



INITIATIVE ON

Aquatic Foods

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Fish and fish-based products in Timor-Leste's School Meal Program:

Understanding existing use, challenges, opportunities and research needs

Key messages

1. Workshop with government agencies and organisations involved in Timor-Leste's School Meal Program (PME) shared experiences about using fish in the program and identified focal areas for research.
2. There is wide recognition for the role of aquatic foods and that greater inclusion of aquatic foods in the program requires cooperation and collaboration between partners.
3. Not enough fish is produced in Timor-Leste for domestic supply to meet demand and PME goals.
4. There is a need to build school level capacity for planning, procurement and meal preparation with aquatic foods.
5. Hygiene and food safety are areas requiring investment and action to improve personal skills and infrastructure to support good practices.
6. Understanding trade-offs in using fresh fish and fish-based products is an important area for research.
7. Given the diversity of Timor-Leste's food production system, a mosaic of approaches will likely be required to produce and supply fish and fish-based products to all students throughout the year.

Introduction

Fish and other aquatic foods are nutrient-dense foods that can be an important part of healthy diets, including for children. Timor-Leste's School Meal Program, *Programa Merenda Eskolár* (PME), is a key component of the Government's strategy to increase children's academic and nutritional outcomes. New Government guidelines on PME menu composition, published in 2023, recommend including nutritious animal-source foods, such as fish, and place emphasis on using foods produced in Timor-Leste.

Including Timorese-produced fish and fish-based products in the PME would have important benefits for school children and presents opportunities for enhancing incomes and livelihoods of rural fishers, fish farmers, fish traders and fish processors. Integrating fish in school meals is also clearly supported in Government fisheries policies, such as the National Aquaculture Development Strategy of Timor-Leste (2012–2030)¹. Putting this into widespread practice, however, requires identifying existing barriers and challenges – from supply through to meal preparation – and collaboratively working towards creating and implementing solutions.

In recent years, a small number of organisations in Timor-Leste have trialled the use of fish or fish-based products in school meals; and/or have carried out activities



to support the local production of fish or fish-based products. This brief documents discussions and learnings from a workshop held to share these experiences and identify opportunities for future engagement and research. The workshop was attended by several government agencies and their development partners.

Overview of Timor-Leste's School Meal Program

School Meal Programs are a critical social safety net for vulnerable children and households. Timor-Leste's School Meal Program, *Programa Merenda Eskolár* (PME), plays a key role in the Government of Timor-Leste's strategy to increase children's academic and nutritional outcomes. The PME was launched in 2005 with support from the World Food Programme. Since 2011, the Government has led its implementation through the Ministry of Education and its National Directorate for Inclusive Education and School Social Action. The program has received bi-partisan support for the past 18 years and was recently enshrined in Decree Law 61/2022, 24 August².

The PME is framed as a government investment to support learning for preschool and primary school students through healthy and balanced meals. Linkages to the importance of food and nutritional status for brain development and optimal learning, as well as impacts on school attendance, are clearly acknowledged. Government funding for the PME has recently increased from 25 to 42 cents per student and meal, comprising a total annual investment of over USD 20 million. In 2022, the PME targeted 314,183 students aged 3 to 15 years³, covering 23.4% of the total population of Timor-Leste⁴.

In 2023, the Ministry of Education, Youth and Sports and the Ministry of State Administration, in collaboration with the Ministry of Health, published policy guidelines for PME operation and menu composition (PME Manual)⁵. The budget for the PME has been decentralised and is now executed through each municipality and school council. Menus encourage the use of ingredients from the three food groups recommended by the Ministry of Health (Figure 1) and indicative quantities and costs are provided. Aquatic foods such as fish, dried fish and shellfish are promoted as a nutritious source of protein and micro-nutrients. Imported tinned fish, however, is not currently permitted due to emphasis on sourcing locally produced foods.

Fish availability in Timor-Leste and potential to supply the PME

The supply of fish in Timor-Leste comes from three main sources: marine fisheries, aquaculture and imports. Based on existing data, the amount of fish available each year is approximately 11,000 tonnes (Figure 2), with around 7,450 tonnes from domestic production. Note this figure is subject to change as improved data become available. Most locally produced fish is distributed fresh, with small quantities processed and sold as dried or cooked fish products.

