



# COMPLETE

## RECOMMENDATIONS FOR MITIGATING POTENTIAL RISKS RELATED TO BIOFOULING OF LEISURE BOATS

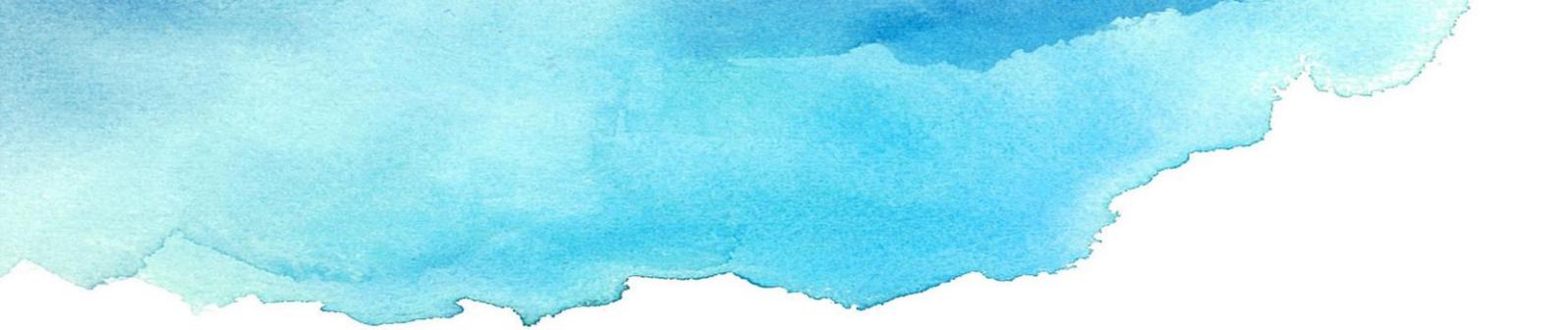
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# 1. DEFINITIONS

Anti-fouling coating	A paint or coating that inhibits, blocks or eliminates the attachment of unwanted biofouling organisms.
Anti-fouling system	A coating, paint, surface treatment, surface or device that is used on a vessel to control or prevent attachment of unwanted organisms <sup>1</sup> .
Biocide	Biocidal products are used to control unwanted organisms that are harmful to human or animal health or to the environment, or that cause damage to human activities. These harmful organisms include pests and microorganisms <sup>2</sup> .
Biofouling	Accumulation of organisms on surfaces or into structures that are submerged or exposed to the aquatic environment.
In-water cleaning	The physical removal of biofouling from a vessel while in the water.
Movable structure	In this protocol, movable structures refer to parts of the vessel that are separate from the boat hull, e.g. fender, ladder, mooring line, bucket, anchors and outboard motors.
Niche areas on vessels	Surfaces or structures that might differ of the hull material, e.g. rudder, water intake, bow thrusters, anodes, knot meter, small cracks and crevices.
NIS	Non-indigenous species. Any species transported intentionally or accidentally by humans outside its native range <sup>3</sup> .
Removed (biofouling) material	The biofouling organisms that have been detached from the vessel.
Vessel	In this document a vessel represents a recreational craft operating in the Baltic sea with maximum length of 24 m.

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<sup>1</sup> Definition by International Maritime Organization (IMO)

<sup>2</sup> Definition by European Commission

<sup>3</sup> Definition by International Council for the Exploration of the Sea (ICES)

## 2. INTRODUCTION

This guidance provides biofouling management recommendations for recreational boaters to help minimize the risk of transferring non-indigenous species (NIS) from biofouling as well as niche areas in the Baltic Sea. The guide aims to share information of such practices that reduce the biofouling on recreational vessels and boat trailers which contributes to reducing the potential of NIS spreading in new habitats.

