

CHANGE NOW, BUT HOW?

WHY DO THE ANTIFOULING PRODUCTS NO LONGER OFFER SATISFACTORY SOLUTIONS?

During or at the end of the season, many of us are disappointed by the lack of effectiveness of the anti-fouling coating that was painstakingly applied in winter. This is not due to a lack of effective biocides or too low concentrations of biocides in the products, but to the fact that most of us move our boats far too little. But unfortunately, not everyone can get on the water every week. However, eroding and self-polishing antifouling coatings need an activation by currents, to erode and release the biocides.

In addition, the biocides released and the microplastics of the eroded or self-polished coatings pollute the waters. Therefore, we should consider whether we should abandon the idea that there will be a coating that can remain free of fouling on a boat with an extended lay time, purely based on its physico-chemical properties. Because the longer we lie down at berth, we offer optimal conditions to all organisms that have to attach themselves to a solid surface. Biocide-containing antifouling products work to a limited extent in commercial shipping, but poorly in recreational craft with low activity. In commercial shipping, it is often said: "Sail without fouling", but even this requires regular cleaning. Because in commercial shipping, fouling-free hulls can only be achieved through high activity and speed or regular cleaning.

Currently, the only proven alternatives for effective fouling protection are the switch to silicone-based non-stick coatings or the use of biocide-free, abrasion-resistant hard coatings with regular cleaning.

Experience has shown that silicone-based non-stick coatings work particularly well when the boat remains in the water all year round and there is no mechanical stress, as these coatings are naturally rubber-like soft. In the middle of the season, cleaning in the water with a soft cloth or glove may be necessary, if the activity level is low.

Another method of keeping the boat free of fouling is the use of abrasion-resistant hard coatings. However, switching to cleaning with a hard coating has so far been like driving an electric car without a charging station infrastructure and without a display of the battery's charge status. In addition, it is unclear when cleaning may still be carried out in the water and when exclusively on land. So far, there is a lack of reliable methods for early detection of fouling development in the biofilm stage and information on where and how cleaning can and may be carried out.

If cleaning is really to be given an important perspective, the aspects outlined would have to be worked on more intensively in the future and practicable procedures developed.

Why should I clean as early as possible and how can I determine the optimal time?

In general, cleaning on hard coatings in the biofilm stage is the easiest, fastest and gentlest method, which may be carried out without a permit. The requirement of permission for in-water cleaning in the biofilm stage is currently being legally examined in Germany. Simple but frequent control procedures are necessary to detect fouling development. The fouling pressure does not prevail permanently throughout the season, but there are phases with very numerous free-swimming stages of fouling organisms and those with very few free-swimming stages that need to settle. Usually, there

is a particularly critical phase on the North Sea and Baltic Sea coasts in spring from March to May and in late summer from August to September. In inland waters, growth pressure, especially from mussels, must be expected throughout the season, with midsummer being particularly critical. Unfortunately, the swarming of the free-floating stages cannot be predicted from the exact time or for each port. Every year, it depends on the prevailing wind direction, the food supply and the solar radiation how many swarm stages of fouling organisms are drifted into the harbors. In order to record when vegetation begins at the berth/harbor, there exist several attempts and methods.

Control of fouling development on plates

In Sweden, for several years now, volunteers have been exposing plastic plates in the ports, which are checked weekly to see if a rough biofilm has formed (<https://batmiljo.se/tvattabaten/havstulpaner/bli-havstulpanobservator/>). If roughness is present, half of the board can then be cleaned in order to observe later what growth would have developed without cleaning. Roughness is mainly caused by barnacle larvae, tube worms and small mussels, which are among the problematic fouling organisms on the coast. Although the plates do not always represent the entire range of the full fouling community, they nevertheless are very suitable for determining the beginning of a growth development. After each check, cleaning must be carried out to detect another larval/spat fall. In larger marinas with harbor masters, they could look for one or more plates on the jetties during their daily walks and check whether they feel rough. A few plates on the jetties per port are probably sufficient to have effective control. Of course, a plate could also be fixed on every boat that need to be cleaned. In the event of a positive, i.e. smooth or rough biofilm, the harbor masters or owners could inform the other boat owners with hard coatings or all other club members via social media. In addition, a message could also be sent to the Fouling Atlas of the German Environment Agency for the corresponding port to show the current, local fouling pressure for the area. In any case, it makes sense to find out about the local and regional fouling pressure from the Federal Environment Agency's Vegetation Atlas in order to gain an insight into the expected fouling pressure (<https://www.umweltbundesamt.de/themen/chemikalien/biozide/biozidprodukte/antifouling-mittel/bewuchsatlas-start>).



