Monitoring mesoplastic concentrations in estuarine waters

A case study in the River Guadalquivir (Southern Spain)

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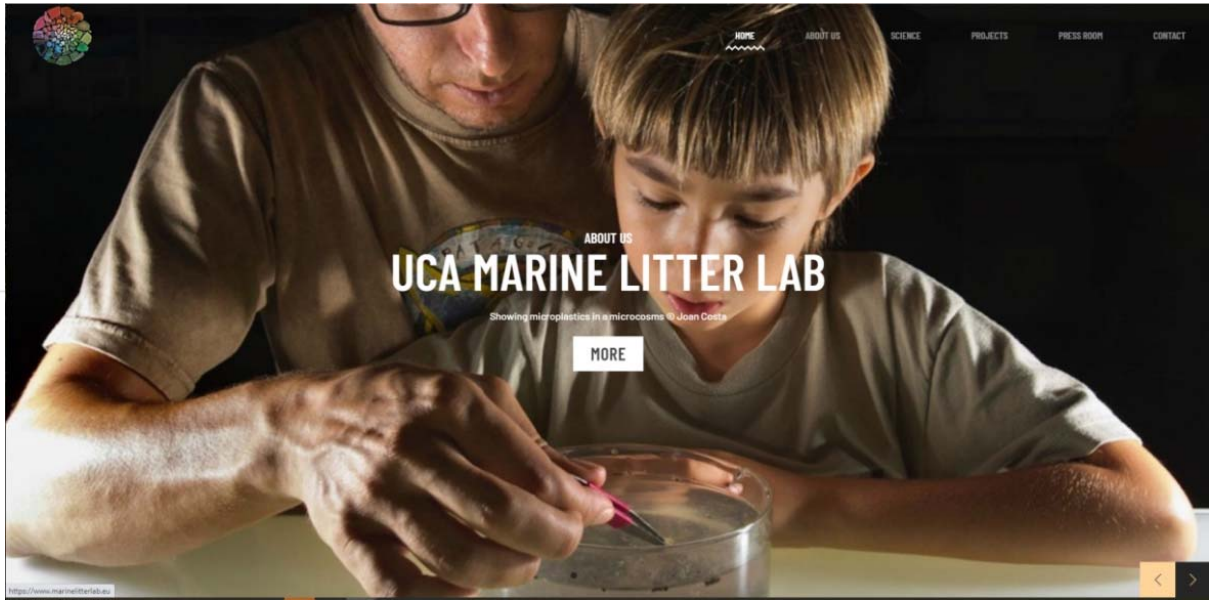
MORALES-CASELLES ET AL. (PDF) | GONZÁLEZ-FERNÁNDEZ ET AL. (PDF)

DATA | PRESS RELEASES | INFOGRAPHIC | PICTURES

CITATIONS

Morales-Caselles, C., J. Viejo, E. Martí, E., ... A. Cózar, 2021. **An inshore-offshore sorting system revealed from global classification of ocean litter.** Nature Sustainability, doi.org/10.1038/s41893-021-00720-8

González-Fernández, D., A. Cózar, G. Hanke, ... M. Tourgeli, 2021. **Floating macrolitter leaked from Europe into the ocean.** Nature Sustainability, doi.org/10.1038/s41893-021-00722-6



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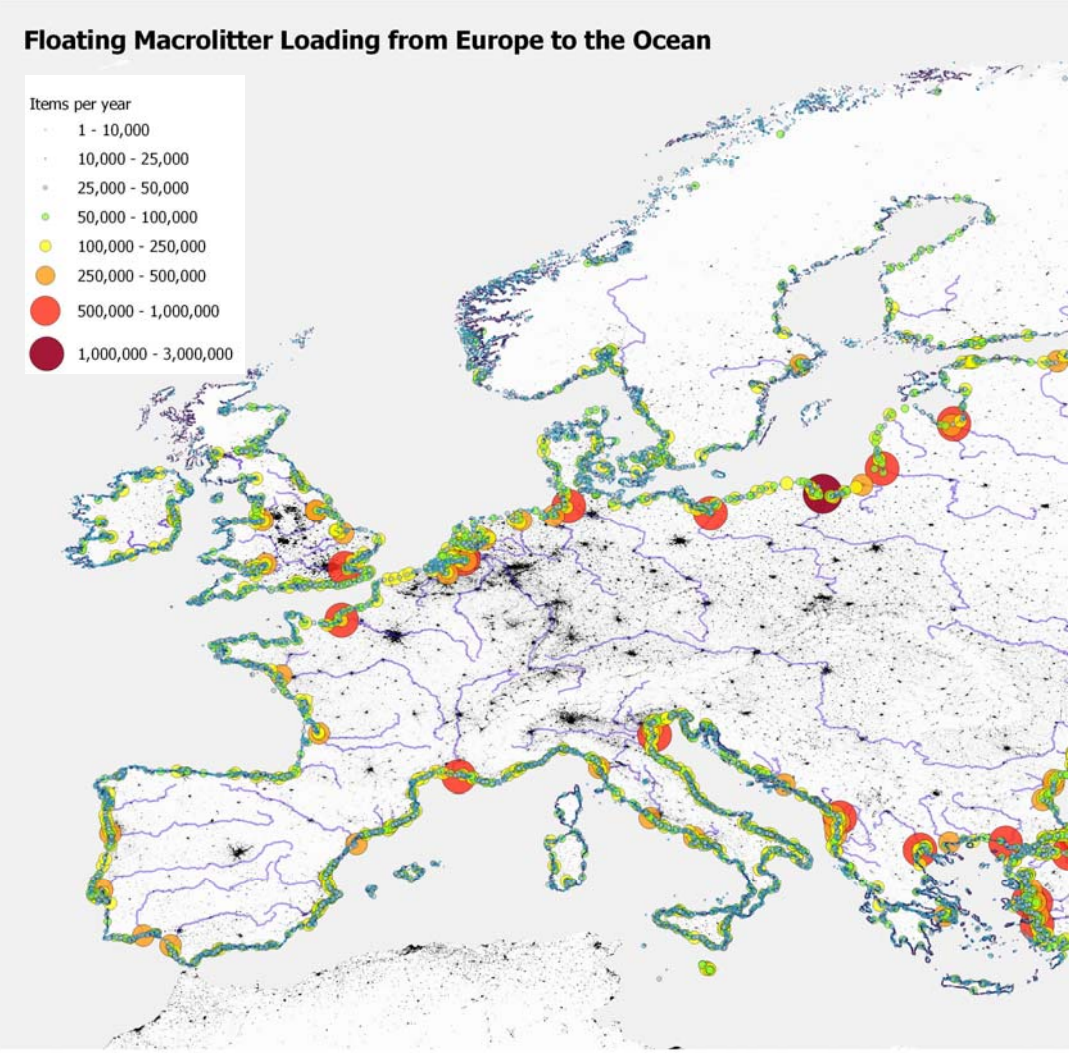
Rivers as pathways for anthropogenic waste transport to the ocean



