UNIVERSITY OF PORTSMOUTH

Environmental Risks of Car Tyre Leachate Pollutants

Henry Obanya

PhD Student

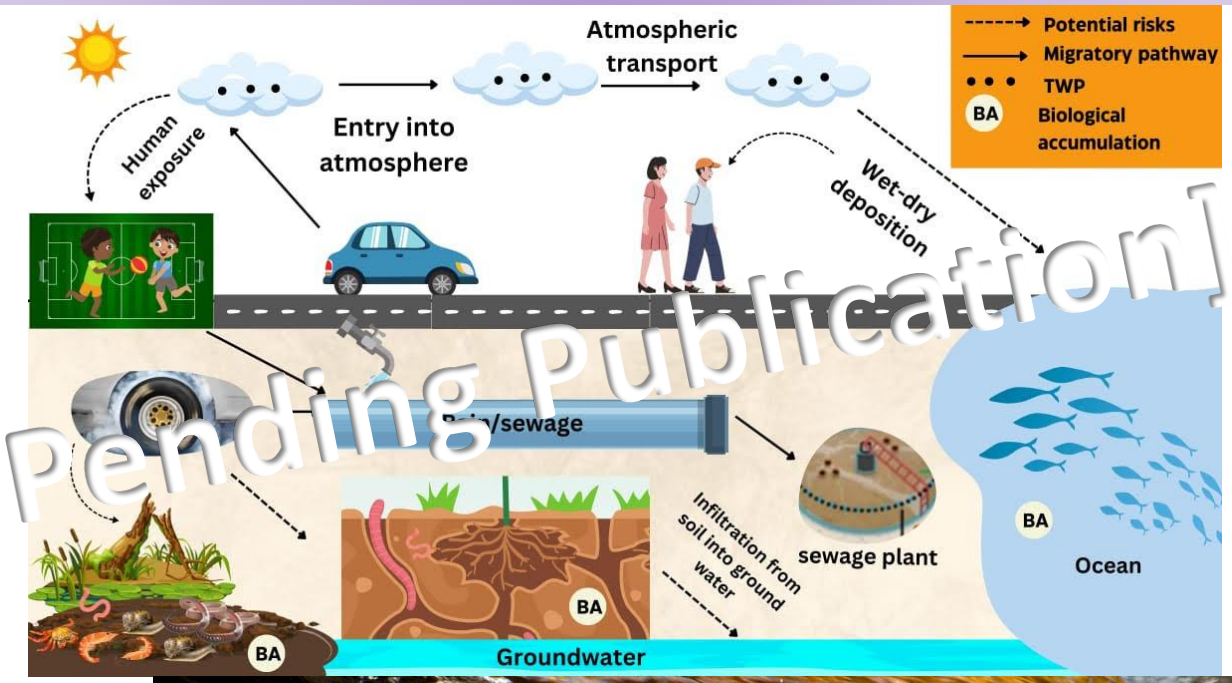
Supervisor: Prof Alex Ford

OUTLINE

- Study background
- Output of scoping workshop
- Environmental sampling and analysis
    - Emmissions analytics lab – GC-GC TOF MS (Non-target sample analysis)
    - ALS Lab – GC MS (PAH analysis)
- Toxicity of tyre leachates to amphipod
- Mitigation measures

UNIVERSITY OF PORTSMOUTH EMISSIONS ANALYTICS SOLENT FORUM EST. 1992

BACKGROUND



"[Data Pending Publication]"

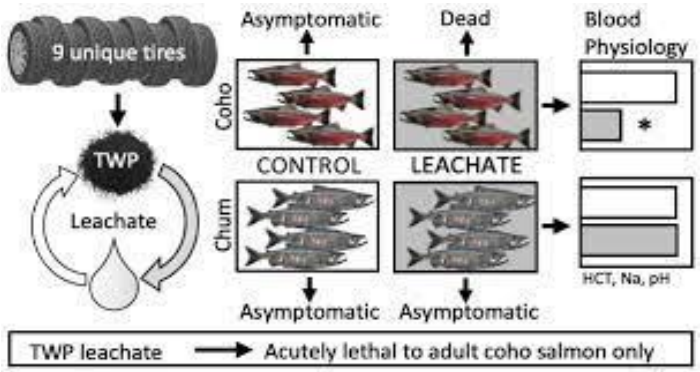


Fig. 1: Toxicity of TWP leachate. (McIntyre *et al.,* 2021)

UNDERSTANDING THE ISSUES

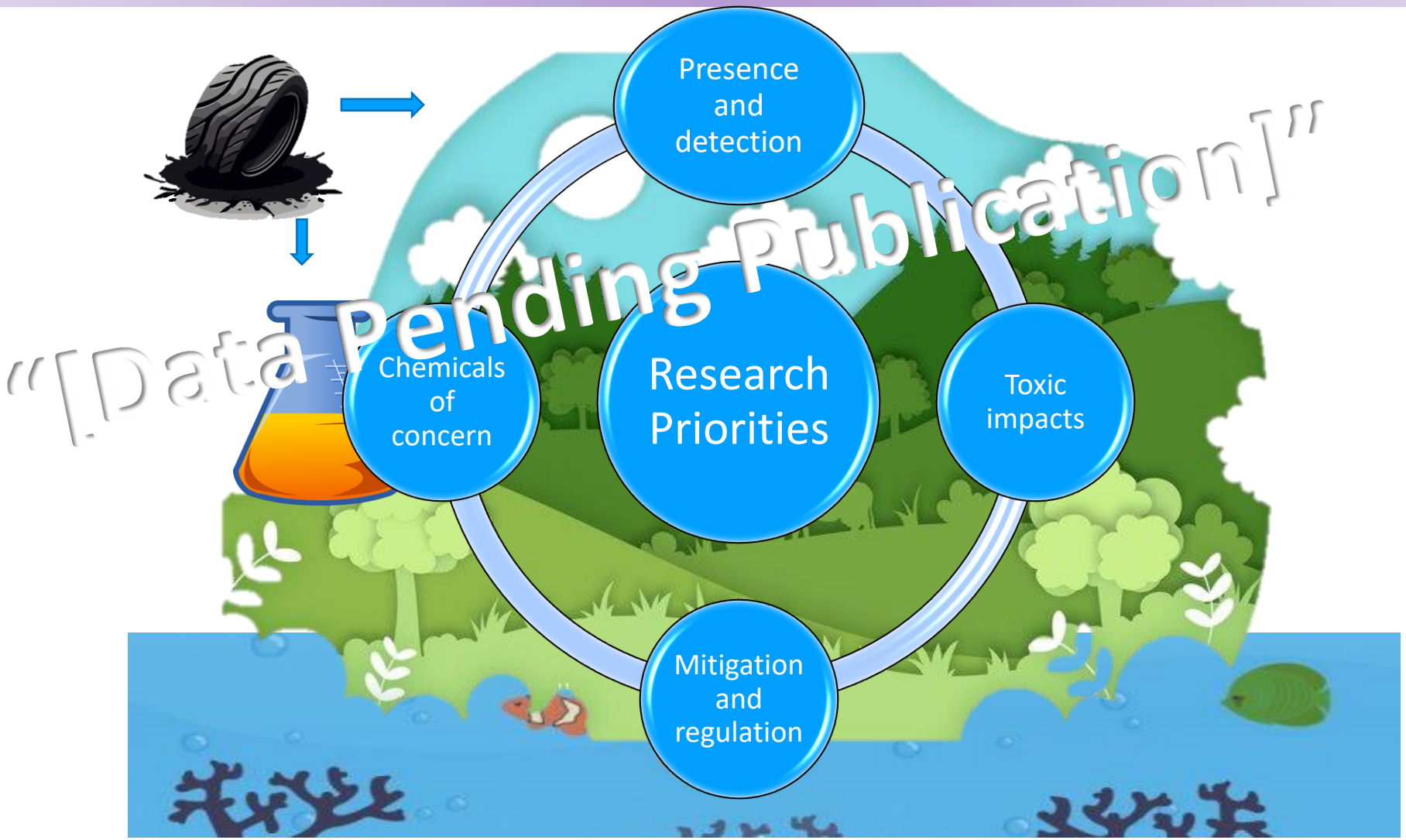
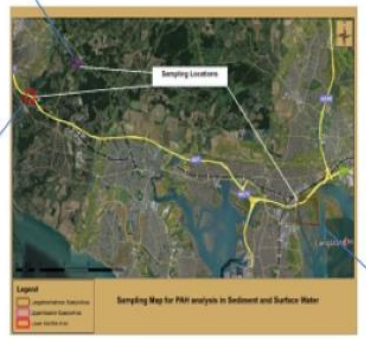


