



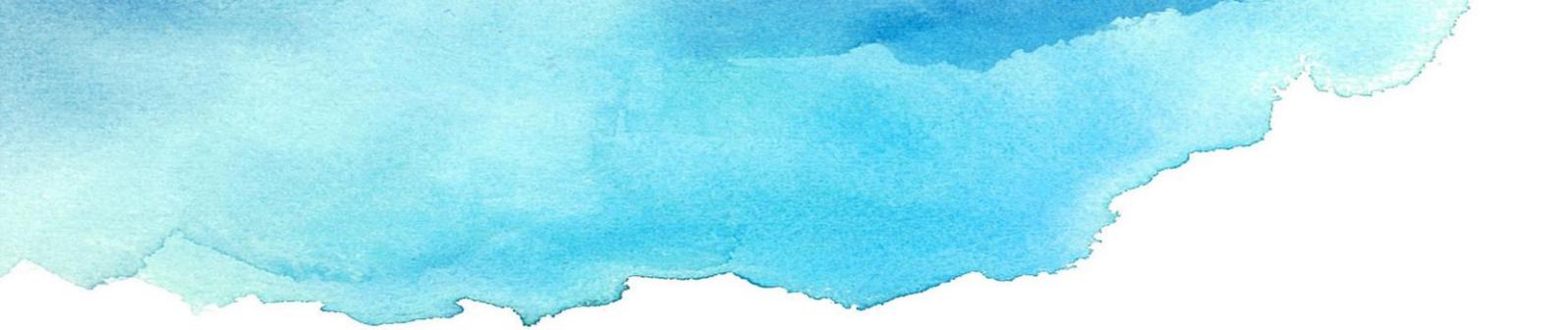
COMPLETE

Supplementary recommendations for a secure maintenance of Drive-in-boat washers

A pre-study on waste water quality

Keep the Archipelago Tidy association, Finland
2021





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Background

As alternative anti-fouling (AF) systems are gaining new ground, possibly due to the harmful environmental impact of biocides used in common AF-paints (Bighiu 2017, Bonus Change Project 2017), recommendations for using and maintaining alternative methods might be needed. This brief report was written after testing a drive-in boat washer in Hanko, Finland, mainly to provide preliminary information concerning the quality of waste produced in a boat washer. Since drive-in boat washers are quite new in the field, both to authorities as well as users, very few specific recommendations or restrictions have been put into place. The facility in Hanko is the first drive-in boat wash, designed for larger sailing boats, to have reached the Finnish coast. These washers come with an enclosed basin, aiming to ensure that waste from the cleaning process will not spread to the main water body. The investment in Hanko was motivated due to great experiences from Sweden, where similar washers have been in use for a longer period and have even become the most popular AF system used by some leisure boating associations, such as Bosö boat club, that has their own [washer](#) and forbids the use of biocide paints by their members. Even though this particular method is becoming more popular, it still covers only about 2% of all AF-systems used in Sweden (Transportstyrelsen, 2020). However, reaching a point where leisure boaters stop using AF-paints altogether and move on to using only physical methods requires quite a lot of getting accustomed to new methods. Therefore, for instance in Sweden, a period of transition for boat washers with a waste water basin was put into place which allows leisure boats painted with hard, biocidal, AF-coatings to try out the washers and perhaps reach a choice where they could switch to biocide-free AF-options altogether (Havs- och vattenmyndigheten, 2015).

The Drive-in boat wash in Hanko, Finland

The boat washer in Hanko marina was installed in 2019 for a two-year test run, financed by the Weisell fund, during which boaters could try out the washer for a fee. To get an idea of waste accumulated in the waste water basin, water samples were taken post season. This testing of the waste water was thought to give an indication concerning two questions: 1) How often should the waste water basin be emptied during a transition period (during which leisure crafts painted with hard biocidal af-paints are allowed to use the washer) and 2) can traces of banned biocides (TBT, TPhT) still be found on the hulls of leisure craft? The analysis included regular biocides used in AF-paints (copper and zinc), but also organotin compounds (OTCs), which have been banned in AF-coatings since 2008.

