TECHNOLOGY ASSESSMENT FOR SEWAGE COLLECTING SYSTEMS FOR LEISURE BOATS

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Index

1 Summary

Even if leisure time boating - and sailing in particular - is considered a rather environmentally friendly hobby and of importance for one's relationship with nature, it can also have negative side effects for the fragile Baltic Sea. One part of leisure boating that has a direct negative environmental impact is emptying sewage waste from leisure boats to the sea. This contributes to the increasing overflow of nutrients in the Baltic Sea, causes further eutrophication and poses a risk for harmful substances to enter the sea, which is already severely eutrophicated and polluted.

This project work was carried out at the Water centre for innovation (Utvecklingscentrum för vatten – UCV), a municipal company in Norrtälje, Sweden, as part of the BATSECO-Boat project, a project under the EU Central Baltic Programme. The aim of this work is to give an overview of the types of technical solutions present in the market, and especially to understand what the sources of the most common problems related with the use of pump-out stations are and to offer practical solutions to improve the sewage collecting service.

The technology assessment consists of two parts: The market investigation and the study of the quality of the service.

The market investigation aimed to give an objective overview of what is the market offer in the Sweden, Finland, Estonia and outside the project area. The investigation was carried out by interviewing producers, municipal employees, ports managers.

In the study of the service quality the project team investigated if the market is able to meet users' needs, maintenance technicians and ports managers' needs, and what the main causes of malfunctions and of users' complaints are.

The study of the quality of the service was done by having a first-hand experience of the use of pump-out stations during a series of field trips in the Stockholm and Turku archipelago, and by interviewing the different actors: Interviews to ports managers and maintenance technicians have been done in person or via telephone, while boat users have been interviewed personally during the field visits and via an electronic survey sent to various boat clubs in Sweden and Finland. Boat and pontoon producers have been interviewed as well during the visits to the Stockholm and Helsinki boat fairs.

The project team proposed some technical suggestions to improve the sewage collecting for leisure boats. An important result of the project are the recommendations for the requirements to set when buying a new pump-out station: Public procurement for the purchasing of new pump-out stations is a means to improve the service and to give an input to the market.

2 Introduction

Visiting leisure boat harbours in the Baltic Sea area fascinates both national and international visitors, many of whom explore the coastal and archipelago areas using small leisure boats. Boat tourism is an important and popular way to spend a summer holiday in archipelagos and coastal areas, which provide beautiful and peaceful maritime nature experiences. However, staying and living for weeks in a leisure boat requires similar kind of community services to what we usually have at home, but require a somewhat different organisation. Usually it is the small boat harbours that provide and sell most of these services to boaters.

The possibility of emptying toilet waste from leisure boats can be considered a fundamental service for boaters, which, when neglected, has a crucial impact on boaters' comfort during. However, this basic service suffers from problems, such as lack of easily accessible and functional sewage pump-out stations; non-harmonized sewage collection equipment; and lack of easily accessible information regarding location and functionality. It is also important to reduce visitor detours (having to make extra trips to other stations, when the nearest station is full or malfunctioning) by improving information regarding the pump-out station network and its' operability. Moreover, it can be difficult for international visitors to know what kind of waste handling and pump-out services that exist. Both Sweden and Finland have an extensive archipelago with an active leisure boat life where boaters commonly cross between the countries. Although toilet waste collection systems have been in place for several years, there is need to address both technical and managerial challenges. In Estonia, where the boating culture is very young, the coastline is open and waters are shallow, the coverage of sewage collection services is low. Thus, it is important to upgrade the service level in Estonia. Cross-border collaboration and exchange of experiences has the potential to facilitate mutual support, good examples and a more systematic approach to the management of toilet waste from leisure boats across the Central Baltic region.

The BATSECO-BOAT (Best Availabe Technologies of Sewage Collecting for Boat tourism) project is a collaborative project between three countries in the central Baltic region: Finland, Sweden and Estonia. The aim is to 1) increase tourism across the Central Baltic Region by investing in best available technologies for sewage collection and management and 2) create improved service facilities for leisure boats visiting small harbours in the Baltic Region.

By installing new pump-out stations, the BATSECO-BOAT project also contributes to the objectives of EUSBSR (EU Strategy for the Baltic Sea Region) in keeping the sea cleaner by facilitating collection of nutrients from toilet waste from leisure boats and thereby reducing a source of algal growth and eutrophication. The project supports the tourism industry with a cross-border approach that benefits both entrepreneurs and public authorities, and the Baltic Sea environment as whole.

The main results of the BATSECO-BOAT project include an upgrade of the sewage collection services in 18 leisure boat harbours in Estonia, in Finland and in Sweden. The upgrade is realised by investments into the best available technology of sewage collection, including both new and renovated pump-out stations. This upgrading ensures good level of unified sewage collection services in the participating leisure boat harbours across the Central Baltic region for the next 15-20 years, way beyond the duration of BATSECO-BOAT project.

The BATSECO-BOAT-project continues for three years (2018-2020) and is coordinated by the Brahea Centre at the University of Turku. Other Finnish project partners are Keep Archipelago Tidy, the Swedish partners Ecoloop AB, UCV/Campus Roslagen and Norrtälje municipality and the Estonian partners are Hoia Eesti Merd (Keep the Estonian Sea Tidy) and Viimsi municipality. The BATSECO-BOAT project is funded by EU's Interreg Central Baltic program, the total budget of the project is 1,48 million euro.

3 Background

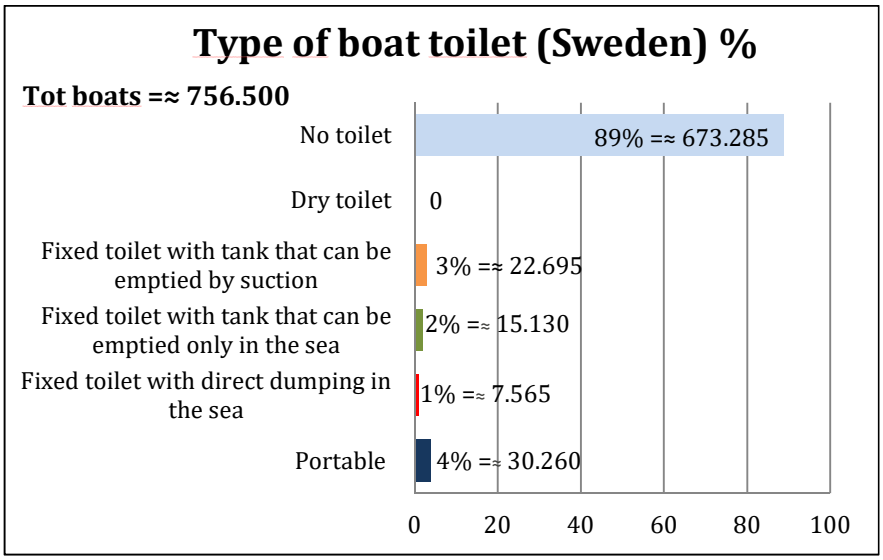
3.1 Environmental policies implementation in Sweden, Finland and Estonia

Across the Baltic countries environmental policies have been implemented in order to reduce eutrophication and increase boaters' awareness regarding the dumping of sewage water directly into the sea.

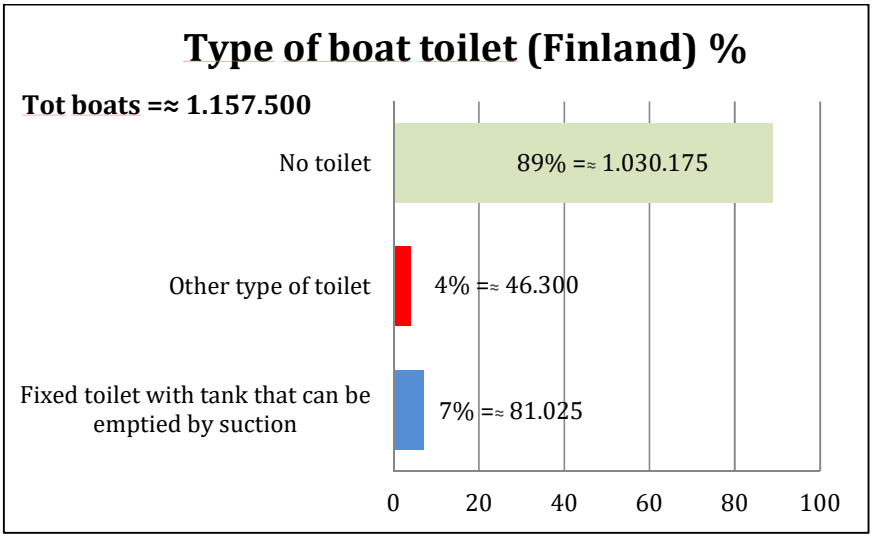
A national law forbids dumping in the sea both in Finland (2005) and in Sweden (2015), while Estonia follows the HELCOM recommendations.