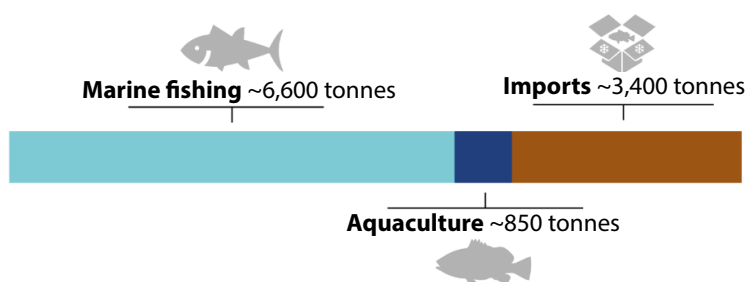


Figure 2. Estimated annual supply of fish in Timor-Leste from marine fisheries, aquaculture and imports. These quantities were estimated using the methods described below and are subject to change as new data becomes available.






Figure 1. The three food groups recommended by the Timor-Leste Ministry of Health and an example of a balanced school meal containing fresh farmed fish.

The annual marine fisheries production estimate is the average annual production from 2020 to 2022 based on data and interpolation carried out through Peskas, Timor-Leste's national catch monitoring system⁶ (accessed 30 October 2023). The annual aquaculture production estimate is the average of lower and upper annual production estimates (633–1,059 tonnes), calculated by multiplying the number of aquaculture households with pond culture facilities (3,768; 83% of all aquaculture households recorded in the 2019 Agricultural Census⁷) by lower and average productivity estimates recorded in Timor-Leste (168 kg and 394 kg per household per year, using local and commercial feed respectively⁸). The estimated quantity of imported fish per year is based on average trade data⁹ for the years 2020 to 2022 for two product categories, 'Fish and crustaceans, molluscs and other aquatic invertebrates' and 'Meat, fish or crustaceans, molluscs or other aquatic invertebrates, preparations thereof', converted from average dollar values (respectively, USD 3.38M and 5.91M minus 20% assumed meat products from the latter) using best available conversion rates (USD 2/kg and 2.7/kg, respectively). Note that fish was not recorded in the top five exports during this period and is assumed to be zero.

The PME Manual recommends that students are provided with animal-source protein foods, such as meat, egg or fish, two times per week. Furthermore, it suggests that preschool students should receive 45 g of such foods per meal (raw edible weight), while primary school students should receive 60 g per meal. Nevertheless, school meals in Timor-Leste have often comprised rice, beans, and vegetables; fish is less prevalent, mainly due to the insufficient supply and its high price¹⁰.

If every student was provided with one meal of fish per week at the recommended quantities over the school year, approximately 831 tonnes of fish (raw edible weight) would be required. To obtain this quantity of raw edible fish, approximately 923 to 2,077 tonnes of whole fish would be needed to be caught or produced, depending on the method used to clean and process the fish. This equates to between 12 to 28% of Timor-Leste's current total annual domestic marine and aquaculture production (Figure 3).

			
	Number of students (2021)	KG fish per student per year (raw edible weight)	Total TONNES of cleaned fish per year (raw edible weight)
PE	25,679	2.0 kg	52 tonnes
EB	288,504	2.7 kg	779 tonnes
Total	314,183		831 tonnes




Processing method	Estimated total TONNES of whole fish per year (raw whole weight)	% total local production
Include bones 	923 tonnes	12%
Edible flesh 	1,385 tonnes	19%
Fillet only 	2,077 tonnes	28%

Figure 3. Estimated quantity of fish required for the PME each year if every student were provided with one fish meal per week, calculated using the methods described below.

The estimated quantity of raw edible fish required is based on: the number of students recorded in 2021³; the provision of 45g and 60g fish per meal for preschool (PE) and primary school (EB) students, respectively, as recommended in the PME Manual; and a school year of approximately 45 weeks. The estimated quantity of whole fish required is based on conversion proportions from whole to raw edible weight ('edible coefficients') of: 0.4 for processing methods that use fillets only and discard other fish parts; 0.6 for methods that include all edible flesh; and 0.9 for methods that include softening and grinding bones¹¹.



