Research report
APPENDIX 2
30.5.2025

Pidä saaristo siistinä ry (Keep the Archipelago Tidy Association)

# Research Report, Fishing Nets

-This is a translation of the Finnish report.

Interreg Co-funded by the European Union

Central Baltic Programme

Re:Fish

## 1. Background Information

The study focuses specifically on the composition and recyclability of plastic and metal components used in recreational fishing gear. It includes a detailed laboratory analysis of a fishing net sample weighing at least 10 kilograms, covering both material composition assessment and a comprehensive review of processes related to recycling potential. The material consists of end-of-life fishing gear collected from the Finnish archipelago during the summer of 2024. This research is part of the Re: Fish project (funded by Interreg Central Baltic), which addresses the issue of plastic pollution and ghost fishing in the central Baltic Sea.

## 2. Procedure

Three numbered boxes containing samples were received and opened. The contents were unpacked, the nets were separated from one another, and each was individually weighed. The results were recorded in Table 1.

Picture 1. Nets unpacked and separated

After weighing, the nets were suspended from hooks attached to the laboratory ceiling and spread out at working height. Using a utility knife, the upper and lower float lines, as well as the netting sections, were cut from each net. The separated components were then weighed, and the results were recorded in Table 1.

Picture 2. Net suspended at working height

| Box 2 | Total Weight | Netting | Float Lines |
|---|---|---|---|
| Net 1 | 854 g | 135 g | 684 g |
| Net 2 | 709 g | 101 g | 600 g |
| Net 3 | 150 g | 11 g | 138 g |
| Net 4 | 250 g | 18 g | 232 g |
| Net 5 | 680 g | 57 g | 623 g |
| Net 6 | 980 g | 93 g | 886 g |
| Net 7 | 822 g | 102 g | 715 g |
| Total | 4445 g | 517 g | 3878 g |

Table 1. Weight distribution

After separation, Fourier Transform Infrared Spectroscopy (FTIR) analysis was performed on both the float lines and netting. The material composition of the samples was identified using a Bruker Alpha FTIR spectrometer. The results showed that the netting and the lower float lines were made of polyamide, while the upper float lines were made of polypropylene. In Figures 3–5, the sample spectrum is shown in red and the reference library spectrum suggested by the device is shown in blue.

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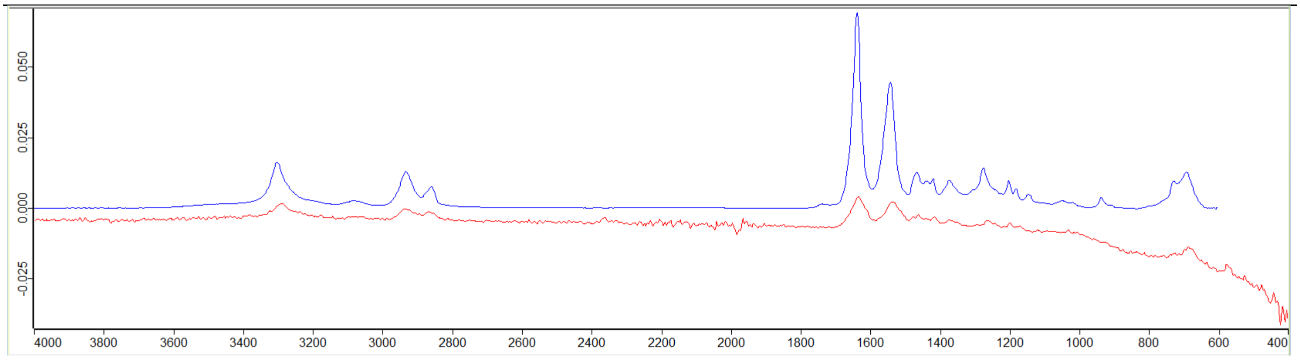