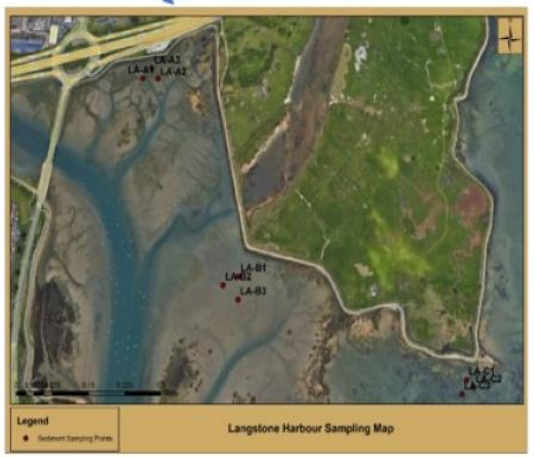
Fig: Output of scoping workshop

UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
SOLENT FORUM

Note: You may wish to refer to item 9 and item 10 on the UPRBA.

Sampling Locations



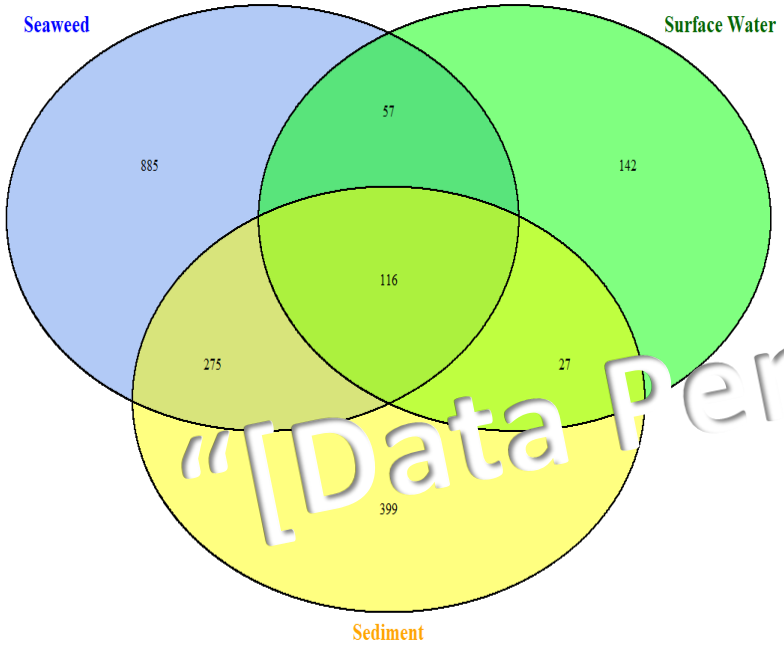


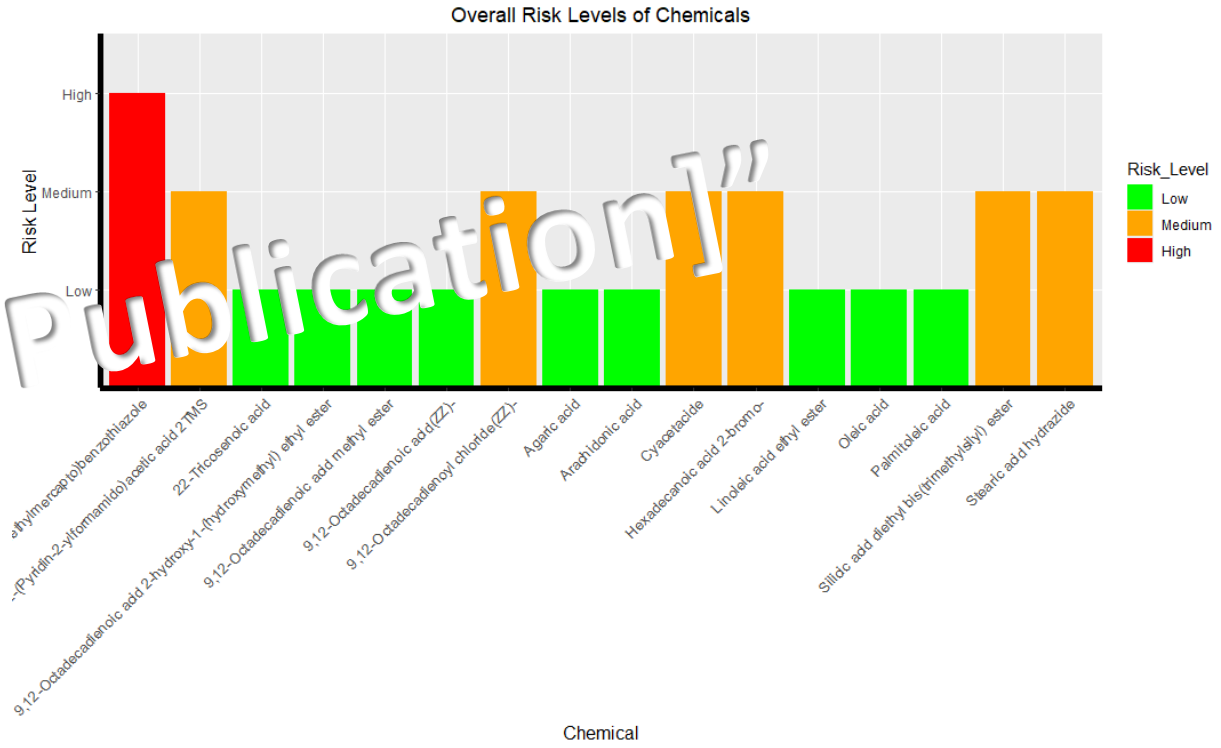
UNIVERSITY OF PORTSMOUTH