This guide was produced as a task of the COMPLETE project, funded by the Interreg Baltic Sea Region Programme in 2019. The abbreviation “COMPLETE” stands for Completing management options in the Baltic Sea Region to reduce risk of invasive species introduction by shipping ([www.balticcomplete.com](http://www.balticcomplete.com)). The management recommendations provided in this document act as a precaution in preventing the NIS spreading in the Baltic Sea region. The recommended practices are compiled in this document are heavily influenced by previous literature, such as a guidance document for minimizing the transfer of NIS in recreational crafts, provided by the IMO<sup>4</sup>.

### 2.1 Background

Leisure boats and ship hulls have been observed to act as potential vectors to transfer NIS through the establishment of species communities enabled by biofouling. However, the potential of recreational boats or trailers spreading NIS has not, to our knowledge, yet been studied in the Baltic Sea region.

The type of biofouling might potentially affect the extent of the risk of spreading NIS. Larger biofouling organisms, such as barnacles, can potentially create surfaces for establishment to other, smaller, organisms. Such biofouling represents a greater risk in introducing NIS and it is therefore important to prevent their growth by using the strategies this guidance provides.

Harmful biofouling NIS have been earlier introduced also in the Baltic Sea. The most well-known is the bay barnacle, *Amphibalanus improvisus* (Figure 1.), which was introduced in the late 19<sup>th</sup> century, most likely by shipping. Since its introduction, the bay barnacle has become a dominant species with a substantial economic impact, due to its efficiency to attach on ship hulls. Increasing fuel consumption and the constant need for hull cleaning and application of antifouling systems are notorious effects of biofouling. Another NIS that might be a potential threat to the Baltic Sea is *Mytilopsis leucophaeata*, a dreissenid bivalve, which has been recorded in very high abundances (28 000 ind/m<sup>2</sup>) close to the nuclear power plant in Loviisa, Gulf of Finland<sup>5</sup>. Outside the borders of the Baltic Sea, the zebra mussel (*Dreissena polymorpha*) and the quagga mussel (*Dreissena bugensis*) are examples of very harmful introductions. These species have altered entire ecosystems in the Northern American freshwater areas. The economic effect of these species is enormous, since

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<sup>4</sup> IMO, 2012. Guidance for minimizing the transfer of invasive aquatic species as biofouling (hull fouling) for recreational craft, MEPC.1/Circ.792

<sup>5</sup> Laine, A. O., Mattila, J. and Lehtikoinen, A. (2006). First record of the brackish water dreissenid bivalve *Mytilopsis leucophaeata* in the northern Baltic Sea, *Aquatic Invasions* 1: 38–41

they attach and clog pipe surfaces and other infrastructure and can cause damages costing millions of dollars annually<sup>6</sup>.

Considering the scale of effect in previous encounters, it is highly important to regard the risk and beware that similar introductions are very likely in the future.



Figure 1. *Amphibalanus improvisus* thrives in the Baltic Sea. Photo: Maiju Lehtiniemi



Figure 2. The zebra mussel, *Dreissena polymorpha*, is an expensive threat to freshwater habitats. Photo: Dan Minchin/aquaNIS

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<sup>6</sup> U.S. Fish & Wildlife Service, The Cost of invasive species, fact sheet: <http://www.fws.gov>, January 2012, accessed 10.9.2019

# 3. STRATEGIES

This guidance presents strategies that eliminate, prevent or disturb the growth of biofouling on leisure craft and trailers. The strategies described in this guide apply as recommended practices for recreational boats and their trailers. According to EU directive, vessels with a length under 24 m are considered recreational boats<sup>7</sup>. Each strategy should first be evaluated by the respective boat owner to find the most suitable strategy for one's vessel or trailer.

**Practically these strategies are a combination of inspection and cleaning. The boat owner should *inspect* the rate of biofouling growth regularly and *clean* the vessel or trailer when necessary.**

The guidance concentrates only to describe the best practices for biofouling management without specifying safety requirements of each strategy. However, health risk precautions are recommended to take into consideration when, for instance, applying, maintaining or removing antifouling paints.

