved farmed tilapia (GIFT)** to Timor-Leste for the first time, starting in 2015 with the import of four cohorts of GIFT brood stock from WorldFish, Malaysia.
- To ensure broodstock quality was maintained, the project upgraded the facilities at the [government hatchery in Gleno, Ermera](#), introduced **rotational breeding** of cohorts, and trained hatchery staff on the entire seed production process, including sex reversal techniques (SRT).
- From a low seed production rate of less than 10,000 fingerlings per year, the Gleno hatchery increased its annual fingerlings production to over **350,000 fingerlings in 2016** and beyond.
- By 2018, more than **1.5 million monosex GIFT fingerlings were distributed** to over 800 farmers across 11 municipalities.

### Issues:

- In a very short time, from 2017, **demand for seed has increased**, outstripping the production capacity of Gleno hatchery. Farmers' demand for seed is expected to continue increasing.
- The country will need **over 70 million fingerlings/year** by 2030 to achieve the NADS production target of 12,000 metric tons of farmed fish per year. The government alone, with its limited resources and staff capacity, can't meet the huge and rising demand for quality seed.

### Way forward:

- The project helped to set up the [first public-private partnership \(PPP\) hatchery](#) in Leohitu, Bobonaro. Launched in June 2019, the hatchery receives quality broodfish and technical assistance from Gleno hatchery. Efforts to set up a second PPP hatchery in Parlamento, Lospalos, are underway in 2020 to serve the eastern part of the country. The PPP model will help to make quality seed more available, accessible and affordable to farmers.
- **Four advanced tilapia farmers** (two in Bobonaro, and one each in Baucau and Ermera) have been **trained to operate nurseries** that serve local farm clusters. Nursery operators acquire SRT fry from the PPP hatchery and sell fingerlings to local farmers after nursing for 4–6 weeks. The government hatcheries, relieved of the seed multiplication and distribution load, can therefore focus solely on maintaining quality broodstock.



Incubation of GIFT eggs at Leohitu hatchery, Timor-Leste.

## Quality feed and pond fertilization: Circumventing the high cost of imports

### Achievements:

- To offset the high cost and availability of imported feed, the project **developed feed formulations** for farmers to make their own pellets using locally-available raw materials.
- **Green water technology** (i.e., pond fertilization using farm manure and inorganic fertilizers) was introduced to farmers for in situ production of feed. This stimulates the growth of plankton, providing extra nutrition for the fish.
- Farmers that used a combination of farm-made feed and green water technology achieved a **three-fold increase in fish yield**.

### Issues:

- There is a **shortage of raw ingredients** to make on-farm feed, and village restrictions prevent farmers from using certain plant ingredients to make fish feed pellets.
- **Making feed pellets** manually on farm requires **a lot of labor**.

### Way forward:

- Considering the 1:1 ratio for feed and target production, an estimated 12,000 tons of high-quality feed/year is needed by 2030 to meet the NADS annual production target of 12,000 tons of farmed fish. Therefore, **more feed-producing facilities need to be established** at the small-medium enterprise level, using combinations of locally-available and imported ingredients. Equally, importing high-quality feed in bulk and establishing distribution systems is vital for the scaling of current small-scale fish farmers to SMEs and commercial scale production systems. This will ensure there is enough feed available at low costs to farmers in rural areas.



Feed making training, Timor-Leste.

## Quality practices: Better management practices

### Achievements:

- The project developed a suite of **better management practices** (BMPs) for GIFT, which was tested on over 250 farms under local conditions. The BMPs cover the whole spectrum of pond culture practices, including integrating aquaculture into agriculture, and marketing and record keeping.
- A **Better management practices for genetically improved farmed tilapia (GIFT) in Timor-Leste** manual was printed in English and Tetum and distributed widely across the country.
- The project incorporated the BMPs into **practical training modules** for trainers and farmers. Nine GIFT farmer field school (FFS) clusters—each comprising 20–30 farmers in Baucau, Bobonaro and Ermera municipalities—participated in a series of BMP training sessions. Over 90 percent of the farmers completed the training and have adopted elements of the BMPs over 1–2 production cycles.
- Farmers adopting the BMPs achieved tilapia yields averaging **4.3± 1.5t/ha/cycle**. With production costs averaging USD 1.50/kg and fish sales averaging at USD 4.00/kg, farmers realized **net profits of USD 2.50/kg**. It has been shown that yields as high as  $7.2 \pm 1.2\text{t/ha/cycle}$  can be achieved by thoroughly following the BMP guidelines.
- The project organized a fish harvesting ceremony and farmer field days in all three PADTL project municipalities to encourage **peer learning** and to reach wider circles of farmer communities.

