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Microplastics in European sea salts

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* c.j.thiele@soton.ac.uk

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- Human food sources, including salt, contaminated with microplastics
  - Microplastics: umbrella term for solid particles of different shapes made of plastic polymers < 5 mm in size
  - Particles ≤ 150 µm able to pass gut tissue barriers [1,2]
  - Microplastics 5 – 10 µm (but not 1.6 – 4.9 µm) shown to translocate (found in human placentas) [3]

- Ubiquitous consumption of salt
  - 8 – 11 g day^{-1} in Europe [6]
  - Western diet 70 – 75% of salt intake through consumption of processed foods, 10 -15% added by end consumer [7]

Exposure pathway

Microplastic consumption through ingestion of contaminated food

Digestive system → importance of particle size

Translocation into tissues (and retention?)	Egestion & back into circulation
≤ 150 µm	> 150 µm

Particles > 5 µm absorption rate < 1%*

*mammalian models, [4,5]

ENVIRONMENTAL Science & Technology

[8]

Article

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Microplastic Pollution in Table Salts from China

Dongqi Yang,[†] Huahong Shi,[*,†] Lan Li,[‡] Jiana Li,[†] Khalida Jabeen,[†] and Prabhu Kolandhasamy[†]

[†]State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China

[‡]Research Center for Analysis and Measurement, Donghua University, Shanghai 201620, China

- 13 shop-bought sea salts, duplicates of 20 g (same package)
- 30% H_2O_2 to digest organic matter
- Entire sample filtered over 5 µm
- Contamination mitigation (low footfall laboratory, 100% cotton laboratory coats, glassware, everything covered)
- Procedural controls (n=5), results corrected using limit of detection
- Visual assessment of 1/3 of each filter and subsample analysed with Raman spectroscopy