Figure 3. Material identification of the netting

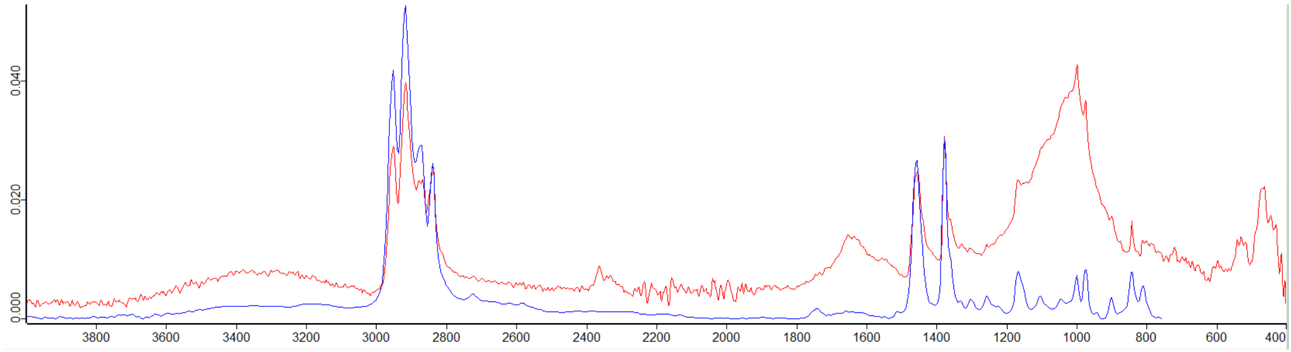



Figure 4. Material identification of the upper float line

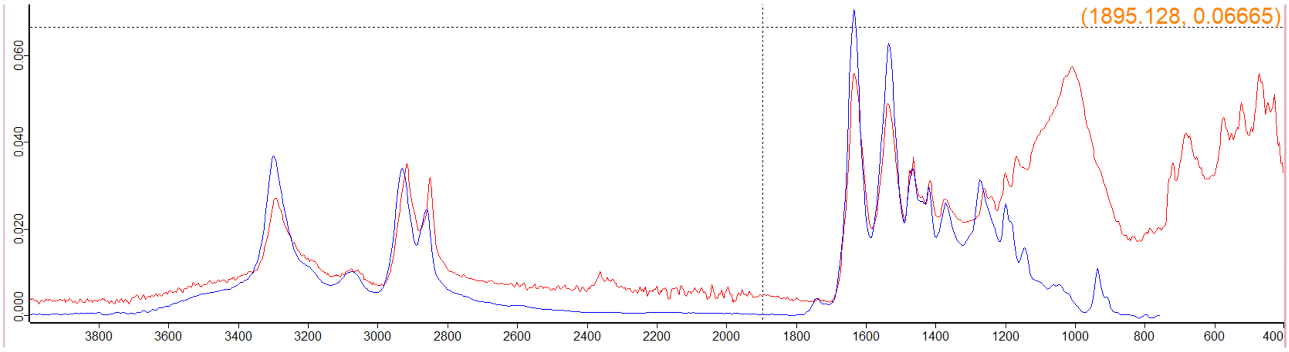



Figure 5. Material identification of the lower float line

After identification, the float lines were further processed into plates in the wood laboratory, for which a separate test report was prepared.

The netting section was first pre-treated by winding it into a hank around two screws mounted 80 cm apart on a wooden board. The surface of the wound net was then fused into a solid layer using a hot air blower.


Figure 6. Thermoformed net hank

Tensile test specimens were prepared from the thermoformed net hank for laboratory analysis. However, the process was unsuccessful due to the unsuitable physical form of the material, which prevented it from being properly loaded into the injection moulding machine. Consequently, it was not possible to produce complete tensile specimens.

In addition, moisture retained in the net evaporated during the melting phase, resulting in significant surface defects during moulding. Polyamides are inherently hygroscopic and can absorb moisture up to 8–10% of their weight. The processing temperature was set at 250 °C, slightly above the melting point of polyamide.

The process was subsequently repeated using non-thermoformed, pre-dried netting as input for the injection moulding machine. In this trial, no moisture-related issues were observed. The netting had been dried at 80 °C for four hours prior to processing.