EMISSIONS ANALYTICS

SOLENT FORUM
EST. 1992

Sampling Locations





The chemicals common to seaweed, surface water, and sediment were extracted to focus on pollutants that impact all environmental components.

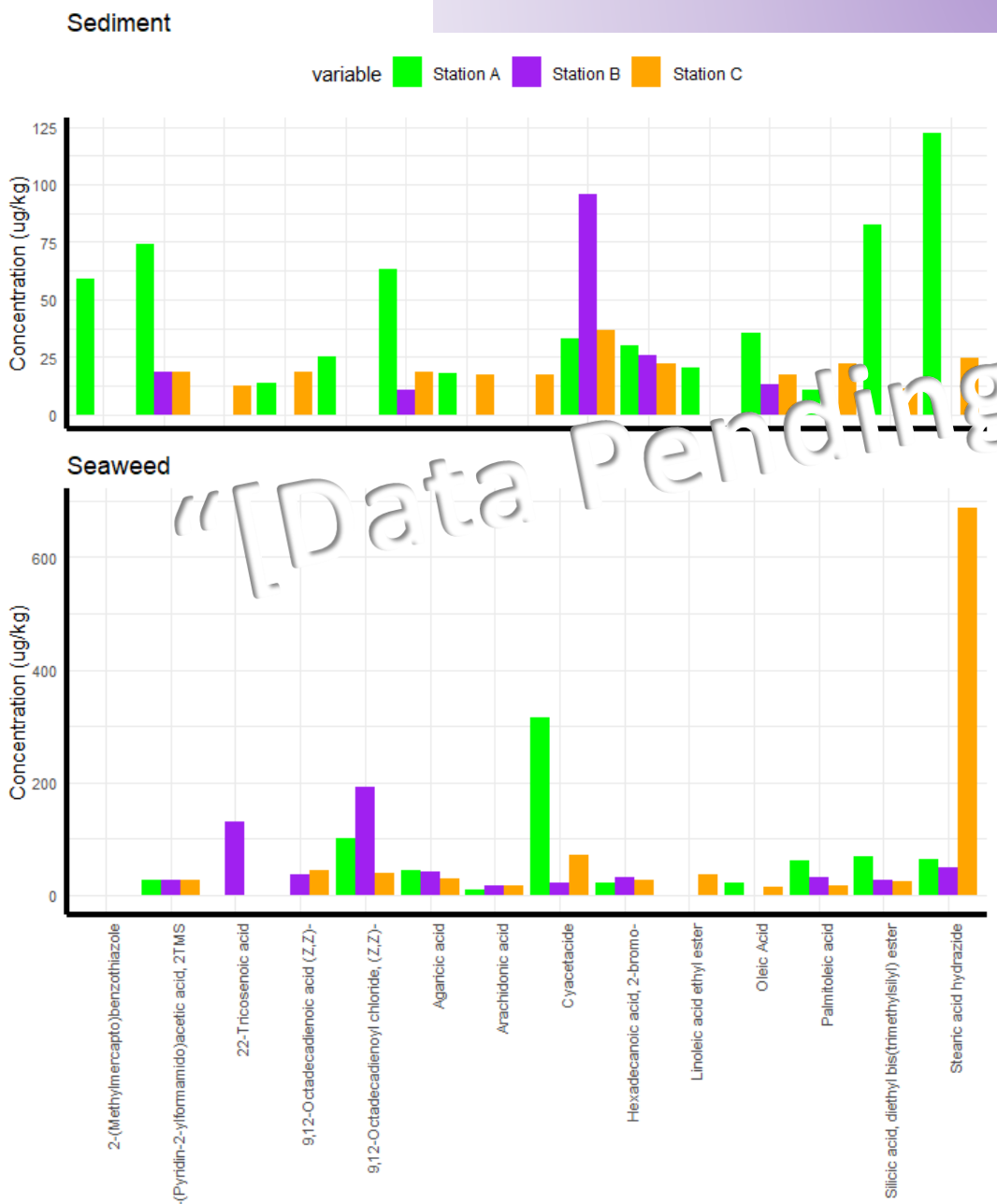
This commonality indicates these chemicals' potential for environmental persistence and mobility.