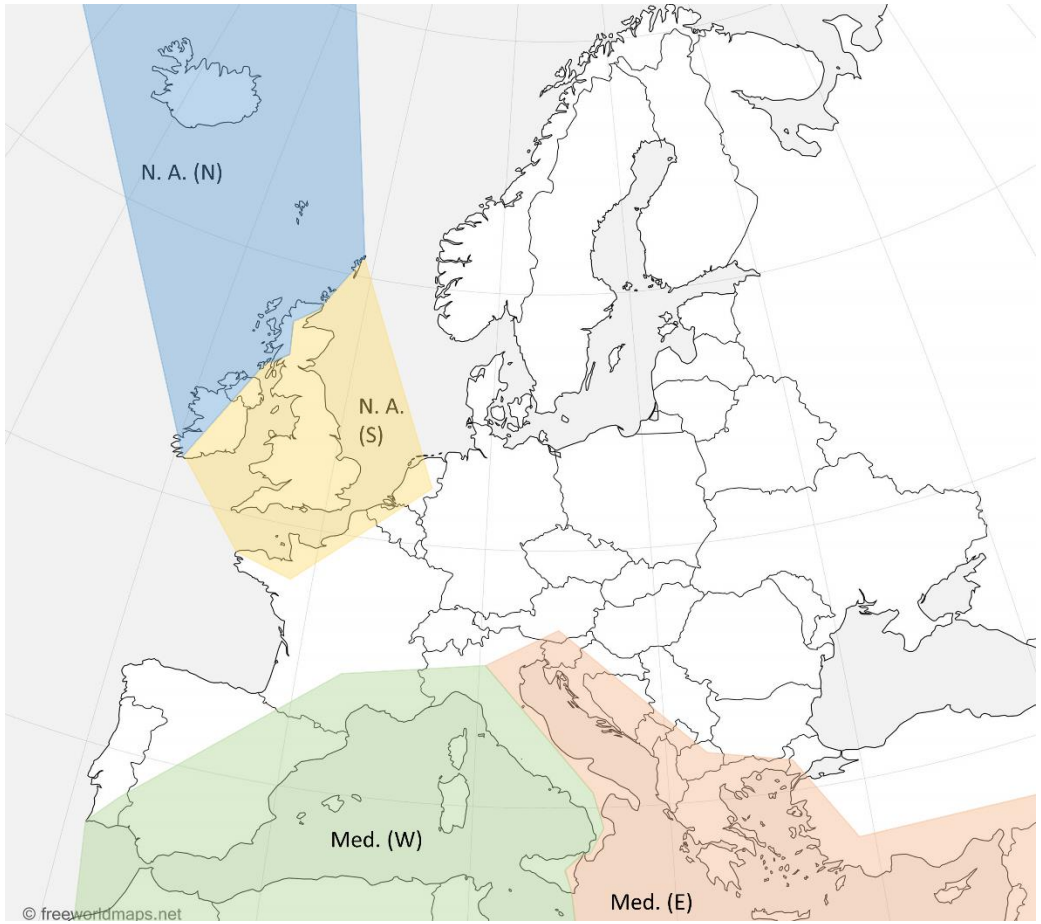


Figure 1 –Origin of sea salt samples grouped into four identifiers: northern area of North Atlantic - N. A. (N), samples coded 'N'; southern area of North Atlantic – N. A. (S), samples