Fig. 1: Control plate to determine incipient growth, on the right the plate was cleaned several times, on the left an undisturbed growth development is visible

Fouling development on the hull

Another way to notice fouling development at an early stage is to use so-called standard trips for boats with motor drive. At the beginning of the season, the ratio of speed to speed can be recorded during a standard drive in the pit lane or harbor entrance and with the least possible external factors such as wind, current, etc. This means that display devices for speed (log or GPS) and RPM must be on board. There are separate or combined indicator gears for both parameters, which can be installed for about 200€. If the ratio of speed and RPM changes in the direction of reduced speed at the same RPM, an incipient growth has created increased frictional resistance. If this is to be used as an indicator for cleaning, the ratio must then be noted again immediately after each cleaning.

How and where should and can cleaning be carried out?

In the water

At berth

A biofilm can be cleaned easily and quickly in the water at the berth or at anchor. In many marinas, diving companies offer their services, but it is crucial to achieve the complete cleaning of all hull surfaces. In visible water, e.g. of most Baltic Sea marinas or in the pre-alpine lakes, this is optically possible, in other marinas such as on the North Sea it is much more difficult to control the efficacy of the cleaning action. But it is essential that all surfaces have been cleaned, as the biofilm would quickly grow into macro growth on uncleaned surfaces.

With suitable cleaning equipment, the hull can also be cleaned from the jetty. This is possible for boats that are berthed parallel to the jetty. Boats that are in boxes can only be cleaned from the boat, which is much more difficult and requires special cleaning equipment that should be optimized.

In a stationary boat wash

Washing systems, in which boats up to 16 meters long can be cleaned in the water using rotating brushes or high-pressure water, are now offered by various companies. Some have a collection basin below the station, where the water can be sucked off and filtered. The systems can remove biofilms but also macro growth up to a certain adhesive strength. So far, no plant has been stationed in Germany, but trials are planned in a marina on the coast from 2026.

On land

So far, there are only a few marinas that offer cleaning at the washing area. In Wedel and Neustadt, this is now possible for sailing boats without rigging. In Hooksiel, cranes are regularly craned and cleaned because of the Australian tube worm. Cranes had also been built in many marinas, where actually during the sailing season eroding or self-polishing biocide coatings which have been fouled are going to be cleaned at high pressure in the washing areas. However, there are hardly any marinas that offer regular cleaning as a fouling protection on biocide-free hard coatings with a low subscription price.

Where and how is it allowed to clean?

Unfortunately, the legal situation regarding hull cleaning has not yet been uniform and not particularly clear. This holds true for Germany but other countries as well. Here are a few examples in the hope that clearer regulations will be found in the future.

While all boats are cleaned at the end of the season at the washing areas with different collection systems, regardless of the antifouling coating, the composition and the degree of fouling, the requirements for the collection and filtration systems vary greatly from marina to marina. Likewise, the discharge of wastewater from these hull cleanings is regulated very differently (adjacent water, combined sewer, separate disposal and incineration). Actually, the wastewater from the washing areas has been highly contaminated with biocides and coating particles, i.e. microplastics, which can lead to disposal costs of €20 – 30,000 in larger marinas. If only cleaning is carried out on biocide-free, abrasion-resistant coatings, many marinas could save a lot of money, as only the removed fouling organisms would have to be disposed of as organic waste.

Statement of the German State Working Group on Water (LAWA)

According to a LAWA statement from 2015, for example, hull cleaning in water is only possible in the biofilm stage and does not require a permit. This is mainly due to the fact that the volume and weight of a biofilm are minimal in relation to macrofouling. While a biofilm has a wet weight of 100g/m², this can reach 40 kg/m² in macrofouling. These differences in the amount of fouling were decisive for the LAWA discussion.

