

Innovation Workshop on Safer and Sustainable Antifouling Rotterdam, the Netherlands 5 October 2018

Final Workshop Report Ministry of Infrastructure and Water Management The Netherlands

Introduction

The need for safer, more sustainable antifouling alternatives in the recreational boating sector has spurred a number of innovations in recent years. However, despite the availability of a variety of alternatives that appear to have lower ecosystem and health impacts, markets have been slow to adopt these new technologies. What are the primary reasons for this in the recreational boat market? What are the needs that if addressed could advance broader adoption of safer, sustainable antifouling choices?

These questions served as the basis for bringing together over 80 stakeholders across the value chain of antifouling technologies for use in recreational boating on 5 October 2018 in Rotterdam, the Netherlands, for a day-long “Innovation Workshop on Safer and Sustainable Antifouling.” The workshop was attended by providers of copper-based anti-fouling paints, providers of alternative solutions, representatives of boat owners, marinas, authorities and research institutes etc. The workshop – hosted by the Dutch Ministry of Infrastructure and Water Management and facilitated by the University of Massachusetts Lowell, Lowell Center for Sustainable Production – aimed to achieve the following outcomes:

- understand and discuss the health and environmental implications and trade-offs of alternative antifouling applications;
- understand the performance and associated testing needs of emerging antifouling technologies;
- explore current marketplace challenges as well as needs and opportunities for multi-sectoral collaboration to scale adoption of sustainable, alternative antifouling technologies;
- identify concrete collaborative next steps to advance sustainable and feasible antifouling innovations.

Co-organisers of the workshop were HISWA Holland Marine Industry, Waterrecreatie Nederland (Waterways Netherlands) and RIVM (Dutch National Institute of Public Health and the Environment). A two-hours networking lunch allowed participants to meet providers of alternative technologies at their demonstration booths.

Workshop programme

The programme was as follows:

Programme	
9:30 - 10:00	Welcome and Opening Remarks <ul style="list-style-type: none"> • Joris van der Voet, Ministry of Infrastructure and Water Management • Jeroen van den Heuvel, ICOMIA Environmental Committee • Willem Dekker, European Boating Association
10:00 - 10:45	Session A: What Do We Know about the Alternatives? <ul style="list-style-type: none"> • Amelia Nester, Northwest Green Chemistry • Joke Wezenbeek, Dutch National Institute for Public Health and the Environment (RIVM) • Discussant: Simon Bray, AQASS Ltd.
10:45 - 11:00	Break
11:00 - 12:00	Session B: Understanding Performance Needs for Safer Anti-Fouling: Stakeholder Perspectives <ul style="list-style-type: none"> • Jaap Molenaar, Dutch Navy • Monica de Vast, Marina Andijk • Ron Mulder, Mulder Yachtservice • Leen Schaap, Schaap ShipCare
12:00 - 14:00	Buffet Lunch and Innovator Networking Session <ul style="list-style-type: none"> • <i>An opportunity to meet with antifouling innovators, discuss their technologies, and identify potential partnerships</i>
14:00 - 15:15	Session C: Innovators Dialogue: Challenges, Successes and Needs <ul style="list-style-type: none"> • Boud Van Rompay, Subsea Industries • Bob Lamers, LS Care • Hans Slegtenhorst, Akzonobel • Philseok Kim, Adaptive Surface Technologies, Inc. • Rik Breur, Finsulate
15:15 - 16:00	Session D: Small Group Table Discussions: Overcoming Barriers to the Adoption and Scale of Safe and Sustainable Anti-Fouling Technologies
16:00 - 16:30	Session E: Where Do We Go from Here? <ul style="list-style-type: none"> • Ronald Flipphi, Ministry of Infrastructure and Water Management

The presentations can be found here:



5 Oct 2018
Anti-fouling Workshop

Session A: What Do We Know about the Alternatives?

Two reports about the status of alternatives were presented.
The first was a report from Northwest Green Chemistry (2017):

<https://www.northwestgreenchemistry.org/news/release-of-the-washington-state-antifouling-boat-paint-alternatives-assessment-report>

The assessment in this report was prompted by legislation in the state of Washington in the United States that will phase out the use of copper-based paint for recreational boats in 2021 due to toxic impacts on juvenile salmon. The published assessment presents a “selection guide” that is intended to inform decisions based on the user’s needs and priorities. The assessment identified six lessons learned:

- Stakeholder engagement is critical to conduct such an assessment, for understanding challenges, gaining knowledge, narrowing the assessment to products that are of interest to stakeholders, and ensuring that the results are used.
- Even products within the same product category and mechanism of antifouling (e.g., ceramic coating) can have dramatically different hazards.
- Hazards vary across life cycle stages. Some products carry risks at the point of application (e.g., hazardous exposures to workers, boat owners), while others present impacts during the use stage (e.g., biocidal coatings based on active substances other than copper).
- There is a distinct lack of quality 3rd party performance assessments. Boaters trust the experience of other boaters more than anyone else. Boaters do not trust performance claims made by manufacturers, as they believe suppliers just want to sell their product. Current performance tests are not generally designed to test alternative, non-biocidal antifouling mechanisms..
- The metric you use for cost matters. Cost per liter may appear high for some alternatives. However, the cost per coverage area or the frequency of application needed can be lower. The question is how higher upfront cost (e.g. to remove the current coating) for some alternatives can be overcome.
- Alternatives may require changes in end-users behavior and need support. For instance, some new products require professional installation rather than do-it-yourself. Some coatings cannot be applied on top of each other and require complete removal prior to recoating. If done poorly, the new coating may fail. And some may require new infrastructure to clean boats.