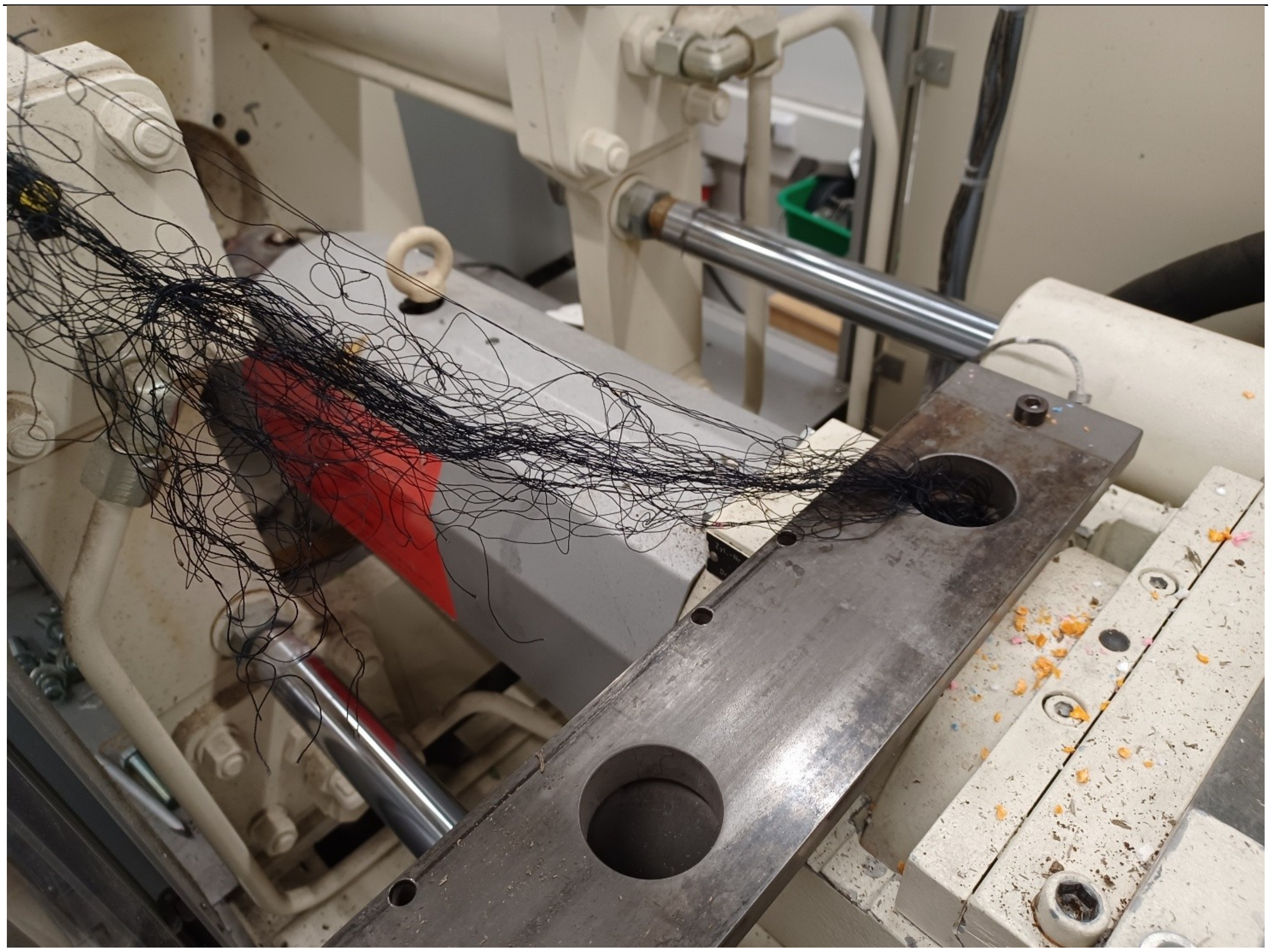


Figure 7. Feeding the netting into the injection moulding machine

A total of 18 tensile test specimens were produced. These were delivered to the materials testing laboratory, where the other tests specified in the assignment were conducted. A separate research report was prepared on the mechanical testing.