At the meeting of the Standing Committee on Water Law of the Federal/State Working Group on Water (LAWA) on 18/19 June 2015 in Lübeck, the representative of the Federal Ministry for the Environment made a contribution on the legal aspects of hull cleaning of recreational boats as an alternative to the use of antifouling products containing biocides. After a discussion, the following position on the regulation of the cleaning of boat hulls was recorded in the minutes of the resolution of 22 June 2015:

Decision

- The LAWA Water Law Committee is of the opinion that the removal of soft fouling in the water body does not constitute an element of use under Section 9 (1) or Section 9 (2) of the Water Resources Act (WHG).
- When hard fouling is removed in the water, there may be a water use offence according to § 9 para. 2 WHG.
- For stationary mechanical boat cleaning systems, § 36 WHG applies to both the removal of soft fouling and hard fouling.

Statement by the Federal Environment Agency

Boat lying in the water

The cleaning of **coatings containing biocides** in water requires a permit, as it is likely to be a measure within the meaning of Section 9 (2) No. 2 of the Water Resources Act that is capable of causing adverse changes in the water quality. It is to be prohibited if harmful changes in water bodies are to be expected, which cannot be avoided or compensated for even by ancillary provisions (§ 12.1 no. 1 WHG). This is likely to be the case in the case of an impact load of the water body with biocides as a result of mechanical cleaning. In addition, more water-friendly, proportionate alternatives are available for cleaning on land. The water authority will take this into account when exercising its management discretion (pursuant to Section 12 (2) WHG) when granting the permit. Cleaning underwater paints containing biocides in water without permission is an administrative offence pursuant to § 103 para. 1 no. 1 WHG.

The removal of **soft fouling** in water from **biocide-free coatings** is unproblematic from a legal point of view. In the case of the removal of **hard fouling** in the water, this must be approved in individual cases by the competent state authority, as this is a water use within the meaning of § 9 para. 2 WHG.

Boat on land

The following explanations assume that the cleaning is carried out using water and explain how the cleaning water is to be disposed of. This is to be classified as wastewater within the meaning of § 54 (1) no. 1 WHG. On land, boat cleaning can be carried out on specially equipped washing and cleaning areas with a sewage system (facility according to § 36 WHG) or on paved or unpaved ground without a sewage system.

Source:

Antifouling in water sports - What is best for people, the environment and your boat? 2019

State Ordinance on the Regulation of Public Use and Navigations by Watercraft on the Wakenitz and the Ratzeburg Lakes of 25 January 2000

Section 6 Special requirements for watercraft

(1) No substances that may contaminate the water or permanently change the properties of the water may be discharged or introduced by watercraft. The use of on-board toilets on watercraft is only permitted if the waste water is collected on board and then properly disposed of on land.

(2) Watercraft whose underwater hull has been treated with a toxic underwater paint may not be used.

(<https://www.gesetze-rechtsprechung.sh.juris.de/bssh/document/jlr-WakenGemGebrRegIVSHrahmen>)

Wakenitz Ordinance

Since 2000, a special ordinance has also been in force for the Ratzeburger and Schaalsee lakes, which prohibits the use of toxic antifouling products. At that time, this regulation focused only on the inputs of biocides, and the problem of the entry of microplastics from soft antifouling products was not yet addressed.

State Bremen

"In the state of Bremen, the removal of the biofilm (soft fouling) by manual cleaning in the water of boats with a biocide-free coating is permit-free.

The removal of hard fouling by manual cleaning in the water of boats with a biocide-free coating is a use pursuant to § 9 para. 1 no. 4 WHG and therefore requires a permit under water law from the competent water authority, § 8 para. 1 WHG. In addition, the hard fouling must be caught and disposed of on land.

The removal of soft fouling or hard fouling by manual cleaning in the water of boats with a biocide-containing coating constitutes use in accordance with § 9 para. 2 no. 2 WHG and is subject to authorisation, § 8 para. 1 WHG. However, in the case of coatings containing biocides, the permit must regularly be refused in accordance with Section 12 (1) of the Water Resources Act, as the cleaning is expected to result in an impact load on the water body with biocides and thus harmful changes in the water."