coded 'S'; Western Mediterranean Sea – Med. (W), samples coded 'W'; Eastern Mediterranean Sea – Med. (E), samples coded 'E'.

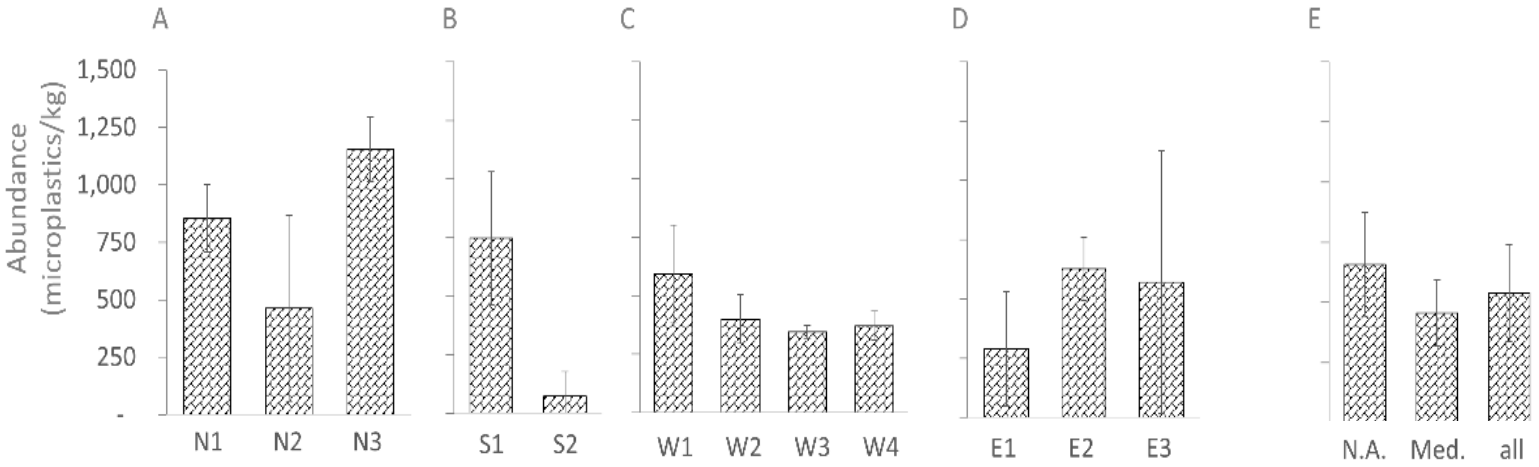
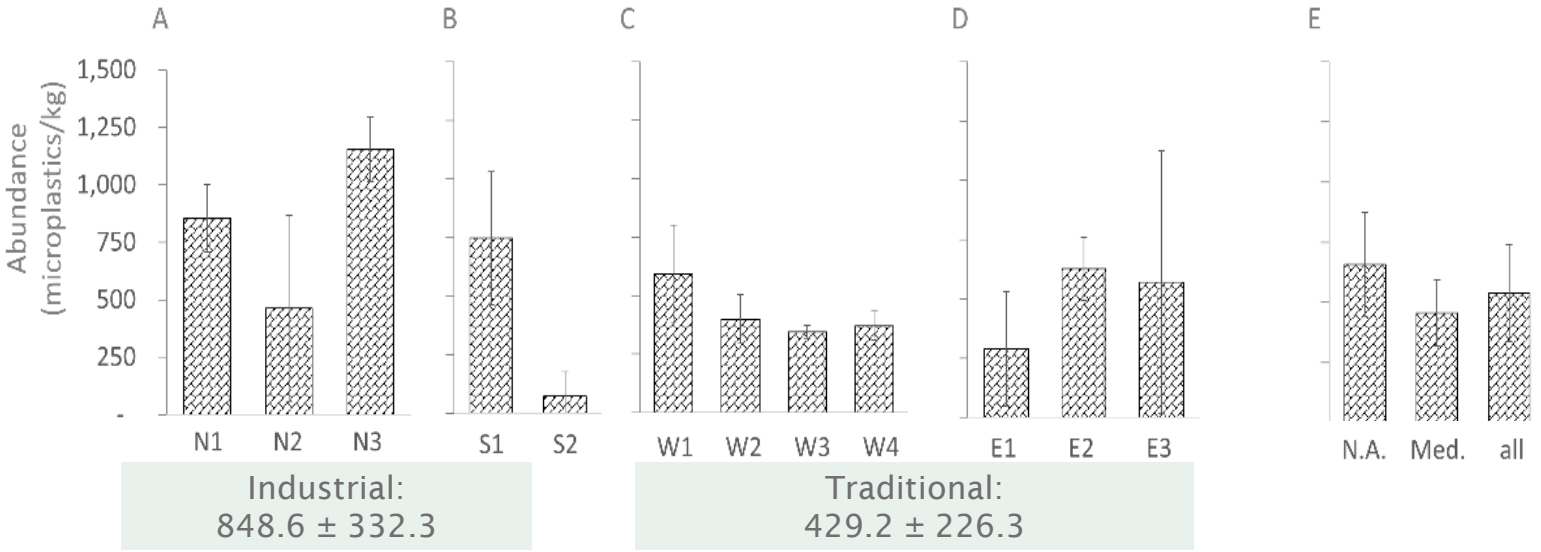