## 3.1 Cleaning practices for boats

**The vessel can be cleaned mechanically of biofouling. The cleaning is recommended to be performed on all the submerged surfaces such as the hull, niche areas and movable structures.**

The intensity of biofouling growth on vessels can vary in the Baltic Sea depending on several different physical, chemical and biological factors<sup>8</sup>. Different cleaning practices can be combined or used on different vessel surfaces since the success of each practice can depend on the type and extent of biofouling. The respective boat owner should estimate the necessity of cleaning regularly.

Apart from guidance provided by IMO, very few areas and harbours have specific cautionary guidance for the possibility of NIS spreading. It is worth considering the risks whenever visiting harbours abroad. Therefore, it is highly recommended cleaning the hull *prior* to a longer voyage and *before* leaving the area visited ("clean before you leave").

### **Mechanical cleaning equipment:**

- brush
- scrape
- sponge
- boat turf carpet
- pressure washer
- hull cleaning machine
- stationary boat washer

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<sup>7</sup> DIRECTIVE 2013/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 November 2013 on recreational craft and personal watercraft and repealing Directive 94/25/EC

<sup>8</sup> Strand, H., Solér, C. & Dahlström, M. 2018. Changing leisure boat antifouling practices in the Baltic Sea - results from the Bonus Change project

**Whether the cleaning of the hull is applied on land or in water, the removed material, apart from biofilm and slime should be treated as waste and not be allowed to enter the water.** Ideally, the boat is lifted from the water when cleaning, since it is easier to collect the removed material on land. On land it is important to avoid the cleaning waters running to the nearest waterway or ending up in storm water drains since they often run directly into the nearest waterway. Some hull cleaning machines and stationary boat washers provide an enclosed system where the removed material does not reach the open water.

The slime layer on the vessel is recommended to be cleaned as often as possible to hinder the attachment of heavier fouling organisms. Preferably, **one should never use a hull cleaning machine if the vessel was painted with antifouling paints containing biocides.** This is especially important if the hull was treated with self-polishing paints (so called “soft” paints) that are designed to wear off with water friction.

In case the vessel has not had a significant change to the craft’s operating profile, the biofouling species are likely to be of domestic origin and the risk of new NIS to the area being found on the vessel should be low. Vessels travelling to further destinations e.g. abroad might have been exposed to species that are not present in the home country or port area. Before a trip to a further destination the boat should be inspected of biofouling and cleaned to reduce the amount of biofouling and hinder the establishment of NIS. The boat should also be cleaned shortly after the trip and ideally the removed material should not be allowed to enter the water. The in-water cleaning procedure should always be done according to the regulations that are in force in the respective nation.

Information on national regulations in the Baltic Sea Region will be available in COMPLETE output 4.1.1. “Database on legal aspects and regulation of biofouling practices in BS States”.



Figure 2. Drive-in boat wash for large recreational vessels such as sail boats. Photo: Keep the Archipelago Tidy



*Figure 3. High pressure wash is efficient for covering the rinsing of all niche areas. Photo: Keep the Archipelago Tidy*



*Figure 4. Cleaning scrape for the removal of barnacles and other biofouling organisms. Photo: Keep the Archipelago Tidy*

### **3.2 Antifouling coating**

Antifouling coatings can be divided into biocidal and biocide-free coatings. The biocidal coatings function chemically, i.e. they release chemicals, such as copper, that harm organisms. Biocide-free coatings act as physical barriers creating a surface that fouling organisms have difficulties to attach to.

Biocidal antifouling paints are regarded harmful to marine life due to negative effects copper and zinc have on fecundity, mortality and hormonal functions<sup>9</sup>. The percentage of copper and zinc vary greatly between paints, with high copper (<34.5% cu) paints often recommended for areas with high fouling, such as the west coast of Sweden. However, studies show that these agents are used in excess in several paints and that an increased release rate in high copper -paints doesn't necessarily increase their antifouling properties, with lower release rates being just as efficient in both low- and high fouling areas<sup>10</sup>. Also, the findings of the CHANGE-project show that an amount of 4 percent of copper is enough to prevent heavy fouling in the Baltic Sea. The CHANGE-project also compared several commercial antifouling paints, concluding that paints with 7.5% copper were just as efficient as high copper (34.5% cu) paints, regardless of area<sup>8</sup>. According to the EU regulation<sup>11</sup>, all biocidal products require a permit and their active ingredients must be approved. The authorization of biocidal products is done nationally and therefore it is important that the boat owner investigates the instructions of the product before appliance. Moreover, some marinas and yacht clubs have their own regulations regarding the usage of anti-fouling coatings on vessels, and they should be taken into consideration by local boaters.

