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Summary of Results:

Ecological Impacts of Nippon Aquaterras Following Simulated In-Water Hull Cleaning

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PML Applications (www.pml-applications.co.uk) contributes towards a sustainable ocean through the delivery of exceptional and environmentally-responsible marine consultancy services and products to a global client base.

We are a uniquely diverse organization, providing scientific research, consulting and training services to help you understand the marine environment's impact on your business and your impact on the marine environment. We accelerate new technologies for a sustainable blue economy.

As the commercial arm of the research charity Plymouth Marine Laboratory (www.pml.ac.uk), our mission is to ensure a sustainable future for the global ocean. As such, all our profits are reinvested in PML's world-leading and cutting-edge research.

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PML Applications is an independent and impartial provider of test-house services for marine biofouling and corrosion prevention technologies. Our aim is to provide information to enable marine infrastructure operators to select coatings and manage their assets with the minimum environmental impact.

PML Applications conducted experimental tests on a range of different antifouling coatings (AFCs) to better understand the environmental impacts of paint debris generated during in-water cleaning events. The full results of this work are currently commercially restricted, with further methods and results due to be published in 2025.

This document provides a summary of the key outcomes and must be taken in context with the experimental limitations of the work. In particular, this work describes short term effects of AFC debris on a limited range of organisms, compared to experimental controls with no AFC debris present. The longer term impacts of any AFC debris on these and other types of organisms may differ significantly from the results described here.

Method Summary

- Industry standard in-water cleaning methods (soft brush, medium brush, and water jet) were experimentally operated on Nippon's biocide free, self-polishing coating *Aquaterras 2000*. The cleaning efficacy, physical impacts on the coatings, and all AFC debris generated during the clean were analysed and characterised.

- Representative AFC particles were introduced to natural substrate (estuarine sand and mud) housing two different species of marine sediment dwelling "indicator" organisms, either ragworms or bi-valve cockles. AFC particles concentrations were 1.2, 3.6, and 6 g/L for cockles and 6, 18, and 30 g/L for ragworms.

- Tests ran for 28 days and results were compared to experimental control organisms housed in substrate without AFC debris.

Results Summary

- No detectable zinc or copper was released from *Aquaterras 2000* during any cleaning method (soft brushes, medium brushes, and water jet methods) compared to experimental controls.

- No mortalities were recorded during the 28 day exposure trials with ragworms and cockles exposed to *Aquaterras 2000* particles.

- No significant behavioural changes were recorded under any exposure levels to *Aquaterras 2000,* and the test organisms continued to grow at similar rates to the experimental control group without coatings debris present.

- Based on this work, no measurable negative effects of exposure to *Aquaterras 2000* were detected during a 28 day exposure time.

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