Estonia has a recreational craft register for boats with LOA (Length Overall) 2,5 - 24 m with about 33000 boats registered. There are no statistics regarding the toilet systems, but the Estonian Maritime Administration estimates that the 10% of the boats registered have a toilet on board. The data are updated to 2019. Surveys about the toilet systems of leisure boats have been conducted in Sweden (2015) and Finland (2017) by the national transport agencies. The surveys assess many aspects related to the leisure boats, the complete studies are mentioned in the references of this report.

Focusing only on the information related to the toilet systems on board the data can be summarized as following:



Graphic 2.1 a – Type of toilet systems on leisure boats in Sweden. Source: Swedish Transport Agency, Båtlivundersökning, 2015



Graphic 2.1 b – Type of toilet systems on leisure boats in Finland. Source: Finnish Transport Agency, 2017

3.2 Geographical conditions

Not all the technical solutions are suitable for the three countries involved in the project. Sweden and Finland have a very similar geographical situation: The coast is protected by the archipelago from wind and waves. Moreover, in many islands there is no connection to the centralized system, in terms of wastewater and electricity: Here the need of having floating solutions that can be easily moved and that do not require electricity if equipped with hand pumps.

On the contrary, this kind of solutions cannot be used in Estonia, where the exposed coastline allows to install only land-based solutions.

3.3 Different technical solutions for pump-out stations

3.3.1 Type of stations

- Land based pump-out stations: The most widely used technical solution. Their placement must be carefully considered, in order to be easily accessible by boaters.

- Portable stations: This type of pump-out station is handy in the way that it can be carried to the boat without the boat needing to be moved. They have a small capacity and require extra work to move the station.

- Floating stations: They can be used only in locations protected from wind and waves. They can be placed outside the harbour and be moved whenever this is needed. Floating stations with hand pump and a tank can be used in those islands where there is no possibility to have electricity and wastewater connection to the municipal network.

3.3.2 Type of pumps

- Membrane or diaphragm pumps: This kind of pumps can displace a great volume of material and they are quite wear resistant, as the friction points are very limited since the only section in a diaphragm pump in contact with the fluid is the diaphragm. They do not provide high pressure, which is important when delivering material over a very long distance. Some users have complained about the membrane getting worn and needs to be replaced after a couple of years. It is not a complicated procedure, the trouble has rather been to track down the correct replacement membrane.

- Impeller pumps need to be equipped with an additional grinder to be able to pump sewage water with larger particles.

- Vacuum pumps: Different types of vacuum pumps are used for blackwater systems in household on-site systems, in airplanes and ferries. Some vacuum systems are never in contact with the liquids, they only evacuate air from the holding tank and produce a suction that moves the liquid. Other

manufacturers build their vacuum pump in combination with a grinding pump that chops up the particles and pumps it to the holding tank.

- Eccentric pumps: Consist of an eccentric "screw-rod" that rotates in a rubber housing. The cavity between the rod and the housing moves as the rod turns, transporting the liquid in the pump from one side to the other. This kind of pumps are common in pumping stations for household sewages, for example, but must be equipped with a shredder when pumping liquids containing solid objects.

- Peristaltic pumps: A wheel resembling a cogwheel squeezes a hose or a soft tube, moving the liquid in the hose or tube forward. The pump type is common in dosing systems and for chemicals that are corrosive to metals, since the liquid does not have to leave the pipe when being pumped. One drawback of the system is that the pipe or hose get worn and have to be replaced regularly.

3.3.3 Connection to the wastewater treatment plant

The pump-out stations are often directly connected to the municipal wastewater system, but in some cases they collect the sewage in a septic tank. This is the case of most of the floating pump-out stations, where the sewage is collected in a floating sewage tank. The advantage with the floating holding-tank station is that it can be placed far from the municipal infrastructure and does not have to be close to the shore. Some of the disadvantages are that in some cases these floating solutions are not very stable, as the holding tank varies in density when it fills up, they must be emptied with a tank vessel and they tend to smell as the gases evacuate from the tank. When logistically possible a land-based station directly connected to the municipal sewage system is to be preferred. Land based pump-out stations also have better accessibility, making the service easier and cheaper.

4 Methods

The project team studied the market offer in Sweden, Finland and Estonia and investigated the main technology producers outside the project area.

In order to understand how to improve the quality of the service of the sewage collecting systems, the project team has interviewed different actors, such as pump-out stations operators, maintenance technicians, boat users, and has visited and tested some pump-out stations in the Stockholm and Turku archipelago.

The goal of this part of the work is to understand how to make the sewage collecting service as simple as possible both for the users and for the maintainers of the stations by suggesting simple practical solutions.

4.1 Market investigation

The project team conducted a market investigation by interviewing technology producers and ports managers to give an overview of the different solutions present in the market of the countries involved in the project and to present the main technology producers or retailers outside the project area. Visits to the Stockholm and Helsinki boat fairs have been a means to conduct the investigation as well.

4.2 Stations operators' interviews

The aim of this series of interviews was to identify the issues related with the operation and maintenance of the stations. The project team has interviewed harbours and marina managers and maintenance technicians, since the harbours have usually a maintenance contract with an external enterprise.

Reducing the downtime for an equipment that is used for a very short period during the year is essential, but it is also important that boaters use the stations carefully and in a proper way. The questions asked during these interviews are reported in the Attachment III.

4.3 Boat users' survey

Boat users have been asked about their habits and their experiences with the pump-out stations by interviewing them in person during the field trips and by an electronic survey that has been sent to different boat clubs in Sweden and Finland. Boaters' survey results are reported in Attachment II.

4.4 Field trips

The project team has conducted a series of field trips to assess the spectrum of different issues related with the pump-out stations. The stations that have been visited are in Sweden in Stockholm archipelago and in Finland in Turku archipelago, for considering the geographical conditions these places are suitable for different types of solutions.

Choice of the stations to visit

During the visits the project team had a first-hand experience of different kind of solutions and interviewed the ports managers for a better understanding of the operation and maintenance of the pump-out stations.

The stations have been chosen based on:

- type of station (stationary, mobile, floating)
- type of pump (hand pump, membrane pump, vacuum pump, etc.)
- destination of the sludge (direct connection to a municipal wastewater treatment plant, storage of the sludge in a tank)
- owner of the station

Pump-out stations visited in Sweden:

- Arholma
- Gräddö
- Svinninge Marina
- Svinninge boat club
- Vaxholm
- Norrtälje guest harbour
- Norrtälje segelsällskåp
- Utö

Fig. 4.4 a – The floating station in Gräddö, in the Norrtälje archipelago

Fig. 4.4 b – The sewage collecting system in Utö, that consists in pumping points and a remote pump located in a pump-house.

Pump-out stations visited in Finland:

- Naantali
- Pargas
- Nauvo
- Kasnäs
- Örö
- Peterzens
- Reso

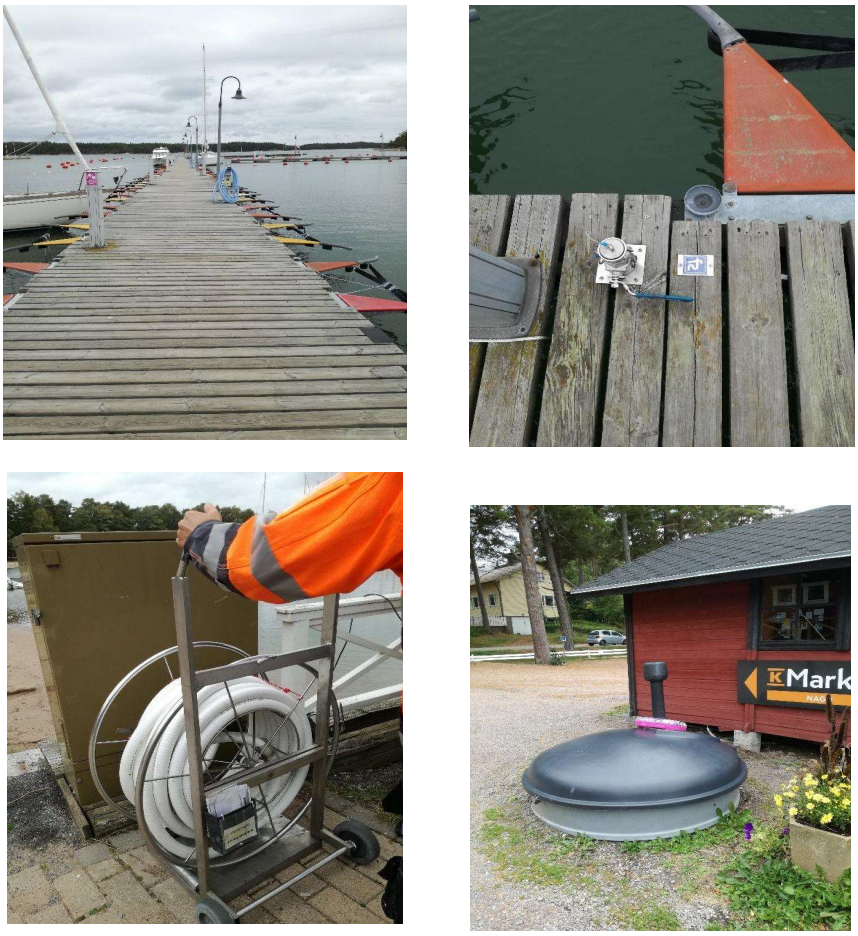


Fig. 4.4 c - Sewage collecting system in Nauvo. In clockwise order: the peer, the suction point, the portable hose, the pump station.




