Subreport Ecotoxicological Evaluation of Three Antifouling Products from the Company Båtfärg Europé AB

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On behalf of the company Boat Paint Europe AB, three new antifouling products have been studied to evaluate i) the effectiveness of the paints in preventing fouling and ii) the potential environmental effects the paints may have on so-called non-target organisms. Below is a report on the potential environmental effects the paints may have on the red alga *Ceramium tenuicorne*, a common macroalga in the Baltic Sea and on the Swedish west coast.

1. Materials and Methods

Three boat bottom paints were included in the study and are referred to as Product A, Product B, and Product C. One way to study the potential risk of using boat bottom paints on the environment is to extract leachate from the product and then study whether and to what extent the leachate negatively affects different types of organisms. Leachate was produced according to the published method developed by Ytreberg et al. (2010). The paints were applied to petri dishes (total painted area was 5 cm^2). The paints were then allowed to dry for at least one week before the petri dishes were placed in a beaker containing 0.5 L of seawater collected from the Baltic Sea (Nynäshamn). To prevent potential algae production, the beakers were wrapped in aluminum foil. The beakers were then placed on a shaker table at a speed of 30 rpm for 7 days. The leachate was then used to perform a growth inhibition test with the macroalga *C. tenuicorne* according to the standardized method ISO 10710. The method is a dose-response-method where increased concentrations of leachate are added to petri dishes containing small pieces of the alga. The concentrations of leachate used were 0% (control), 0.1%, 0.3%, 1%, 3%, 10%, and 30%. Four replicates were used for each treatment (including the control). The initial length of the alga was determined, and then the length was measured again after 7 days of exposure. Growth and growth inhibition relative to a control (where no leachate is added) were then calculated. Results are usually reported in the form of an EC50 value, which is a measure of how much leachate needs to be added to achieve a 50% negative response, in this case, how much leachate (in percentage) needs to be added to inhibit growth by 50% compared to the controls (where no leachate is added). As a comparison, a leachate and alga test was also conducted with a commonly used copper paint registered for use on boats with recreational purposes.

2. Results

No negative effect of increased leachate could be detected for any of the paints from Båtfärg Europé AB (Figure 1). The growth rate was approximately 1 mm/day for all treatments and

controls, and no effect of increased leachate concentration could be detected. Since no negative effect could be detected, it was not possible to calculate an EC50 value.

For the copper paint, however, a clear negative effect was observed at higher treatments (3 and 10% leachate) (Figure 2). An EC50 value was calculated to be 3.3% leachate with a 95% confidence interval of 2.5-4.5%.

Thus, it can be concluded that the paints from Båtfärg Europé AB, from an ecotoxicological perspective, do not have any negative effects on the macroalga *C. tenuicorne*, unlike copper paints.

