

Briefing | Note

EPS & XPS Fish-Box Waste Cycle in the European Market

Executive Summary

The INTERREG funded OceanWise project (2018-2022) has developed a set of long-term measures to reduce the impact of expanded polystyrene (EPS) and extruded polystyrene (XPS), with the aim of reducing marine plastic litter and achieve better environmental outcomes in the European Atlantic. OceanWise research focuses on resource-efficiency, participatory methods, and circular economy principles to inform new and best practices in the use, manufacturing, recycling, and uptake of EPS and XPS.

EPS fish-boxes are a significant source of input for marine litter in the European Atlantic Area. This brief provides an overview of EPS waste (e.g. fish-boxes) for refrigerated fishery and aquaculture products in Europe and identifies where waste management and recycling interventions are required across the supply and distribution chain.

Introduction

EPS fish-boxes are the most widely used packaging material for the transport of fresh fish and seafood. As there are currently no viable alternatives for EPS fish-boxes, management interventions are required to prevent waste from entering the marine environment. This brief presents OceanWise findings on the waste cycle and users of EPS fish-boxes to inform best practice waste management and valorisation strategies.

EPS fish-box waste can be classified into three different categories; industrial, commercial, and household waste (see Box 1), with each category will requiring different management and treatment pathways.

Industrial Waste stems from industrial activity such as manufacturing, transformation, application, consumption, cleaning, or maintenance processes. Waste producers (the industry) have the legal obligation to correctly manage this waste by hiring a private waste manager for proper treatment.

Commercial Waste is generated by wholesale and retail commercial activity, catering services, cafes and bars, offices, and markets, and other service sector actors. The legal obligation on the treatment of the commercial waste belongs to the producer who must take care of it through a private waste manager or utilise municipal commercial waste systems where possible.

Household Waste is generated in households, and other urban services and industries engaging in similar activities and includes waste from cleaning public roads, green or recreational areas. Municipalities have the legal obligation to take care of household waste, so it is managed through the Municipal Waste Management System.

Box 1. EPS Fish-Box Waste Categories



EPS Packaging Manufacturing

EPS packaging manufacturers specialise in moulding EPS for the production of fish-boxes for commercial and industrial packaging. This process generates small amounts of EPS waste which must be managed by an authorised waste manager. However, if fish-boxes are not separated from other plastic materials it is more likely to be landfilled or used in energy recovery rather than recycled. Additionally, dirty EPS waste materials (EPS sweeps), are highly susceptible to becoming marine litter if not correctly managed and should be collected separately by an authorised waste manager.

Commercialisation & Distribution Channels

The **first level of the commercialisation and distribution channel** is comprised of processing companies, aquaculture, wholesalers, and logistic platforms for distribution. Waste management at this level is processed by authorised managers.

Aquaculture Companies distribute their products in EPS fish-boxes to logistic platforms, wholesalers, processing companies and retailers and depending on the company size they may have an inhouse packaging centre.

Waste: EPS broken boxes during packaging process.

Wholesalers distribute products in the original EPS packaging bought from fish auction markets and supply fresh fish to central markets, logistic platforms and distribution or processing companies.

Waste: EPS broken boxes.

Logistic Platforms receive products in EPS fish-boxes and then repackage the products for sale in new EPS boxes.

Waste: EPS broken boxes during packaging process.

Processing Companies receive raw materials in EPS boxes and repackage the product for sale in new boxes.

Waste: EPS broken boxes during packaging process.

The **second level of the commercialisation and distribution channel** is comprised of modern supply chains, small supermarkets, central markets of big cities (MERCAS – wholesalers), local markets (retailers) and retailers trading outside markets and the HORECA (hotels, restaurants and coffee shops). Waste generated at this level comes from different activities in addition to the fishing sector such as the distribution of fruits, vegetables and meat.

At this level, only wholesalers use EPS boxes for sale to retailers and HORECAs and in the case of the other categories, the final consumer receives the product in XPS and/or PET packaging. Here, the management of waste is under the competence of a public or private waste management company. These companies have both specific and non-specific waste deposition sites depending on the category of retail as detailed in Table 1 (below).

Waste Processing and Collecting		
Retailer Type	No specific Area	Specific Area
Large Chain Distribution Chains		Depending on volume of EPS waste collected
Medium sized Distribution Chains		Integrated into Municipal Waste Management System
Large Central Markets (MERCAS)	In medium or small cities	In large cities
HORECA		Integrated into Municipal Waste Management System

Table 1. Waste Processing and Collection

Waste Management

Waste generated in the first and second commercialisation levels is managed by an external waste manager, which covers collection, transport, recycling, treatment, and recovery. Depending on the country or region, a Municipal Waste Management System (MWMS) will cover household waste and an authorized private waste manager will cover commercial and industrial waste.

MWMS are the most established system for household waste collection and consist of three categories; door to door collection, kerbside collection, and drop-off points.

Private Waste Managers manage industrial and commercial waste and are in charge of processing EPS fish-box waste. If EPS waste is clean it is sent on to recycling processors and if not, it is sent to Material Recovery Facilities (MRFs) for incineration energy recovery.

Extended Producer Responsibility Schemes (EPR) are operated by MWMS and household waste is disposed in different containers for kerbside collection. EPS fish-boxes are not covered by these schemes as they are categorised as industrial/commercial waste.