Fig. 4.4 d - Örö floating pump-out station. In the third picture it is possible to see the mechanism that indicates when the tank is full.

4.5 Investigation of innovative solutions

Because of the lack of economic incentives there are not significative innovations in the pump-out stations market. However, some entrepreneurs outside the project area have developed on-site wastewater treatment plants that could be used in the harbour or marina and solve the problem of the sludge logistic and transportation.

This kind of technology has not been used yet in the Baltic sea; it is first necessary to investigate if these products can comply with the legislation in force in the countries involved in the project.

The investigation focused on understanding the requirements and limits that this kind of technical solutions should comply with in Sweden, Finland and Estonia and consisted in interviewing the other project partners and municipal employees in Sweden and Finland.

The project team also took contact with the Research institute of Finland, that is testing a solution suitable to treat different types of wastewater, also from boats.

5 Results

5.1 Market overview

Pump-out stations production or selling is usually a non-core business activity.

In Estonia the market is relatively small, due to different socio-economical context, geographical conditions and different environmental policy compared to Sweden and Finland. The market situation in Sweden and Finland is quite similar, with local and international producers present in the market. In these countries technology producers or retailers report about a decreasing demand for new pump-out stations, despite the intense boat tourism, and ask for a more severe implementation of the environmental law.

The investigation has been conducted in an objective manner, the website address of every producer can be found in this report and the reader is welcome to contact the producers for more detailed information on the products.

The list of producers might not be complete, and it can also vary over time. The prices, when reported, are only indicative.

The results of the market investigation are presented in the Attachment I of this report.

5.2 Boat users' survey

The survey for the boat users has been sent out in Sweden and Finland, under the assumption that the boaters' population in Estonia is mainly composed by Swedish and Finnish.

The number of survey participants has been about 180, 90% of which have a toilet system suitable for using pump-out stations. The inputs from the survey contributed to identify the most recurrent problems regarding the use of the pump-out stations. 74% of the survey participants had problems when using the pump-out stations, in most cases because of a not well working or out of service station.

65% of the interviewed users do not think that it would be useful to have a land toilet besides the pump-out station. Finally, there is not a clear preference on the type of station, with a consistent number of interviewees just aiming for a well working pump-out station.

Boaters' survey results are reported in Attachment II.

5.3 Quality of the service: Major problems related with the operation of the stations

Combining the information from the user survey, the ports managers and maintenance technicians' interviews, and the field trips the project team has individuated some major problems related with the operation of the pump-out stations that might discourage users from using this type of facilities and that make the work of maintenance technicians more difficult.

1) Lack of instructions or instructions not readable

Not clear instructions can lead to an improper use of the pump-out station with ensuing problems for the functionality of the station. Among the stations that the project team has visited only a couple were not provided with instructions at all or the instructions were ruined and not readable.

The first recommendation is to always locate the instructions at a height that allows everybody to read them.

The Baltic sea has an intense marine tourism with boaters from different countries. In order to overcome language problems, having instructions in both the local language and in English might not be enough, it would be recommendable to have also images that illustrate the operations to execute to empty the boat holding tank.

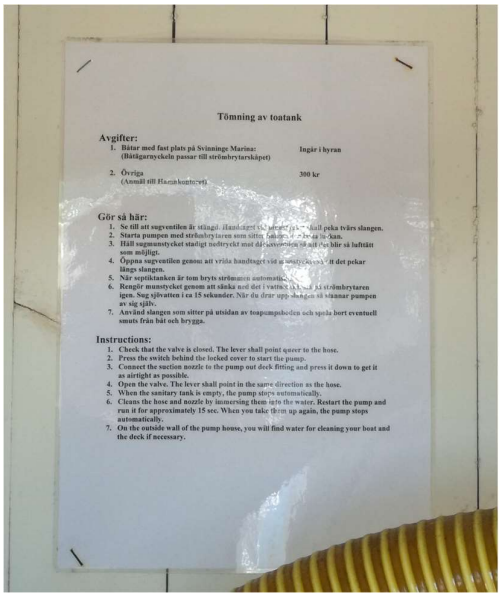


Fig. 5.3 a – Two examples of instructions: The second one is understandable by everyone thanks to the illustrations.

2) Hose not long enough

When interviewing boat users, some have mentioned that they had trouble in using the pump-out stations because the hose had not a proper length to arrive to the boat's deck waste fitting.

Many suppliers provide hoses with different length, the recommendation is for the port managers to take into consideration this issue and choose the appropriate length depending on the location of the station. Another option is to have two hoses of different length available at the station.

3) The hose nozzle of the stations is not suitable for all the boat's deck waste fitting

In 2000 the ISO standard 4567 has been repealed by the standard ISO 8099: 2000. One of the reasons why this new standard came about was that people would not need to use an adapter between the boat and the suction nozzle to reduce the emissions when sucking and cleaning the adapter. In 2018 a new version of the standard has been published, the ISO 8099:2018, but it does not report changes to the fitting dimensions, just the following statement: *'The cap retention system, if used, shall not impede the proper function of the pump-out'*.

Albeit almost 20 years have passed since the adoption of the new standard, it is not uncommon that the hose nozzle of the stations is not suitable for the boat's deck waste fitting. A solution might be to have different nozzles at the station, but they need to be well anchored, as a producer suggested, so that they cannot be stolen or dropped.

The experience of the field trips is that in Sweden and Finland the conic nozzle is one of the most used and this one fits well with different kind of boat's deck waste fitting.

Fig. 5.3 b – Conic hose nozzle

4) Difficulty at creating vacuum conditions when using the pump

If the hose nozzle of the station does not fit well with the boat's deck waste fitting it is hard to pump because air is entering in the deck fitting. In order to create vacuum, some people use some tissue that can be sucked by the pump and ruin it.

A possible solution for this inconvenient is to have the pump-out nozzle equipped with a sucker, that allows to create the vacuum:

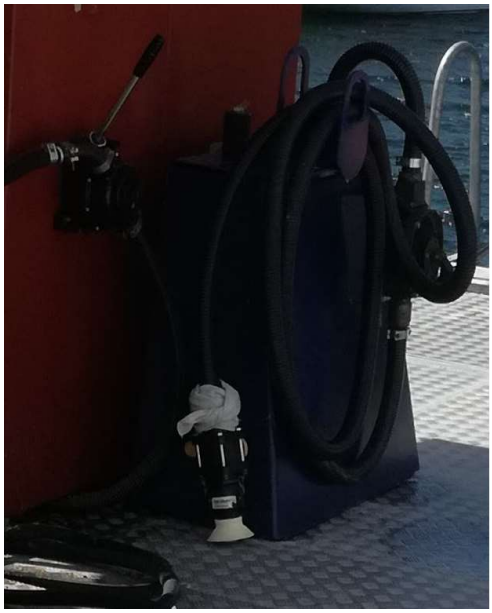


Fig. 5.3 c – The hose nozzle of this floating station is equipped with a sucker, that makes it easier to have a vacuum condition.

5) The plexiglass piece of the hose gets often broken

Many modern pumps have a plexiglass part that allows users to see if the pump is working. Unfortunately, it can happen that boaters break this plexiglass piece and the station is than out of service until it is repaired.

6) Accessibility to the stations

Accessibility to a pump-out station in terms of location is not an easy issue to solve. BATSECO-Boat project is investigating boat traffic to individuate the best locations for the new pump-out stations in Norrtälje municipality. What boaters complain of is the fact that they have to enter all the way into a harbour in order to empty their holding tank. In this region one of the ways to solve this problem might be using floating stations, but apart from the logistic that needs to be studied, some of these kinds of stations are not always easy to access due to difference in height with the boats. Keep the Archipelago Tidy (KAT), a Finnish partner in the project, has recently bought a floating pump-out station that can solve this problem: The floating pontoon has steps on one side in order to have two different heights and be easily accessible by different types of boats.

