



# Baltic MUPPETS



# DELIVERABLE 3.1

## Report on the Mussel Production Line



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<b>Author</b>	Susanna Minnhagen (Ecopelag EF)
<b>Editor</b>	Reviewed by Maya Miltell and Sarah Tamulski (SUBMARINER Network)
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## 1. EXECUTIVE SUMMARY

Baltic MUPPETS is a three-year project funded under the Interregional Innovation Investment (I3) Instrument. It aims to create a new value chain for small mussels in the Baltic Sea region by developing high-value and healthy pet food products. The project will invest in innovative submerged farming, harvesting, and processing techniques, contributing to local economic growth and quality employment opportunities. Besides the socioeconomic benefits, mussel farming will provide a range of ecosystem services such as nutrient removal, improved water quality, and increased biodiversity.

This document outlines the Deliverable 3.1 Report on the Mussel Production Line, submitted by ECOPELAG AB. It describes the construction and installation of the new production line in the Baltic Sea Factory processing room in Västervik. This includes technical descriptions and adaptations of equipment, as well as further processing activities planned for the production line within the project.

## 2. INSTALLATION OF THE COOKER AND MEAT-SHELL SEPARATOR

In Spring 2023, Ecopelag AB began installing and testing a mussel cooker and meat-shell separation line from Kramer machines [CL100 Cooking line for shellfish - Kramer Machines Colijnsplaat](#) in a specially built process room in the Baltic Sea Factory in Västervik, Sweden. This was preceded by a procurement process. Quotes were requested from five different mussel processing machine manufacturers, from which two offers were received. The decision on which manufacturer to contract was made in December 2022.

The cooking line was modified by the manufacturer. Specifically, the perforated dimensions of the collector baskets were reduced. The purpose of this modification was to keep inside mussels that were smaller (1-4 cm) compared to conventional industry mussels (4-8 cm).



**Figure 1:** The mussel cooker and meat and shell separation line installed in the processing room at the Baltic Sea factory.

On-site scale drawing of the mussel processing line was followed by specification and installation of the necessary connection points (power, steam pipes, pressured air, water, drainage, chimney, and transport screw for separated shells) in the process room.

Renovations of the Baltic Sea Factory, including the construction of new interior walls, a new drainage trench, floor covering, a chimney outlet, laying of electrical cables, plumbing and electrical cabinets were completed during Spring 2023. This happened in tandem with Ecopelag AB's installation of the cooker and shell separator, also including a steam generator and steam pipes together with necessary safety equipment.

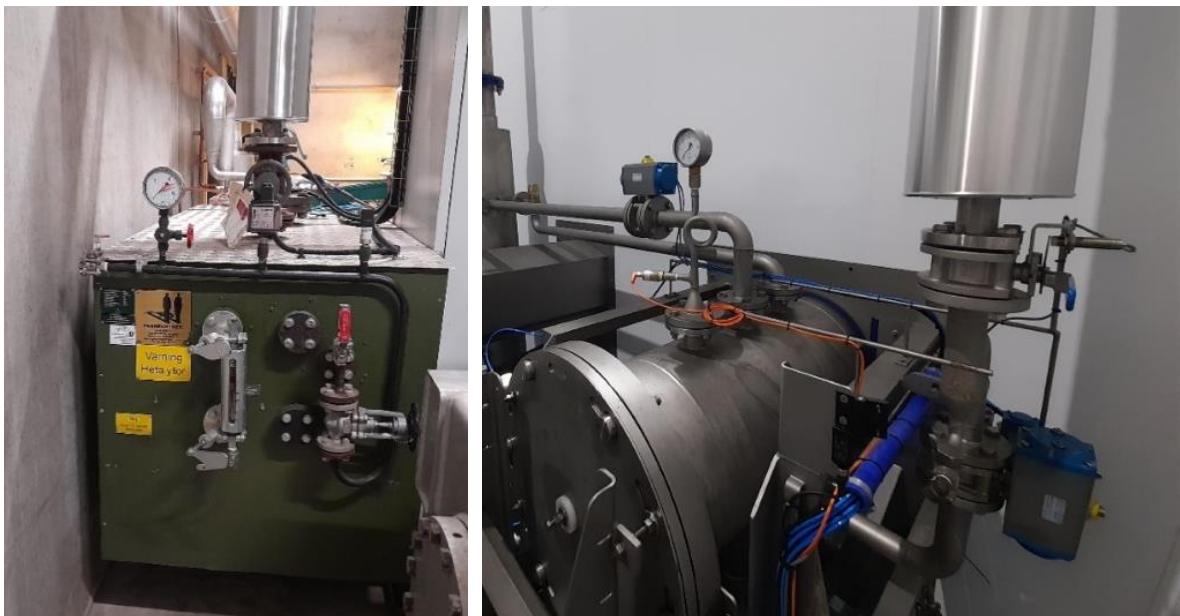
Installation of the mussel cooker and meat-shell separation line was successfully completed and tested in June 2023. The first pilot product, **freeze dried mussel pet snacks**, was prepared with the help of an external contractor in July 2023. This was followed by a second pilot, the production of dog pellets, by Kiel university in Oct 2023 using extruder technology.