Preschool children enjoying a nutritious meal of fresh farmed tilapia in Ermera as part of the 'Fish in School Meals Pilot', implemented by the PADTL2 project.

Current use of fish in school meals

Several development partners are engaged in the production of fish and fish-based products and/or supporting implementation of the PME with a focus on serving nutritious foods.

WorldFish

WorldFish Timor-Leste has been involved in various activities relating to fish-based product development and fish in school meals. From 2017 to 2020, WorldFish supported a women's group in Bobonaro to establish a microenterprise producing a fish-based seasoning powder. Over 7 months, 12.7 kg were produced, of which 10.6 kg were sold at retail outlets in Dili, generating USD 232 profit. Challenges included transport to market, business skills and confidence, as well as group cohesion. Production has continued intermittently with some external support. In 2023, nutrient content analyses by CSIRO Australia on three fish powders produced in Timor-Leste, including one with farmed tilapia, showed relatively consistent nutrients profiles with high levels of protein, calcium, iron and omega 3. Also in 2023, the Partnership for Aquaculture Development in Timor-Leste Phase 2 (PADTL2)¹² project, piloted the supply of locally farmed fresh tilapia to 10 schools in Ermera over 4 months with the PME. The pilot was designed to document opportunities for and constraints to including fresh fish in school meals. Over 1,000 students received one nutritious fish dish per week after school cooks were trained using a purposely developed cookbook featuring tilapia recipes.¹³ The supply of locally produced tilapia to schools used an innovative distribution system comprising cool boxes on motorbikes, and has contributed substantially to the municipal economy. Challenges included a lack of refrigeration at schools, delivery to remote schools with poor road accessibility, limited availability of ice and the substantial time required for school cooks to clean and prepare the fresh fish.

PARCIC

PARCIC has been involved in promoting rural agribusiness in Timor-Leste since 2002, and specifically in supporting women's food processing activities since 2008. From 2019 to 2022, PARCIC implemented a project to produce a fish-based seasoning powder, *Furikake*, for use in school meals in Dili and Ermera municipalities. A dedicated facility was built in Bikeli on Atauro Island to produce the powder and generate income for women from coastal communities. The powder is made from local ingredients: whole dried fish (including bones), moringa leaves, sesame, salt, galangal and turmeric. Laboratory analyses indicated high nutrient content and aflatoxin levels within accepted limits. Challenges experienced during the project were production capacity at the Atauro facility as well as lack of nutrition awareness at the school level, where decisions on menu and ingredients are made. PARCIC has since facilitated a collaboration with CARE International to produce the powder for school meals in 4 municipalities.

CARE International

Since 2018, CARE International in Timor-Leste with partners Mercy Corps and Water Aid have implemented an Integrated Education and Nutrition Program, HATUTAN, that seeks to improve literacy outcomes for students and increase use of improved health and nutrition practices in schools and communities in Ainaro, Ermera, Manatuto and Liquiçá municipalities and the Special Administrative Region of Oe-Cússe–Ambeno. The HATUTAN Program is funded by

the U.S. Government through the United States Department of Agriculture. The donated and locally procured food commodities supplement the PME at the start of the school year. During 2023, the program supported 29 preschools (1,553 students) and 155 primary schools (33,515 students) with local and regional protein-enriched commodities to complement students' carbohydrate-rich diets at home. Meals for preschool students consist of 50g rice, 30g beans, 20g peanuts and 2g fish powder, while that of primary students consist of 100g rice, 50g beans, 30g peanuts and 3g fish powder. In 2023, 6.15 tonnes of fish powder were served, with approximately two tonnes sourced from the PARCIC-supported Atauro facility and four tonnes imported from Indonesia. Preliminary before and after literacy testing suggests the program has resulted in substantial gains in learning outcomes for students.

