Towards Ensuring the Safety and Viability of Seafood: the Regional Guidelines on Cold Chain Management of Fish and Fishery Products in the ASEAN Region

Ong Yihang

Seafood is a perishable commodity that undergoes several chemical and biological changes immediately after capture or harvest. With inadequate temperature control protocols along the supply chain, the quality, and safety of the seafood could deteriorate. Adoption of proper cold chain management and monitoring at every stage of the supply chain is critical in order to extend the shelf-life of seafood and ensure its freshness, safety and economic value. In conformity to the need to ensure the safety and quality of fish and fishery products, the ASEAN-SEAFDEC Member Countries adopted in 2011, the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 that includes provisions calling for the ASEAN And SEAFDEC to: "*Optimize the utilization of catch from water to market by reducing post-harvest losses and waste to increase fish supply and improve economic returns through promotion of appropriate technologies and facilities along the supply chain*" (Resolution No. 20), and specifically, "*Introduce and provide support for the development and application of technologies that optimize the utilization of catches, reduce post-harvest losses, wastes and discards in commercial and small-scale fisheries and processing operations, through improved processing, facilities and infrastructure development, on-board and on-shore handling, storage, distribution and marketing if fish and fishery products*" (Plan of Action No. 58), and "*Promote and conduct training programs and develop training materials to upgrade the technical skills and competencies of personnel in the public and private sectors on fisheries post-harvest technology and food safety management system*" (Plan of Action No. 63).

In responding to such call, the Government of Singapore allocated funds for the implementation of a project aimed at creating a platform for the ASEAN Member States (AMSs) to share knowledge, experiences, and cost-effective technologies on cold chain management of seafood, and developing generic guidelines on cold chain management for fish and fishery products to serve as benchmark for the AMSs in developing their respective national guidelines. Implemented by the former Post-harvest Technology Centre of the Agri-Food and Veterinary Authority of Singapore (now the Marine Aquaculture Centre of the Singapore Food Agency) as the SEAFDEC Collaborating Centre for the programmes of the SEAFDEC Marine Fisheries Research Department (MFRD), the project on Cold Chain Management for Seafood involved assessment and pilot trials of cold chain management in the AMSs and consultation workshops, the results of which had been used to develop the generic guidelines on cold chain management.

Based on the definition provided by Codex Alimentarius Commission (2008), cold chain denotes the continuity of successively employed means to maintain the defined temperatures of foods from harvest to market, *i.e.* from receiving, processing, transporting, storing, until retailing of the seafood. Cold chain is a temperature-controlled supply chain that encompasses maintaining the temperature of perishable goods, such as seafood (Emond, 2008), and where the quality, safety, and traceability of food products could be guaranteed through the adoption of a desirable cold chain management (Lailossa, 2015).

The ASEAN Member States (AMSs) are among the world's major producers of fish and fishery products, contributing a total of about 22 % to the world's total fisheries production in 2017. According to FAO (2017), fish and fishery products are the world's most traded food commodities, of which about 38.9 % (live weight equivalent) of Asia's total fisheries and aquaculture production entered the export market in 2016. Considering that seafood consisting of fish and fishery products, is temperature sensitive and highly perishable where deterioration occurs almost immediately following catch or harvest, cold chain management is an essential tool in maintaining and ensuring the quality, safety and economic viability of seafood. Deterioration in seafood could occur through microbiological metabolism, oxidative reactions, and enzymatic activity, accelerated by inadequate temperature control. Proper cold chain management should therefore be practiced to ensure the quality, safety and commercial viability of fish and fishery products. From post-harvest handling, receiving, processing, packing, transporting, to retailing of aquaculture produce or wild catch, it is essential to ensure there is no breakage in the cold chain while the application of ice, use of refrigerated seawater, storage in refrigerated facilities, and chilling or freezing, should be practiced to ensure that the seafood is kept under the cold chain throughout the supply chain, which must also be supported by good and hygienic handling facilities and practices.

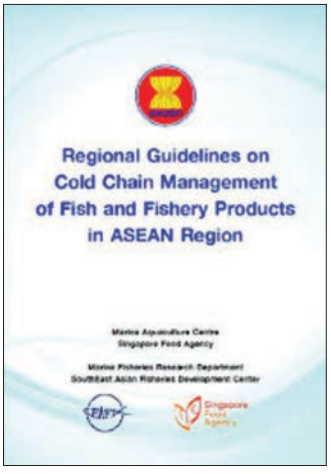
During the implementation of the Project, it was noted that the fisheries industry players in the Southeast Asian region had been confronted with many challenges in the implementation of a cold chain system. Firstly, most of the players are small-medium enterprises with limited access to technologies and appropriate facilities, and insufficient knowledge of cold chain management practices. Furthermore, many fisheries

supply chain systems in the region involve individual players operating as single entities. Thus, even if facilities and technologies are available to apply cold chain management in the handling of seafood, problems arise in maintaining the system throughout the supply chain. Most significantly, the adoption of cold chain management practices is still voluntary in most of the AMSs and not yet enforced as a general policy.

