



COMMITTEE ON FISHERIES

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AQUATIC FOOD SYSTEMS AND UTILIZATION: A NUTRITIONAL AND FOOD LOSS AND WASTE APPROACH

Executive Summary

This document reviews the vital role of aquatic food systems in nutrition, food security and livelihoods. Aquatic foods, particularly fish, are recognized as a unique source of essential fatty acids, providing the micronutrients and protein many diets lack, especially in poor and vulnerable communities. However, food loss and waste within aquatic food systems undermines their sustainability, and by extension their contribution to food and nutrition security.

Suggested action by the Sub-Committee

- Provide guidance and advice on how to improve FAO's assistance to Members for increasing the role of aquatic foods in improving nutrition and food security;
- Propose sustainable actions on how FAO could assist Members in improving the trade of sustainable aquatic foods as a tool in combating malnutrition and hunger;
- Note the importance of the Voluntary Code of Conduct for Food Loss and Waste Reduction (CoC) and the role it can play in contributing to food loss and waste (FLW) reduction;
- Provide guidance on how to support Members in FLW reduction, including applying the CoC.

INTRODUCTION

1. Diverse aquatic food systems play an important role in nutrition, food security and livelihoods. They provide sustainable food and are considered more supportive of sustainable animal food systems.^{1,2,3} Consumption of aquatic foods provides essential fatty acids, vitamins, minerals and protein for human nutrition that are crucial to the food security of certain countries. Furthermore, aquatic foods are a traditional and culturally important part of many diets. Considering the growing global population, demand for aquatic foods is expected to continue to increase, but with differing national and regional trends. As an example, Africa is the only region where the per capita consumption of aquatic foods is expected to decline over the next decade.⁴

2. Trade in fisheries and aquaculture products provides an important source of income for many countries, particularly developing countries. While exports from some developing countries consist of high economic value species, with significant income generated, in other developing countries exports can consist of species of lower economic value, including small pelagic fish used in reduction fisheries to produce fish-based feeds.^{5,6}

3. Small pelagic fish provide high levels of essential fatty acids and micronutrients, especially when eaten whole with heads and bones. Prioritizing these nutritious fish for direct human consumption and repurposing micronutrient-rich by-products such as frames, bones and viscera, and diversifying consumption beyond high-value, high-trophic species can all contribute to improved nutrition, reduced food loss and waste (FLW) and more sustainable food systems.

AQUATIC FOODS FOR NUTRITION

4. Fisheries and aquaculture products have always been regarded as good sources of protein. There is increasing awareness that aquatic foods are high in essential vitamins and minerals and unique sources of long-chain omega-3 fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are major building blocks of our neural system. Aquatic foods are among the only natural sources of iodine, iron and zinc. Fish are an important source of these nutrients, particularly when eaten with bones, as is often the case for small fish species.

5. Experts agree that the consumption of fisheries and aquaculture products, particularly oily fish, is essential for the proper development of children's brain and neural system, as omega-3 fatty acids in the form of DHA is needed to ensure cognitive development.

¹ Ahern, M., Thilsted, S.H. & Oenema, S. 2021. The role of aquatic foods in sustainable healthy diets.

Discussion paper. [unnnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN.pdf](https://www.unnnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN.pdf).

² Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T. *et al.* 2019. Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170): 447–492.

³ Hilborn, R., Banobi, J., Hall, S.J., Pucylowski, T. & Walsworth, T.E. 2018. The environmental cost of animal source foods. *Frontiers in Ecology and the Environment*, 16(6): 329–335.

⁴ OECD-FAO Agricultural Outlook 2021–2030, OECD Publishing, Paris. [fao.org/documents/card/en/c/cb5332en](https://www.fao.org/documents/card/en/c/cb5332en).

⁵ Ahern, M., Thilsted, S.H. & Oenema, S. 2021. The role of aquatic foods in sustainable healthy diets.

Discussion paper. [unnnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN.pdf](https://www.unnnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN.pdf).

