Uptake, distribution and excretion of microplastic fibres in green sea urchin *Strongylocentrotus droebachiensis*: an experimental exposure

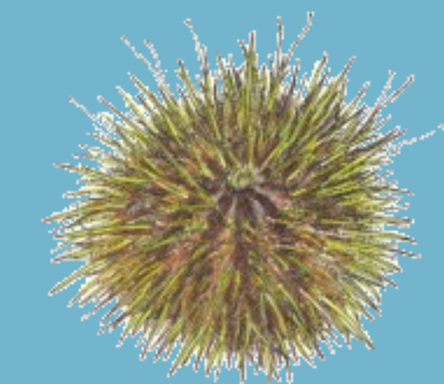

Figure: Green sea urchin
http://thisfish.info/fishery/species/green-sea-urchin/

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BACKGROUND

- Microplastic (MP) fibres, mainly derived from laundry of synthetic textiles, are abundant polymers in the ocean[1]
- Yet, more research is needed on the fate of MP and different polymer types under different environmental conditions[2,3]
- This study investigates the fate of MP fibres in the Arctic benthic environment

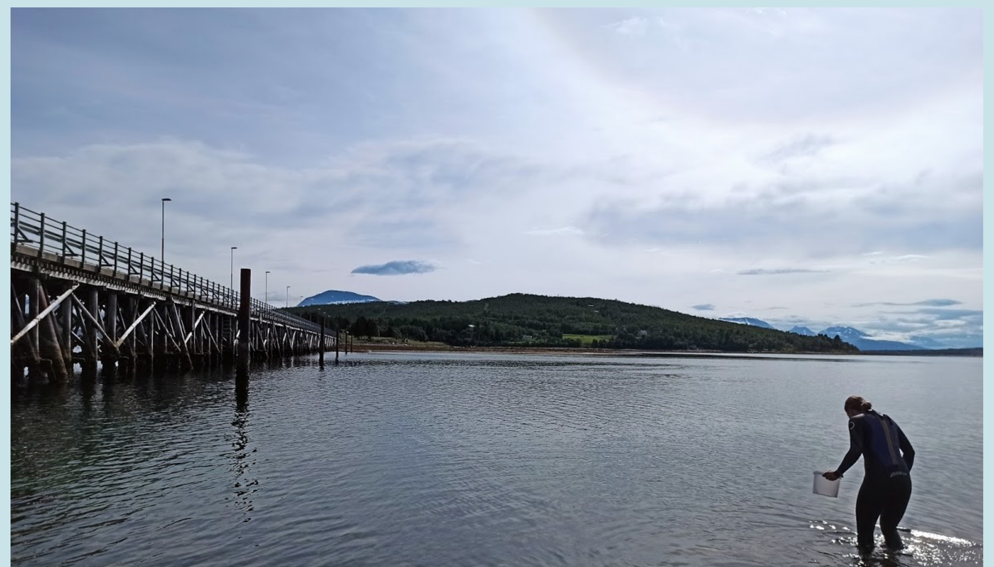

Figure 1: S. droebachiens collected from Kvaløya, Norway

STUDY AIM: To investigate ingestion, retention time and egestion in sea urchin *Strongylocentrotus droebachiensis* of natural wool fibre and a synthetic acrylic fibre, and investigate influence of biofouling