nature sustainability

ARTICLES

https://doi.org/10.1038/s41893-021-00722-6

Check for updates

Floating macrolitter leaked from Europe into the ocean

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Riverine systems act as converging pathways for discarded litter within drainage basins, becoming key elements in gauging the transfer of mismanaged waste into the ocean. However, riverine litter data are scarce and biased towards microplastics, generally lacking information about larger items. Based on the first ever database of riverine floating macrolitter across Europe, we have estimated that between 307 and 925 million litter items are released annually from Europe into the ocean. The plastic fraction represented 82% of the observed litter, mainly fragments and single-use items (that is, bottles, packaging and bags). Our modelled estimates show that a major portion of the total litter loading is routed through small-sized drainage basins (<100 km²), indicating the relevance of small rivers, streams and coastal run-off. Moreover, the major contribution of high-income countries to the macrolitter inputs suggests that reducing ocean pollution cannot be achieved only by improving waste management, but also requires changing consumption habits and behaviour to curb waste generation at source. The inability of countries with well-developed recovery systems to control the leakage of waste into the environment further supports the need to regulate the production and use of plastic on a global scale.

https://www.nature.com/articles/s41893-021-00722-6

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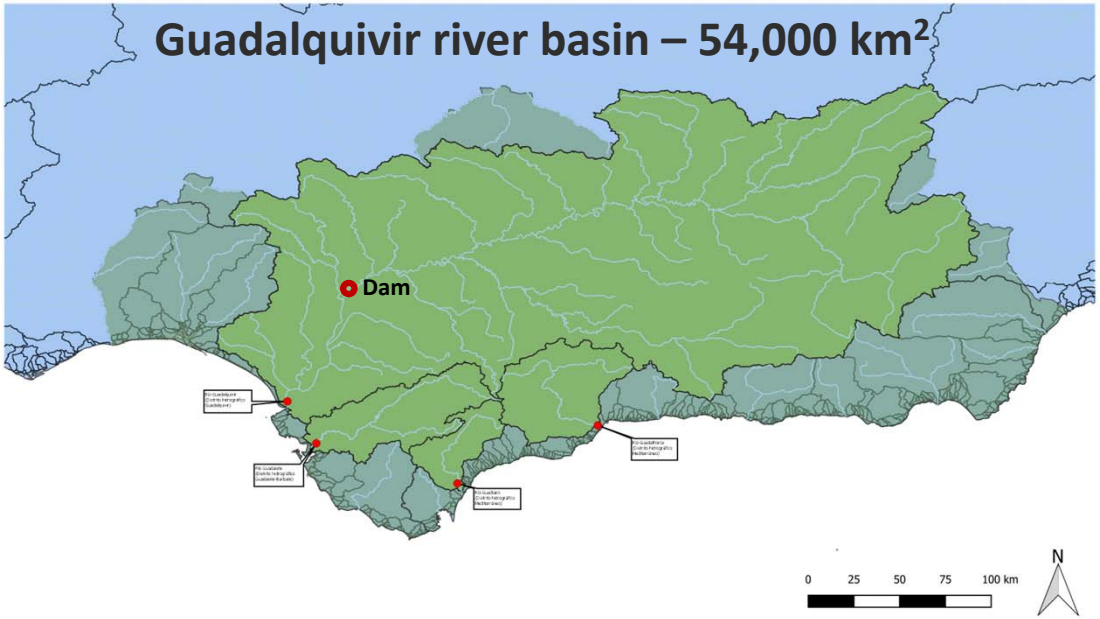
STUDY AREA

- 110 km long estuary
- Average depth of 7 m
- Width 150 - 800 m
- Alcalá del Río dam:
  80% freshwater input
  Flow below 40 $m^3 s^{-1}$
  (highly regulated)