⁶ Hicks, C.C., Cohen, P.J., Graham, N.A.J., Nash, K.L., Allison, E.H., D'Lima, C., Mills, D.J., Roscher, M., Thilsted, S.H., Thorne-Lyman, A.L. & MacNeil, M.A. 2019. Harnessing global fisheries to tackle micronutrient deficiencies. *Nature*, 574(7776): 95–98.

6. Micronutrient deficiencies affect hundreds of millions of people, particularly women and children in the developing world. The World Health Organization (WHO) estimates that 40 percent of pregnant women and 42 percent^{7,8,9} of children under five years of age are anaemic, partly due to iron-deficient diets. Vitamin A deficiency persists in Africa and South Asia, and nearly half of all children are affected by zinc deficiency.⁹ Rural diets in many countries may not be adequately diverse. Diverse diets have been shown to support adequate micronutrient intake through the consumption of a variety of foods. Diets in rural areas are often characterised by high consumption of cereal crops, with lower consumption of nutrient-rich foods such as aquatic foods, fruits and vegetables.

7. Consumption of aquatic foods is particularly beneficial during foetal development and infancy. Aquatic food consumption contributes to improved maternal dietary diversity, balanced breastmilk composition during pregnancy and lactation, positive birth outcomes, improved cognitive development, reduced stunting and reduced severe acute malnutrition, as well as higher intelligence quotient (IQ), improved school and work performance, and reduced all-cause mortality, including reduction of the levels of blood pressure and cholesterol, and the risk of death from coronary heart disease.¹⁰

AQUATIC FOOD SYSTEMS AND TRADE OF FISH

8. The increasing demand for aquatic foods is linked to advances in technology and expansion of trade that have facilitated the dramatic growth of aquaculture. In some low-income countries, monoculture fish production has had negative consequences for nutrition, as consumption has shifted from small fish species. Aquaculture can make diets more nutritious if it focuses on diversified or combined production, such as polyculture of carp and small fish species.

9. Demand and trade for small pelagic species have increased in some regions, partially due to greater awareness of their exceptional nutritional value. Examples of this include Mola (*Amblypharyngodon mola*) in Bangladesh and Dagaa (*Rastrineobola argentea*) and Kapenta (*Limnothrissa miodon* and *Stolothrissa tanganicae*) in southern Africa. Significant volumes of Dagaa, for example, are being traded intra-regionally, providing nutritious food to people in countries far from where they are caught. At the same time, robust demand from the aquaculture and agriculture sectors has made small pelagic fish a valuable feed ingredient, diverting production from direct human consumption.

10. A growing share of fisheries and aquaculture production is processed into different product forms. By-products can represent between 30 and 70 percent of the live weight of inputs.¹¹ Due to international demand and the increasing importance of international trade, many countries export the higher value parts of the fish while directing less valuable by-products such as heads, viscera, and back-bones to local markets. From a nutritional point of view, by-products can, in many cases, be of higher value than the main product, particularly in terms of essential fatty acids and micronutrients such as minerals and vitamins. At the industrial level, these by-products are further processed into fishmeal and fish oil, primarily for feed purposes, and therefore indirectly contribute to food security.

11. The increasing global demand for fish oil as a nutritional supplement has made it profitable to extract fish oil from by-products such as tuna heads. Fishmeal and fish oil are internationally traded products. They constitute an important source of revenue for some countries and an essential feed

⁷ Although other reports suggest that the percentage of children in low- or middle-income countries under five years of age suffering from anaemia could be as high as 60 percent.

⁸ Victora, C.G., *et al.* Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. *Lancet* 2021; 397(10282):1388–99.

⁹ Global Nutrition Report. 2021. 2021 Global Nutrition Report. Development Initiatives. globalnutritionreport.org/reports/2021-global-nutrition-report/.

¹⁰ Ahern, M., Thilsted, S.H. & Oenema, S. 2021. The role of aquatic foods in sustainable healthy diets. Discussion paper. unnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN_.pdf.