Mercy Corps

In 2023, Mercy Corps was contracted through the PADTL2 project, implemented by the Timor-Leste Government and WorldFish, to develop the 'Fish for Improving Nutrition Cookbook'¹³. The cookbook is a practical tool designed to support households and public institutions, such as schools and hospitals, to serve delicious and nutritious meals that include fish – in particular, tilapia. Showcasing 12 recipes, the cookbook depicts recipes step-by-step through photographs. Several pilot tests with 69 end-users, including school cooks, private sector meal providers to hospitals and household members of aquaculture producers, helped to refine the recipe guidelines. Learnings include the importance of providing flexible ingredients for recipe making, while challenges to prepare fish in schools meals include concerns around fish bones, time required to clean, and fish affordability and availability. Dried fish flakes or *ikan abon* – a tasty fish-based product that lasts for 3-months without refrigeration – was the most liked recipe among participants.

World Food Programme (WFP)

The WFP in Timor-Leste is working with the Timor-Leste Government and the World Health Organisation (WHO) to support various activities relating to the school meals program. Activities include the introduction of fortified rice in Baucau, Bobonaro, and Manufahi municipalities, upgrades to school kitchens to improve cooking hygiene and the development of a recipe book in collaboration with Agora Food Studio to aid school meal preparation¹⁴. Fish is included in several of the recipes, which have been designed to be specific to each municipalities and based on local ingredients. In addition, the WFP and WHO program 'Say No to the 5 Ss' – Starvation, Skin infection, Soil transmitted helminths, Smoking and Sugar/Alcohol drinking – includes school-based actions relating to children's nutrition and health.



Including fish in school meals: Key discussion topics and priorities

Several topics relating to inclusion of fish in school meals emerged through workshop discussions. The topics identified as highest priority to discuss and address going forward were linking schools with suppliers, food safety and hygiene, fish supply and providers'/suppliers' skills and knowledge. Summaries of the opportunities, challenges and identified research needs related to each topic, as discussed during the workshop, are presented below.

Discussion topics	% votes
Linking schools with suppliers	18
Food safety and hygiene	17
Fish supply: marine and pond production	13
School and provider knowledge and capacity on fish supply and preparation	12
Fish distribution: transport, refrigeration	11
Coordination: national, municipality, school and community	9
Types of fish and fish products by municipality	8
Price/affordability	6
Market linkages	3
Livelihoods and incomes of producers	1
Food security: production, distribution, transport and utilisation	1
Fish seasonal calendar	1

Table 1. Ranking of topics on the inclusion of fish in school meals emerged during the workshop discussions.

1. Linking schools to suppliers

Including fish in school meals has the potential to contribute to children's nutrition and improve learning outcomes. The administrative arrangements to implement the PME are in place: funds to supply the meals are provided by the Ministry of State Administration and are managed at the school level by the Meal Management Team (EJR, *Ekipa Jestaun Refeisaun*). This creates a reliable economic opportunity for fisheries actors to increase production and income by enabling the development of contracts between producers, traders or suppliers and schools. However, realising this opportunity requires suppliers that can deliver fish in reliable quantities and quality. It is also challenged by the high cost of fish as well as fluctuations in the availability of fresh fish due to seasonal fishing conditions and lack of permanent fish trading locations. A lack of fridges or freezers limits schools' ability to store fresh or frozen products. Unrefrigerated fish-based products provide ways to overcome challenges with fluctuating supply and cold storage. There is a need for research on such novel production and distribution activities to help guide strategies for how schools in different locations can best obtain a reliable supply of fish or fish-based products throughout the year.

2. Food safety and hygiene

Eating fresh fish that comes from a clean sea and tastes good is widely enjoyed by many people in Timor-Leste including children, and the health and nutritional benefits are increasingly recognised. There are fishers, fish farmers and fish traders involved in the local industry and good market demand.

However, fish handling and processing is challenged by access to clean water and equipment in schools, knowledge on how to select and prepare fresh fish as well as personal hygiene practices. Allergies and food taboos, as well as widespread concerns about fish bones when served to children, must also be considered when promoting fish in school meals. The development of a targeted program to monitor and improve practices in production and distribution could assist to improve fish safety and hygiene. This could also include development of laboratory facilities for investigating and monitoring food poisoning occurrences, which have occurred in schools in the past. Developing fish-based products that do not require refrigeration and exclude or grind down bones presents an opportunity to overcome some of the current distribution, storage and food safety challenges. Fish-based product development would benefit from further research on students' preferences (taste, texture, smell and colour), storage needs and shelf-life, nutrient composition over time, as well as methods that minimise potential contamination.