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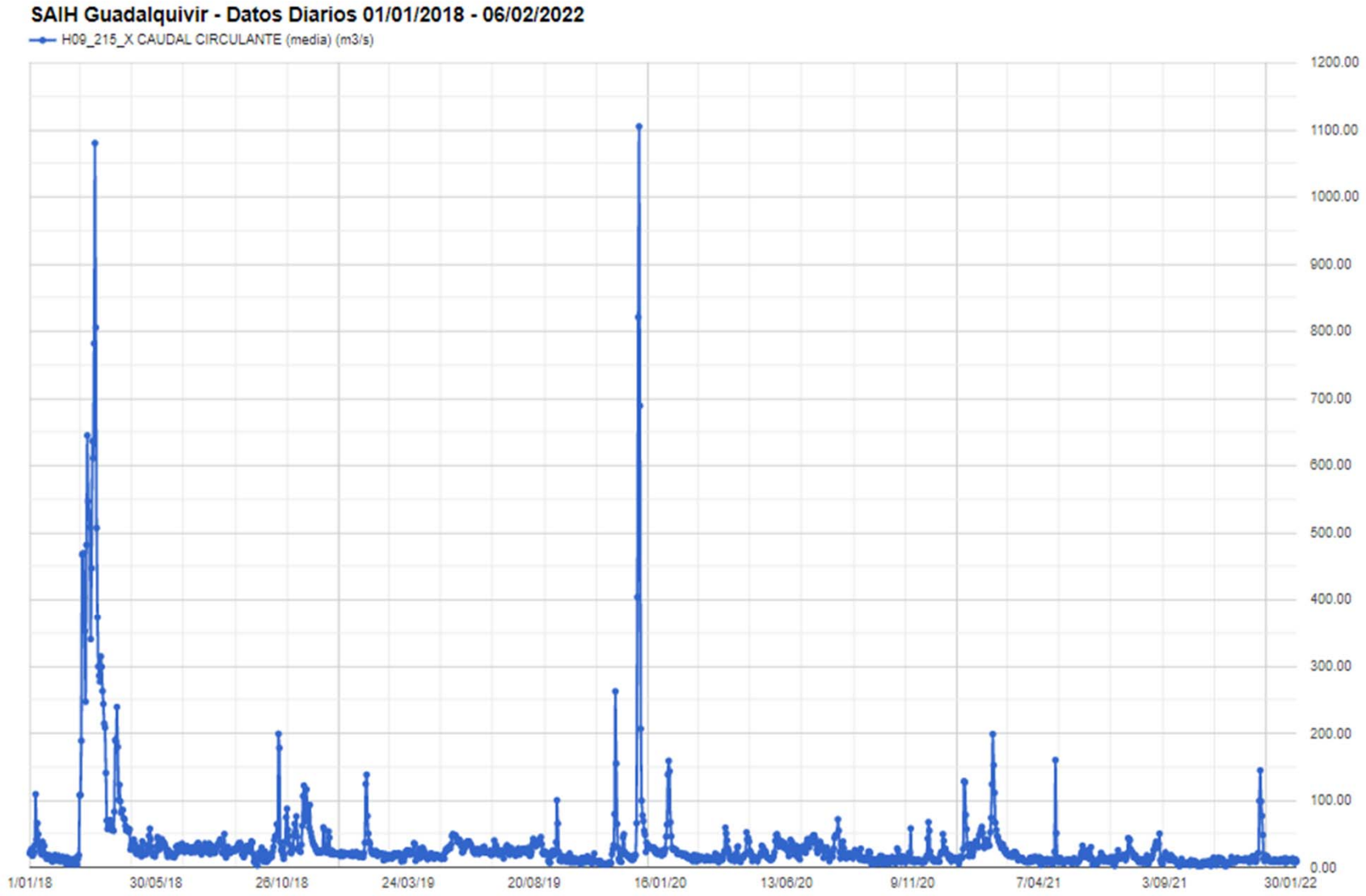

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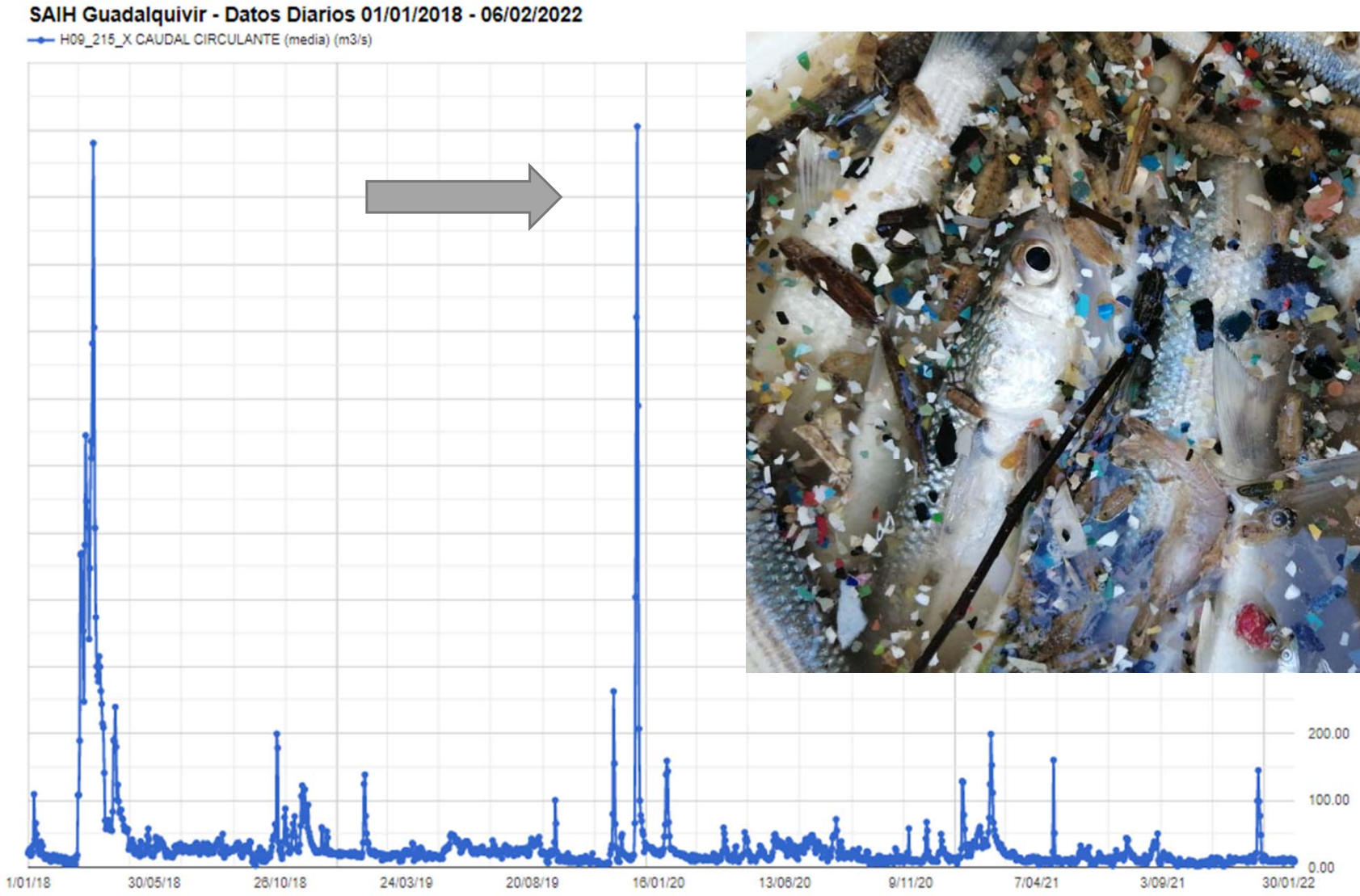