Regional Guidelines on Cold Chain Management of Fish and Fishery Products in ASEAN Region

The development of the Regional Guidelines is the main output of the MFRD Project on Cold Chain Management of Seafood, based on the results of the series of participatory and consultative processes and workshops involving fisheries officials from the ASEAN-SEAFDEC Member Countries, as well as those of the cold chain trials that were conducted in each AMS. Adopted by senior fisheries officials from the AMSs during the End-of-Project Meeting in April 2018 in Singapore, the Regional Guidelines is meant to serve as a common platform and reference for the AMSs when implementing cold chain management for their fish and fishery products. Moreover, the Regional Guidelines is also intended to serve as a reference for best practices in cold chain management for raw and minimally processed chilled and frozen fish and fishery products to ensure safety, quality, and wholesomeness of such products, taking into consideration the capabilities of the various players in the fisheries industry of the Southeast Asian region.

The Regional Guidelines (SEAFDEC/MFRD, 2019) covers the application and observation of time and temperature control protocols for the cold chain management of raw and minimally processed chilled and frozen fish and fishery products, along the stages of post-harvest handling, chilling, receiving, processing, freezing, glazing, packing, cold storage, transport and distribution in retail and wholesale markets. Comprising five (5) chapters and annexes, the Regional Guidelines (**Box 1**) include an introduction that comprises the scope and overview, definitions of terms used in the Guidelines, and a generic flow chart on the cold chain for fish and fishery products (**Figure 1**) in the first three chapters. The introductory chapters provide the basic understanding of the elements and focus of the Regional Guidelines. The fourth chapter (**Box 2**) focuses on the actual guidelines, highlighting the points at which cold chain management should be implemented, and how it can be implemented by the AMSs. Critical points, as well as common challenges faced are also listed in the chapter, along with potential solutions. The next chapter comprises the Annexes containing information on controlling and monitoring techniques, as well as technologies and microbial limits on materials used in the implementation of cold chain management. The final chapter shows the references used in drafting the Regional Guidelines.



Box 1. Main features of the Regional Guidelines on Cold Chain Management of Fish and Fishery Products in the ASEAN Region

1. Scope and Objective
2. Definition of Terms
3. Generic Flow Chart on Cold Chain for Fish and Fishery Products (**Figure 1**)
4. Production (**Box 2**)
   a) Post-Harvest
   b) Receiving
   c) Chilling
   d) Processing
   e) Freezing
   f) Glazing
   g) Packing
   h) Storing
   i) Transport and Distribution
   j) Retailer and Wholesaler
5. Skills and Knowledge
6. Annexes
   a) Chilling Methods
   b) Temperature Monitoring Methods
   c) Checklist on Temperature Monitoring
   d) Different Types of Freezing Techniques
   e) Thawing Methods
7. References

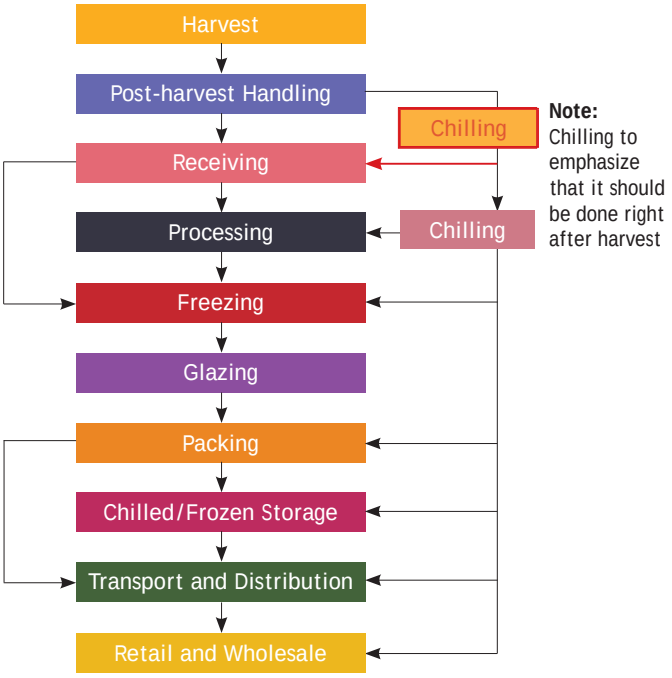


Figure 1. Generic Flow Chart on Cold Chain for Fish and Fishery Products

Box 2. Brief summary of the practices in adopting the Regional Guidelines on Cold Chain Management

Includes tips for implementing the Regional Guidelines, and in ensuring that the products from post-harvest to markets are of good quality and safe for human consumption, the details of which are shown in the Guidelines

During the entire production processes, proper monitoring and recording of the time and temperature control protocols should be in place. For example, temperature of chilled fish and fishery products should be maintained between 0 to 5°C, while the core temperature of frozen fish and fishery products should be -18°C or below, and during processing for short periods, the temperature of fish and fishery products should not exceed 10°C, subject to national regulations.