STUDY DESIGN

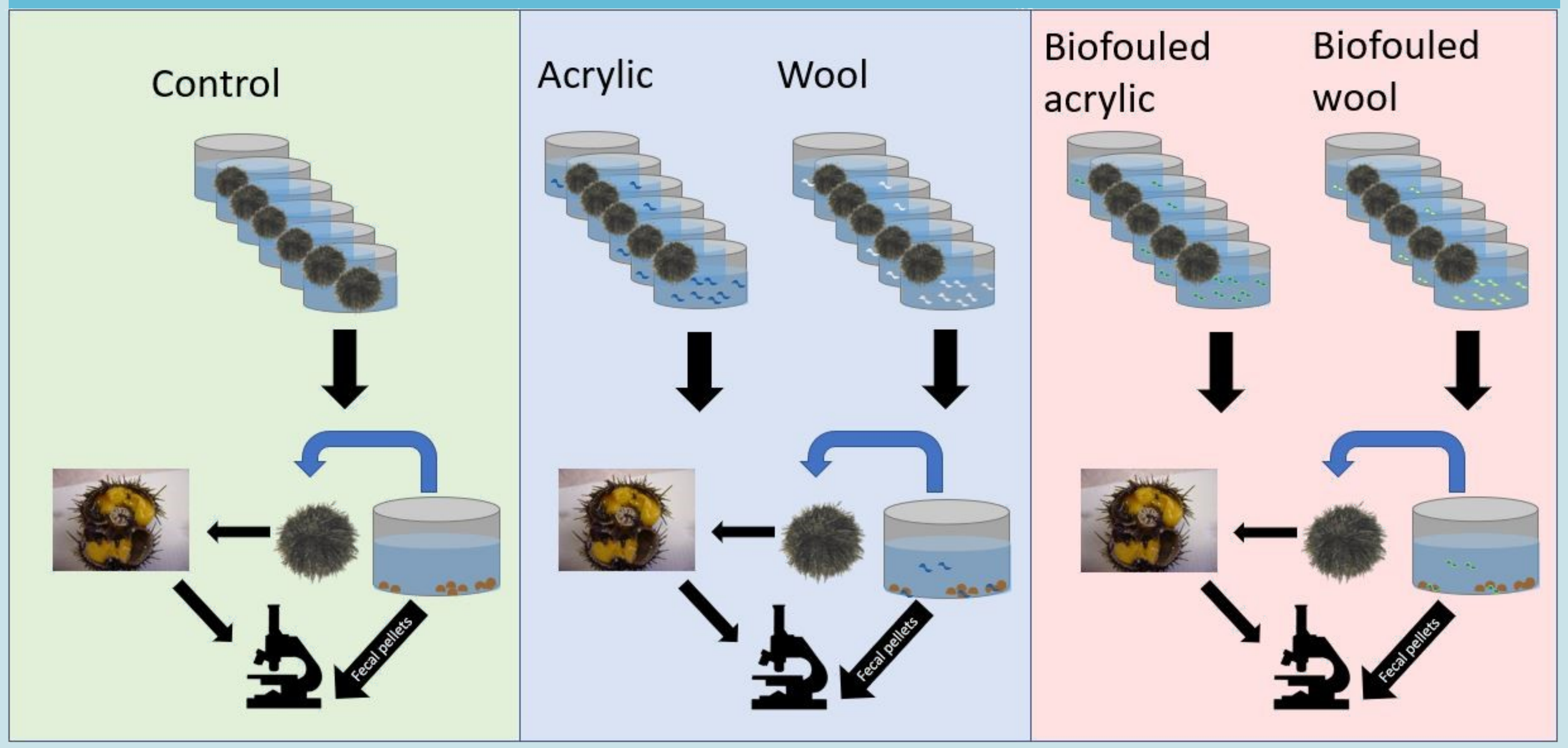

Figure 2: Study design with two fibre types (natural wool and acrylic) in two states (clean and biofouled). Six adult sea urchins were exposed individually to each fibre types, in addition to six controls without fibres. Exposure time to fibres was 48 hours, then fecal pellets collected, and three individuals from each treatment were dissected for gut contents. Remaining individuals relocated into new beakers with fresh seawater for depuration. Fecal pellets were collected at 72 and 134 hours, and all remaining individuals dissected at 134 hours.

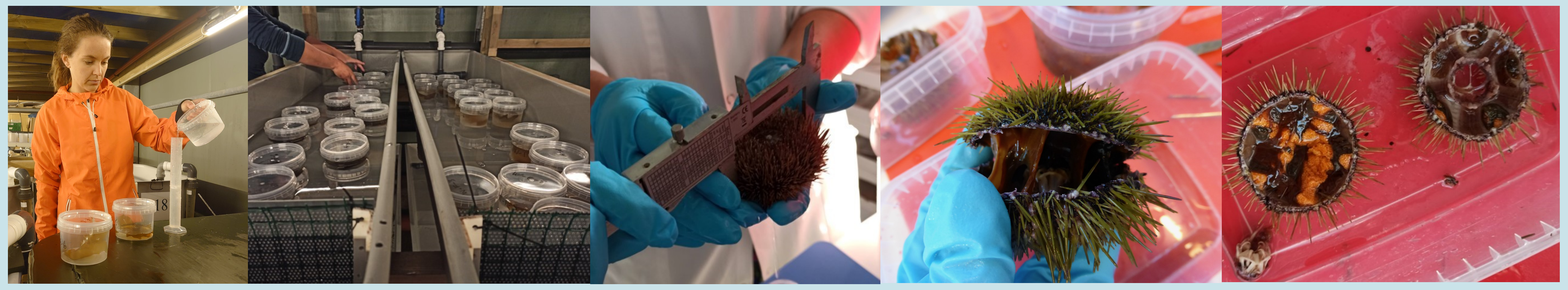

Figure 3: Experimental set up. a) measuring aliquots of seawater containing fibres, b) beakers incubated in running sea-water at in situ temperature, c) sea urchin diameter measurement , d) dissection, e) dissected sea urchin with gonads (orange; no analysis)