3. Fish supply

Including fish and fish-based products from domestic sources in the PME clearly requires increasing aquaculture production and marine harvest. This is a challenge that spans ecological constraints, fisheries capacity, governance and broader social and economic factors. Possible actions to address this includes the delivery of technical and financial services through collaborations between governments and their development partners. These services need to consider community interests, priorities, knowledges and resources, such as water and infrastructure. There are also clear opportunities for scaling tilapia aquaculture, based on the sustainable production model developed over a decade by PADTL 1 (2015–19) and Phase 2 (2020–24), which require significant investment in the sector. Tilapia can be stocked and harvested year-round in Timor-Leste through adjusting stocking and harvesting strategies. Cold storage and processing technologies that enable safe storage and preservation of nutritious species that occur seasonally in large quantities, such as small pelagic fish, may also assist to create a more reliable supply of fish for school meals year-round. Further research is also required on the productivity and abundance of fish stocks in Timor-Leste's coastal waters as well as the availability and species of fish sold in markets. Such research should build on information already available from past research and existing programs such as the national fisheries catch monitoring system, *Peskas*¹⁵.

4. School and provider knowledge and capacity on fish supply and preparation

There is a need for greater knowledge and capacity at the school and provider level on how to supply and prepare fish for school meals. Current challenges for schools and suppliers include lack of cold storage, insufficient fish supply and seasonal fluctuations, the high cost of fish, poor road infrastructure in some areas, lack of access to clean water, poor handling practices and limited nutrition knowledge. Producing and supplying processed fish products to schools has the potential to reduce preparation time for school cooks as well as food safety risks, particularly in inland schools where fish preparation knowledge is less commonplace. Research is required to support the development of recipes and processed fish products, which should seek to minimise trade-offs between nutritional content, convenience and price. Fish species and seasonal availability as well as palatability and taste preferences among students should also be considered.

Conclusions and next steps

The PME is an established program that spans national to municipality to school-level administrations. Within this program there is flexibility in menu planning recommendations to accommodate Timor-Leste's diverse, localised and largely informal food system so that safe and nutritious meals are delivered to all students. A similar strategy will be necessary for including fish in school meals because the quantity and species of fish available varies by season and location. Understanding this diversity, as well as current systems of fish trade and distribution, will help to inform the mosaic of approaches required to produce and supply fish and fish-based products to all PME schools across the country throughout the year. Addressing food safety and hygiene challenges, supporting nutrition education for PME implementers and suppliers, and ensuring continued coordination between government agencies and development partners will also be essential.

WorldFish and the General Directorate of Fisheries, Aquaculture and Marine Resources (DG-PARM) sought to convene this workshop with multiple government departments and organisations to create a shared understanding of the opportunities, challenges and research needs associated with including fish in school meals. The information summarised in this brief will be shared widely with relevant government and non-government organisations to promote its use in planning and future activities.

About the workshop

This brief summarises discussions and learnings from a workshop held in Dili on 7 November 2023. The workshop brought together government representatives and development partners to share experiences of using fish or fish-based products in the PME and to facilitate learning and connections across organisations. The workshop was attended by 32 participants (19 women and 13 men) and comprised both presentations and small-group discussions.

To set the context and to develop a shared understanding about the current use of fish in school meals in Timor-Leste, the morning session was dedicated to presentations from government representatives and organisations about the PME program, fish supply in Timor-Leste and activities carried out to use or trial fish in the PME. In the afternoon session, workshop participants identified key topics for further discussion from presentations and comments made in plenary. Participants were each given five votes to collectively identify the priority topics for further discussions. The top four topics, ranked by counting the number of votes received, were selected for small group discussions focused on identifying opportunities, challenges and

research needs. Discussion notes were made on flipcharts and presented back to all participants for further input and validation – summaries of these discussions are presented in this brief. The different professional backgrounds of participants provided a broad overview of topics; however, these may not be exhaustive. Similarly, while efforts were made to include all relevant agencies and organisations, there may also be others engaged in similar activities who did not participate at the workshop.