METHODS

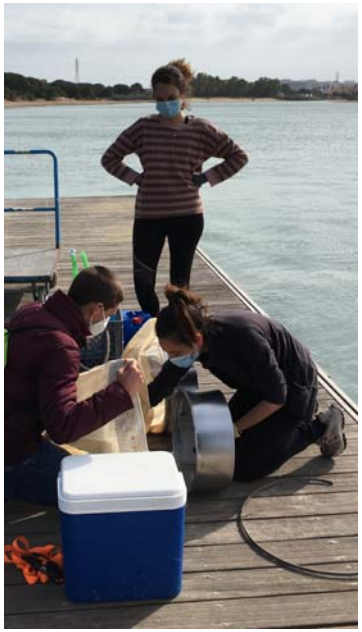
Monitoring strategy

- Monthly – Neap and Spring tide
- Manta net / Plankton net
- Mesh size: 250 microns
- 3 sample replicates
- Flowmeters
- Average sampling volume:

  Manta ~17 m^3 / Bongo ~31 m^3

https://aquaticbiotechnology.com/

https://aquaticbiotechnology.com/



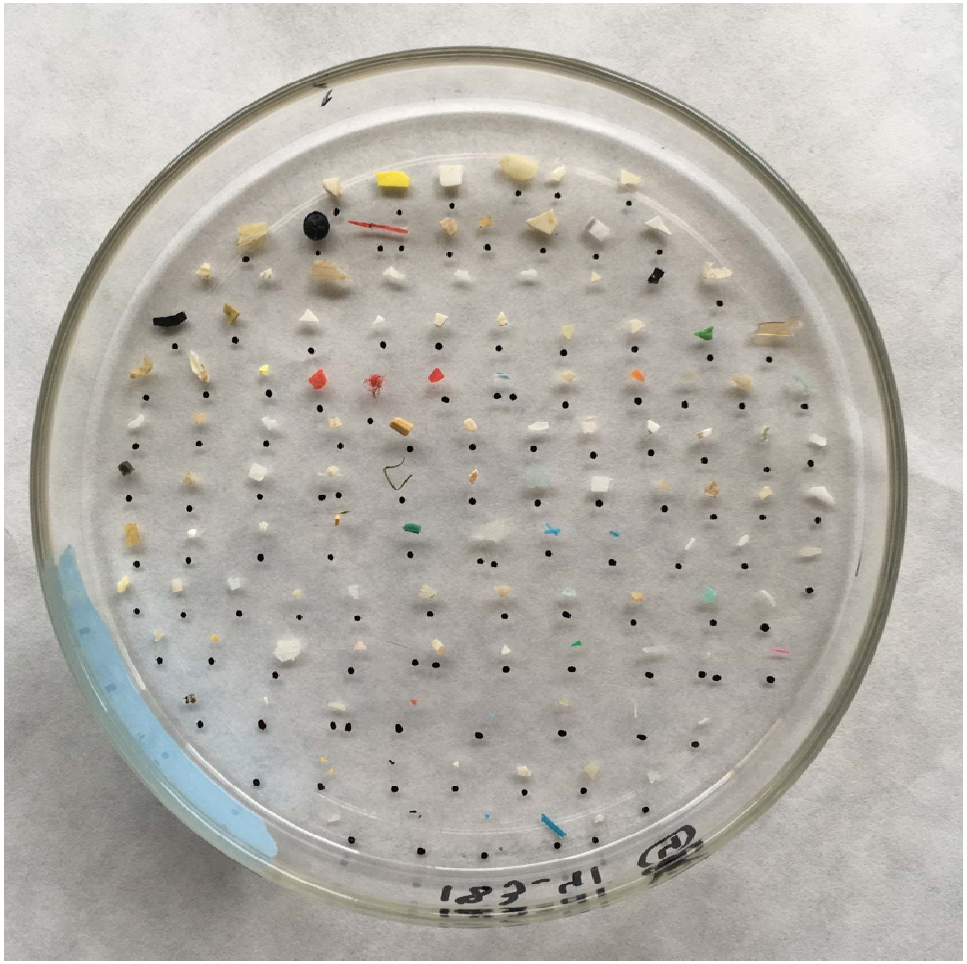
Microplastics

Monitoring Station

METHODS

Laboratory analysis

- Visual inspection
- Identified ~6500 particles
- Particle characterization - ImageJ Fiji® (Area/Feret/colour/etc.)
- FTIR polymer analysis (still pending)



RESULTS

Microplastics (< 5 mm)
Mesoplastics (5-25 mm)