Additional information: Guidelines of the Federal Environment Agency "Antifouling in water sports: What is best for people, the environment and your boat?"

(https://www.umweltbundesamt.de/system/files/medien/421/publikationen/190514_uba_lf_antifouling_bf.pdf) and the accompanying flyer

(https://www.umweltbundesamt.de/system/files/medien/421/publikationen/190513_uba_fl_antifouling_bf.pdf).

The reservoirs of the Ruhrverband

Protective coatings for watercraft, so-called "antifouling coatings", must meet the general requirements for biocide-free protective coatings. At this point, we would like to refer to the LimnoMar homepage: [Environmentally and climate-friendly bio-fouling management – Limnomar](https://www.limnomar.de). (www.ruhrverband.de)

High-pressure cleaning of watercraft in the reservoir area and bank area of the reservoirs is prohibited.

The Ruhrverband prohibits the use of biocide-containing and eroding antifouling products on its reservoirs. These reservoirs include: -Bisse-, Lister-, Ennepetal-, Hennetal-, Möhne-, Sorpe-, Verse- and the Fürwigge-Talsperre.

What is micro- or macrofouling?

But since the fouling development and composition is unpredictable, even the occurrence of a few small barnacles or short filamentous algae can no longer be legally assessed unambiguously as to whether cleaning should be carried out in the water or on land without a permit.

The problem here lies in the definitions of the different stages of fouling. Microfouling is also known as biofilm or soft fouling. Macrofouling is often called hard fouling.

The official definition of the International Maritime Organization (IMO) states that only bacteria, fungi, microalgae, protozoa and other microscopic organisms may be present and thus form a slimy surface

Microfouling is biofouling caused by bacteria, fungi, microalgae, protozoans and other microscopic organisms that creates a biofilm also called a slime layer.

Macrofouling is biofouling caused by the attachment and subsequent growth of visible plants and animals on structures and ships exposed to water. Macrofouling is large, distinct multicellular individual or colonial organisms visible to the human eye such as barnacles, tubeworms, mussels, fronds/filaments of algae, bryozoans, sea squirts and other large attached, encrusting or mobile organisms.

Source: MEPC 23-04-80-17

Therefore, this definition of the IMO means that there must be no mussel seed, barnacle seed or encrusting algae present in microfouling that would result in a roughness of the control plate or a hull surface that would be palpable and visible. If this definition of microfouling/soft fouling/biofilm were to be applied, these surfaces would not be allowed to be cleaned in water.

However, it might be justifiable to adopt a definition of microfouling from commercial shipping, as formulated in warranties on the effectiveness of antifouling coatings. There, growth of barnacle or mussel seed up to a height of 2 mm, and growth of algae or organisms with body appendages with heights of up to 5 mm is considered microfouling or biofilm that cannot be objected to.

If recreational boats were to be cleaned with a rough biofilm in the water, inputs of 250g for 10m² underwater area and 500g dry weight for 20m² underwater area would have to be expected. Since this is only biomass, here the question of water pollution is relevant with regard to oxygen consumption, the risk of which can be estimated. In addition, the cleaning of young stages, such as barnacles and mussels, does not trigger sudden release of spores or larvae, as these stages are not yet capable of reproduction. Since no one will measure the height of the fouling, the roughness criterion should therefore be accepted as a practicable control of incipient fouling and the cleaning of a rough biofilm as microfouling in the water should be permitted.

Legal work would have to be applied here, which would bring clarification at the state level, but in as many federal states as possible. In practice it would be helpful to have a plaque attached to the boat indicating and easily recognizable that this unit is provided with a hard coating and can be cleaned in the water at the biofilm stage.

As the examples show, the legal assessment of when, how and where cleaning may be carried out is not yet clear. There is a need for clarification here in order to give legal certainty to those who want to practice fouling protection by cleaning. We will present the current developments on an ongoing basis.

Prevention of the introduction of alien species through cleaning?