Fig. 5.3 d – Floating pump-out station in Finland: The pontoon has steps on one side in order to make it easily accessible to higher boats.

7) Transportstyrelsen app is not always updated

The Swedish national transport agency has created an app (*Hamnkarta*) that allows to localize all the pump-out stations for leisure boats in Sweden. The app gives the exact coordinates of the stations and there is the option for the users to report malfunctions. On one hand this is very useful for other users to know whether a station is working or not, but on the other hand the responsibility to update the state of the station is only on the users, without any warranty of having an updated information on the state of the facility.

When a fault is reported, the manager of the station (municipality, boat club, regional organizations, marinas, etc.) should be demanded to fix the station timely and then update the status of the station in *hamnkartan*.

8) Edge or perimeter of the floating stations or peer too sharp

It is not rare that the edges of a floating pump-out station or of a peer are too sharp or that the shielding system is not durable, ensuing aesthetic damages or even more serious structural damages to the boat.

A solution adopted by some maintenance operators is to use a hose to create a shielding system, by cutting, bending and hardening it. In their experience this is a durable remedy.

Fig. 5.3 e – Two floating stations: The station on the left has no shielding system on the edge which can cause aesthetic or more severe damages to the boat.

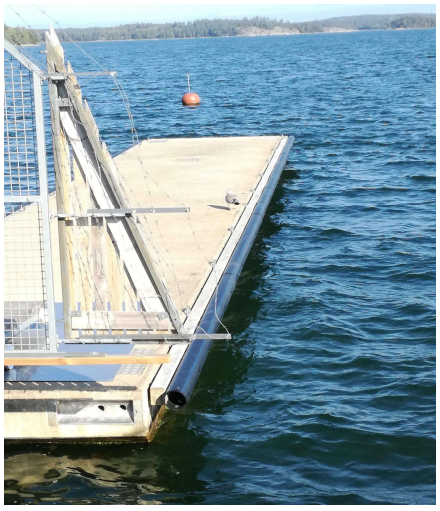


Fig. 5.3 f – Shielding system on a peer. As it is possible see from the picture a hose has been added to a previous but not functional system.

9) Users forget to close the hose valve

Some stations that work with the vacuum technology are activated by opening a valve located on the hose. When the user has finished pumping it is important to close the valve, otherwise the pump continues sucking air and this can cause problems to the engine. It is important then to highlight the step of closing the hose valve in the instructions.

10) Evacuation column not efficient

Floating stations are provided with an air evacuation column in order to prevent bad odours, but they are not always efficient. The evacuation system has to be dimensioned in a proper way and tall enough to avoid this inconvenience to boaters.

11) Extra options can lead to extra problems

Some stations are equipped with a mechanism to roll back the hose after the use, which on one hand is an extra comfort but on the other hand is a source of extra work for maintenance operators. The suggestion is to keep the station as simple as possible in order to limit sources of malfunction.

12) Problems related to the logistic of the station

The pump-out station has been considered as a whole with the wastewater system. During the field trips the project team has visited a floating station connected to the municipal wastewater treatment plant through a pipe running in the sea. This station has an electric screwing pump with a rubbery gasket that at some point got dried and broke. In order to prevent this from happening again the maintenance operators installed a pump that pumps sea water into the system, so that the gasket does not get dry. This has been a good solution for this kind of system, but if the station was not directly connected to the wastewater treatment plant but rather to a tank this would not have been an efficient solution since it would fill the tank faster. This is an example of the importance of considering the whole system when choosing the technology to purchase.

13) Difficulty in getting spare parts

Some harbours have experienced long downtime during the boating season due to the difficulty of getting spare parts from the pump-out station supplier. Depending on the part that needs to be replaced, one solution can be to always keep a stock of this part in order to minimize the downtime. The buyer should specify a clause regarding this issue when buying a new station.

14) Long term responsibility

The eventuality of a supplier bankruptcy is rare, but it is anyway a risk to assess when purchasing a new pump-out station. It is important to define long term maintenance responsibilities in order ensure a continuous service of the station.

5.4 Suggestions for floating solutions

Floating stations are needed in the Swedish and Finnish archipelago: Users do not have to enter the harbour only to dump their sewage water and the station can be moved whenever it is needed.

However, some floating tanks made entirely in marine aluminium are having problems of corrosion in the inner part of the tank.

An alternative solution can be a floating station consisting of a pontoon that hosts a replaceable tank inside of it and a pump-out station on top. Even though users seem to prefer electrical pump, if there is no possibility of having electricity connection the pump has to be a hand pump.

For these kinds of solutions it is important to consider:

- The pontoon has to be big and sturdy enough to avoid stability problems and make the users feel comfortable when staying on it. Indicative pontoon dimensions are 3 x 12 m, in order to let big boats approach it easily

- The tank producer has to guarantee that the tank is made of a material resistant to corrosion for a time equal to the life span of the station, or easy to replace.

Keep the Archipelago Tidy, a Finnish partner in BATSECO-Boat project, has recently bought such type of floating station. In this case the pontoon has steps to facilitate the accessibility to the station both to small and big boats:

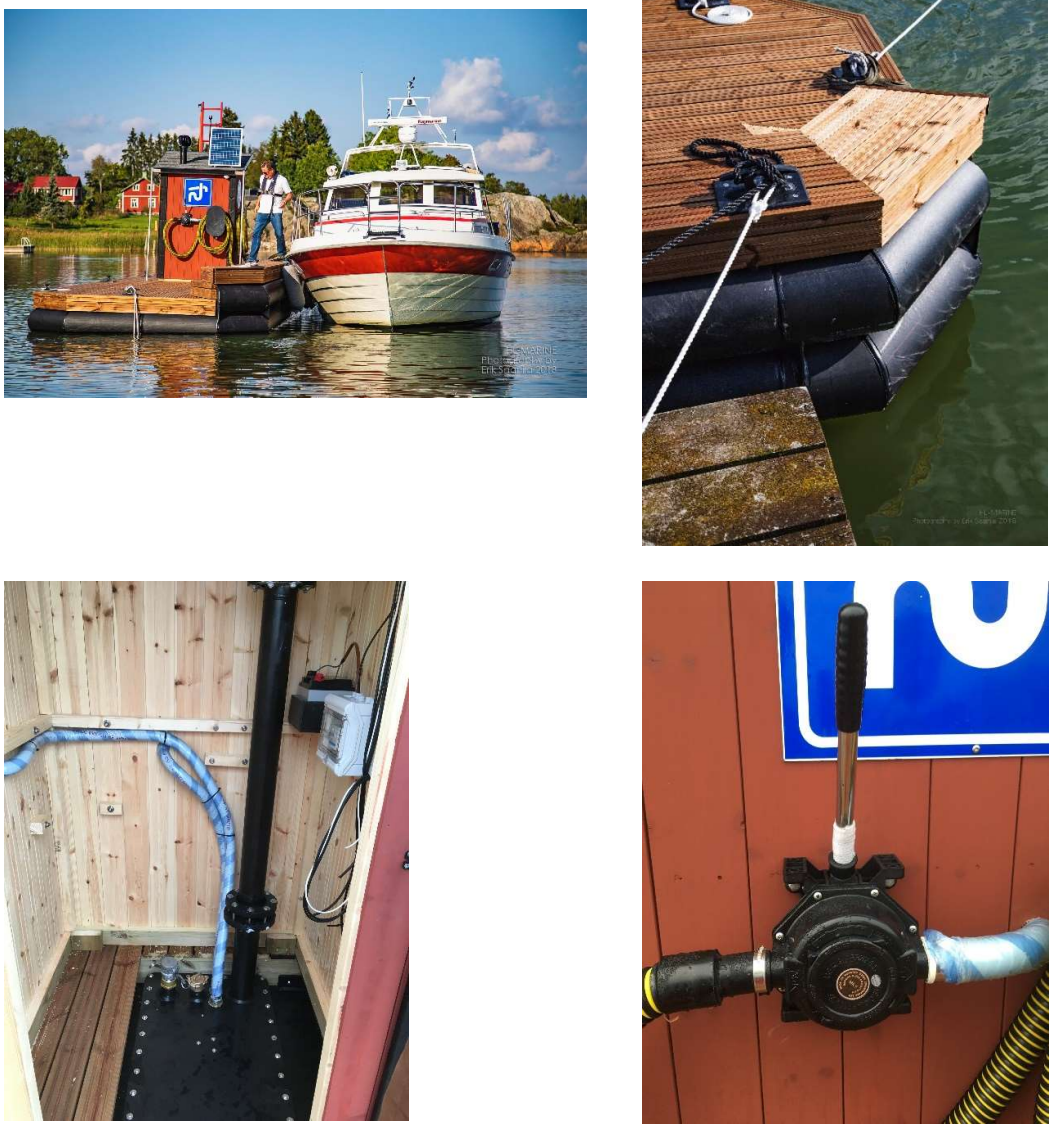


Fig. 5.4 – Floating pump-out station in Finland: The steps on one side allow easy access to boats with different heights. This pump-out station is equipped with a hand-pump and the tank is inside the pontoon.