Figure 8. Tensile test specimen

The tensile test specimens were once again analysed with the FTIR device to obtain their spectra:

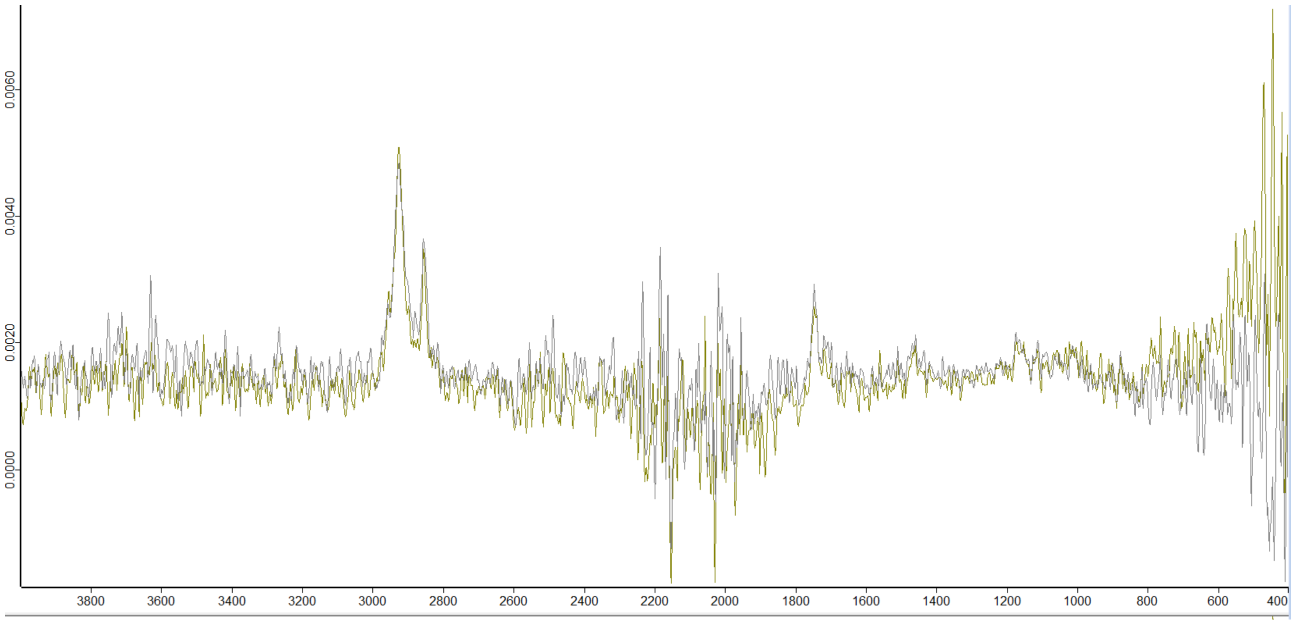
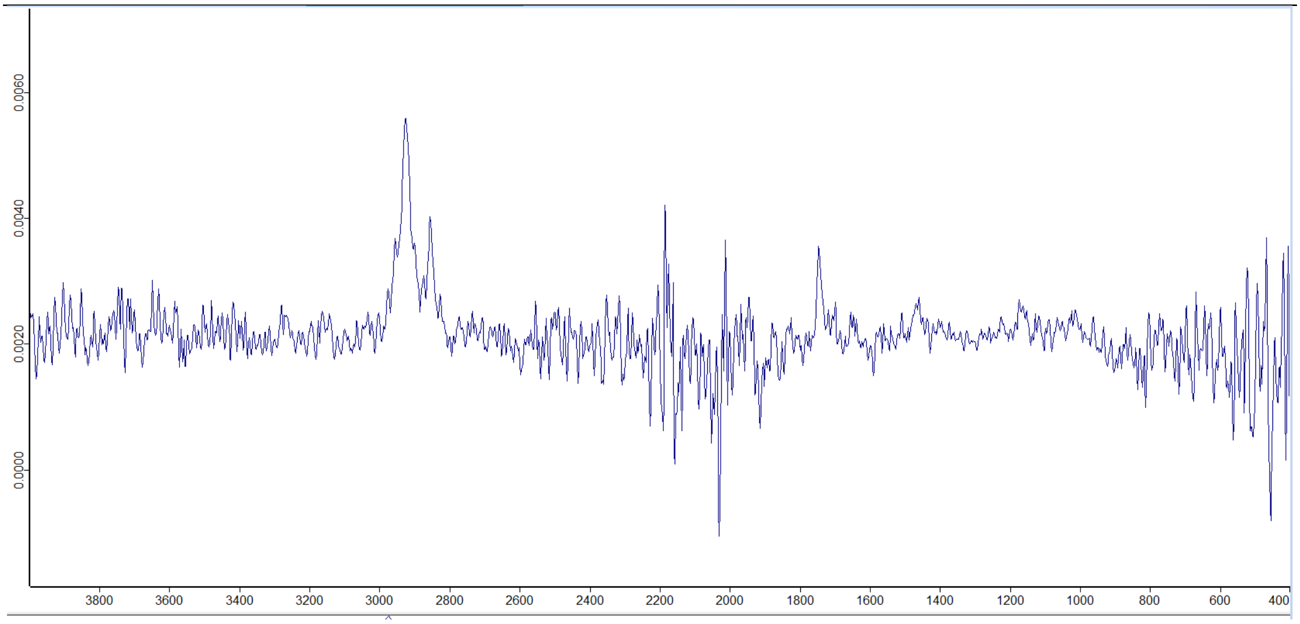



