MICROPLASTIC IN FRESHWATER ENVIRONMENTS

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WHY PLASTIC?

Durable
Lightweight
Inert
Raw material availability
Low melting point

- Food security
- Fuel economy
- Medical technology

THE PROBLEM WITH PLASTIC

- Durability – product lifetime >>> intended use period.
- Low production cost → high availability → low value
- High volumes – waste management issues
- Lightweight – economic viability of recycling

MICROPLASTICS: OUTLINE

Small plastic noted in 1990s marine samples

'Microplastic' first mentioned in 2004 (Thompson *et al.*)

Research picked up from 2008 (mostly marine)

Plastic particles 1 µm - 5 mm

Primary – microbeads, pellets, recyclate

Secondary – litter wear, tyre wear, synthetic fibres

MICROPLASTICS: SOURCES

Microbeads – Cosmetics; sandblasting abrasive

Primary pellet leaks

Tyre wear

Litter breakdown

Textile wear

FRESHWATER MP RESEARCH IN AFRICA

- China – 31% of global plastic production; Africa is their greatest export target.
- Africa – rapid population growth (3.5% p.a.), cheap imports, poor waste management (~88.5% mismanaged waste).

Research history:

- 2016: Great lakes study – Nile perch, Nile tilapia (Biginagwa; 2016)
- 2018: WRC report – Microplastic in Gauteng riverine and drinking water (Bouwman *et al.*, 2018)
- 2018: Bloukrans River (Eastern Cape) sediment and larvae (Nel *et al.*, 2018)
- 2019: Gaining momentum – first freshwater study from Nigeria (Ebere et al., 2019)
- 2020 onwards: Other African regions coming to party (mostly coastal countries) – Morocco, Ghana, Uganda etc.

- Great Research gaps: Congo River Basin, Blue Nile, several Rift Valley Lakes.

FRESHWATER MP RESEARCH IN SOUTH AFRICA

- 2018: Boukrans River sediment and larvae (Nel et al.)
- 2018: Riverine & drinking water from Gauteng (Bouwman et al.)
- 2019: Orange-Vaal system (Weideman et al.)
- 2020: CSIR Science review of SA Marine plastic.
- 2021: Gauteng WWTP samples characterised (Vilakati et al.)

Source: C Verster
Macroplastic in the Mooi River, North West


eeld

Donderdag 19 Julie 2018 R11,60

BONUSLEES BINNE:

- Hanteer eksamenstres
- Oorleef skoolrapport sô
- Koester Afrikaanse skole
- Howe leer kinders van regte
- Groot lof vir onderwysprojek
- Dink oor geskiedenis op skool

– Bl. 18 - 23, 24, 25

Onderwys in die kollig

PRETORIA, JOHANNESBURG 'BESMET'

Waterskok

Plastiek in drinkwater

Visse vrek in die Vaalrivier

Elize Tempelhoff en News24

Dit gebeur in jou lyf

Bron van mikroplastiek

op jou trane

My man het my nie kom red nie, maar

Government considering ban on microbeads after Gauteng drinking water is found to be contaminated

2018-08-09 07:09

Melanie Gosling, Correspondent

news24

The government has set up a task team to look at imposing a total ban on microbeads – the tiny plastic beads used in cosmetics, toothpaste and sandblasting.

This comes after a Water Research Commission study found microplastic pollution in tap water in Johannesburg and Tshwane, as well as in all rivers tested in Gauteng and in borehole water in the North West province.

The study, conducted by researchers at North-West University, recommended a ban on the manufacture, importation and use of microbeads in South Africa.

In response, the Department of Environmental Affairs (DEA) has set up a task team of officials from the departments of trade and industry, health and science and technology to examine the possibility of phasing in a microbead ban.

Impact of WRC report on Gauteng microplastics, 2018

Microplastic in freshwater environments – A scoping study (Bouwman *et al.*)

FRESHWATER MP IN SOUTH AFRICA

- Method variability – results hard to compare.
- River water and sediment results relatively similar to global picture.
- High pollution levels in Vaal and Orange River systems.
- MP pollution corresponds with surrounding landscape pollution levels.