5.5 Public procurement – an opportunity for improvement

As aforementioned, the pump-out stations market is lacking economic incentives and investments. Public procurement can be the instrument to help the market and improve the service as well. When procuring a pump-out station there are many aspects worthy of consideration already mentioned in this report, but some of them could be emphasised:

- One significant problem seems to be finding spare parts. This should be taken into consideration already in the procurement, by demanding that spare parts could be delivered within one week, for example.

- There are several examples of floating stations that have sharp edges, making it hard to dock. That problem should be easy enough to avoid if mentioned in the procurement.

- The drawback when using a hand-pump is that you need to be two persons to empty the boat tank: One that pumps and one that connects the nozzle. But on boats large enough to be equipped with toilets you tend to be more than one almost always. Hand-pumps seem to be much more reliable, with less down-time, and should be considerable cheaper, but it is important to keep in mind that users tend not to prefer this kind of pumps.

- The pump-out stations should be equipped with alarms both to indicate if the holding tank is full and to report if the station is out of service.

- Not in the procurement but in the service contract it should be defined the maximum downtime allowed during the boat season and the measures to guarantee it (e.g. periodical maintenance visits, with a defined frequency of the visits).

Finally, it is also important to highlight that the choice of the most suitable type of solution must consider the pump-out station as a part of the wastewater system and all the related aspects such as capacity of the wastewater treatment plant, transport logistic, etc.

5.6 Potential innovative solutions

5.6.1 Answers from municipalities in Sweden and Finland

In Sweden and Finland the municipalities are responsible to establish the requirements and limits for wastewater treatment and discharging. However, there are no rules set for on-site wastewater treatment plants to treat boats sewage, since this type of technical solution is not in place yet in these countries.

Eight municipalities in both countries were contacted to investigate the possibility to use an on-site wastewater treatment plants. The question asked was:

"If you received an application for an on-site wastewater treatment plant that treats only the latrine fraction and has a direct outlet into the sea what requirements would you define?"

Most of the interviewees were sceptical and were not able to answer the question.

Two interviewees replied with the following observations:

- the boat latrine is very concentrated and its composition is not well known, so it can be difficult to be treated by an on-site solution
- considered the highly concentrated sewage from the boats, the requirements for nutrients and chemical parameters should be expressed as limit values in mg/l rather than in percentage of reduction.
- technology would be in operation for a short time, which can represent a problem for the optimal functionality of an on-site wastewater treatment plant.

Only one interviewee answered with some figures:

- 0,3 mg/l P_{tot} and 10 mg/l BOD_7 for a wastewater treatment plant with a direct outlet in the sea, from 25 pe (persons equivalent) upwards.

5.6.2 The regulation in Estonia

In Estonia water treatment is regulated by the Water Act. In the chapter 5 of the Act "Limit values for pollution indicators of wastewater discharged into water bodies and stages of wastewater treatment" it is recommended to follow the Annex 2 to the Water Act.

The Annex 2 identifies the following limit values for the range 2000 – 9999 person equivalent (pe):

- total phosphorus: 1,5 mg/l, or a percentage of reduction at least equal to 80%
- BOD_7: 15 mg/l, or a percentage of reduction at least equal to 90%

5.6.3 Conclusions

Due to the lack of economic incentives there are no significant innovations in the pump-out stations market.

If there is an interest towards the aforementioned on-site wastewater treatment plants, it is necessary to test them first.

A project that is worth to mention is Resource container 2 (Resurssikontti 2) of VTT (Technical Research Centre of Finland). The project is testing a wastewater treatment plant located into a ship container, hence without a direct outlet into the sea. The aim is the wastewater reclamation for irrigation purporses and the nutrients recover. The project will test the facility on different types of wastewater, boat wastewater among others.

Attachment I

Market investigation in Sweden

Below a list of producers and catalogue of products. The list of producers can vary over time. The prices, when reported, are only indicative.

ALFABRYGGAN

The core business of this Swedish enterprise based in the Stockholm region is piers production. They are also retailers of Marinarmatur products and of a floating solution of the Finnish enterprise **Reittitiimi OY**, which is equipped with a pump-out station, a toilet and a garbage container.

More information on https://www.alfabryggan.se/ehandel/, https://www.reittitiimi.fi/

RTI Combi Miljöbrygga

Pier dimensions: 3,15 x 15,25 m
Tank: 3 tanks in the piers
Material: marine aluminium
Pump: Membrane hand pump
Hose: L = 8 m
Toilette
Garbage container
Price: ~40000 – 50000 €

BAGA

Baga is a Swedish enterprise specialized in wastewater solutions. They can produce pump-out stations and the solution can be customized to the needs of the customer.

More information about the different type of pumps can be found at http://baga.se/avlopp/produkter/pumpar/

BÅT – MAJA

Båt Maja is a producer based in the Stockholm region. They produce their own technology, both stationary and mobile solutions, and their market is pretty local.

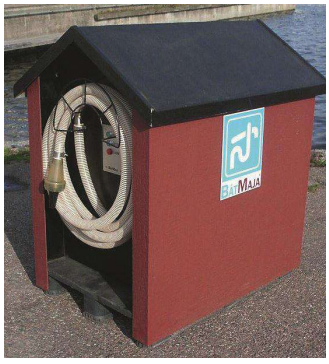
More information at http://www.batmaja.se/

Stationary solutions

BåtMaja 51

Dimensions: L= 1310 mm, W= 940 mm, H = 1380 mm
Material: Pump in stainless steel House / Ceiling: Fiberglass reinforced plastic
Pump: Peristaltic pump DN 40
Electrical connection: 400 V
Draining Capacity: 60 l/min
Hose: L = 10 m
Price: 80000 kr (~8000 €), VAT not included

BåtMaja 21



Dimensions: L= 710 mm, W= 940 mm, H = 1380 mm
Material: Pump in stainless steel House / Ceiling: Fiberglass reinforced plastic
Pump: Peristaltic pump DN 40
Electrical connection: 400 V
Draining Capacity: 60 l/min
Hose: L = 10 m
Price: 80000 kr (~8000 €), VAT not included

Mobile solutions

BåtMaja 12067 (4 wheels)

Dimensions: 120x67 cm
Pump: Diaphragm pump
Electrical connection: 230 V
Draining Capacity:
Tank: 95 l, with carbon filter to reduce odor
Hose: L = 6 m
Price: 15950 kr (~1595 €), (VAT not included)

BåtMaja10060 (2 wheels)

Dimensions: 100x60 cm
Pump: Diaphragm pump
Electrical connection: 230 V
Draining Capacity:
Tank: 95 l, with carbon filter to reduce odour
Hose: L = 6 m
Price: 15950 kr (~1595 €), VAT not included

EL-EFFEKT

This enterprise located in the Stockholm area is the Swedish retailer of products from Leestrom, one of the world leaders in this field. More information on https://www.el-effekt.se/ and http://www.leestrom.eu/

Delivery time of 4 weeks, the transport fee is included in the pump-out station price.

For Finland and Estonia it is TOP MARINE the retailer of Leestrom products.

Stationary solutions

LS60W

Dimensions: L= 400 mm, W= 395 mm, H = 1400 mm
Material: Cabinet in stainless steel, pump in bronze
Pump: Diaphragm pump
Electrical connection: 230 V or 400 V
Draining Capacity: 60 l/min
Hose: different length available
Price: 105600 kr (~10560 €) VAT included (84480 kr VAT excl.)

LS160W-B

Dimensions: L = 1050 mm, W = 750 mm, H = 1300 mm
Material: Cabinet in stainless steel, pump in bronze
Pump: Diaphragm pump
Electrical connection: 230 V or 400 V
Draining Capacity: 60 l/min
Hose: L = 15 m, diameter 38 mm
Price: 130000 kr (~13000 €) VAT included

Portable solution

LSM80W

Dimensions: L = 840 mm, W = 730 mm, H = 1130 mm
Material: pump in bronze
Pump: Diaphragm pump
Electrical connection: 230 V
Draining Capacity: 25 l/min
Tank: 80 l
Hose: L = 7,5 m and 38 mm diameter both for suction and for discharge hose
Price: 38200 kr (~3820 €) VAT included

JETS

Jets headquarters are set in Norway, with offices and retailers all around the world. They manufacture and sell vacuum sanitation systems.