Figure 2 – Microplastics found in sea salt samples from 12 locations (see Figure 1 for geographic subregions). A-E show mean abundances of microplastics kg^{-1}, graphs F-J show proportions of types of microplastics (%). Sample codes: N = northern area of North Atlantic, S = southern area of North Atlantic, W = western area of Mediterranean, E = Eastern Mediterranean, N. A. = North Atlantic means, Med. = Mediterranean means. Error bars = 1x standard deviation. Sample S3 was excluded as an outlier.



Sea salts from traditional manufacturing significantly lower microplastic concentrations than when harvested industrially (t-test, $p = 0.008$)

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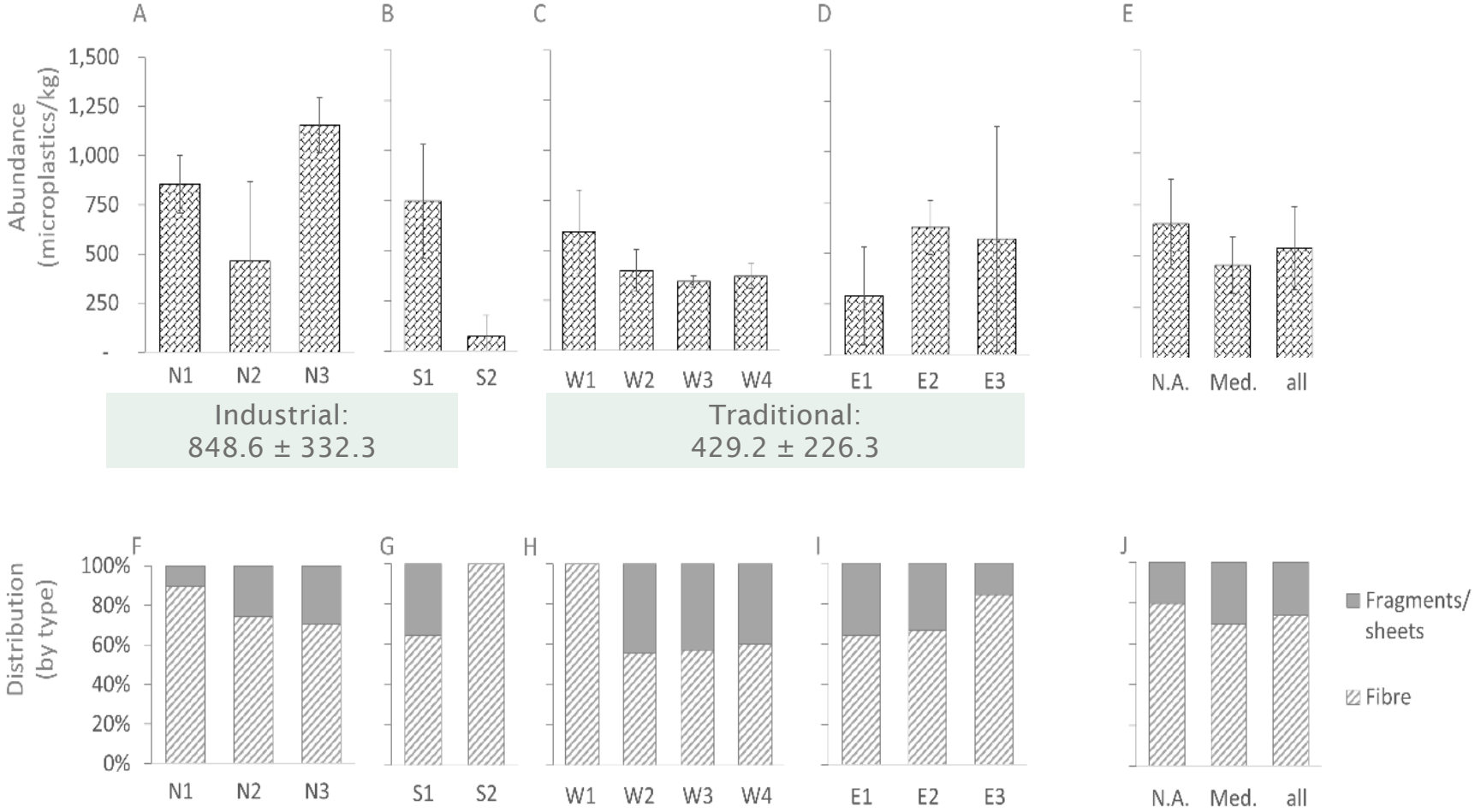

Sea salts from traditional manufacturing significantly lower microplastic concentrations than when harvested industrially (t-test, $p = 0.008$)

Estimated particles < 150 µm:
80.1% of fragments
100% of fibres by diameter
4.7% fibres by length

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Exposure pathway

Daily microplastic consumption through 10 g sea salt ingestion: 4.7 microplastics*

* 2 g/day consumer choice
8 g/day through processed food (cheaper alternatives?)

Digestive system

3.2 microplastics < 150 µm

1.5 items ≥ 150 µm

Potential accumulation year^{-1}
11.6 microplastics
(13.9 µg)

Translocation into tissues (and retention?)

0.03 microplastics
(1% of pieces < 150 µm)

Egestion & back into circulation

4.63 microplastics
(99% < 150 µm & all pieces ≥ 150 µm)

Back into the system person^{-1} year^{-1}
1,689.3 microplastics
(1.9 mg)

446 million

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