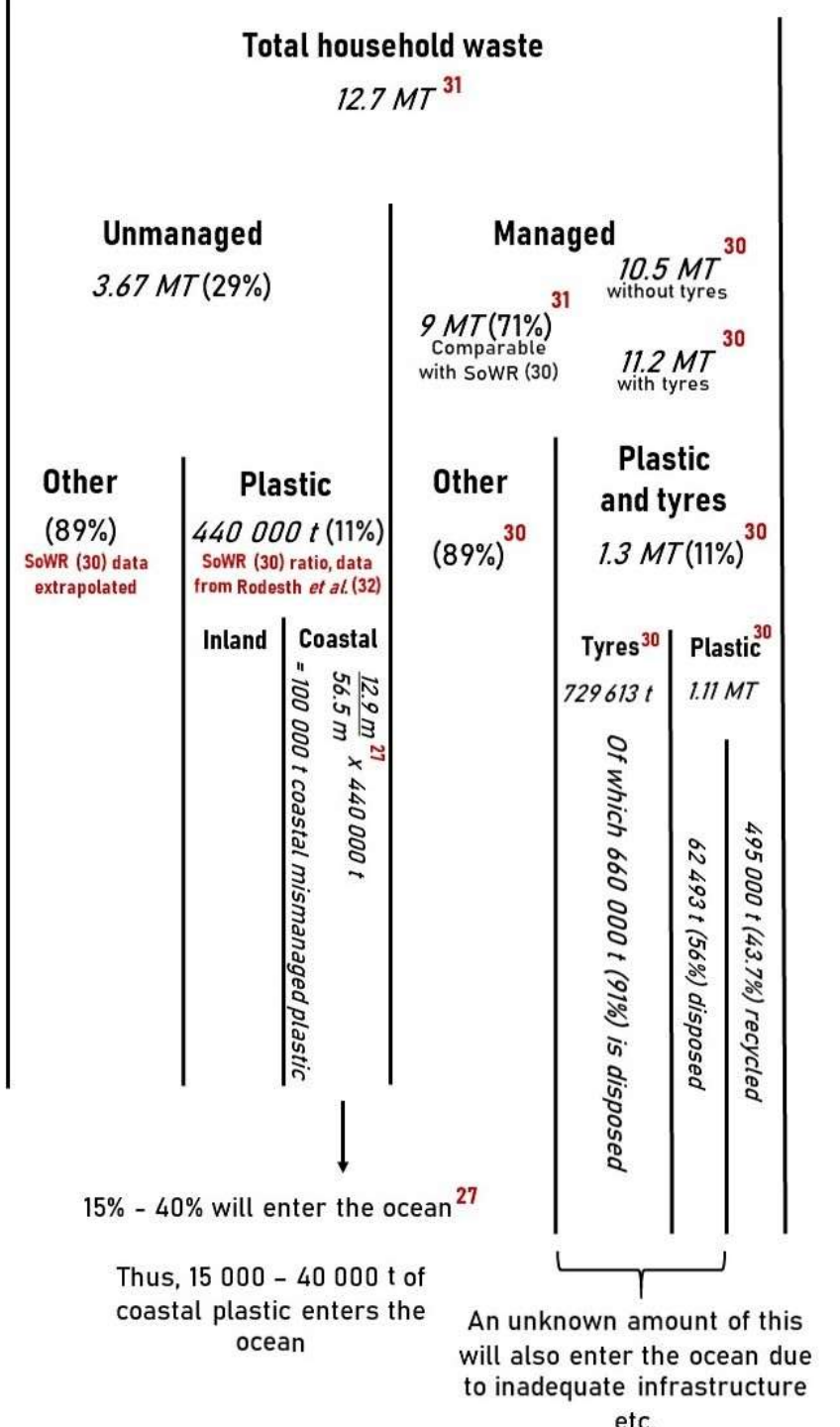
Source: C Verster
Microbeads from the Klip River, Gauteng.

LAND-BASED SOURCES AND PATHWAYS OF MARINE PLASTICS IN A SOUTH AFRICAN CONTEXT

Source: C Verster
Macroplastic in the Klip River, Gauteng

1. 15 000 - 40 000 tonnes of plastic to the oceans from South Africa p.a. – x6 less than previous estimate.
2. Riverine sediments major sinks for plastic en route to the ocean.
3. Management of treated waste-water sludge, as well as the state of WWTPs are key concerns. Up to 40% of the country's waste water is untreated and data and management practices of sludge are unavailable.
4. Major data gaps in the South African waste sector.

LAND-BASED SOURCES AND PATHWAYS OF MARINE PLASTICS IN A SOUTH AFRICAN CONTEXT



27. Jambeck J, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R, Law KL. Plastic waste inputs from land into the ocean. Mar Pol. 2015;347(6223):768-71.

30. South African Department of Environmental Affairs (DEA). South African state of waste. A report on the state of the environment. Final draft report. Pretoria: DEA; 2018.