In Sweden the retailer of pump out stations is **Bryggkompaniet**, in Finland is **Septor OY**, while the reference for Estonia is Jets' Lithuanian office.

https://jetsgroup.com/other-vacuum-systems/marina-pump-out-station, http://www.bryggkompaniet.se/,

https://www.septor.fi/en/products/marine

The final solution can be customized to the needs of the customer, the pumps are standard. Here some examples of pumps, more information on Jets website.

15MB-D Vacuumarator

Pump Dimensions: L= 554 mm, W= 214 mm, H = 332 mm
Material: Pump house in bronze, rotor house in stainless steel
Pump: Vacuum pump
Electrical connection: 220 V, 255 V, 380 V, 440 V, other voltages available
Draining Capacity: 83 l/min

25MBA Vacuumarator

Pump Dimensions: L= 690 mm, W= 200 mm, H = 275 mm
Material: Pump house and rotor house in stainless steel
Pump: Vacuum pump
Electrical connection: 220 V, 255 V, 380 V, 440 V, other voltages available
Draining Capacity: 200 l/min

Latrina

Latrina produces stationary and portable pump-out solutions.

The prices depend on the type of equipment/accessories provided.

More info on http://www.latrina.se/

LATRINA BAS

Dimensions: L=1180 mm, W= 455 mm, H = 2190 mm
Material: Fiberglas reinforced plastic
Pump: eccentric pump
Electrical connection: 380 V
Draining Capacity: 60 l/min
Hose: L = 5,2 m, 32 mm internal diameter
Price: 67000 - 72000 kr. (6700 – 7200 €) VAT not included

LATRINA PREMIUM

Dimensions: L = 1650 mm, B = 840 mm, H = 3410 mm
Material: Fiberglas reinforced plastic
Pump: eccentric pump
Electrical connection: 380 V
Draining Capacity: 100 l/min
Hose: one or two 8 m long hoses, both with automatic rewinding into the cabinet
Price: station with one suction hose 105000 kr (10500 €); with 2 hoses 135000 kr (~13500 €). VAT not included

LATRINA MINI

Dimensions: L = 1200 mm, W = 800 mm, H = 2000 mm incl. mast
Material: Fiberglas reinforced plastic
Pump: eccentric pump
Electrical connection: 380 V
Draining Capacity: 100 l/min
Hose: L = 3-15 m, 32 mm internal diameter
Price: 49000 kr – 60000 kr. (~4900 – 6000 €) VAT not included

MARINARMATUR

This Swedish enterprise located on the west coast is one of the main producers of pump-out stations in the Nordic countries. Their retailers in Sweden are: **CC Marinutvecling, Bryggkompaniet, Alfabryggan.**

For more information http://marinarmatur.se/index.html, http://www.ccmarinutveckling.se/, http://www.bryggkompaniet.se/, https://www.alfabryggan.se/

Stationary solutions

CLEANPORT – SEPTIC 200

Dimensions: L=725 mm, W= 650 mm, H = 900 mm
Material: Stainless steel pump
Pump: impeller pump
Electrical connection: 400 V
Draining Capacity: 150 l/min
Hose: L = 7 m
Price: 49000 - 74000 kr (~4900 – 7400) VAT included

CLEANPORT – SEPTIC + OIL 200

Dimensions: L=725 mm, W= 650 mm, H = 900 mm
Material: Stainless steel pump
Pump: impeller pump
Electrical connection: 400 V
Draining Capacity: 150 l/min
Hose: L = 7 m
Price: 64000 - 80000 kr (~6400 – 8000 €) VAT included

CLEANPORT – SEPTIC 2000

Dimensions: L=725 mm, W= 650 mm, H = 900 mm
Material: Stainless steel pump
Pump: Peristaltic pump
Electrical connection: 400 V
Draining Capacity: 25 l/min
Hose: L = 7 m
Price: 79000 - 98750 kr (~7900 – 9875 €) VAT included

Portable solution

CLEANPORT – MOBILE

Dimensions: L=1300 mm, W= 650 mm, H = 900 mm
Material: Stainless steel pump
Pump: impeller pump
Electrical connection: 230 V
Draining Capacity: 120 l/min
Hose: L = 7 m
Price: 64000 - 80000 kr (~6400 – 8000 €) VAT included

RENT HAV

They are retailer of the Canadian pump producer WMW. For the ease of the reader two pumps series are reported as examples, but more information can be found at https://www.wmwpump.com/marine-vacuum-pump-systems/

Stationary solutions

AVR series

AVR20

Dimensions: L= 1170 mm, W= 590 mm, H = 870 mm
Pump: Vacuum pump
Electrical connection: 120 V, other voltages available
Draining Capacity: 75 l/min
Hose: it's a remote system, any hose can be chosen

AVR60

Dimensions: L= 970 mm, W= 870 mm, H = 1220 mm
Pump: Vacuum pump
Electrical connection: 120 V, other voltages available
Draining Capacity: 190 l/min
Hose: it's a remote system, any hose can be chosen

AVR125

Dimensions: L= 1530 mm, W= 870 mm, H = 1220 mm
Pump: Vacuum pump
Electrical connection: 120 V, other voltages available
Draining Capacity: 190 l/min
Hose: it's a remote system, any hose can be chosen

Portable solutions

DPK electric series

DPK20E

Dimensions: L= 1780 mm, W= 690 mm, H = 970 mm
Pump: Vacuum pump
Electrical connection: pre-wired for standard 120V power outlet (other voltages available)
Draining Capacity: 75 l/min
Tank: 94 l
Hose: different length available

DPK240E

Dimensions: L= 1830 mm, W= 920 mm, H = 1280 mm
Pump: Vacuum pump
Electrical connection: 208 - 230 V AC, other voltages
Draining Capacity: 340 l/min
Tank: 94 l
Hose: different length available

STAINLESS ENGINEERING

This enterprise is based in the Stockholm area. They are retailer of Zickert Systems and of Mobimar, a Finnish enterprise that produces floating pump-out stations.

This latter type of solution has been thought for those places where the connection to the public electricity and wastewater network cannot be realized.

The prices are around 20000 – 30000 € depending on the type of solution.

More information on http://www.stainlessengineering.se/Septicon/septikon.htm

http://www.mobimar.com/water-management

SEPTIKON

Tank Volume:	3 m^3	6 m^3	9 m^3
Dimensions:	3,35 x 3,35 m	4,1 x 4,1 m	5,0 x 5,0 m
Material: marine aluminium			
Pump: Membrane pump			
Draining Capacity: 100 l/min			
Hose: L = 10 m			

TRI - SEPTIKON

Tank Volume: 6 m^3
Material: marine aluminium
Pump: Membrane pump
Draining Capacity: 100 l/min
Hose: L = 10 m
Toilette
Capacity of garbage container: 5 m^3

VÄTE CONSULTING TEKNIK

They are a consulting firm that offers services in the fields of railway transportation and technology, transport logistic and different technical solutions, pump-out stations among others. For pump-out stations they are retailers of the Vogelsang pumps.

http://www.va-te.se/index.html

https://www.vogelsang.info/int/products/supply-and-disposal/pierpump/

S160

Dimensions: L= 960 mm, W= 580 mm, H = 1050 mm
Material: protective case in stainless steel
Pump: Rotor pump
Electrical connection: 230 V
Draining Capacity: 180 l/min
Hose: 15 m
Price: starting from 73000 kr (~7300 €)

SB160 waste and bilge water

Dimensions: L= 960 mm, W= 580 mm, H = 1050 mm
Material: protective case in stainless steel
Pump: Rotor pump
Electrical connection: 230 V
Draining Capacity: 2x180 l/min
Hose: 2 x 15 m

ZICKERT SYSTEMS

Zickert had been in the wastewater pumps and pump-out stations business since many years. Their retailers in Sweden are **Ima VVs & Värmepumpar** and **Stainless Engineering.**

More information on http://www.zickertsystems.se/sugtomning/start/,

http://www.imavarmepumpar.se/battommning/

http://www.stainlessengineering.se/Zickertsystems.htm

Stationary solutions

Buddy 120-E

Dimensions: L = 900 mm, W = 480 mm, H = 890 mm
Material: pump in stainless steel
Pump: Membrane pump
Electrical connection: 230 V
Draining Capacity: 152 l/min
Hose: L = 14 m

Caddy

Dimensions: L = 1020 mm, W = 710 mm, H = 1020 mm
Material: pump in stainless steel
Pump: Membrane pump
Draining Capacity: 35 l/min
Hose: L = 7 m

Market investigation in Finland

Below a list of producers and catalogue of products. The list of can vary over time. The prices, when reported, are only indicative.