a) Post-harvest *(includes on-board handling and harvest from aquaculture facilities)*: Adequate time and temperature control protocols for the fish and fishery products should be observed

b) Chilling: Fish and fishery products should be chilled using ice made from clean and potable water, and temperature maintained between 0 to 5°C

c) Receiving *(includes the good processes in collecting, storing and grading, and holding of fish)*: Measures in collecting, sorting and grading, and holding should be observed by handlers who are competent in product safety and quality evaluation techniques, facilities with adequate supplies (*e.g.* fish containers) provided, damages to the fish and fishery products avoided, and temperature control protocols properly observed throughout the processes which should be done with very minimal delays

d) Processing *(includes proper processes of washing and gutting, filleting/deboning, and thawing)*: Adequate time and temperature control protocols should be observed, and using adequate containers, temperature of fish and fishery products should be maintained at not more than 10°C during filleting and deboning, and at 0 to 5°C while thawing

e) Freezing: Should be done as quickly as possible following the time and temperature regime (at -18°C or below) using appropriate freezing equipment and capacity, and immediate transfer of frozen products to cold storage facilities

f) Glazing: Using chilled potable water, the entire surface of the frozen fish product should be covered with suitable protective coating of ice with no exposed areas where dehydration could occur

g) Packing: Should be done in the shortest time possible to ensure product is maintained within required temperatures, using materials that are clean, good, durable, of food grade, and sufficient for the intended use

h) Storing: Should be in accordance with temperature control protocols, *i.e.* for chilled fish and fishery products maintained between 0 to 5°C, and core temperature of frozen fish and fishery products at -18°C or below

i) Transport and Distribution: Before loading, fish and fishery products should be kept chilled or frozen while observing the time and temperature control protocols. Possible damages to fish and fishery products should be avoided. Therefore, the cleanliness, suitability and sanitation of the transport vehicles should be taken into consideration and during distributions, products should be protected from possible contamination, exposure to extreme temperatures and the drying effects of the sun or wind

j) Retailer and Wholesaler: Transfers should be done properly in the shortest time possible while following the time and temperature control protocols. Quick and proper unloading of seafood should be practiced upon receipt in the facilities using equipment that are clean. Handlers should keep fish and fishery products protected from external factors such as sunlight and pests while making sure products not conforming to descriptions in packaging should not be accepted. In addition, "first in first out" policy should be observed

Way Forward

Following the endorsement of the Regional Guidelines by the SEAFDEC Council of Directors during its Fifty-first Meeting in March 2019, the ASEAN Officials subsequently endorsed the Guidelines during the Meeting of the ASEAN Working Group on Fisheries (ASWGFi) in June 2019, the Special Senior Officials Meeting of the ASEAN Ministers on Agriculture and Forestry (SSOM-AMAF) in August 2019, and finally at the 41AMAF in October 2019. In order to support the adoption of the Regional Guidelines in the Southeast Asian region, MFRD would implement a new project on information sharing of the implementation of the ***Regional Guidelines on Cold Chain Management of Fish and Fishery Products in ASEAN Region*** under the ASEAN-JICA Food Value Chain Program.

References

Codex Alimentarius Commission. (2008). Code of practice for fish and fishery products. CAC/GL 69-2008; FAO, Rome

Emond J. P. (2008). The cold chain. ***In***: RFID technology and applications. Miles S. B., Sarma S. E., Williams J. R. (eds), Cambridge University Press; Chapter 11, pp. 1-2

FAO. (2017). Trade Policy Briefs No. 28 (October 2017). Retrieved from *http://www.fao.org/3/a-i8003e.pdf*

Lailossa G. W. (2015). The new paradigm of cold chain management systems and its logistics on tuna fishery sector in Indonesia. AACL Bioflux 8(3): 381-389

SEAFDEC/MFRD. (2019). Regional Guidelines on Cold Chain Management of Fish and Fishery Products in the ASEAN Region. SEAFDEC Marine Fisheries Research Department, Singapore; 15 p

About the Author

Mr. Ong Yihang is an Assistant Director at the Agri-tech & Food Innovation Department of Singapore Food Agency (SFA). He also concurrently holds the appointment as the Chief of Marine Fisheries Research Department (MFRD) Programmes under the Southeast Asian Fisheries Development Center (SEAFDEC). Prior to the re-organization of the Agri-food & Veterinary Authority of Singapore (AVA) into the existing SFA in April 2019, he was a Senior Scientist at the Post-Harvest Technology Department (PHTD) of AVA. At AVA, his research area includes food waste reduction through quality preservation and shelf-life enhancement, and food by-product recycling through value-addition into food and/or feeds. With his strong background in food technology, he and his team had successfully developed okara floss from okara and it was commercialized by a local manufacturer. Besides okara, his team has also successfully converted the Brewery Spent Grains, a by-product from beer processing into a Low Glycemic Index snack product. More recently, he has developed a range of value-added food products from fishery by-products from local aquaculture. He worked at Dessert Art – The Dessert Specialist as R&D Manager. Apart from his full-time job, he also gave night lectures (part-time) at the Institute of Technical Education for a year before he decided to further his research interest at AVA-PHTD.