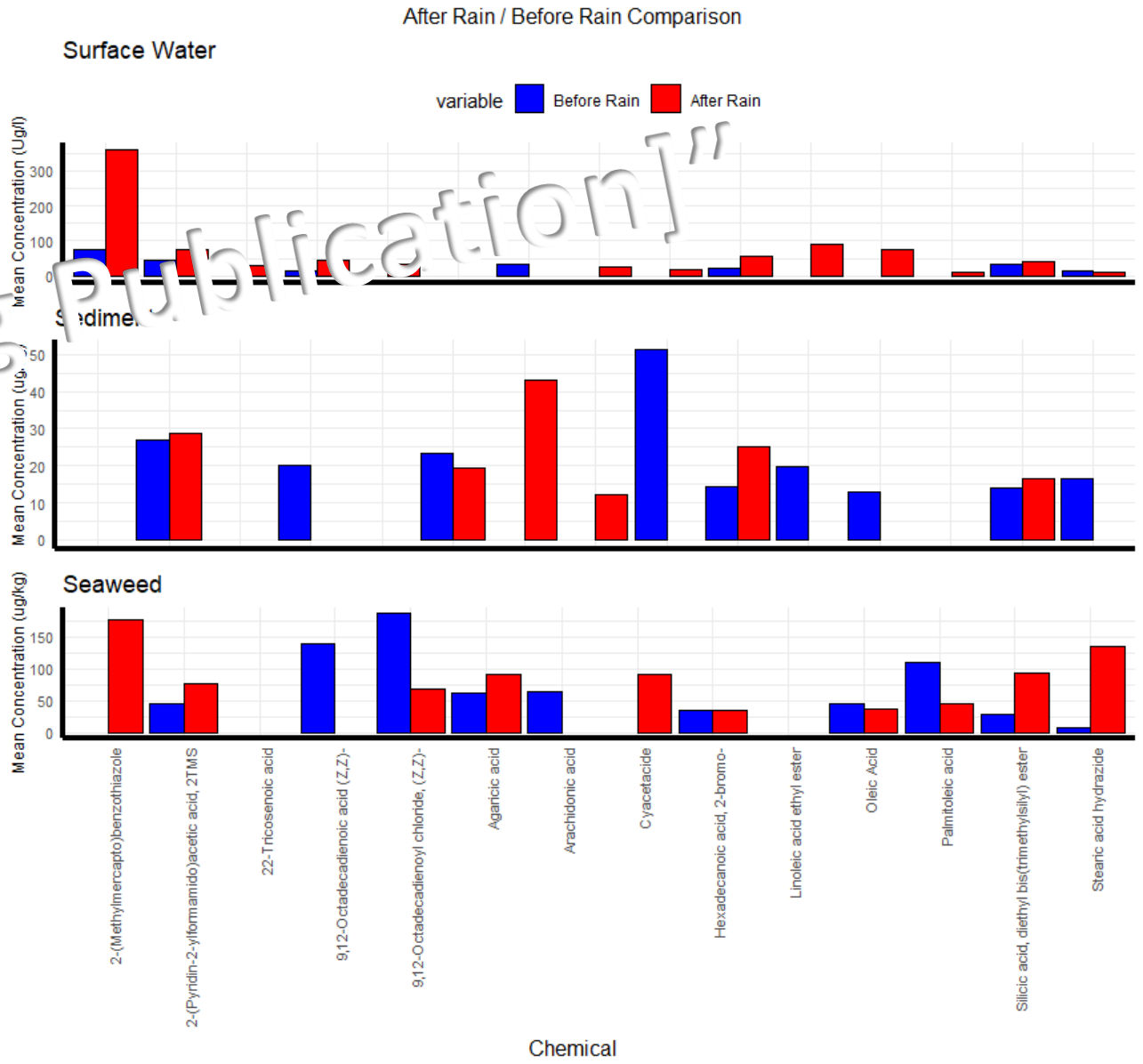
Chemicals were classified into **low**, **medium**, and **high-risk** categories based on their:

- **Toxicological impact**: Harmful effects on humans, aquatic life, or wildlife.
- **Regulatory Status**: Chemicals regulated or monitored by organizations like **EPA**.
- **Persistence and Bioaccumulation**: Ability to accumulate in the environment over time

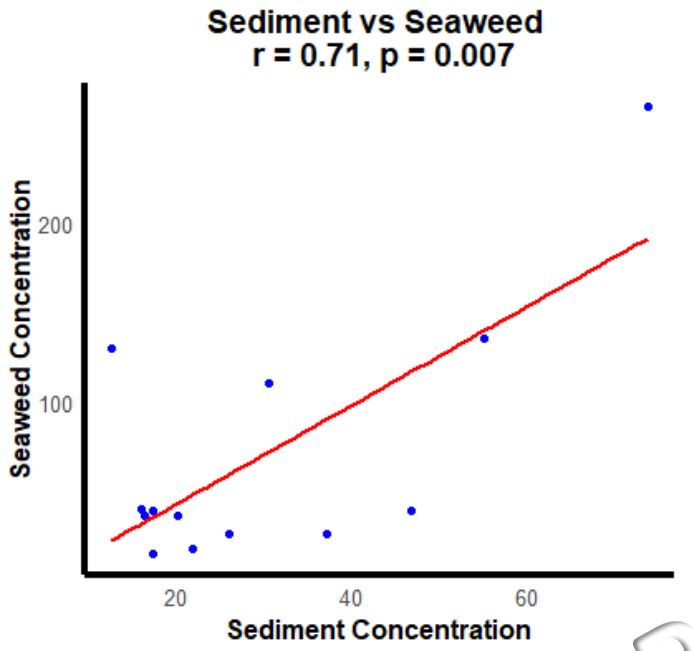
UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
SOLENT FORUM

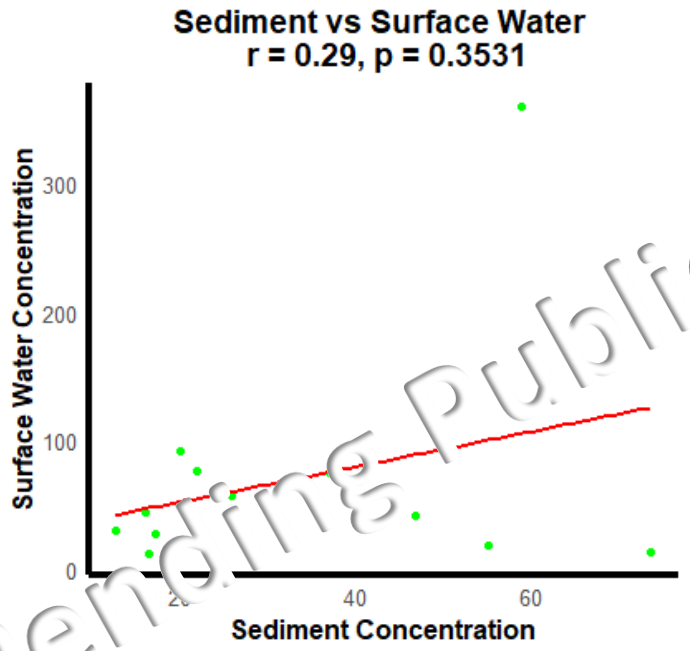
NON-TARGET ANALYSIS RESULTS (Langstone)