ESLEYHTIÖ OY

They are retailers of Vogelsang pumps http://esleyhtio.fi/tuotteet/satamaimulaitteet/vogelsang-siirtopumppulaitteistot/

S160

Dimensions: L= 960 mm, W= 580 mm, H = 1050 mm
Material: protective case in stainless steel
Pump: Rotor pump
Electrical connection: 230 V
Draining Capacity: 180 l/min
Hose: L =15 m

SB160 waste and bilge water

Dimensions: L= 960 mm, W= 580 mm, H = 1050 mm
Material: protective case in stainless steel
Pump: Rotor pump
Electrical connection: 230 V
Draining Capacity: 2x180 l/min
Hose: 2 x 15 m

HL-METAL

This Finnish enterprise is a supplier to the maritime industry, with solutions for ship yards and marinas. They have been collaborating long time with Keep the Archipelago Tidy, and they have developed a floating pump-out station with the following characteristics:

BW12

Pontoon dimensions: 3,2 x 7 m or 3,20 x 13 m
Pump-out station: Equipped with two pumps
Pump: Hand-pump
Tank: 10 m^3

More information on http://www.hlmetal.fi/

H20KEE

This Finnish enterprise is specialized in wastewater solutions. They have developed their pump-out stations called "Dokki"; their solutions can be used as stationary, portable or for floating pump-out stations.

For more information https://www.h2ok.fi/

DOKKI series

DOKKI Septic

Material: stainless steel and marine aluminium
Electrical connection: 230 V or 400 V
Draining Capacity: 80 - 150 l/min
Hose: L = 12 m, 32 mm in diameter

DOKKI Bilge

Material: stainless steel and marine aluminium
Electrical connection: 230 V or 400 V
Draining Capacity: 80 l/min
Hose: L = 700 mm, 14 mm diameter

DOKKI Twin: A double unit combining septic and bilge

DOKKI Max

Material: stainless steel and marine aluminium
Electrical connection: up to 400 V
Draining Capacity: 300 - 800 l/min
Hose: L = 12 m, 32 mm in diameter

MEREDIN OY

Their core business is marina installation, home marina operations, winter storage of boats and retailing of boating equipment and parts. They are also in the market of pump-out stations as retailer of Foke pumps and Marinarmatur (See Marinarmatur section for products description).

More information on https://meredin.fi/

Foke pump-out 2000S401-1

Dimensions: L = 725 mm, W = 650 mm, H = 900 mm
Material: Pump in stainless steel, case in stainless steel, carbon, ceramic, neoprene
Pump: Impeller pump
Electrical connection: 230 V or 380 V
Draining Capacity: 120 l/min
Hose: L = 7 m

NAUTIKULMA OY

This Finnish enterprise based in Turku is in the business of pump-out stations since many years. For their solutions they use membrane pumps of the American producer Sealand.

http://www.nautikulma.fi/septi/index.html

DS1 (1 pump)

DS2 (2 pumps)

Dimensions: L = 715 mm, W = 485 mm, H = 1240 mm
Material: Pump in bronze, case in stainless steel
Pump: Membrane pump
Electrical connection: 230 V or 400 V
Draining Capacity: 56 l/min
Hose: L = 6, 9, 12 m
Price: starting from 6330 € incl. VAT, the price varies with the length of the hose

PELLOS-MARIN OY

Pellos marin is specialized in pontoons production. They are in the pump-out stations market as retailers of Pellmac solutions.

https://www.pellosmarin.fi/muut_tuotteet_ja_palvelut/imulaitteet

2 permanently mounted pumps, one for wastewater and one for bilge water
Pump: Diaphragm pump

REITTITIIMI OY

This Finnish enterprise is specialized in the production of pontoons, floating piers, bridges and other structures. They produce the floating pump-out station RTI Combi, equipped with a hand pump, a toilet and a garbage container. This solution is sold in Sweden by Alfabryggan.

https://www.reittitiimi.fi/

RTI Combi Miljöbrygga

Pier dimensions: 3,15 x 15,25 m
Tank: 3 tanks in the piers
Material: marine aluminium
Pump: Membrane hand pump
Hose: L = 8 m
Toilette
Garbage container
Price: ~40000 – 50000 €

SEPTOR OY

Septor is a supplier to the maritime industry, with solutions both for boat owners and for ship yards and marinas. They are retailers of Jets solutions, among others. (See Jets description for products information).

More information at https://www.septor.fi/en/

https://jetsgroup.com/other-vacuum-systems/marina-pump-out-station

Market investigation in Estonia

Below a list of producers and catalogue of products. The list of producers can vary over time. The prices, when reported, are only indicative.

ROLEC

Rolec solutions are sold in Estonia through Renoport. Rolec is a British enterprise providing different types of services for marinas.

More information at http://www.rolecserv.com/marina

http://www.renoport.eu/?p=1926

RS100

Dimensions: L= 480 mm, W= 480 mm, H = 1165 mm
Material: Head: ABS Granulate Natural Polyethylene Body Internal: Hot-Dipped Galvanised Steel Body External: Powder Coated Aluminium / 304 Stainless Steel
Pump: Peristaltic pump
Electrical connection: 230 V or 400 V
Draining Capacity: 60 l/min
Hose: L=10 m
Price: about 3000 € VAT included

RS250

Pump Dimensions: L= 620 mm, W= 390 mm, H = 442 mm
Material: Pump: aluminium, stainless steel and brass Housing: polypropylene or aluminium powder coated housing
Pump: Peristaltic pump
Electrical connection: 400 V
Draining Capacity: 300 l/min
Hose: L=10 m

Pump-out pedestal completed with a remotely sited pump located in a coated housing

RS300

Pump Dimensions: L= 620 mm, W= 390 mm, H = 442 mm
Material: Pump: aluminium, stainless steel Housing: polypropylene or aluminium powder coated housing
Pump: Peristaltic pump
Electrical connection: 400 V
Draining Capacity: 300 l/min
Hose: L=10 m

Pump-out pedestal completed with a remotely sited pump located in a coated housing

SEIJSENER

Seijsener is a Dutch enterprise offering different marina services. They produce their own pump-out stations and they are also the European distributors of Keco (see Keco description), a pump-out stations producer from USA.

Pump-Out SP-20

Dimensions: L=350 mm, W=1000 mm, H=970 mm
Material: pump in bronze, house in stainless steel
Pump: diaphragm pump
Electrical connection: 400 V
Draining Capacity: 60 l/min
Hose: L=15 m

Duo-Type pump type SPC-6

Dimensions: L = 1000 mm, W = 750 mm, H = 1300 mm
Material: pump in bronze, house in stainless steel
Pump: diaphragm pump
Electrical connection: 230 V or 400 V
Draining Capacity: 60 l/min
Hose: L=15 m

Portable solutions

Mobile Pump-Out SP-510

Dimensions: L = 840 mm, W = 730 mm, H = 1130 mm
Material: Stainless steel and marine aluminium
Pump: Diaphragm pump
Electrical connection: 230 V
Draining Capacity: 60 l/min
Tank: 210 litres
Hose: L = 6 m

TOP MARINE

Top Marine is specialized in the production of pontoons and floating piers. They also provide pump-out stations (Leestorm solutions) and they have recently developed a floating solution consisting in a floating pier with a pump-out station and a septic tank.

http://topmarine.ee/

Stationary solutions

LS60W

Dimensions: L= 400 mm, W= 395 mm, H = 1400 mm
Material: Cabinet in stainless steel, pump in bronze
Pump: Membrane pump
Electrical connection: 230 V or 400 V
Draining Capacity: 60 l/min
Hose: different length available
Price: 7300 € VAT included

LS160W-B

Dimensions: L = 1050 mm, W = 750 mm, H = 1300 mm
Material: Cabinet in stainless steel, pump in bronze
Pump: Diaphragm pump
Electrical connection: 230 V or 400 V
Draining Capacity: 60 l/min
Hose: L = 15 m, diameter 38 mm
Price: 13000 € VAT included

Portable solution

LSM80W

Dimensions: L = 840 mm, W = 730 mm, H = 1130 mm
Material: pump in bronze
Pump: Diaphragm pump
Electrical connection: 230 V
Draining Capacity: 25 l/min
Tank: 80 l
Hose: L = 7,5 m and 38 mm diameter both for suction and for discharge hose
Price: 3820 € VAT included

Floating solution

Concrete pontoon: 3,16 x 15 x 1,07 m
Pump-out station: LS60W
Draining Capacity: 60 l/min
Tank: 4,5 m^3
Price: ~40000€, incl. transport and installation

Producers outside the project area

Below some of the main producers outside the project area:

CEI - PORALU

This French enterprise is one of the world leaders for pump-out stations in harbours environment. They have distributors in many countries around the world, Sweden among others.

This kind of pump-out station is available in single, double or triple pump version.

More information at http://www.poralumarine.fr/

Dimensions: L= 1250 mm, W= 1275 mm, H = 920 mm
Material: stainless steel
Pump: Peristaltic pump
Electrical connection: 380 V
Draining Capacity: 75 l/min
Hose: L = 10 m

KECO

Keco is one of the world leaders for marine pumps and marine pump-out stations products. The enterprise is set in the US, their retailer in Europe is the Dutch enterprise Seijsener, an European leader in the sector.