PRELIMINARY RESULTS

- Labwork is currently underway. The study aims to be completed by May 2021
- So far, 25% of fecal pellets from each individual (48 hour exposure) have been analysed, and fibres have been found in fecal pellets of all treatments (fig 4 & 5)
- Clean acrylic treatment has lowest fibre counts and lowest variation between individuals
- The number of biofouled acrylic fibers per pellet is higher than that of non-biofouled
- Both clean and biofouled wool have large variation in fibre count per individual. Clean wool has highest median count
- Gut contents is awaiting analysis and will provide information on retention time

OUTLOOK

- Occurence of fibres packed in fecal material in all treatments demonstrates ingestion and excretion of fibres through the gastrointestinal tract
- Biofouling possibly promotes ingestion of acrylic fibres, but not wool fibres.
- Whether the observed differences on fecal egestion between fiber types is due to lower uptake and/or longer retention time will be revealed by analysis of gut content.

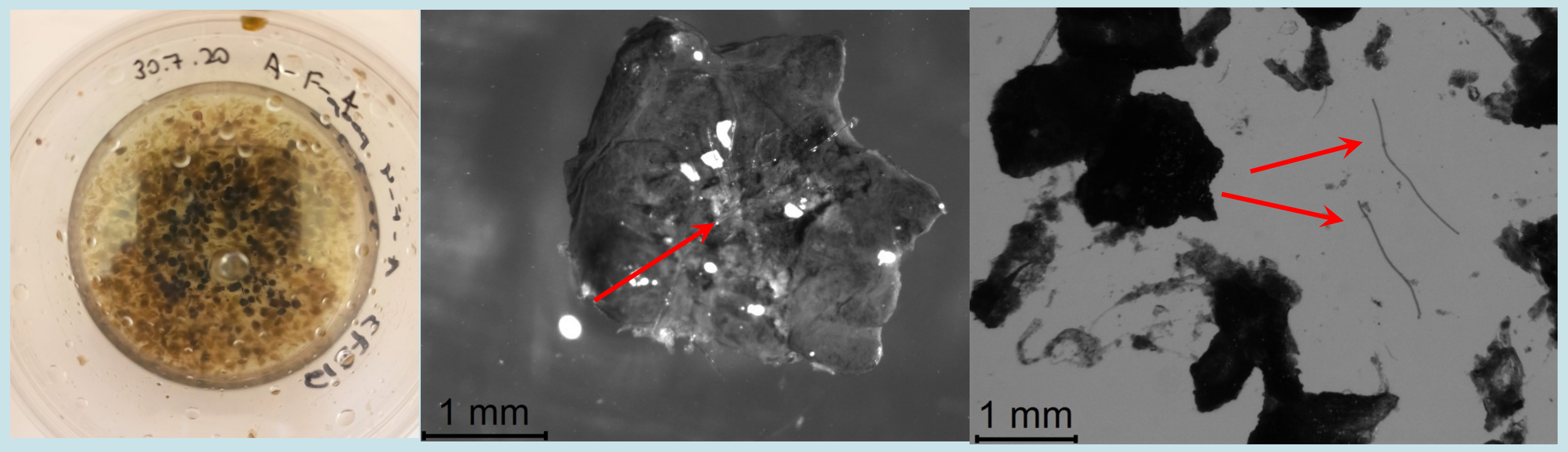

Figure 4: a) fecal pellets stored in ethanol until analysis b) intact fecal pellet with incorporated fibres (red arrows), c) dissected fecal pellet with fibres separated (red arrows)