### Issues:

- As farmers gain experience and benefit from fish farming, they express an increasing need for **labor-saving measures** to go beyond subsistence production. For example, using a backhoe instead of manually digging a pond is a more efficient way to expand a pond size and area.
- With an increasing number of farmers now growing fish, the **fish price will go down** as supply increases (which is good for low income consumers). Farmers, therefore, need to find ways to optimize production and productivity while reducing costs.

### Way forward:

- There is still scope to **narrow the yield gap** to increase fish productivity and income from fish farming through research and development efforts to refine the grow-out technologies.
- By **improving fish productivity**, farmers can maintain acceptable profit margins while making farmed fish affordable to poor consumers.
- **Farmer training**, through proven approaches like farmer clusters and farmer field schools, must be continued to further build farmers' knowledge and skills.



Farmer field school at Batugade, Timor-Leste.

## Quality extension: capacity building of NDA

### Achievements:

- National Directorate of Aquaculture (NDA) staff at central and local levels received **hands-on training** and mentoring on hatchery operations and grow-out technologies, and were trained in how to conduct participatory training using a farmer field school approach.
- An **online hatchery database system** was set up and hatchery staff were trained to update the database and keep track of hatchery operations and outputs. The NDA staff have continued this work.
- Select staff were invited to participate in **regional training opportunities** at the Asian Institute of Technology Thailand on advanced hatchery and grow-out management.

### Issues:

- **Capacity building efforts** within MAF need to continue and be enhanced as technologies are refined and aquaculture areas expand.

### Way forward:

- Staff from NDA will need **refresher training** on hatchery and grow-out technologies periodically.
- **Continuous mentoring** of NDA staff to enable them to play a pivotal role in scaling GIFT.



GIFT harvesting ceremony at a farmer field day, Timor-Leste.



# Conclusions and main recommendations

The high demand for fish in Timor-Leste must be met, in part, through **farming fish in sustainable ways**. This message was reiterated at the [2nd National Aquaculture Forum](#) hosted by the project in August 2019.

The PADTL project has laid a **sound foundation** for the expansion of tilapia farming in Timor-Leste—by developing appropriate seed and feed technologies, upgrading basic hatchery infrastructure and developing knowledge sharing platforms to engage farmers. To build on these efforts, a grant fund agreement between NZ MFAT has been signed for the 2nd phase of PADTL—a three year project (2020–2023)—to facilitate scaling of aquaculture in Timor-Leste. The 2nd phase has three major focal areas: increased availability, increased accessibility and increased consumption of fish.

Over the next decade, aquaculture areas in Timor-Leste could expand to **more than 1000 hectares**. Servicing this area will require the supply of adequate quantities of seed and feed, and the development of efficient marketing channels to reach the people in greatest need of fish. This is key to realizing the NADS targets for farmed fish production to improve food and nutrition security in Timor-Leste.

**In PADTL 2, further R&D efforts** to achieve the production targets will focus on three key areas:

Increased availability	Increased accessibility	Increased consumption
<ul style="list-style-type: none"><li>• Refine grow-out technologies to improve productivity and reduce production costs</li><li>• Improve feeding regimes with green water technology to increase nutrition efficiency</li><li>• Expand culture area</li><li>• Transition fish farmers from subsistence to semi-commercial levels</li><li>• Establish more hatcheries using PPP model</li><li>• Promote SME-level feed manufacturing</li></ul>	<ul style="list-style-type: none"><li>• Develop a market system that links producers with demand hubs</li><li>• Conduct a market needs analysis to understand links in the value chain</li><li>• Improve post-harvest handling of fish</li><li>• Promote development of fish products</li></ul>	<ul style="list-style-type: none"><li>• Include fish in the meal programs of schools, hospitals and other institutions</li><li>• Promote the nutritional benefits of eating fish</li></ul>

**Capacity building within MAF as well as the private sector** must continue, and even extend beyond technical aspects, to provide effective leadership for forging functioning partnerships between government, non-government, the private sector and research institutions. For example, the national aquaculture forum, held annually, is a key means to enhance cooperation between stakeholders. These partnership efforts will enable the full spectrum of aquaculture stakeholders to work in complementary and coordinated ways to achieve the NADS production targets. In addition, **enabling policies** must be put in place to facilitate finance and public-private partnerships to support progress toward the NADS targets and realize the full potential of aquaculture in Timor-Leste.

## **About WorldFish**

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish is a member of CGIAR, the world's largest global partnership on agriculture research and innovation for a food secure future.