31. Rodseth C, Notten P, Von Blottnitz H. A revised approach for estimating informally disposed domestic waste in rural versus urban South Africa and implications for waste management. S Afr J Sci. 2020;116(1/2), Art. #5635, 6 pages. https://doi.org/10.17159/sajs.2020/5635

MICROPLASTICS: DYNAMICS

- Seasonal variability
- Localised sources
- Flow rate determines amount of MP in sed vs. in water column
- Riverbeds – MP temporary sinks (and 2° source)
- Major contributors: Untreated wastewater & mismanaged waste

Source: C Verster
Macroplastic in the Klip River, Gauteng

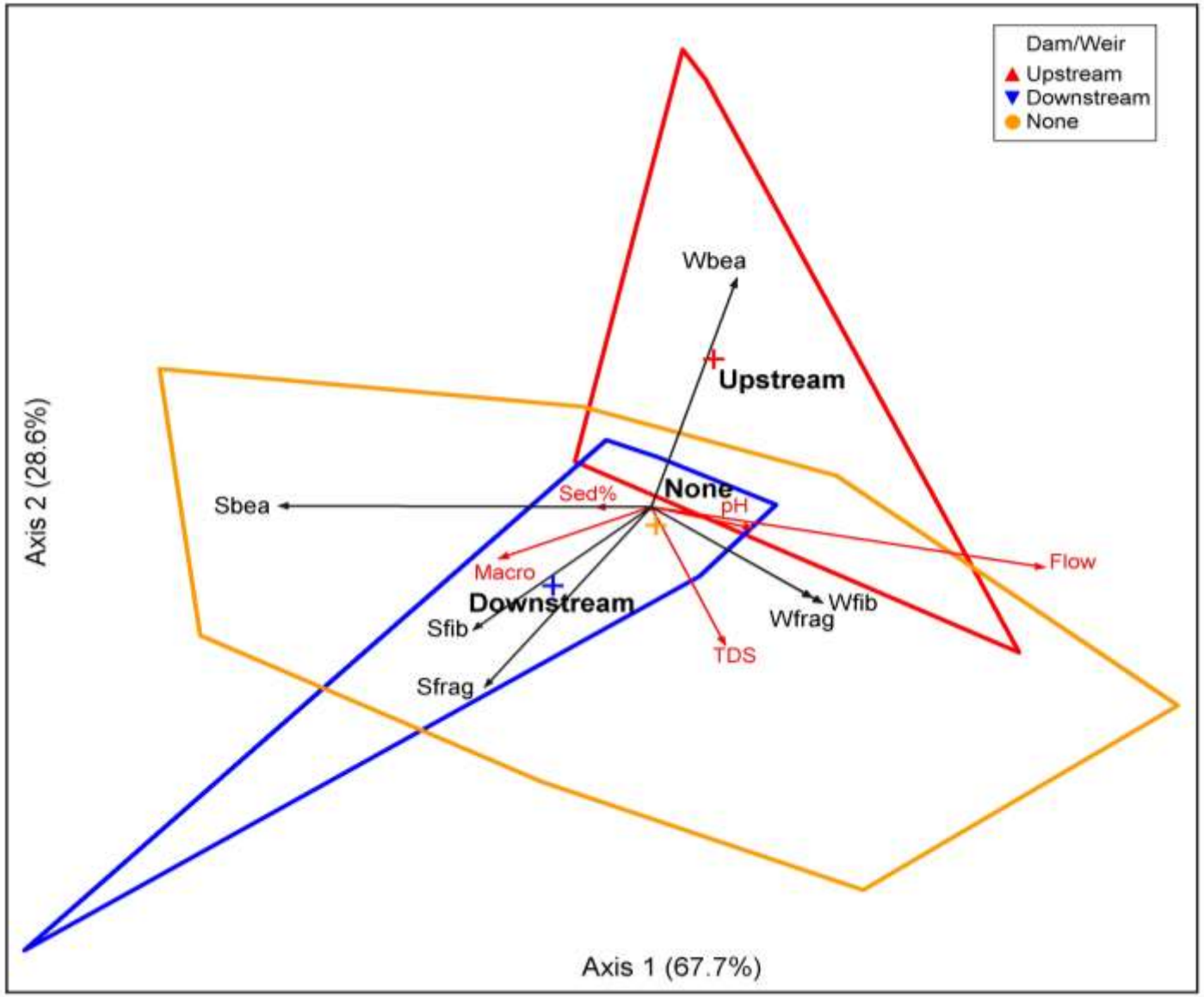
VAAL SYSTEM

Definite distinction between upstream and downstream sites – deposition.

Fragments and fibers in surface water ≠ sediment frags and fibs

Beads in sediment ≈ 1/Flow

Beads distributed differently between water ad sediment of same site.