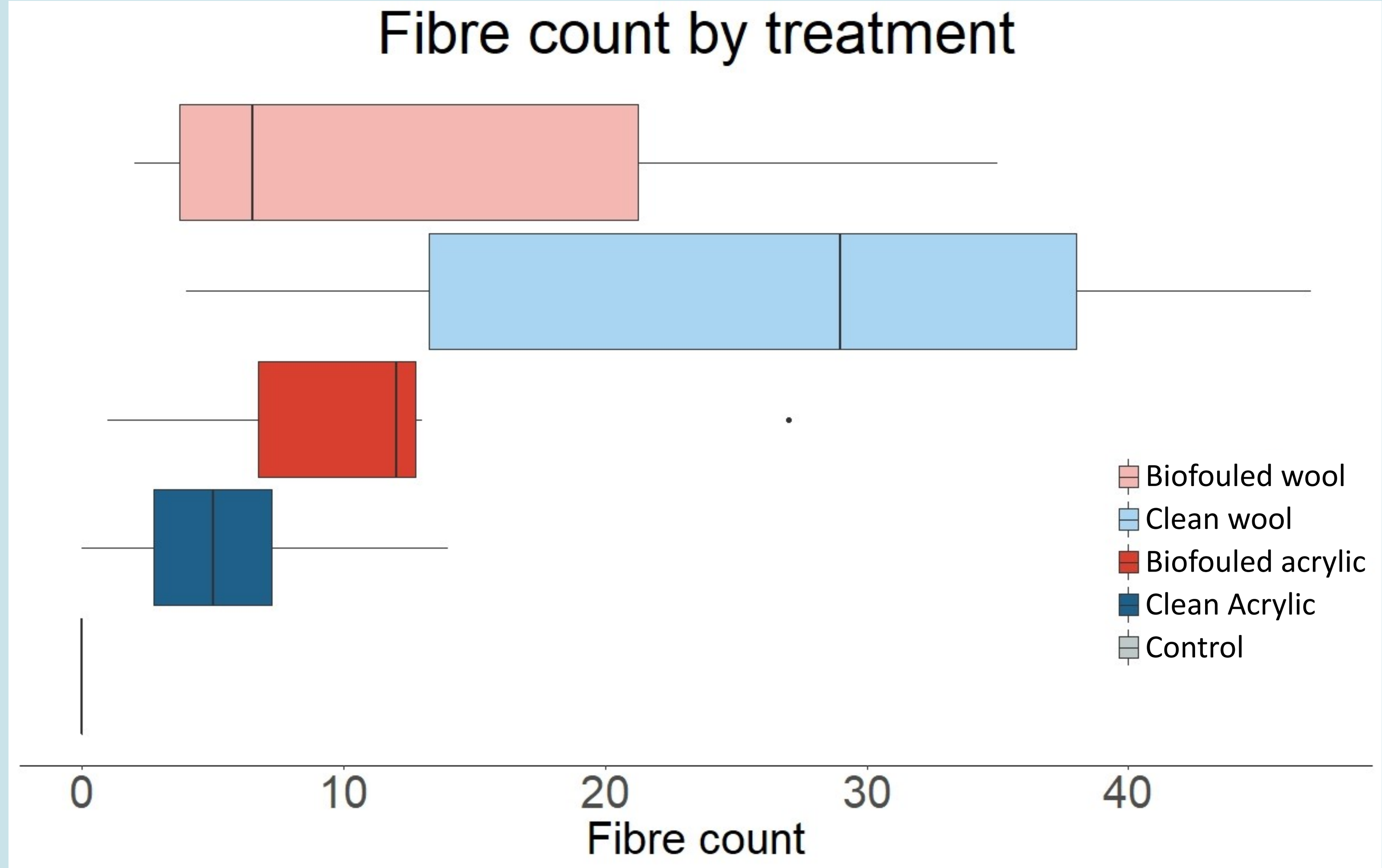

Figure 5: Boxplot showing sum of fibres per individual (from 25% of total fecal pellets) in each treatment after 48 hours

REFERENCES [1] Boucher, J., & Friot, D. (2017). Primary Microplastics in the Ocean: A Global Evaluation of Sources. doi:dx.doi.org/10.2305/IUCN.CH.2017.01.en [2] Henry, B., Laitala, K., & Klepp, I. G. (2019). Microfibres from apparel and home textiles: Prospects for including microplastics in environmental sustainability assessment. *Sci Total Environ, 652*, 483-494. doi:10.1016/j.scitotenv.2018.10.166 [3] GESAMP. (2015). *Sources, Fate and Effects of Microplastics in the Marine Environment: A Global Assessment* (GESAMP No. 90). https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/GESAMP_microplastics%20full%20study.pdf

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