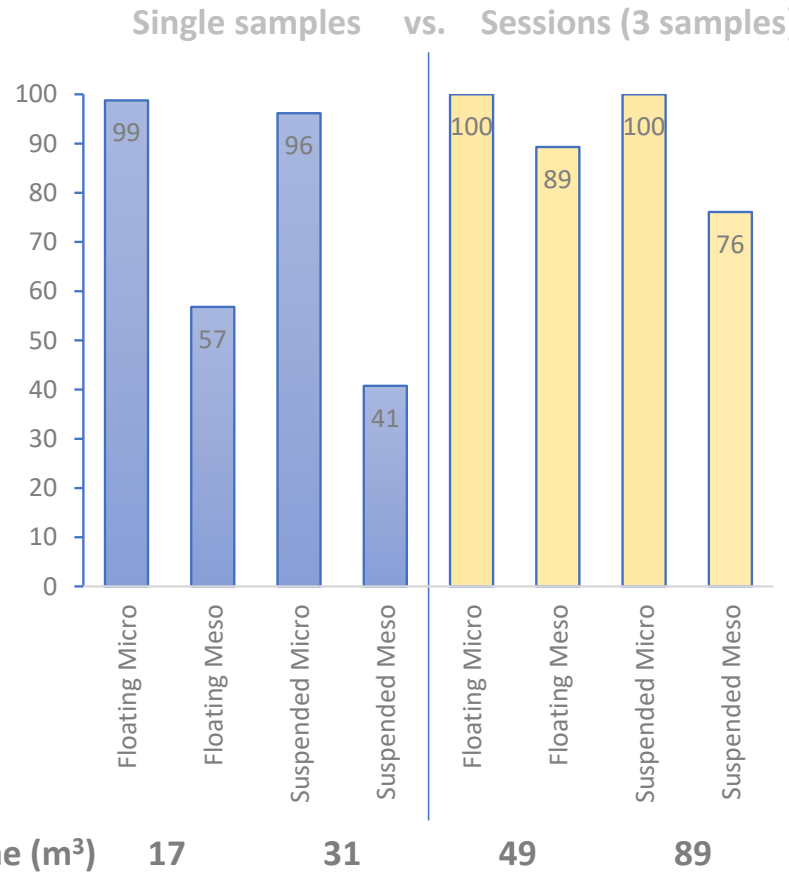
Sampling effort:

- Surface layer
  - 28 sessions
  - 81 samples
  - 1,362 m^3
- Water column
  - 46 sessions
  - 130 samples
  - 4,087 m^3

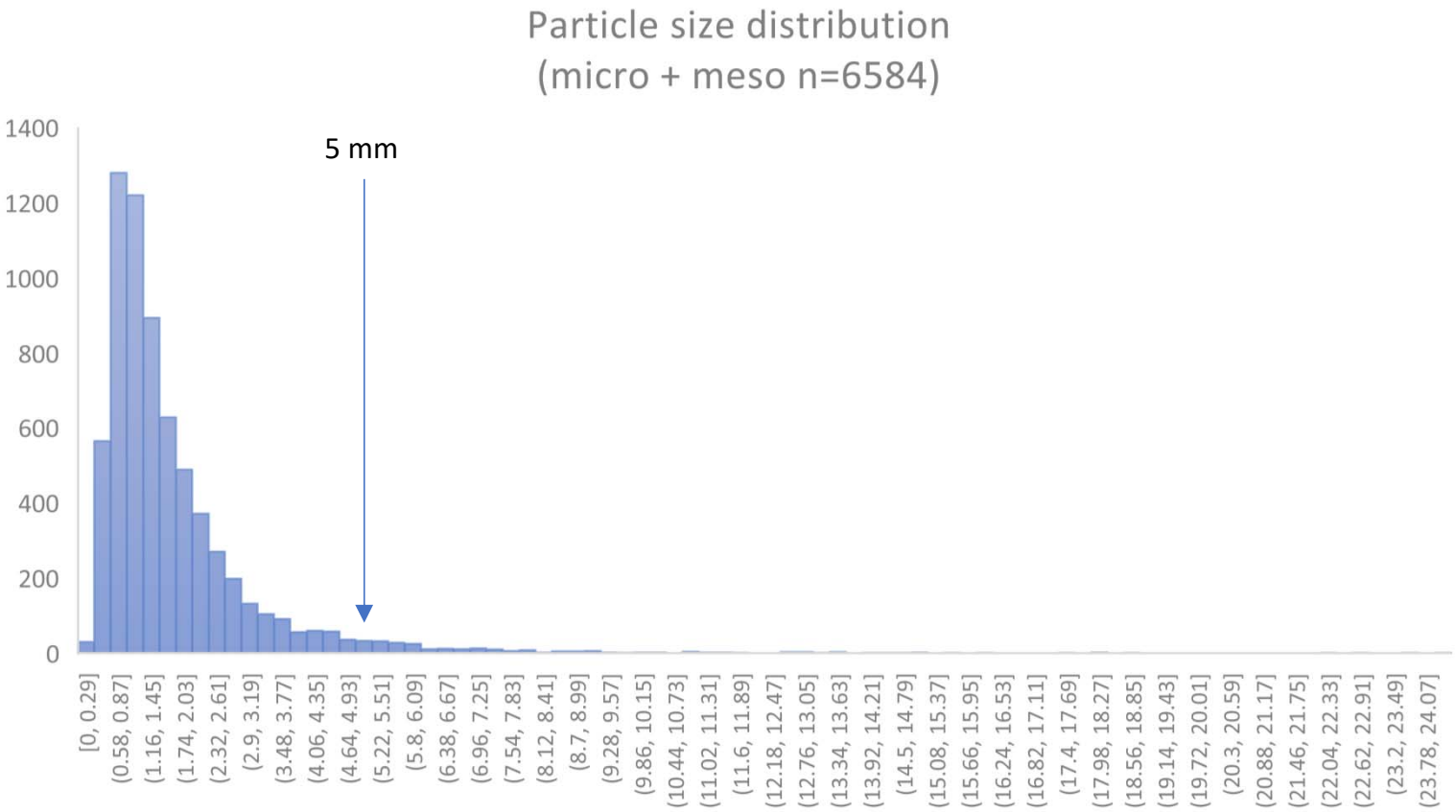
Initial Data Analysis:

- Surface layer
  - Microplastics n= 3454
  - Mesoplastics n= 145
  - Average ratio Micro/Meso = ~24
- Water column
  - Microplastics n= 2898
  - Mesoplastics n= 87
  - Average ratio Micro/Meso = ~33

