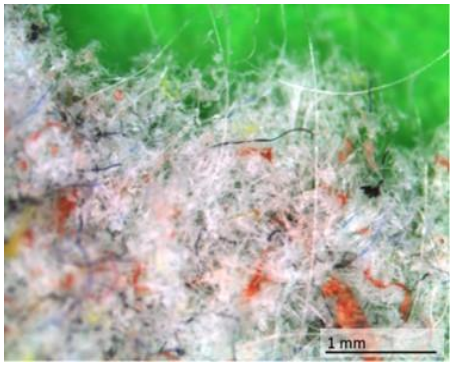
SMARTER

Surveying Microplastic Release from Aquaculture Nets and Ropes Using Different Technologies for Emission Reduction

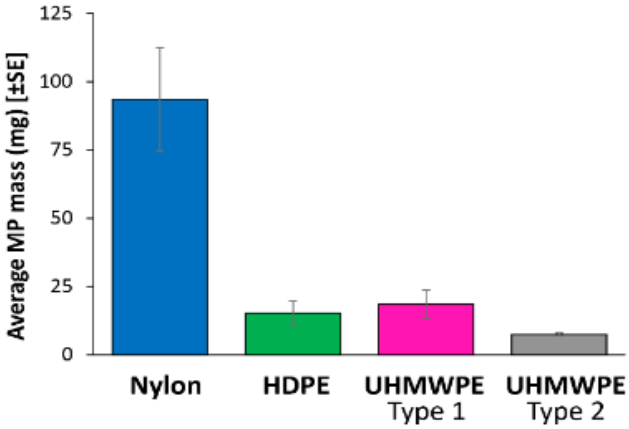
Objective

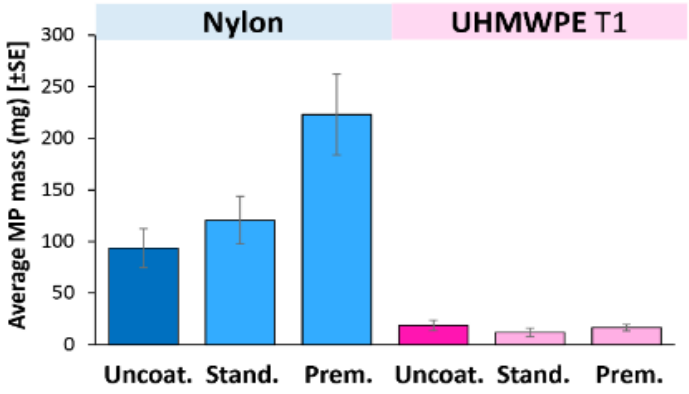
To quantify microplastic (MP) emissions from aquaculture nets and ropes, assess the influence of materials, coatings, and operational practices (e.g., cleaning methods), and develop a scenario-based emission model to support mitigation strategies and regulatory development.



Wear on aquaculture nets from high pressure cleaning (left). Microplastics collected from abrasion testing of various materials for fishing gear (right), Photos: SINTEF Ocean

Key Research Findings



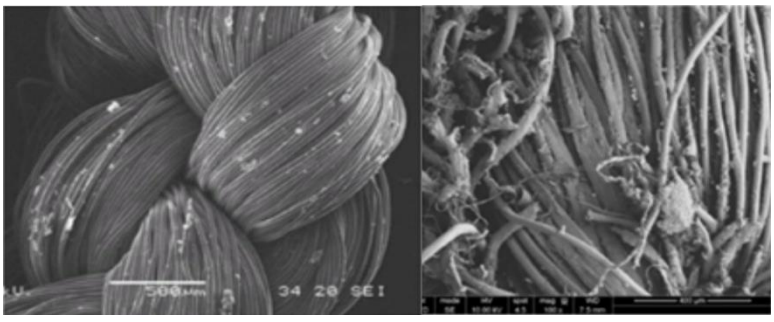


Net Materials and Coatings

- **Nylon nets** emitted **up to 5× more MPs** in laboratory abrasion tests than polyethylene-based alternatives (High Density and Ultra High Molecular Weight Polyethylene; HDPE and UHMWPE).
- **Coating type and compatibility matter:** Premium coatings increased MP release from nylon nets, while UHMWPE netting showed no significant change with either standard or premium coatings.
- **Age effects:** Used nets—especially from zones affected by wear and aging (near surface and bottom)—emitted more MPs. Residual coating was often a significant MP source.

Ropes

- Ropes made from **recycled polyolefins** and **used UHMWPE ropes** had significantly higher MP emissions in abrasion tests than their virgin counterparts.
- Rope structure (e.g. lay of rope and yarn properties) may have affected abrasion resistance, especially for the multi-filament UHMWPE rope consisting of very thin fibres.



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Cleaning Technologies

- **Water sampling** during accelerated cleaning tests assessing the three cleaning technologies showed **no statistically significant increases** in MP concentrations above ambient levels, though microscopy indicated potential localized releases.
- **AUV brushing** resulted in **less coating damage** than pressure washing or cavitation cleaning (as assessed via stereomicroscopy).

Field & Service Site Observations

- **Field cleaning events** showed variable MP concentrations; highlighting that sampling conditions can impact test results (e.g., lice skirt presence, water currents).
- **Service site discharges** from drum washers with robust filtration systems (e.g., sedimentation, flocculation) effectively prevented MP entry into the marine environment.

Pressure cleaning (left), cavitation cleaning (centre) and AUV brushing (right) technologies tested within SMARTER. Photos SINTEF Oecan.

Recommendations for the Sector

- **Material selection is critical**: UHMWPE and HDPE show promise as lower-emission alternatives to nylon.
- **Coatings must be matched to substrate**: Improper combinations can increase MP emissions.
- **Mitigation potential exists** via less abrasive cleaning methods, targeted use of compatible coatings, and the development of nets and ropes with improved wear resistance (including improved recycled materials).
- **Routine monitoring and lab-field alignment** are needed to validate model predictions and refine emission factors over time.

Outlook

SMARTER has established a **research baseline** for MP emissions from aquaculture gear and developed a preliminary modelling framework with future potential to inform **procurement, operational practices, and future policy**. **Given that many of the evaluated solutions are already commercially available, emission reductions are immediately actionable. Further empirical validation** and longitudinal field studies, including with aged nets, are recommended to strengthen the current data sets, provide input to the emission model, and inform regulatory thresholds.

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