Waste Treatment

Treatment and recovery are the last steps of the waste management chain. Treatment aims to maximise segregation of materials by quality. Recovery of waste means the processing of waste into new industrially useful products thus achieving circularity. Quantity of EPS waste recovered depends on collection and treatment:

- Briquetted clean EPS has a high market demand. It is sent on to recycling companies to process it. Most of industrial waste from processors and some of the commercial waste is managed this way.
- EPS from the plastic packaging fraction of MWMS managed by EPR schemes is dispatched to MRFs. EPR schemes only cover household packaging that has a low volume of EPS. Also, MRFs do not segregate a specific EPS/XPS fraction. EPS ends up mixed alongside other materials on the mixed plastic bale (MP).
- EPS on rest fraction containers managed by MWMS is mixed with different materials (organic waste included) and recovery and reuse levels are very low. It is treated for final disposal at landfills or incineration with energy recovery.
- Every treatment process (even recycling) produces a small reject fraction of nonrecovery material. This fraction is landfilled or use for energy recovery (waste to energy, WtE).
- Recycling companies are the last step of the management chain and specialize in processing EPS waste into new recycled products for industrial applications. EPS is 100% recoverable but the odour in fish-boxes poses a significant constraint for recyclers but new industrial processes are addressing this. The role of recyclers is crucial for preventing EPS loss and leakage into the marine environment and support the transition towards a circular economy.

Limitations to EPS Fish-box Recycling

- The barriers for recycling EPS fish-boxes are purity, cleanliness, and difficulty in recovering large volumes and transportation costs. The collection system of EPS waste limits its valorisation as it affects purity levels which are essential for the recycling process and final applications.
- Recycling EPS from fish-boxes have had some difficulties due to cleanliness and odours. Currently, these drawbacks are solved through various mechanisms like limiting the percentage ($\approx 30\%$) of waste used to development of new products, or specific cleaning processes to eliminate these difficulties (EEA Grant-EPS FISH)
- Food safety legislation forbids using recycled EPS in food contact applications, but there are projects that are trying to solve this limitation to increase the value of EPS waste (e.g. Life EPS-SURE Project).



Image source: EPS Household waste (Sorema)

Actors in Uptake of Recycled EPS

Industrial moulded EPS producers use commercial and industrial EPS waste and process it into ground form and use it for the production of new moulded products (e.g. insulation sheets, light bricks and concrete).

Producers of agglomerates and pellets from the mixed plastic fraction downcycle mixed plastics including EPS waste for the production of recycled material such as plastic wood for urban infrastructures (e.g. walkways, garden furniture).

At this level, only wholesalers use EPS boxes for sale to retailers and HORECAs and in the case of the other categories, the final consumer receives the product in XPS and/or PET packaging. The management of waste at this level is under the competence of a public or private waste management company. These companies have both specific and non-specific waste deposition sites depending on the category of retail as detailed in the table below.

Energy Recovery (WtE)

EPS waste from commercial and household sources which has not been recovered further up in the waste hierarchy is used for energy recovery. There is a fraction of EPS fish-boxes which are processed for WtE.

Landfill

Landfilling is one of the last options in the waste hierarchy for EPS, so waste that was not processed by MRFs is disposed.

Critical Intervention Points & Recommendations

- ✓ Reverse Logistics Systems .
- ✓ Implementation of separate collection for commercial waste.
- ✓ Implementation of selection of EPS fraction in Material Recovery Facilities.
- ✓ Increase municipal landfill rates.
- ✓ Creation of Recycling Areas in Large Central and Local Markets.
- ✓ Promote the use of good cleaning practices.

Waste Management Recommendations

- ✓ **Encourage** waste management authorities to simplify the process of licensing for waste management companies.
- ✓ **Promote** specific measures and protocols for cleaning and disinfection of EPS fish-box waste through EPS associations (e.g. ISO/CEN food safety standard).
- ✓ **Integrated** selective EPS collection at a municipal level for commercial waste in markets, fish auction markets and door-to-door collection systems.
- ✓ **Authorities** should clearly define household packaging and commercial packaging specifications.
- ✓ **Develop** legislation on EPS collection drop-off points to centralize the volume of collection and make its transport less costly.
- ✓ **Incorporate** mobile drop-off points with a weekly collection agenda.
- ✓ **Analyse** the EPR requirements established by Directive 2018/8522.
- ✓ **Encourage** the production of polystyrene bale for crystal PS, XPS and EPS to promote recycling uptake and valorisation.
- ✓ **Develop** plastic waste separation schemes to improve landfilling rates of EPS waste.
- ✓ **Implement** recycling areas in central markets for EPS waste separation.
- ✓ **Municipalities** should finance and install recycling infrastructure equipment (e.g. compactors, briquetting machines).
- ✓ **Create** an EPR scheme for commercial EPS waste.
- ✓ **Promote** the adherence of companies to Operation Clean Sweep and its certification scheme (e.g. ISO 14001).
- ✓ **Beyond** voluntary certifications, there should be legal requirements for the transport of EPS to avoid its leakage into the environment (e.g. industrial sweepers, bins with lids, external storages areas).

References

Cetmar, Sociedade Ponto Verde & Repak. 2022. OceanWise Project Report: EPS/XPS fish-boxes waste cycle through the European market. Available online at: www.oceanwise-project.eu

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