It is recommended for boat owners to record information about the used anti-fouling coating: the brand, type, biocide concentration and date of application.

### 3.3 Lifting the boat from the water

Lifting the boat from the water protects the hull of biofouling. This can be done by using e.g. boat lifts. The longer the boat is out of the water, the more efficient impact, since drying damages most of the aquatic organisms.

### 3.4 Cleaning of the boat trailer

The boat trailer has also the potential to spread NIS especially since its surface is rarely treated with any antifouling system. **After the trailer has been in contact with the water or marine environment, it should be inspected thoroughly for biofouling or other organisms present.** Surfaces on trailers that should be inspected include for example: frame, axle, tires, lights, licence plates, wires, cavities and niches. As some parts of the surface might be difficult to inspect visually, it is recommended to feel them out carefully with hands or fingers.

**The trailer should be cleaned of all biofouling before transporting it to another water system.** This can be done by using similar mechanical cleaning equipment as for boats, e.g. brush, scrape, sponge or pressure washer. It is recommended to give the trailer a rinse with a pressure washer, even if the

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<sup>9</sup> Bighiu, M. 2017. Use and Environmental impact of antifouling paints in the Baltic Sea, Academic Dissertation, Stockholm University

<sup>10</sup> Lindgren, J. F., Ytreberg, E., Holmqvist, A., Dahlström, M., Dahl, P., Berglin, M., Wrangle, A-L. & Dahlström, M. 2018. Copper release rate needed to inhibit fouling on the west coast of Sweden and control of copper release using zinc oxide, *Biofouling* 34: 453–463

<sup>11</sup> Regulation (EU) No 528/2012

fouling rate is low, since several species are not visible to the naked eye. It is also recommended to let the trailer dry before transporting it to a new waterway.

The cleaning of the boat trailer should be taken very seriously, since it is widely acknowledged that trailers represent a significant vector for NIS-introductions<sup>12</sup>. There is a risk with trailers because they can be transported overland large distances within and perhaps outside of the Baltic Sea area. It is especially important to remove snagged weeds where some NIS can be attached in large numbers. For example, legislations to prevent secondary introductions of the zebra- and quagga mussel are in place in some states of the US, enforcing prevention programs and regulations. These very often include managing overland pathways, to which trailers are included<sup>13</sup>.

## 4 KEEP RECORD OF ANTIFOULING STRATEGIES AND REPORT NIS

Whether you use mechanical cleaning, anti-fouling coating or other practices to keep the vessel clean, it is recommended to keep record of the management type, schedule and plans. Destinations and voyages are also recommended to be recorded in the logbook in case of a severe NIS outbreak.

### **Recommended records include:**

1. Type of antifouling used (paint, Ultrasonic device etc.)
  - Paint: brand, type, biocide concentration, date of application
2. Hull cleaning (how often, which methods used)
3. Voyage destination and route (including different marinas visited in country/area)
4. Mooring duration at specific marinas (hours)

Contact local environmental authority if you confront an unknown NIS. Note its location and if possible, remove the organism for conservation and/or photograph the organism.

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<sup>12</sup> Rothlisberger, J. D., Chadderton, W. L., McNulty, J. & Lodge, D. M. 2010. Aquatic Invasive Species Transport via Trailered Boats: What is Being Moved, Who is Moving it, and What Can Be Done, *Fisheries Magazine* 35: 121–132

<sup>13</sup> California Department of Fish and Wildlife, <https://www.wildlife.ca.gov/Conservation/Invasives/Quagga-Mussels>, accessed 6.11.2019