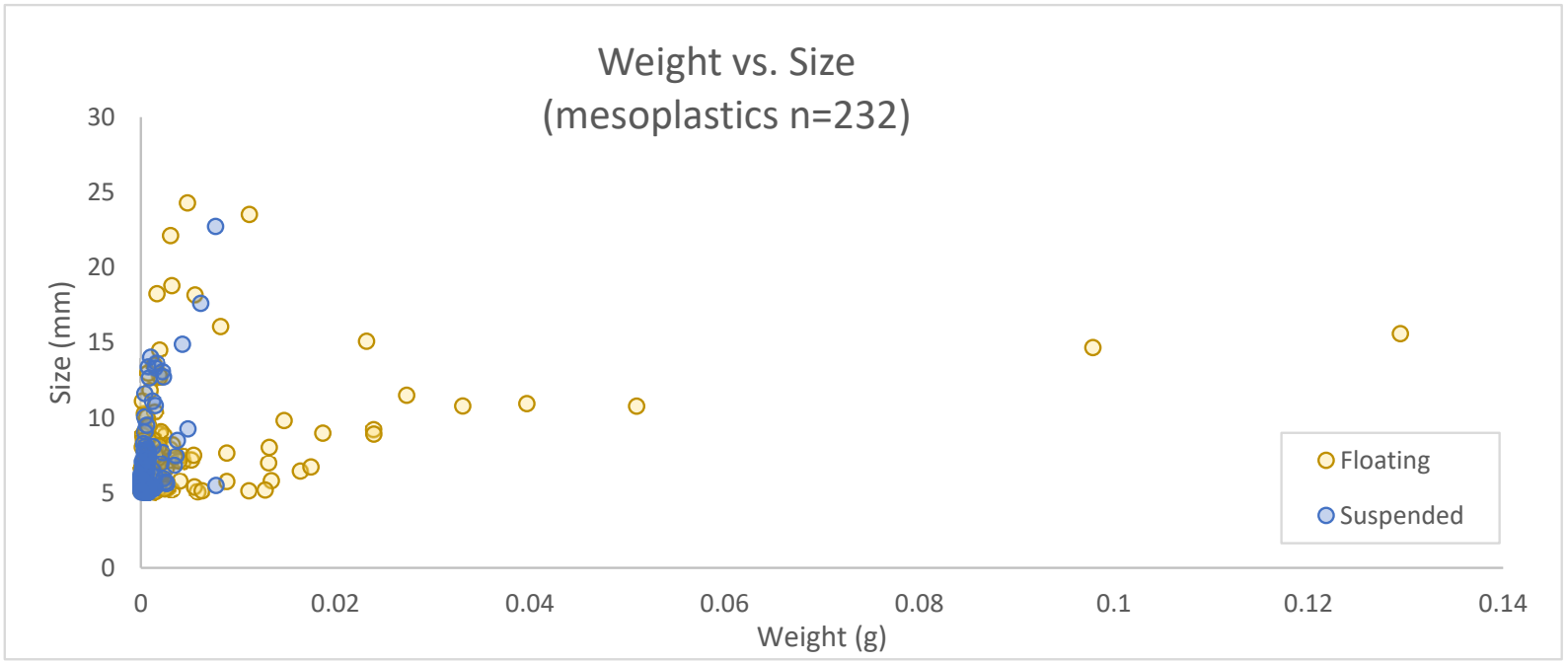
Presence of particles
(% of positives)