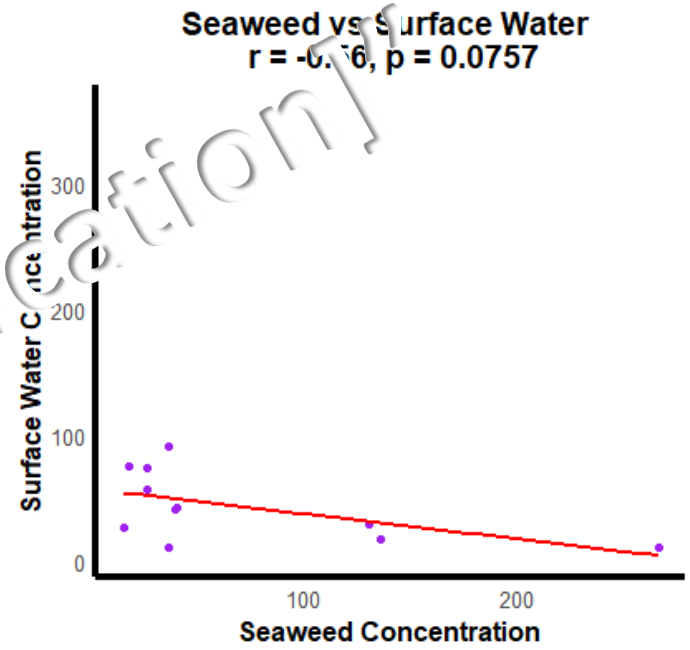


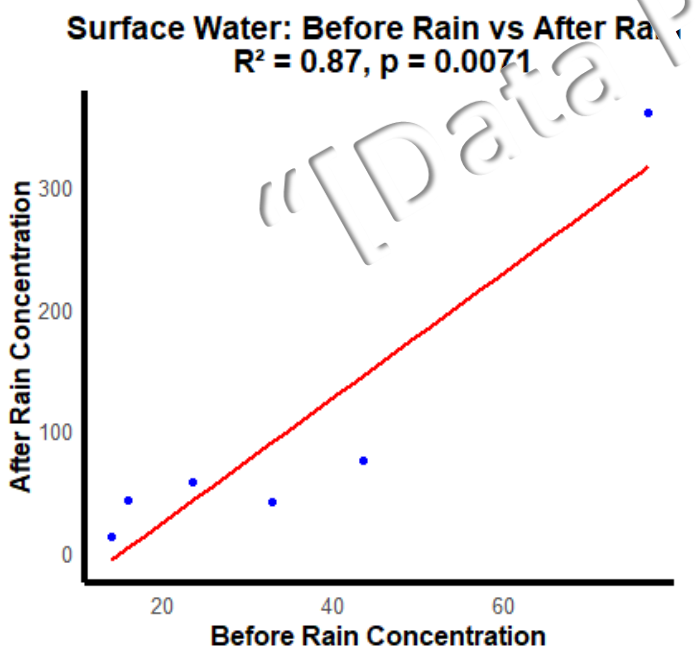


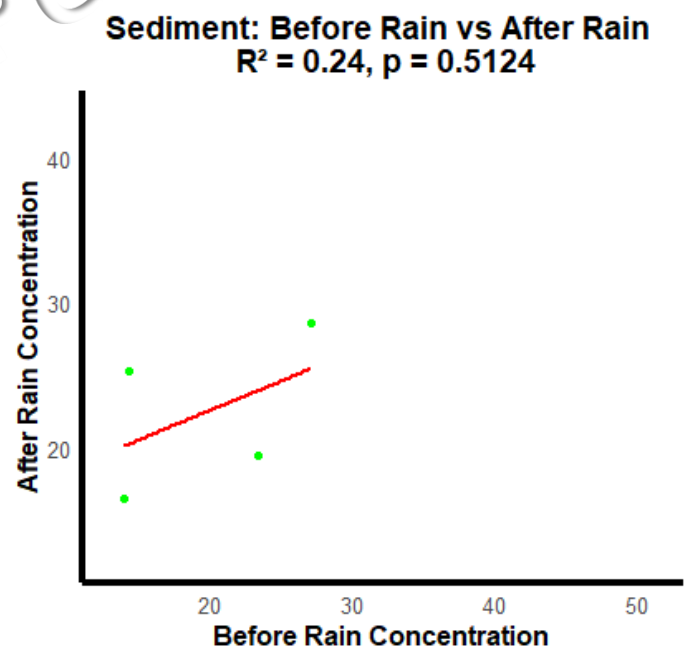
RELATIONSHIP BETWEEN VARIABLES

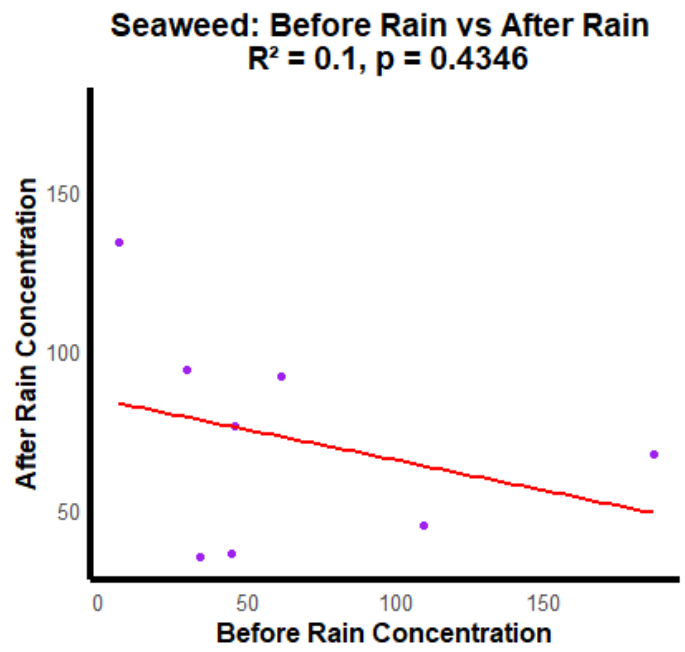




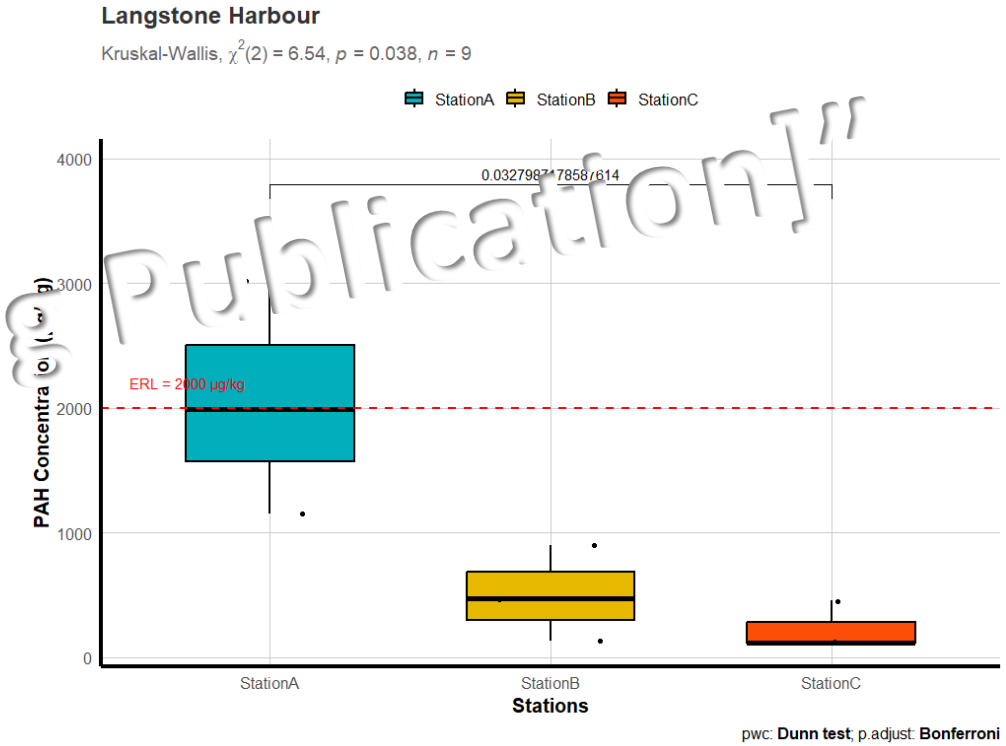