The second report is from the Dutch National Institute for Public Health and the Environment (RIVM) about safe and sustainable antifouling technologies for the Dutch market:

https://www.rivm.nl/Documenten_en_publicaties/Wetenschappelijk/Rapporten/2018/Okttober/Antifouling_systems_for_pleasure_boats_Overview_of_current_systems_and_exploration_of_safer_alternatives

The report concludes that biocidal and self-polishing paints are a relevant source of emissions of toxic substances such as copper and zinc into the aquatic environment. The report also revealed that a

number of the available alternatives are expected to be safer, including 'hard' foul release coatings, other hard coatings when combined with easy cleaning systems, silicone coatings, films with fibers, ultrasound systems and storage out of the water. However, many questions remain about alternatives, including leaching and use of toxics, release of VOCs during application, use of persistent fluoropolymer components, the impact of ultrasound systems on other aquatic organisms, and the impact from the generation of toxics/debris during cleaning and maintenance. Recommendations for next steps included: (1) obtaining additional data on the content (composition) and risks of alternatives, given confidential business information constraints; (2) developing standardized performance tests that consider performance, durability and ease of cleaning; and (3) making sure information on safety and performance of the different options is more available for users.

In the discussion, microplastics was also mentioned as a possible effect of some antifouling products that should be taken into account. More generally, public attention to microplastics may also increase awareness of risks from antifouling.

Session B: Understanding Performance Needs for Safer Antifouling: Stakeholder Perspectives

A panel discussion and participant question and answer was held about performance needs from the end-user perspective. There are many different types of recreational boat owners, from those that sail in regattas to those that only put their boats in the water a few times a year. All users expect the same performance: they do not want growth/fouling that reduces the boat's speed or increases fuel use; they want to see a clean hull; and they want solid corrosion protection.

Furthermore, panelists identified the following concerns:

- Current alternatives are seen as not effective and are not practical for the recreational boat owner. Customers would rather have a product with no environmental impacts, but if the product does not work, they will switch back to what they used before. As a consequence, several panelists noted that clients often go to other countries to apply the copper-based products, which are currently restricted in the Netherlands.
- Confusion. Customers are not sure what alternatives are available and which work. There are too many questions about the effectiveness of antifouling alternative products and it is simply too expensive for boat owners and boat yards to experiment with the newer products. If there was clearer and independent information and transparency about the performance of various products, boat owners would be more willing to try them. However, they need strong evidence ("proof").
- Strained client relationships. Boat owners look to boat yards/boat service providers for solutions; customer relationships suffer when poor performing products are used.

Other issues raised in the discussion were:

- When asked about the importance of offering do-it-yourself (DIY) products, panelists thought that norms and expectations could change over time. Many of the current alternatives are seen as expensive and need to be applied under controlled conditions in order for the product to work. For boat owners to be convinced that a given antifouling product applied by a professional is the best option, they need evidence. Cost is often the main driver of DIY activities since people are looking

for the cheapest option. Traditionally, the cheapest options were paints that owners could apply themselves.

- New payment models are needed. The new generation of boaters may be able to think differently about costs. Payment support models will be needed (e.g., monthly fee service models) to address up-front costs that are significantly higher for some technologies (including removal of paint).
- Where do boat owners get their information about specific products? Panelists responded that most talk with each other and rumors abound. They also read magazines and go to exhibitions. Boat yards and boat owners need simplified information. In some cases, people heavily rely on the recommendations of a marina. In such as case, the marina is likely to be blamed if a solution fails. Sales persons and consumers are not scientifically oriented.
- The Dutch Navy has tested alternative antifouling products since 2004 – including foul release coatings, UV and ultra-sonic. Given the positive results with foul-release coatings, the Navy as of 2016 is phasing out all copper-based coatings and phasing-in the use of foul-release coatings on all vessels. The Navy needs to rely on empirical testing because it is still not clear what material properties are relevant to the behavior of antifouling.

Discussions among participants and panelists elaborated on some of the above aspects. The need was stressed for independent, objective evidence of efficacy based on testing conducted by neutral third parties, but engaging all stakeholders. It was added that it is important to engage the whole supply chain, including wholesalers and retailers, in the conversation. Furthermore, the government could look how to support boat yards, based on an understanding of their education and awareness needs.

Session C: Innovators Dialogue: Challenges, Successes and Needs

A panel of innovators – each at different stages along the innovation curve – discussed what they saw as the current challenges, needs and lessons learned confronting the development and diffusion of safer and sustainable antifouling technologies.