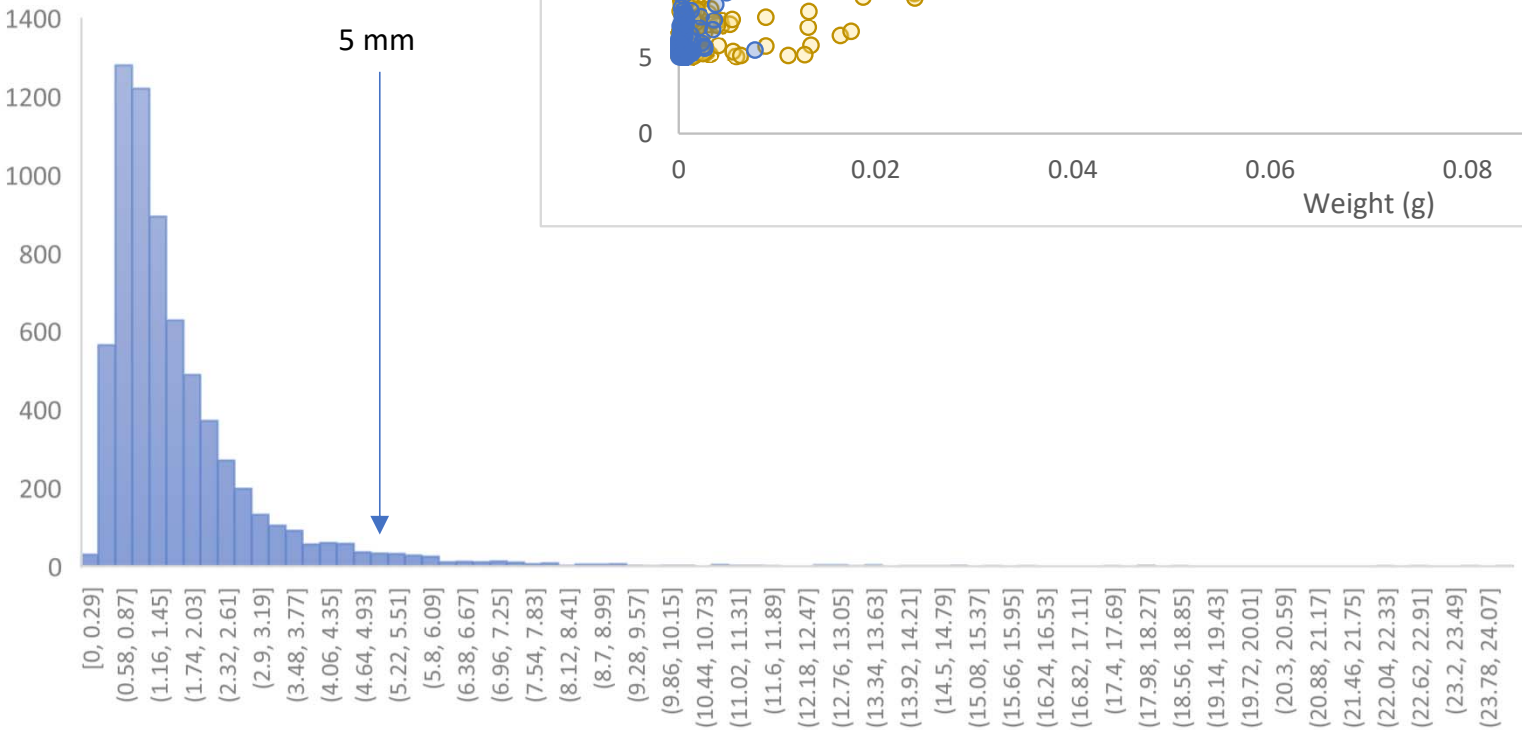


RESULTS


Particle size distribution
(micro + meso n=6584)
5 mm
1400
1200
1000
800
600
400
200
0
[0, 0.29]
(0.58, 0.87]
(1.16, 1.45]
(1.74, 2.03]
(2.32, 2.61]
(2.9, 3.19]
(3.48, 3.77]
(4.06, 4.35]
(4.64, 4.93]
(5.22, 5.51]
(5.8, 6.09]
(6.38, 6.67]
(6.96, 7.25]
(7.54, 7.83]
(8.12, 8.41]
(8.7, 8.99]
(9.28, 9.57]
(9.86, 10.15]
(10.44, 10.73]
(11.02, 11.31]
(11.6, 11.89]
(12.18, 12.47]
(12.76, 13.05]
(13.34, 13.63]
(13.92, 14.21]
(14.5, 14.79]
(15.08, 15.37]
(15.66, 15.95]
(16.24, 16.53]
(16.82, 17.11]
(17.4, 17.69]
(17.98, 18.27]
(18.56, 18.85]
(19.14, 19.43]
(19.72, 20.01]
(20.3, 20.59]
(20.88, 21.17]
(21.46, 21.75]
(22.04, 22.33]
(22.62, 22.91]
(23.2, 23.49]
(23.78, 24.07]

RESULTS


Weight vs. Size
(mesoplastics n=232)
Size (mm)
Weight (g)
0
5
10
15
20
25
30
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
Floating
Suspended


5 mm
0
200
400
600
800
1000
1200
1400
[0, 0.29]
(0.58, 0.87]
(1.16, 1.45]
(1.74, 2.03]
(2.32, 2.61]
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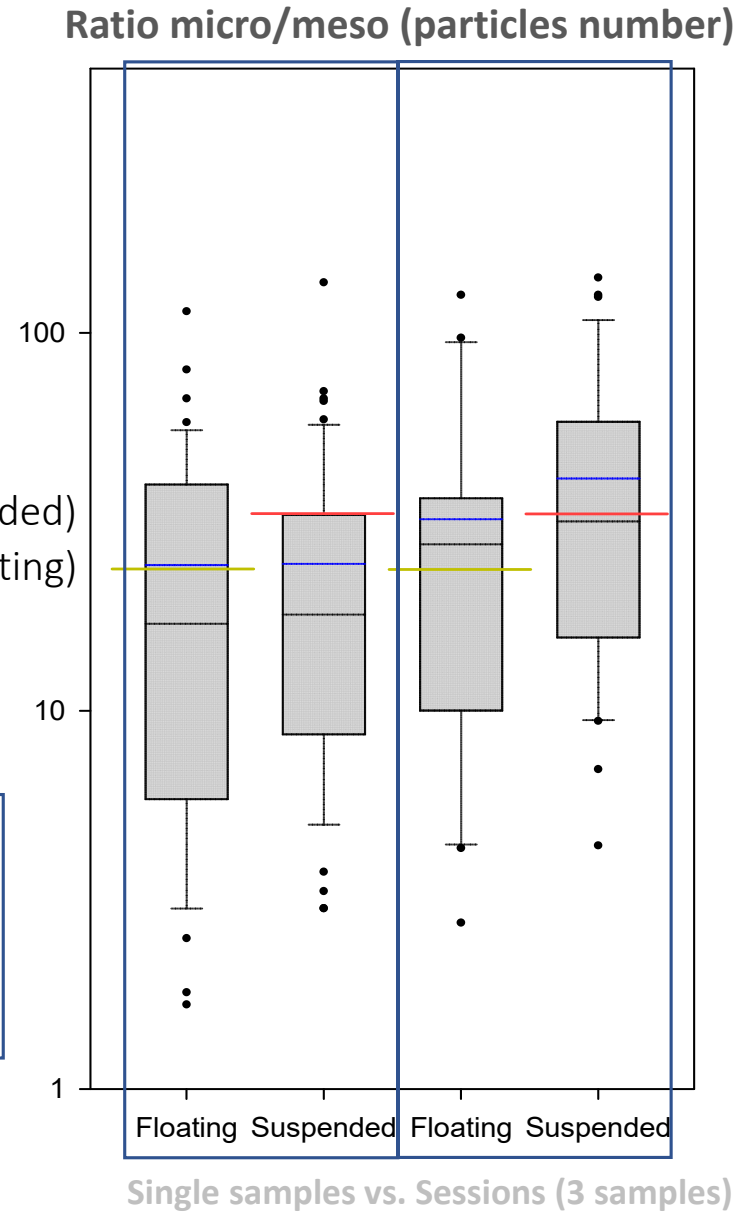
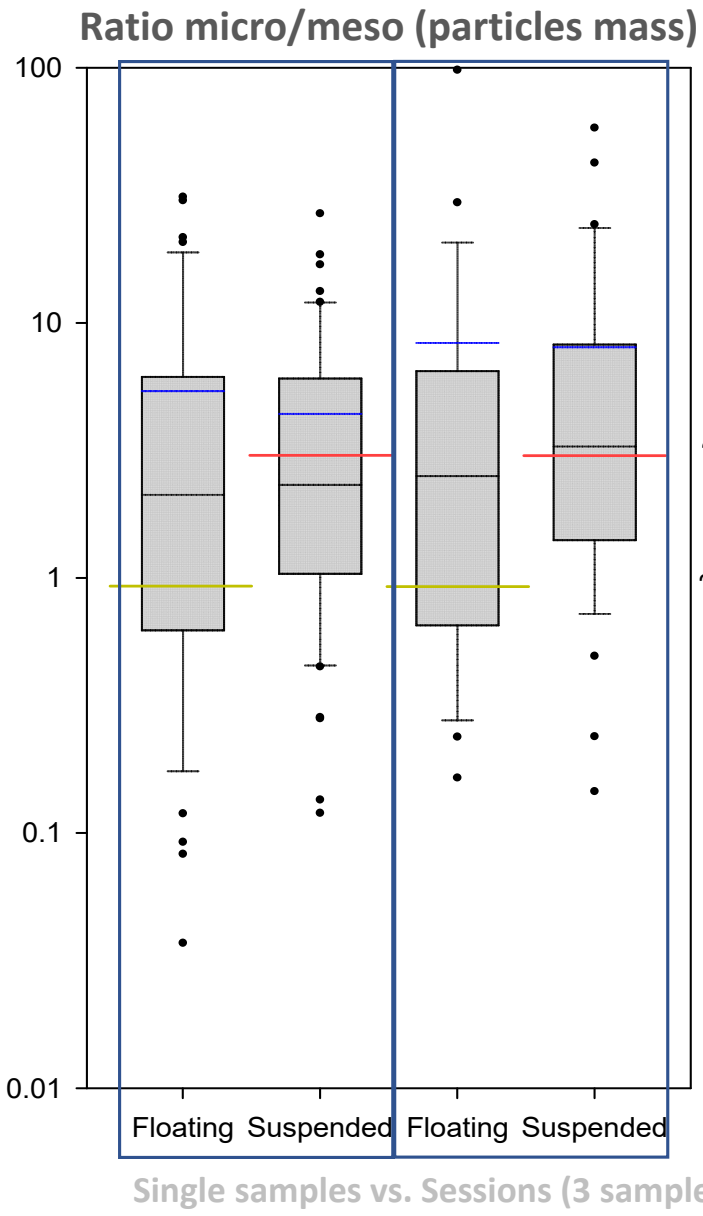
RESULTS