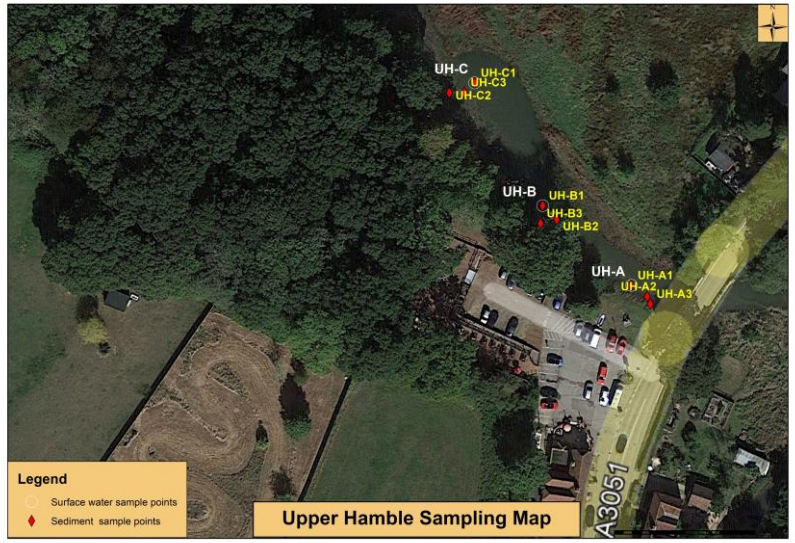
TARGET ANALYSIS RESULTS FOR PAHs (Sediment)

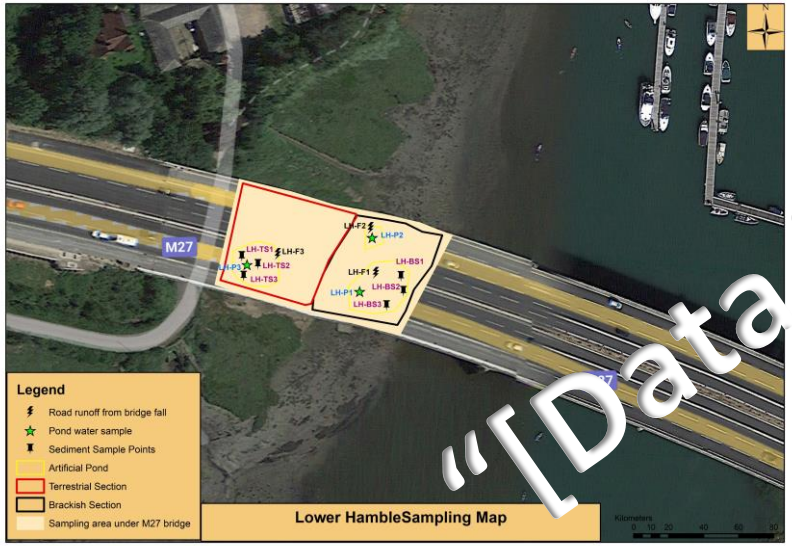


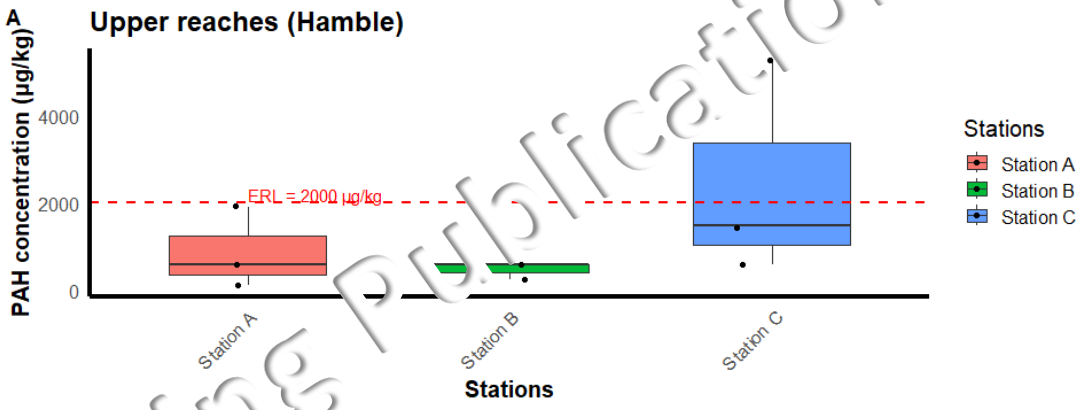
❑ **Significant impact of road runoff seen**