Type of boat wash

The boat wash in Hanko is a [BIGWASH](#) 16 -model, a drive-in boat wash (Figure 1). This particular model can clean sailing boats up to 16m in length, 5m in width and 2.4m in depth. The keel, or the bulb of the keel, cannot be wider than 45 cm. Other restrictions include that the washer can only wash craft with regular oval shaped bulbs, which excludes winged and keeled bulbs. The BIGWASH16 features a PVC collection basin, with gates that open and close in between washes to keep debris from getting out to the main water body.



Figure 1. The BIGWASH-16 boat wash in Hanko, Finland

Water samples

The first water samples were taken during 2019, as a part of the test round financed by the **Weisell fund**. Additional samples were taken 2020, as a part of the **COMPLETE project**, funded by the **Interreg Baltic Sea Region programme**. Water samples were taken from inside the collection basin and right outside the washer. Analysed compounds included Cu, Zn and OTCs. When water samples were taken from the collection basin, the bottom of the basin was stirred to get some of the debris included in the sample. Although not optimal, stirring mimics the possibility of a boat leaving the facility and putting the debris in motion.

Sediment samples

During 2020, sediment samples were included to give an indication of biocides and other compounds accumulated in the sea bottom of the marina. Sediment samples from harbours can give information concerning the degree of contamination and an insight in the history of biocide use in boating. Analysis included Cu, Zn, Pb, and OTCs. Samples were taken next to the washer (S1), outer (S2) and inner marina (S3) (Coordinates ETRS-TM35FIN: S1: 6638088-0273975, S2:

6638081-0273764, S3: 6638267-). The inner marina is located in between the inner piers of the marina, the outer marina is just outside the inner marina, right before open waters. The washer is located on the far-right location marked in Figure 2.

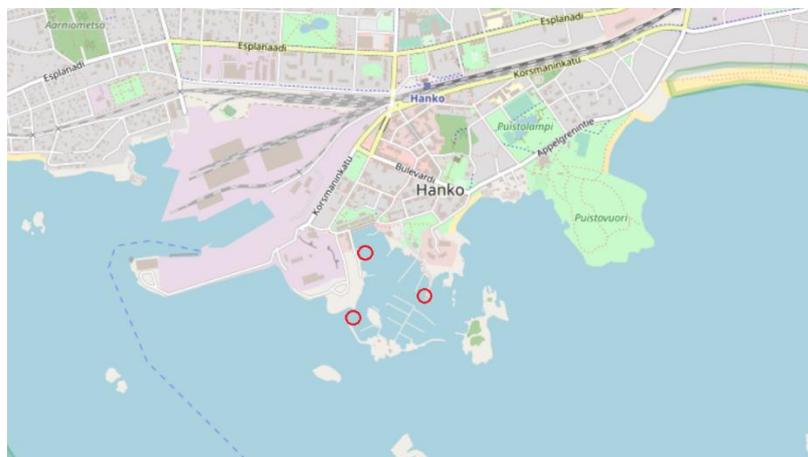


Figure 2. Approximate locations for sediment samples taken from Hanko, Southern Finland (picture source: Openstreetmap.org).

Results

Table 1. Cu and Zn concentrations right outside the boat wash

Date	Water temperature (°C)	Cu (µg/l)	Zn (µg/l)
6.5.2019	5,8	1,2	2,7
3.6.2019	10,0	0,7	6,8
22.7.2019	19,2	1,4	74,0
1.8.2019	19,0	1,7	3,9
20.8.2019	17,3	1,4	3,0
28.10.2020	10,9	2,9	12,0

Table 2. Cu and Zn concentrations in water samples from the collection basin of the boat washer

Date	Water temperature (°C)	Cu (µg/l)	Zn (µg/l)
22.7.2019	19,1	N/A	N/A
1.8.2019	19,0	33,0	71,0
20.8.2019	19,3	2,1	5,3
23.9.2019	10,3	580,0	220,0
28.10.2020	10,9	620,0	300,0

Table 3. Organotin concentrations from the collection basin

Date	TBT (µg/l)	TPhT (µg/l)	DBT (µg/l)
23.9.2019	0,0028	0,005	0,001
28.10.2020	0,085	0,007	0,007