¹¹ Estimated from certain industrial processing.

ingredient for the aquaculture sector, the fastest-growing food production system globally. At present, more than 31 per cent of the raw material for producing fishmeal and fish oil comes from by-products and waste rather than whole fish.¹² The majority of fishmeal and fish oil is still obtained from wild fish, particularly small pelagics, although processing by-products into fishmeal and fish oil is becoming increasingly significant.

12. By-products can be processed into valuable foodstuffs for direct human consumption. For example, there is growing attention to using underutilized aquatic foods such as whole small fish and by-products¹³ in food-based approaches to improve school meals. These programs have the potential to offer a regular market for locally procured fisheries resources to reduce FLW while also delivering nutrient-rich meals to schoolchildren who may suffer from one or more micronutrient deficiencies.^{14,15} Mineral supplements can be made from fish bones, although this is not currently widespread. Pilot production of a fish bone-based mineral product showed high levels of most essential minerals, particularly zinc, iron, and calcium. The product was tested in traditional school feeding meals and was highly appreciated by the school children.

FOOD LOSS AND WASTE IN FISHERIES AND AQUACULTURE

13. FLW in the fisheries and aquaculture sector is a significant issue for sustainable food systems, irrespective of the country's economic status, the scale of fisheries or value chain complexity. It is estimated that 35 percent of fisheries and aquaculture production intended for human consumption wasted every year. In most regions of the world, total FLW lies between 30 percent and 35 percent.¹⁶ FLW affects the sustainability of aquatic food systems, leading to negative impacts on the economy, food security and nutrition, and the environment.

14. FLW occurs throughout fisheries and aquaculture value chains, from harvest to final consumption. FLW can result from direct causes when at specific stages of the food supply chain, secondary causes across the food supply chain, and systemic causes involving the entire food system.¹⁷

15. Direct causes include inadequate inputs in production operations; poor scheduling and timing of harvesting operations; inappropriate production, harvesting, and handling practices; poor storage conditions and temperature management; inadequate conditions and marketing techniques at the retail stage; poor practices of food service providers and poor consumer practices during food purchase, preparation or consumption.

16. Secondary causes of FLW include inadequate availability of appropriate equipment, transport and storage capacity; poor organization, coordination, and communication between food supply chain actors; inadequate infrastructure; and unsuitable conditions, practices, and actions in downstream stages of the food supply chain. Other secondary causes arise from insufficient information, inability to anticipate market conditions, excessively stringent quality standards imposed by processors, retailers, or target markets, and confusion arising from the limited understanding of different food date labels.

17. Systemic causes refer to the development of secondary and direct causes of FLW along the food supply chain. Systemic causes include inadequate institutional, policy and regulatory frameworks required to facilitate the coordination of actors, enable investments and support improved practices along the food supply chain.

¹² iffo.com/update-product-marine-ingredients.

¹³ For example, tuna frames ground into powder.

¹⁴ Ahern, M.B.; Thilsted, S.H.; Kjellevoid, M.; Overå, R.; Toppe, J.; Doura, M.; Kalaluka, E.; Wismen, B.; Vargas, M.; Franz, N. (2021). Locally-Procured Fish Is Essential in School Feeding Programmes in Sub-Saharan Africa. *Foods* 2021, 10, 2080. doi.org/10.3390/foods10092080.

¹⁵ fao.org/3/cb7960en/cb7960en.pdf

¹⁶ fao.org/3/ca9229en/ca9229en.pdf.

¹⁷ fao.org/3/i3901e/i3901e.pdf.

FOOD LOSS AND WASTE REDUCTION

18. The magnitude, impact and causes of FLW, along with the behaviour of various actors, must be fully understood to design and implement solutions efficiently. FLW reduction requires a multi-dimensional and multi-stakeholder approach that considers the factors affecting national capacities in loss prevention, supportive policies, legislation, skills, knowledge, services, infrastructure and technology. It is imperative to understand how these different factors interact in a given context in order to provide effective solutions for FLW. The design and implementation of FLW solutions must take into consideration the influence of location, species, climate, gender and culture.