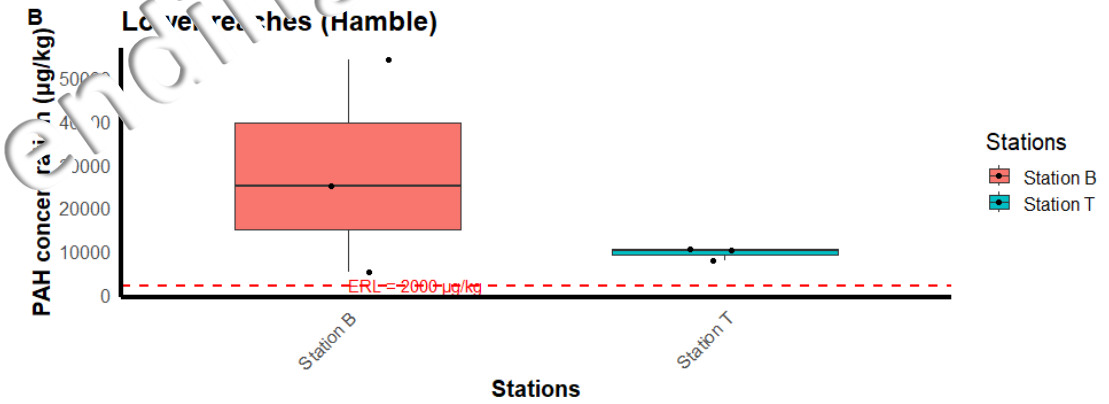
UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
SOLENT FORUM

TARGET ANALYSIS RESULTS FOR PAHs (Sediment)



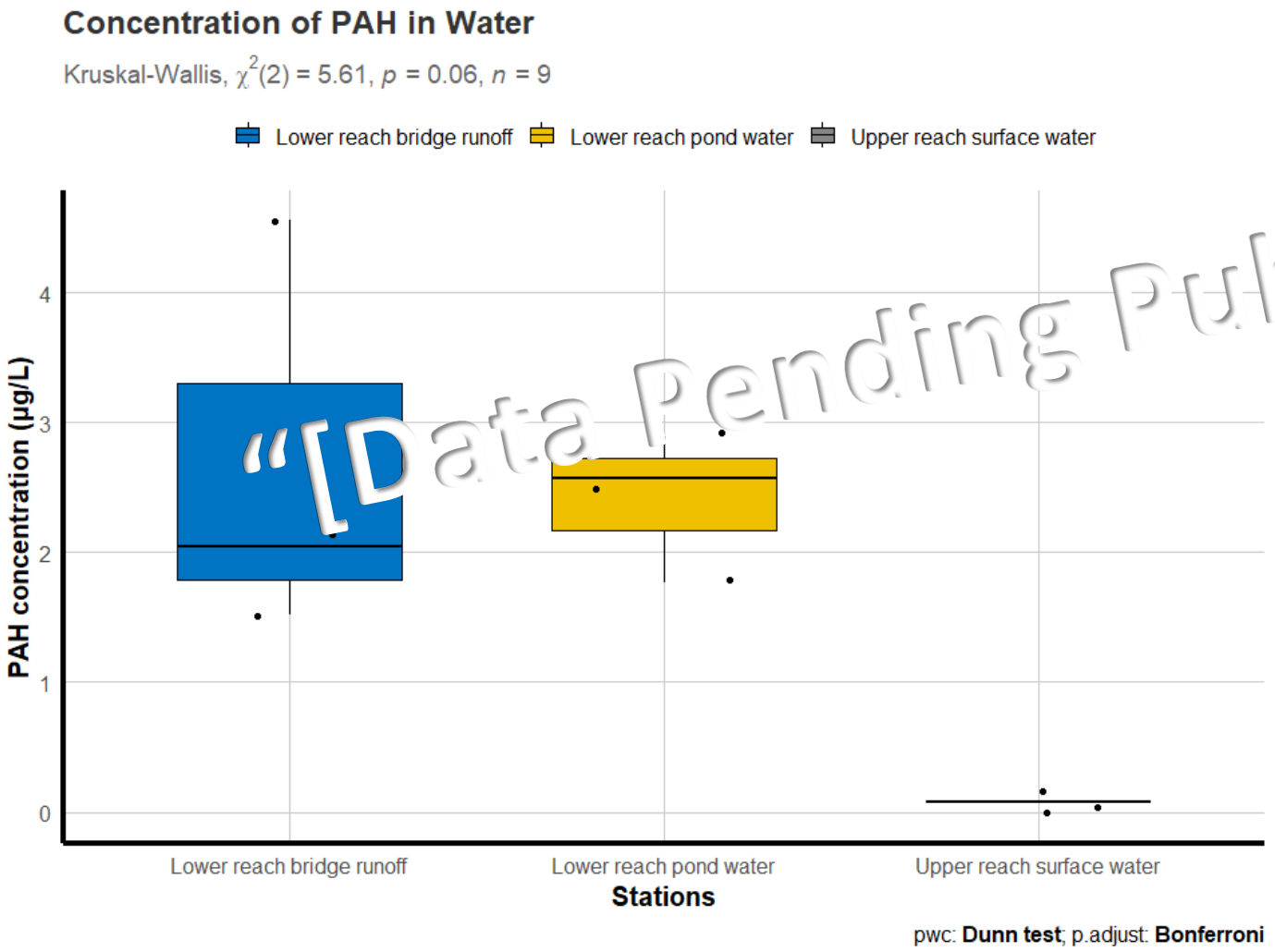






❑ Significant impact of road runoff seen

TARGET ANALYSIS RESULTS FOR PAHs (Water)

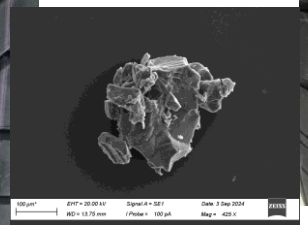


Components Exceeding Environmental Quality Standards (EQS):

- **Fluoranthene** exceeded the EQS of **0.0120**.
- **Benzo(b)fluoranthene** and **Benzo(k)fluoranthene** exceeded their EQS of **0.0170**.
- **Benzo(a)pyrene** exceeded its EQS of **0.2700**.
- **Benzo(g,h,i)perylene** exceeded the EQS of **0.0082**

UNIVERSITY OF PORTSMOUTH

TOXICITY OF TYRE LEACHATES TO AMPHIPODS



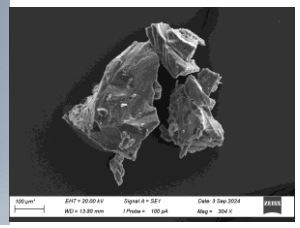


Fig: Contisportcontact (Ctire) and Laufenn (Ltire) before and after micronization

UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
SOLENT FORUM
EST. 1992

TOXICITY OF TYRE LEACHATES TO AMPHIPODS

Fig: Micronization

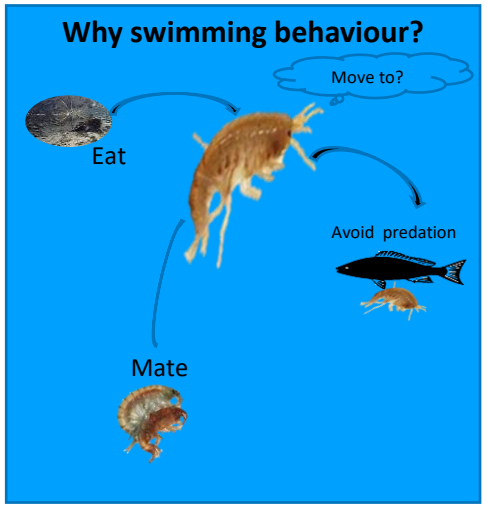


Fig: G. Pulex sampling

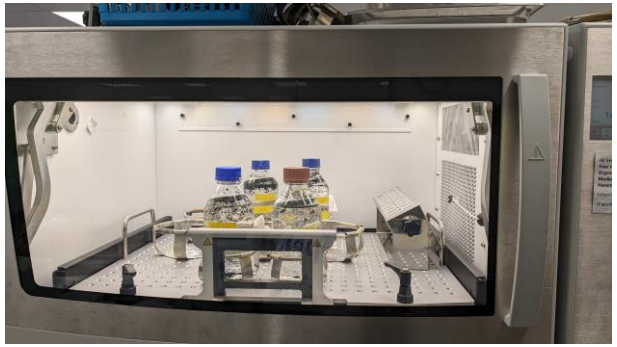
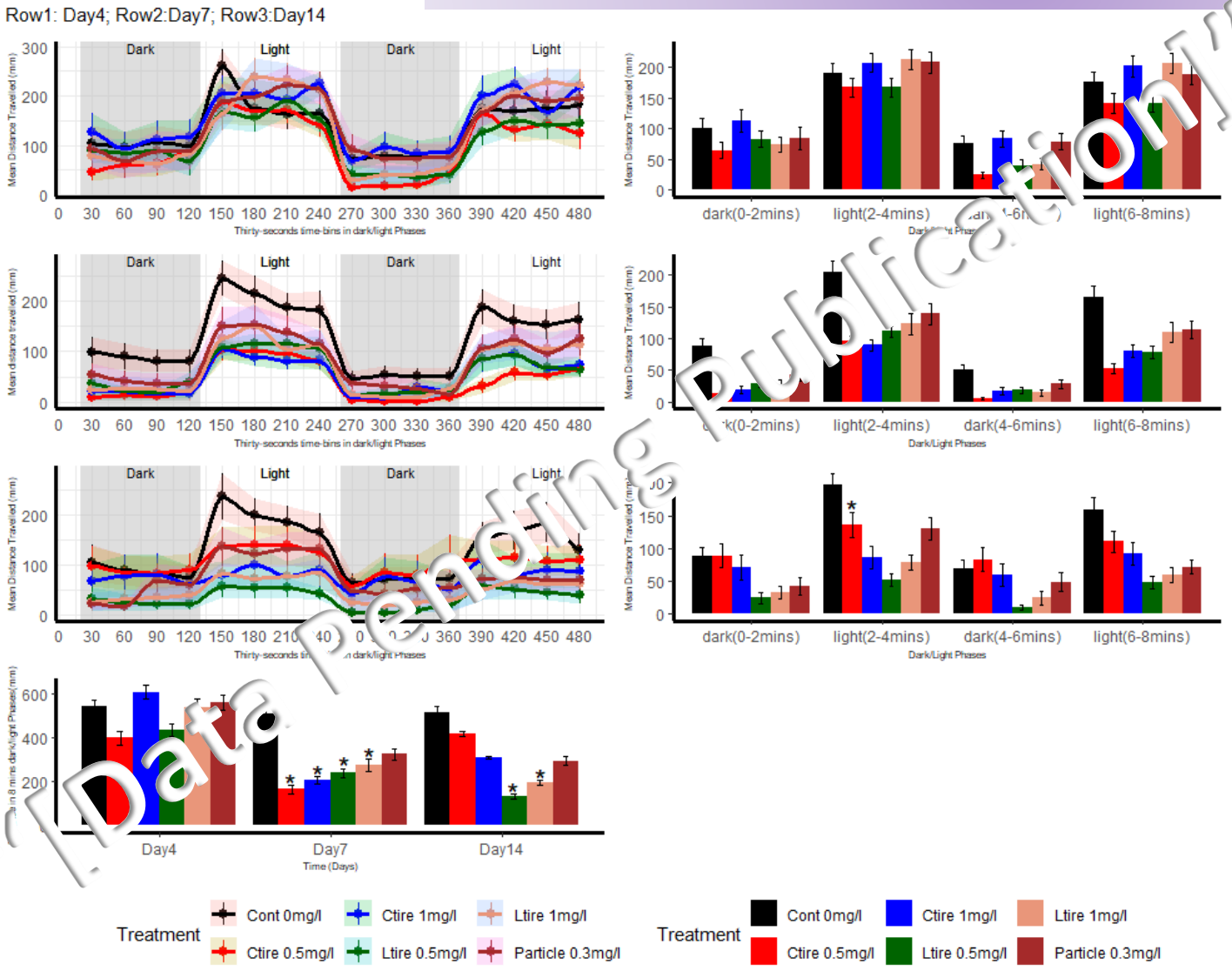


Fig: Lixiviattion and Leachate Filtration

Fig: Exposure experiment to G. pulex completed.

TOXICITY RESULTS



- All treatments show effects on swimming activity on day 7 except particle exposure
- Contisport exposure recovered from effect on day 14

UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
SOLENT FORUM

Conclusion

Significance of Tyre Leachates

Environmental Threat:

Tyre wear particles (TWP) contain harmful chemicals that pose risks to:

- Aquatic life
- Human health
- Wildlife

Key Findings:

- PAHs exceed environmental quality standards.
- Amphipods (*G. pulex*) showed reduced swimming activity, indicating toxicity.

UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
SOLENT FORUM

Conclusion

Mitigation measures

- Establishment of SPP Panel
- Standardized Guidelines
- Stormwater Treatment
- Engineered Soil Mixes
- Chemical Additive Substitutes
- Tyre Recycling
- Particle Capture
- Street Sweeping

Fig: Collected Car tire road wear particles

UNIVERSITY OF PORTSMOUTH
EMISSIONS ANALYTICS
The Tyre Collective.
SOLENT FORUM

Acknowledgement

The University of Portsmouth and the entire staff

My Funder, The PTDF

My Collaborators

My Colleagues

My Supporting Supervisor

THANK YOU FOR YOUR ATTENTION