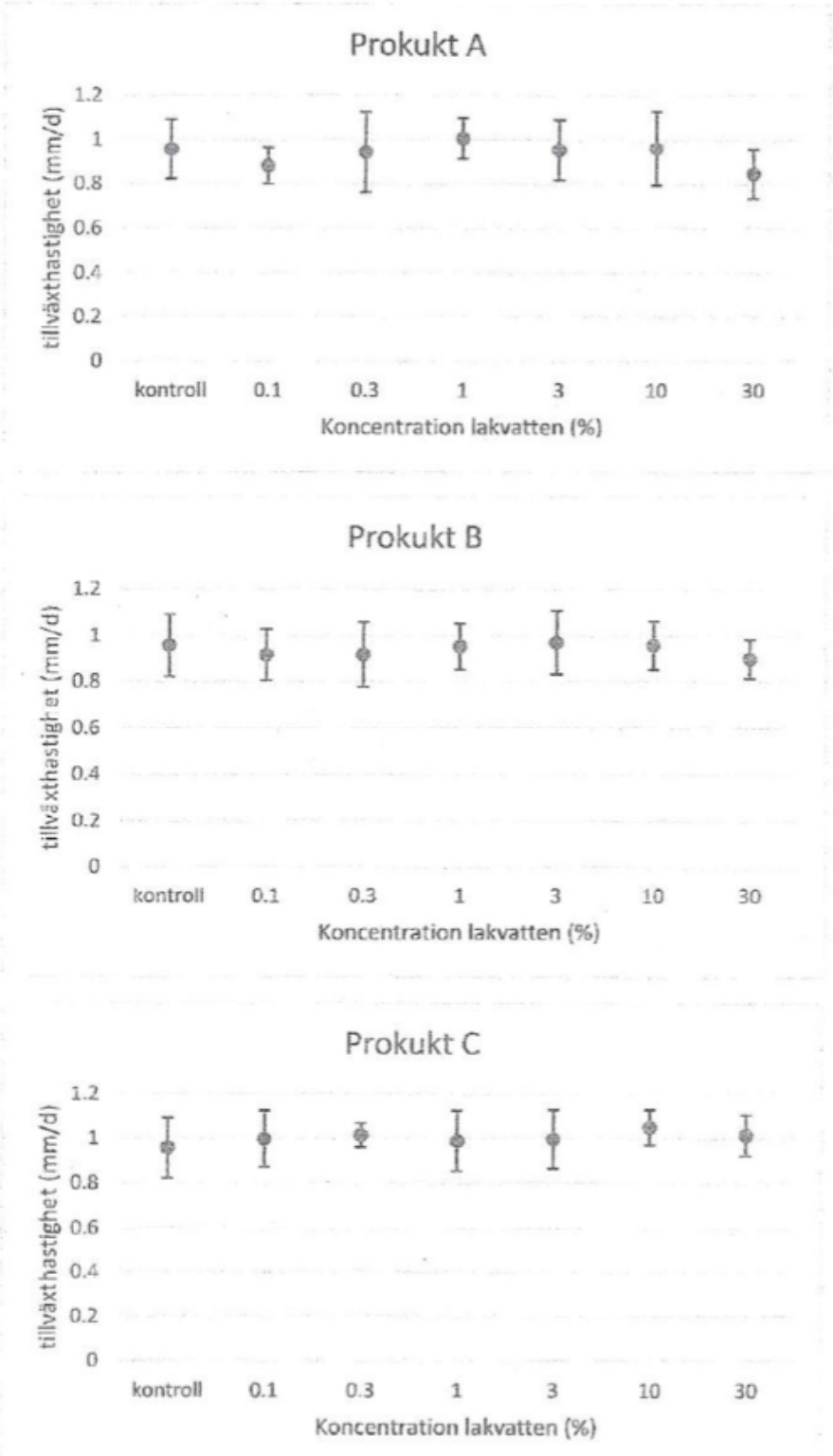

Figure 1. Growth rate of the macroalga *Ceramium tenuicorne* at increased concentrations of leachate from Båtfärg Europé AB. Error bars represent standard deviation.

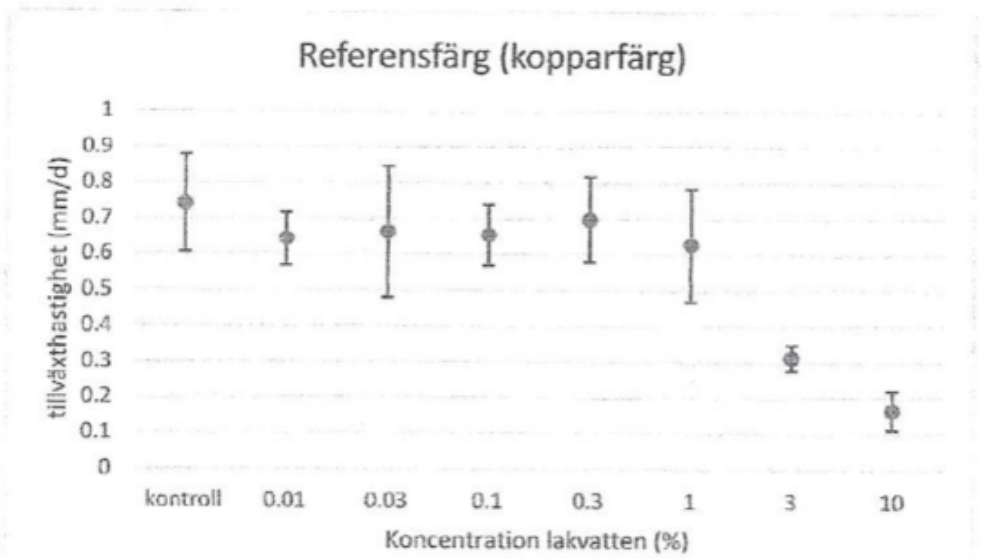

Figure 2. Growth rate of the macroalga *Ceramium tenuicorne* at increased concentrations of leachate from a copper paint registered for use on recreational boats. Error bars represent standard deviations.

References

Ytreberg, E., J. Karlsson, and B. Eklund. 2010. Comparison of toxicity and release of Cu and Zn from anti-fouling paints leached in natural and artificial brackish seawater. Science of the Total Environment 408:2459-2466.

ISO 10710. Water Quality – Growth inhibition test with the brackish water and marine macroalga Ceramium tenuicorne. ISO/DIS; 2008