Table 4. Sediment analyses from Hanko marina, where S1= next to washer, S2= Outer marina and S3= Inner marina

Compound/element (Mg/Kg)	S1	S2	S3
Cu	44,0	6,6	20,0
Zn	35,0	29,0	54,0
Pb	<10,0	<10,0	26,0
TBT	0,003	0,002	0,025
TPhT	0,006	0,011	0,328
DBT	0,002	0,002	0,013

Discussion and concluded remarks

Firstly, it must be noted that this report is meant merely as background information, especially for transition periods for boat washers. More research (as well as samples) is needed before it is possible to draw any conclusions. The optimal use of hull washing facilities requires that they only be used by biocide free leisure boats. However, a transition period is vital for introducing leisure boaters to new biocide free antifouling systems, especially since copper antifouling-paint is one of the most common antifouling-systems used, at least, in the Finnish coastline.

The results from the water samples in this report show that the accumulation of copper and zinc in the collection basin rises quite quickly under frequent use. In 2019, the washer in Hanko was used 54 times. In 2020, the facility was used more frequently, closer to 300 times, but no confirmed number on how many boats were cleaned is yet available. The copper and zinc concentrations in the basin (Table 2) exceed recommended levels (7,8 µg/l for Cu and 3,1-7,8 µg/l for Zn) by the Finnish environmental authorities. However, it is worth remembering that the bottom of the basin was stirred prior to taking the sample. What is more alarming is that traces of OTCs were still found, even though their use is prohibited (Table 3). After two seasons, the concentration of TBT in a sample from the collection basin had risen to 0,085 µg/l, exceeding the restricted concentration of 0,0015 µg/l for TBT and other OTCs in the EU Water Framework Directive. When comparing to the findings in the sediment samples (Table 4) it seems that OTCs may still play a negative role in our marine ecosystems, especially in the marinas. For instance, a very high value for TPhT, 0,328 mg/kg, was recorded in a sediment sample from the inner marina, and a majority of the other OTCs analysed were represented in high concentrations as well. The Finnish ministry of environment regards concentrations over 0,2 mg/kg dry weight of TBT (or equivalent TPhT, or other organotin) in the sediment polluted (Ympäristöopas, 2004). These concentrations of OTCs in the marina are most likely due to the long history of use of these biocides, in both larger ships and leisure boats. Other factors around the area, such as decades of transporting goods in and out of the Hanko Port and runoff from shipyards, may have contributed as well. Similar results from analysing OTC concentrations have been reported in Sweden, where run off water from high-pressure cleaning of boat hulls was put under investigation. In an article by Lagerström, 2019, the concentrations of TBT in run-off water surpassed EU recommendations by 10 000-fold, showing that OTCs still represent a relevant threat in the Baltic sea.

These results give an indication that boat washers should be treated with caution and that maintenance should include adequate collection and removal of waste generated. During transition periods, harmful biocides will accumulate in the collection basin in great amounts, meaning that the collection basin must be emptied at least once a season to avoid any spilling from the basin to the main water body. It also seems likely that boaters might not be aware of traces of OTCs in their boat hulls, which further strengthens the need for caution. This was also shown in Sweden, where a questionnaire found that only 1 % of boaters were aware of traces of OTCs in their boat hulls (Transportstyrelsen, 2020). The supervision of boats using the facility is also very tricky, which means that ensuring that only biocide-free leisure boats use the facility is quite difficult, especially since many types of hull cleaner facilities are automated and do not require physical assistance for payment or use. The debris from the washer must be regarded as

dangerous waste and disposed accordingly. Additionally, our recent experience with the Hanko boat washer tells us that one of the most common problems has been the malfunction of the gates, that are meant to keep debris from getting out from the collection basin. It is of foremost importance that the gates are repaired as soon as possible, since it is very likely that traffic and waves might stir the debris in motion and pulling it out from the collection basin. In Hanko, the gates were broken once during the season 2020, when a boater driving in did not notice that the gates had not opened. It is also vital that the gates are always above sea level to ensure that no spilling is possible.

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