19. It should be emphasized that reducing FLW can reduce pressure on aquatic resources and improve resource sustainability and food and nutrition security. Reducing FLW would lead to more sustainable food systems and positive economic, social, and environmental outcomes.

HIGHLIGHTS AND RECENT DEVELOPMENTS

20. In 2021, UN Nutrition released a report on the role of aquatic foods in sustainable healthy diets,¹⁸ which aims to build consensus on the role of aquatic foods in sustainable healthy diets, presenting the breadth of evidence available to inform and steer policy, investments, and research to make full use of the vast potential of aquatic foods in delivering sustainable healthy diets and meeting the Sustainable Development Goals (SDGs). One of the report's recommendations for ensuring a sustainable supply of diverse and nutritious aquatic foods is to reduce FLW.

21. In 2021, the 42nd Session of the FAO Conference endorsed the Voluntary Code of Conduct for Food Loss and Waste Reduction (CoC),¹⁹ which was developed through an inclusive process under the overall direction and guidance of the Committee on Agriculture Bureau. The CoC provides a set of internationally recognized, nationally adaptable guiding principles and standards for responsible practices to effectively reduce FLW, including through the valorisation of non-edible parts, by-products and material that leaves the food supply chain as FLW. At the same time, it promotes sustainable and inclusive agricultural and food systems, aiding a broad approach to achieving sustainable development.

22. The FAO Strategic Framework 2022–2031²⁰ identified twenty Programme Priority Areas (PPAs) to achieve better production, better nutrition (BN), better environment, and a better life for all. While the FAO Blue Transformation PPA captures the bulk of activities carried out by the FAO Fisheries and Aquaculture Division, other PPAs as relevant to the utilization of aquatic food systems, including BN1: “Healthy diets for all” which aims to realize the right to adequate food by enabling equitable physical and economic access to safe, sufficient and diverse, and nutritious food for healthy diets for all, addressing all forms of malnutrition; and BN4: “Reducing food loss and waste” supports countries in identifying and overcoming the challenges of addressing FLW at scale, by adopting a multi-pronged, holistic approach to filling knowledge gaps, improving education and training, and advising on appropriate regulatory frameworks and incentives, such as the farm to fork initiative, among others.

23. The COFI Declaration for Sustainable Fisheries and Aquaculture²¹, endorsed by the 34th Session of the Committee on Fisheries, included the following targeted actions:

¹⁸ Ahern, M., Thilsted, S.H. & Oenema, S. 2021. The role of aquatic foods in sustainable healthy diets.

Discussion paper. [unnnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN_.pdf](https://www.unnnutrition.org/wp-content/uploads/FINAL-UN-Nutrition-Aquatic-foods-Paper_EN_.pdf).

¹⁹ [fao.org/3/nf393en/nf393en.pdf](https://www.fao.org/3/nf393en/nf393en.pdf).

²⁰ [fao.org/3/cb7099en/cb7099en.pdf](https://www.fao.org/3/cb7099en/cb7099en.pdf).

²¹ [fao.org/3/cb3767en/cb3767en.pdf](https://www.fao.org/3/cb3767en/cb3767en.pdf).

- Ensure that fish are fully considered in national, regional, and global food security and nutrition strategies, and contribute to the long-term sustainability of food systems to eliminate hunger and address the triple burden of malnutrition and reduce diet-related diseases.
- Encourage the reduction of pre- and post-harvest loss and waste in the sector, including discards, by implementing internationally agreed standards through appropriate actions, including awareness building, education, and training, according to the national context, capacities, and priorities, in particular, safety and quality standards, to improve fish processing, distribution, and consumption, thereby also increasing the value of fish products in support of sustainable and inclusive ocean economies.