[Click here to view to a video on the construction of the processing room and mussel shell separation line, including the first test-run in June 2023.](#)

## 1.1 Technical description

The mussel cooking line contains the following specific parts: Buffer-Dosing conveyor, transfer unit, pressure cooker with automated inlet/outlet, cooling-dosing conveyor, meat-shell brine separator, inspection conveyor, and a meat-washer container return system. The system is controlled by electrical and pneumatic switchboxes.

Steam is generated in an electrical steam-boiler model PP375 from Pannpartner AB (375 kW, 12 bar) placed in the machine room and connected to the mussel-cooker by welded steam tubes.



**Figures 2 & 3:** Steam is transferred from the steam generator (left), installed in a separate machine room, to the pressure boiler (right) in the process room.



### 1.1.2 The meat-shell separation process

Raw mussels transported by the buffer-dosing conveyor are collected in metal baskets and then pushed into the cooker. Pressure cooking shells the mussels and the baskets are emptied into a cooling bath after cooking, meat and shells mixed.

The mix then passes through a brine bath, water, and salt, with adjusted salinity so that the meat parts will float while the shells sink to the bottom. When the two pieces are separated, they continue in different directions. The shells are transported with a transport screw out of the processing room, while the meat continues through a water stream and several rinsing steps to an inspection band, before being collected.



**Figures 4 & 5:** Separated meat transported on the inspection band (left). The shells are transported with a transport screw out from the process room (right).

### 1.1.3 Production capacity

According to the technical data in the procurement documents, the cooking systems' production capacity is to process 2-3 tons of raw mussels per hour in wet weight. This capacity has not yet been reached, but observations suggest that the small size of the mussels is not a limiting factor. Production capacity will also depend on the time that the mussels must spend going through the separating brine bath and conveyers. This in turn depends on product requirement specifications.

## 1.2 Further adaptations

### Washer and Declumper

Most mussel processing includes pre-treatment steps such as mechanical washing, de-clumping, and de-byssing. De-clumping increases the efficiency of the meat-shell separation because clumps can hinder the shells from opening properly. However, declumping machines are generally designed for large mussels with strong shells. For small and more fragile mussels a prototype drum washer has been tested. This machine was originally designed for shrimps and has been modified by Kramer machineries <https://www.kramermachines.nl/> for the washing and declumping of small mussels.

### Scraper and desalination bath

At the end of the inspection conveyer, the separated mussel meat falls into a cool bath with running water. This pallet container, modified by Ecopelag, desalinates the meat and functions as a temporary cool storage before further processing. The mussel meat is transported on conveyer belts after the brine bath passing several rinsing steps. Since the meat is intended for feed production and not human food, it must reach an even lower salt content. Hence, a further desalination step has been added to the process.

The meat from the smallest mussels has the tendency to stick to the conveyor belts and not fall into the desalination bath at the end of the inspection band. This problem has been solved by mounting of a scraper that swipes off the smallest meat from the band and into the container.

## 3. FURTHER PROCESSING OF THE MUSSEL MEAT

From autumn in 2023 until present Ecopelag AB continued to test different processing techniques, bought additional equipment to compliment the first processing steps, and obtained necessary production permits. Presently, the process line in the Baltic Sea Factory can manufacture, pack, and sell two different feed-ingredients and one consumer-ready product. The feed-ingredients are:

1. Frozen separated mussel-meat, which is intended for bulk production (2.1), and
2. Dried mussel-meal (2.3)

There is also a complete processing line ready to manufacture freeze-dried pet snacks (2.2). It is planned to be launched in 2024.

### 2.1 Frozen separated mussel meat

From the cooking and meat shell separation line, the separated mussel meat is poured into block freezers. 32 frozen blocks of approximately 25-30 kg each are then packed on to EU-pallets and sealed with cover sheets and stretch film. Ecopelag AB will deliver this product to project collaborators and to contracted manufacturers for development and production of mussel-based pet food.





Figures 6 & 7: Block freezer with frozen mussel meat (left) and the packaging (right)

## 2.2 Freeze dried pet snacks

Premium separated mussel meat will be stored frozen on trays and then processed in a freeze-dryer from Wave Trockensysteme GmbH. A packaging line for freeze dried mussels will be set up, so that from this process line, the pet snacks will be packed, sealed, and labelled in their final consumer bags, designed for marketing and sale.



Figures 8 & 9: Freeze-dryer (left) and design of the pet-snack product packaging (right)

## 2.3 Dried mussel meal

Some of the separated mussel meat will be dried in a food dehydrator from Royal Catering, and then grind by a grain grinder from VEVOR. The mussel meal will be evaluated for feed production in a cooperation with the Swedish AX foundation, project [Framtidens foder för fågel, fisk och fläsk \(axfoundation.se\)](http://axfoundation.se). If approved it can replace fish meal, also in the production of pet feed.



**Image 10&11:** Mussels in the dehydrator (left). Grinder for pilot-scale mussel meal production (right)



**Image 12:** Pilot products from Ecopelag's processing of small mussels in the Baltic Sea Factory. Left: Freeze dried cooked and separated mussel meat. Right: Dried cooked and separated mussel meat.