~33 (suspended)
~24 (floating)



~3 (suspended)
~0.9 (floating)

Overall ratio

Suspended

Floating

OUTCOME

- **Relevant numbers of individual samples with zero mesoplastic counts**
- **Ratio micro/meso – variability of 2-3 orders of magnitude**
- **Floating particles – mesoplastic mass > microplastic mass**
- **Suspended particles – mesoplastic mass < microplastic mass**
- **Alternative monitoring methods: large nets with > 1 mm mesh size (can filter in 1 hour far more water volume than these 211 microplastic samples)**

Thanks for your attention!

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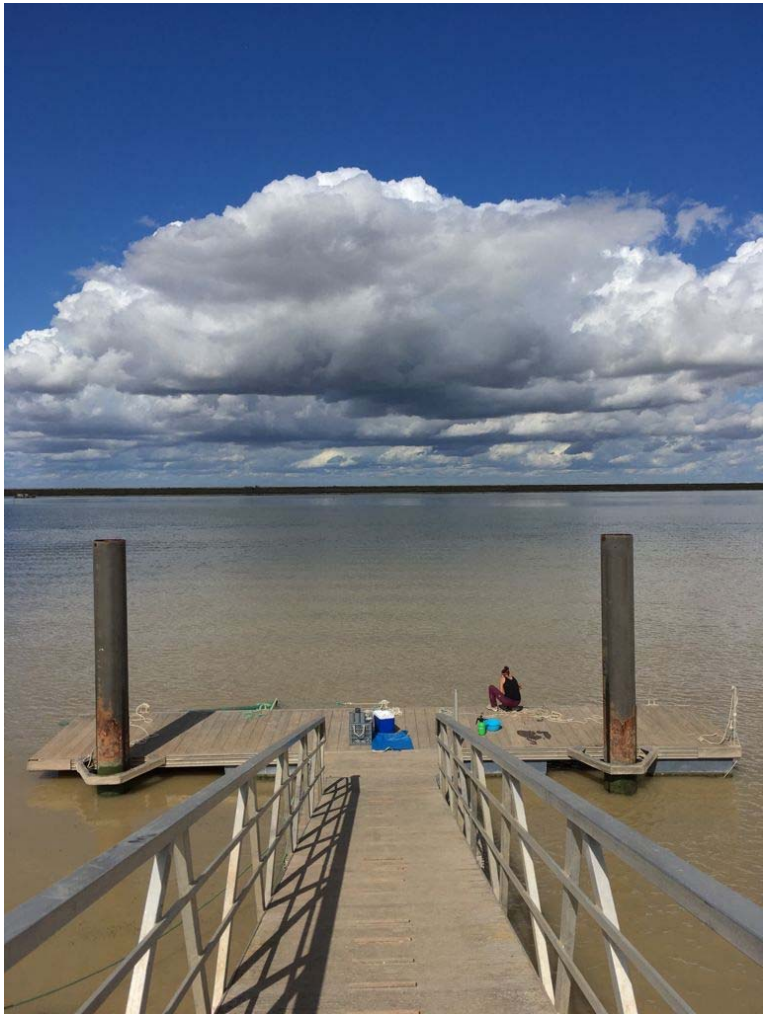

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