Vaal River system – January & July; water and sediment
NMS of sites with relation to dams and weirs
(Verster, Unpublished)

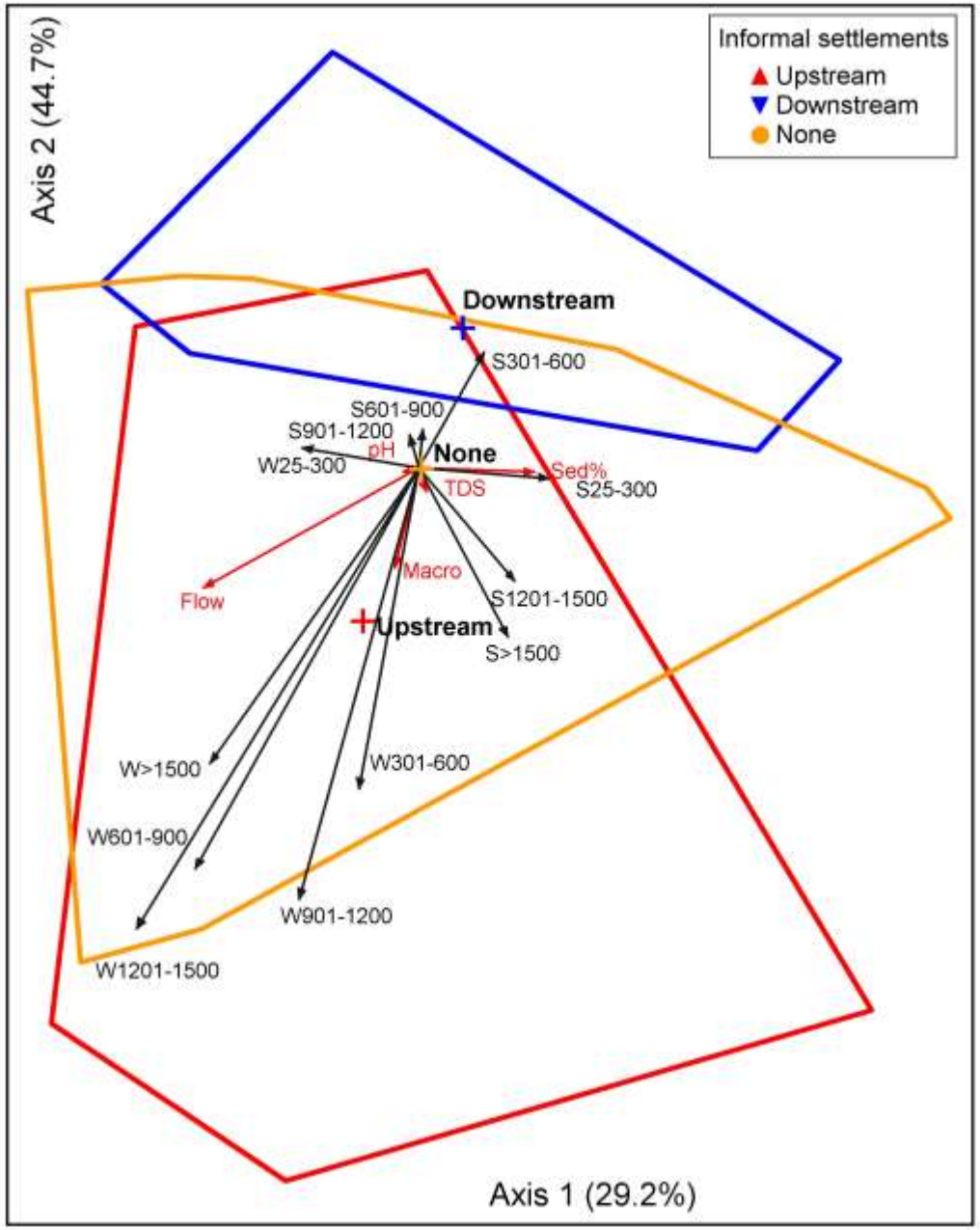
VAAL SYSTEM

MP profile different downstream of informal settlements.

Low flow causes deposition in sediment.

Smaller fragments (along with sand and clay particles) get deposited downstream from informal settlements.

Higher flow rate causes larger fragments to stay in suspension in water column.



Vaal River system – January & July; fragments in water and sediment
NMS of sites and fragment size classes with relation to informal settlements
(Verster, Unpublished)

CONCLUSION

- Africa starting to catch up since 2020
- Streamlining of methods and reporting units needed.
- High levels of MP found in SA freshwater and river sediments
- Rivers are possible sinks for MP

Source: C Verster
MP from the Vaal River


NWU
THANK YOU