The RIVM report mentioned above gives an overview of available products. Examples highlighted in the panel discussion were a hard coating, an ultrasonic system, a slick, self-cleaning and repellent surface, and a surface with spines that prevents barnacles and other organisms from reaching and attaching to the hull, which is applied as a film/wrap.

When asked for the biggest challenges and what they have done to overcome these, a number of themes emerged:

- Lack of consideration of lifetime ownership costs. Switching to new technologies may cost more upfront, but considering lifetime ownership costs may reduce the overall cost of the technology.
- Moving from the laboratory to full production is a challenge. Customers that are willing to navigate the innovation experience are needed. Failures will inevitably happen. The key is to take care of customers that are not happy and foster long term relationships.
- There is a need for partners who already have access to distribution channels. Intellectual property protection (despite the cost) is important, especially for newer start-ups.
- Lack of testing capability and standardized testing is a significant barrier. Test methods are still old fashioned and not dependent on context/mode of action. Time is money and companies cannot wait years to prove that the product lasts for 10 years. At minimum, it takes 2-4 years after

installation to see that a given antifouling product works. Different modes of testing are also needed, e.g. dynamic testing. Right now the sector is comparing apples to oranges.

- Convincing pleasure boat customers is difficult. We cannot test on every vessel type located on every type water all over the world. The industry is highly influenced by word-of-mouth. It is important to work with boatyards to put the product on a given vessel to demonstrate effectiveness.

When asked, “what can government do to facilitate the growth and adoption of safer and sustainable innovations?” the panel had the following remarks:

- Create awareness of the market availability of safer technologies.
- Incentive members in the value chain. Incentives could include taxes, subsidies, training/workshops for applicators, and certification programs, among others. Incentives will help the boatyards and owners adopt. Many of the new technologies will require a combination of coating and hull cleaning as well as removal of previous coatings. However, the infrastructure for cleaning is not available.
- Utilize the government’s large fleet of vessels for testing/use of alternative antifouling technologies.
- Define what performance needs are more clearly.
- Enhance regulation and enforcement of technologies of concern.

Panelists’ final thoughts about priority ways forward included:

- There is no single ideal solution for safer and sustainable antifouling. The diversity of solutions/different technologies is important. . The general impression was ‘ there is room for all of us’.
- The need for cleaning is central. Many alternative approaches require cleaning. But this infrastructure is not generally available at present.
- Government should be a leader. Innovation is team-work and an opportunity for government to take a leading role in showcasing these technologies on its own fleet of boats.

In discussions with participants, some larger producers of paints disagreed that copper from antifouling products is a problem, particularly in salt water. These producers also need to invest a lot of time and money to comply with biocidal regulations. Once a biocide is registered, there is a significant interest/need for companies to continue focusing on this large capital investment, which unfortunately can hinder innovation in other areas of the business.

Overcoming Barriers

Working in small groups, workshop participants discussed three questions to reveal priority next steps.

1. What additional evidence, knowledge or information do we need to advance the adoption of alternative antifouling technologies? Among participant responses, there was broad consensus on the importance of additional performance testing. Additional priorities included environmental impact studies, and increased monitoring efforts to support regulatory enforcement and to improve continued understanding of antifouling ecosystem impacts.
2. Who are the key change agents or influences that need access to this information/evidence to drive a shift in the market and in adoption? Multiple groups mentioned three entities:

government/legislation, HISWA and boatyards. Additional priority change agents noted included online retailers, wholesalers, companies that construct new boats, and boating magazines.

3. What other actions are needed to stimulate development and adoption of safe and sustainable antifouling options? Responses included:
- need government to stimulate transition options, particularly hull cleaning operations;
 - use fleet of government vessels to showcase alternative technologies;
 - create a group of “pioneers” – shipyards and boat owners – to test the new alternatives;
 - undertake government-initiated education and awareness initiatives.

Workshop attendees in discussions and using a SLIDO poll voiced strong support for:

- Continued evaluation of environmental impacts. There are residual questions about the impacts of several types of antifouling alternatives. These should be addressed before broad market adoption.
- Performance testing program where users, producers and scientists are active participants in the program. Key elements of a performance testing program as voiced in workshop discussions included:
 - Importance of commissioning the research by a neutral trusted third-party.
 - Necessity for a standardized testing protocol around the end-user requirements for antifouling. Key to the success of the program is to engage boat owners so that the testing results can improve customer awareness, and exchange of information in order to influence changes in behavior.
 - Need for resources: antifouling product suppliers could provide their technologies and boat owner who agree to try out the technologies.
 - Different types of testing, static, dynamic, users want to see evidence from application on boats.

Where Do We Go from Here?

The Ministry of Infrastructure and Water Management closed out the workshop. It was clear that a productive dialog is possible despite some areas of disagreement. The Ministry will continue to work on different lines of action suggested at the workshop, such as awareness raising and communication, and looking for incentives for adoption of alternatives. In particular, the Ministry will, together with stakeholders, endeavour to set up a joint performance testing programme. This is seen as a key next step.

The workshop provided a model of safe-by-design innovation supply chain dialogues. Participants appreciated the range of perspectives as well as hearing from both users and suppliers of antifouling technologies.