Notes

- 1 National Directorate of Fisheries and Aquaculture (2013) Timor-Leste National Aquaculture Development Strategy 2012–2030. Ministry of Agriculture and Fisheries. <https://hdl.handle.net/20.500.12348/861>.
- 2 Decree-Law No. 61/2022 approving the School Feeding Programme on 24 August 2022. <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC211807/>
- 3 Ministry of Education (2021) Number of Students 2021: District-wise by education level, by school type and by gender. Ministry of Education. Available from: <https://www.moe.gov.tl/me/projetu-best/summary/8-dadus-estatistiku/253-0-number-of-students-district-wise-by-education-level-by-school-type-andby-gender-2021>
- 4 INETL (2023) Main Report Timor-Leste Population and Housing Census 2022. Timor-Leste National Institute of Statistics (INETL). Available from: <https://inetl-ip.gov.tl/2023/05/18/main-report-timor-lete-population-and-housing-census-2022/>
- 5 MoEYS and MSA (2023) Manual Implementasaun Programa Merenda Eskolár [Implementation Manual of School Meals Program]. January 2023, second edition. Dili: National Directorate of School Social Action and Hygiene, Ministry of Education, Youth and Sports (MEYS) and National Directorate of Municipal Finances, Ministry of State Administration (MSA).
- 6 Tilley A, Dos Reis Lopes J, Wilkinson SP (2020) PesKAAS: A near-real-time, open-source monitoring and analytics system for small-scale fisheries. PLOS ONE 15(11): e0234760. <https://doi.org/10.1371/journal.pone.0234760>
- 7 GDS, MoF and MAF (2020) Timor-Leste agriculture census 2019: national report on final census results. General Directorate of Statistics (GDS), Ministry of Finance (MoF) and the Ministry of Agriculture and Fisheries (MAF).
- 8 Data provided by CRS–TOMAK and WorldFish in 2022.
- 9 GDS (2022) External Trade Statistics 2022. General Directorate of Statistics (GDS). Available from: <https://inetl-ip.gov.tl/2023/05/12/annual-trade-statistics-2022/>



¹⁰ Pant J, Thilsted SH, Teoh SJ, Gomes S, Byrd KA, Jesus LSD, Duarte A and Kam SP. (2020) Making land-based aquaculture in Timor-Leste nutrition-sensitive. Penang, Malaysia: WorldFish. Program Brief: 2020-23. <https://hdl.handle.net/20.500.12348/4313>

¹¹ Edible coefficients obtained from typical species (or similar) caught in Timor-Leste from FAO and WorldFish publications: (1) Torry Research Station (1989) Yield and nutritional value of the commercially more important fish species. FAO Fisheries Technical Paper. No. 309. FAO: Rome; and (2) Bogard JR, Bonis-Profumo G, Ximenes I do R, Alves Almeida CJ, Gomes M, Burgos A and Boylan S. (2023) Measuring aquatic food consumption in the first 1000 days: An approach to estimating portion sizes in Timor-Leste. Technical Report: 2023-27 WorldFish: Penang. <https://hdl.handle.net/20.500.12348/5634>

¹² The PADTL2 project is funded by the Ministry of Foreign Affairs and Trade (MFAT), New Zealand (2020–2024), with complementary funding from USAID (2021–23), implemented by WorldFish in partnership with the Ministry of Agriculture, Livestock, Fisheries, and Forestry. The PADTL2 project focuses on increasing availability, accessibility, and consumption of farmed fish through a holistic approach.

¹³ Mercy Corps and WorldFish (2023) Fish for Improving Nutrition Cookbook. Penang, Malaysia: WorldFish. Booklet: 2023-55. <https://hdl.handle.net/20.500.12348/5658>

¹⁴ WFP, Agora Food Studio and Government of Timor-Leste (2023) Timor-Leste School Feeding Recipe Book. <https://www.wfp.org/publications/timor-leste-school-feeding-recipe-book-2023-reseita-merenda-eskolar>

¹⁵ Further information on Peskas and the latest fisheries production data in Timor-Leste is available at <https://timor.piskas.org/>.

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