Figure 9. FTIR spectrum of the surface of the tensile specimen

It was observed that the surface of the tensile specimens did not produce a high-quality spectrum. As a result, the surface was carved, and the sample was analysed from the core of the specimen (Figure 10).




10. FTIR spectrum of the carved core sample from the tensile specimen

It was observed that the absorption spectrum exhibited a high level of noise, which interfered with the automatic material identification. However, characteristic peaks of polypropylene were distinguishable in the wavenumber range of 3000–2000 cm$^{-1}$, corresponding to the region of alkenes and dimeric carboxylic acids. A peak observed between 1800–1700 cm$^{-1}$ indicates the possible presence of carboxylic acids, although ester bonds may also be responsible. Additionally, peaks near 2200 cm$^{-1}$ and 1750 cm$^{-1}$ indicate the possible presence of aromatic nitriles.

Applying a noise-reduction algorithm improved the readability of the spectrum, revealing similarities with polyethylene reference spectra. The adjusted spectrum showed similarities to those of polyethene in comparison analysis.

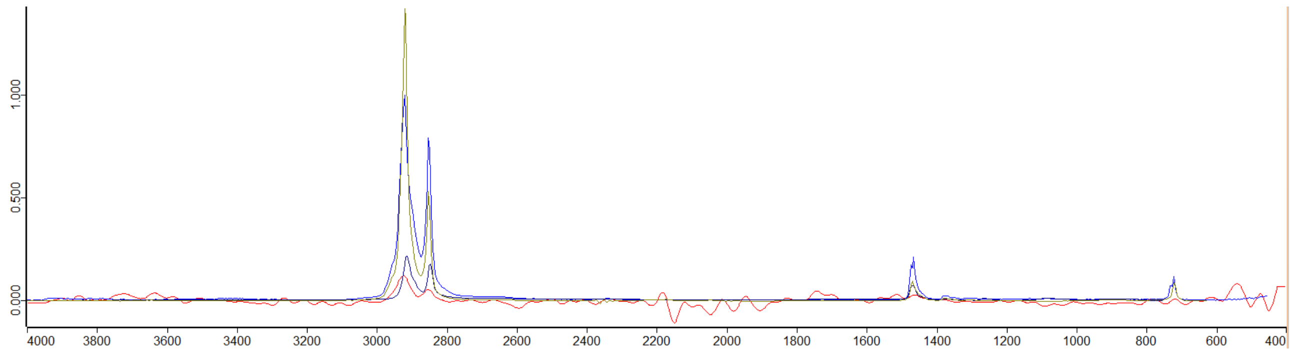



Figure 11. Processed FTIR spectrum of the tensile specimen with comparison

It can therefore be concluded that the IR absorption characteristics of the sample are altered during the injection moulding process, making the final result difficult to analyse using near-infrared spectroscopy. However, the presence of alkene and possibly ester bonds can still be inferred. The N-group typical of polyamide is likely present in the form of an aromatic nitrile. However, the relative proportions and structures of the bonds are difficult to determine using this method.

## 3. Observations

Optimal moulding results were obtained when pre-dried netting was directly fed into the injection moulding machine without prior thermoforming.

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