In order to prevent the ever-increasing spread of alien species by boats and ships, there have been frequent calls for the use of more biocides and these in higher concentrations in antifouling paints. Some countries such as Australia and New Zealand, for example, also require pleasure boats to provide proof of the active presence of effectively classified antifouling coatings before entering the harbor, plus proof that the hull is not fouled. But in the end, the spread of alien species could not and is not prevented by antifouling paints. Especially in niche areas, fouling occurs and contributes to continuing transport of organisms and their propagules. Strict rules for trailer boating in the Great Lakes area have also existed for many years to prevent the spread of zebra and quagga mussels, and recently very strict requirements have been imposed for trailering boats between the pre-Alpine lakes of Switzerland. Since 2025, there have been recommendations in Germany for the thorough cleaning of boats in the area of the Ruhrverband's reservoirs when changing waters.

Recommendations of the Ruhrverband for cleaning when changing water bodies

"Before every change of water (even outside the Sauerland), boats and leisure equipment must be completely cleaned and dried to prevent further spread. The AHOI principle applies to boats with badges, Optimists, motorised boats and dinghies, while a simplified cleaning and drying regulation applies to other leisure equipment.

The AHOI principle – how to clean properly

A – Empty

→ Remove all water from the boat, bilge, accessories and, if present, daggerboard box or cooling circuits.

H – High-pressure cleaning

→ Thorough cleaning of the parts of the boat that come into contact with water (including the trailer), preferably with water heated to 45-60 °C. Please make sure that the washing area is connected to the sewer system.

O – Optional disinfect

→ Use 3% hydrogen peroxide solution (H₂O₂) to treat hard-to-reach areas and spaces where water collects and leave it on for an hour. Pay attention to the material compatibility and your own safety!

I – Dry intensively

→ Allow the boat and trailer to dry completely for at least 5 days. The larvae do not survive complete drying.

The following applies to all water sports and fishing enthusiasts:

Water sports equipment (e.g. SUPs, kayaks, canoes, inflatable boats, air mattresses, bellyboats), swimwear, wetsuits, diving accessories (e.g. BCD, regulator, mask, snorkel, fins) and fishing accessories (e.g. waders, fishing rod, landing net, bucket) must be cleaned and completely dried before use to prevent the quagga mussel from being introduced into waters that have not yet been populated"

Source: <https://ruhrverband.de/flussgebiet/invasive-arten-und-schaedlinge/quaggamuschel>

Ship cleaning obligation also in Swiss lakes

To protect the waters, the Canton of St.Gallen introduced a ship reporting and cleaning obligation (SMRP for short) on 1 April 2025. He joined the cantons of Central Switzerland and the Canton of Bern, which had introduced the SMRP in the summer of 2024.

Since April 2025, registered ships on St.Gallen waters have been subject to a ship reporting and cleaning obligation (SMRP for short). In the Central Swiss cantons of Nidwalden and Obwalden, Lucerne, Schwyz, Uri and Zug, as well as in the canton of Bern, the SMRP has already been in force since 2024. The cantons of Graubünden and Zurich also introduced the SMRP on 1 April 2025, and in Glarus from 1 May 2025. In Switzerland, ships of 2.50 m or more in length must be registered, bear an official registration number and have a ship's licence. For each water change, the planned water change must be registered online, the ship/boat must be professionally cleaned, including equipment

at an approved cleaning center (exception: for Lake Constance, the cleaning obligation does not apply. Subsequently, a launching permit for the water is automatically issued and the ship/boat may be put into the water. The permit must be carried digitally or printed on the ship/boat and shown during inspections.

Modified rules apply to intercantonal or international lakes on the SMRP system border (currently applies to Lake Constance and Lake Biel). Anyone who wants to enter Lake Constance on St.Gallen soil must also report this, but the cleaning obligation does not apply. When reporting the change of water body to Lake Constance, a launching permit (without proof of cleaning) is automatically sent.

Source: <https://www.sg.ch/umwelt-natur/natur-landschaft/Schiffsreinigungspflicht.html>

The listed cleaning regulations to prevent the spread of species are therefore not intended as fouling protection, but can be seen as a supplement, as these regulations will multiply the technical procedures, cleaning options and certifications.

Last update May 2026