Complete catalogue of products at https://www.pumpahead.com/

MARICER

This British enterprise is specialized in the design manufacture and installation of marina utility service equipment.

More information about the products at http://www.maricer.com/product-category/pumpout/

Maricer portable solution

Material: Pump in bronze
Pump: Diaphragm pump
Tank: 80 l
Draining Capacity: 25 l/min
Voltage: 230 V
Hose: L = 8 m

RMCS & ARABEL

RMCS works with different marine services such as pedestals, lightning solutions and also pump-out stations; it is based in the UK. Arabel is a Belgian enterprise that produces transformers and coils, but also equipment for marinas. They are both retailers of Leestrom pump-out stations.

More information about RMCS at http://www.rmcs.co.uk/marine/sanitation-and-pump-out-systems

More information about Arabel at http://www.arabel.be/en/marina-integrated-systems/?pid=103

WASTECORP

Wastecorp is a leading OEM (original equipment manufacturer) of pumps and pump parts, with offices in the United States and Canada.

Complete catalogue of products at https://wastecorp.com/

Pump Dimensions: L= 965 mm, W= 864 mm, H = 1397 mm
Pump: Vacuum pump
Draining Capacity: 227 l/min

Pump Dimensions: L= 965 mm, W= 864 mm, H = 1397 mm
Material: Marine grade aluminium
Pump: Vacuum pump
Electrical connection: 115 V or 230 V
Draining Capacity: 189 l/min

Portable solution

Material: polyethylene tank
Pump: Vacuum pump
Tank: 378 l, 567 l, 757 l
Draining Capacity: 189 l/min

Boat equipped with a pump to dump the sewage from leisure boats

Material: Pump body casing in aluminium
Pump: Vacuum pump or diaphragm pump options
Tank: From 189 l to 2270 l
Draining Capacity: 757 l/min
Hose: customizable

Pontoon producers

The number of pontoons producers in the project area is quite high. Here reported a list of some of the biggest pontoon producers:

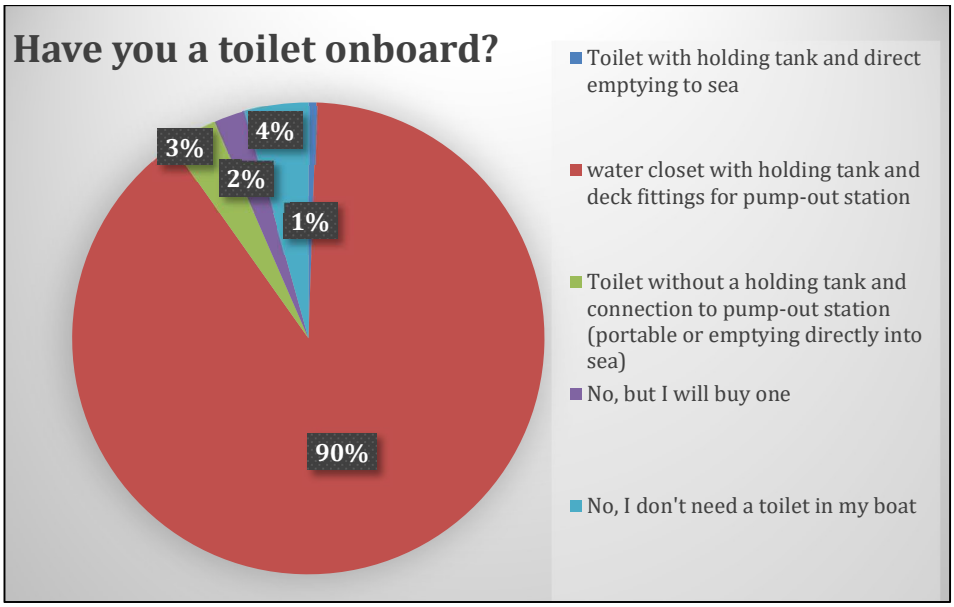
- **A-Laiturit,** https://www.a-laiturit.fi/laiturit/kelluvat-laiturit
- **AlfaBryggan,** https://www.alfabryggan.se/ehandel/14-pontoner
- **Bluet,** https://en.bluet.fi/
- **Bryggkompaniet,** http://www.bryggkompaniet.se/
- **Laakson Laiturit,** https://www.laaksonlaiturit.fi/fi
- **Marina Produkter,** http://www.marinaprodukter.se/
- **Marinetek,** http://www.marinetek.fi/millainen-laituri-sopisi-minulle/
- **Pellos Marin,** https://www.pellosmarin.fi/laiturit
- **Pontech,** http://pontech.se/
- **Savorak Pier,** https://savorak.fi/
- **SF Pontona Sverige,** https://www.sfpontona.se
- **Top Marine,** http://topmarine.ee/

Attachment II

Below the summary of the survey results in Sweden and Finland (for every answer it is indicated the total number of answers n_{tot}):

1. Have you a toilet on board?

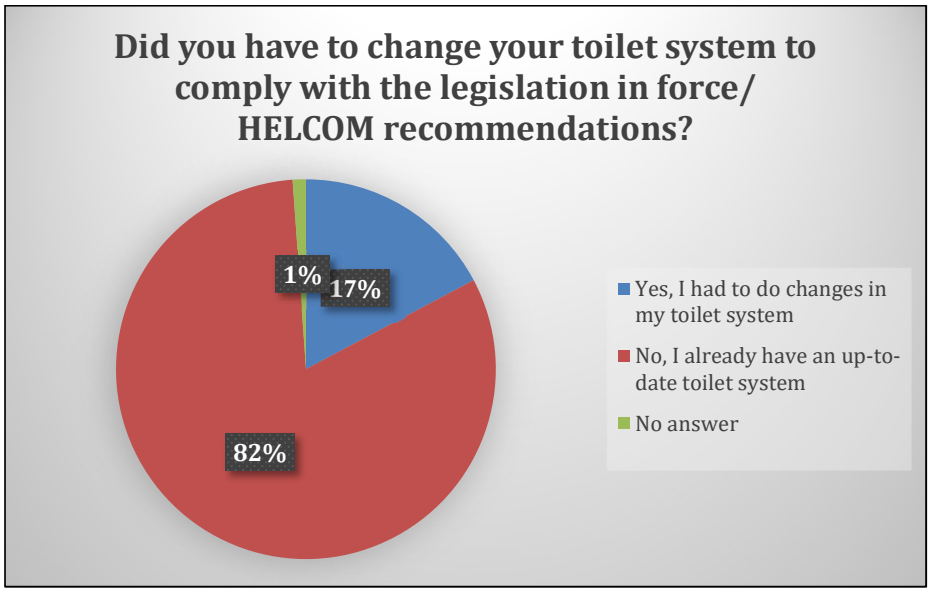
   n_{tot} = 184



Answer	n.	tot	%
Toilet with holding tank and direct emptying to sea	1	184	0,5
Water closet with holding tank and deck fittings for pump-out station	165		89,7
Toilet without a holding tank and connection to pump-out station (portable or emptying directly into sea)	6		3,3
No, but I will buy one	4		2,2
No, I don't need a toilet in my boat	8		4,3

2. Did you have to change your toilet system to comply with the legislation in force/ HELCOM recommendations?

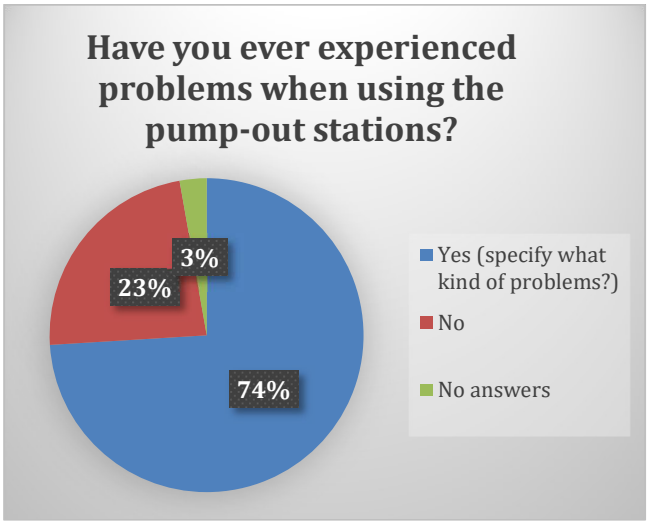
n_{tot} = 180



Answer	n.	tot	%
Yes, I had to do changes in my toilet system	31	180	17,2
No, I already have an up-to-date toilet system	147		81,7
No answer	2		1,1

3. Have you ever experienced problems using the pump-out stations? If yes, please specify them.

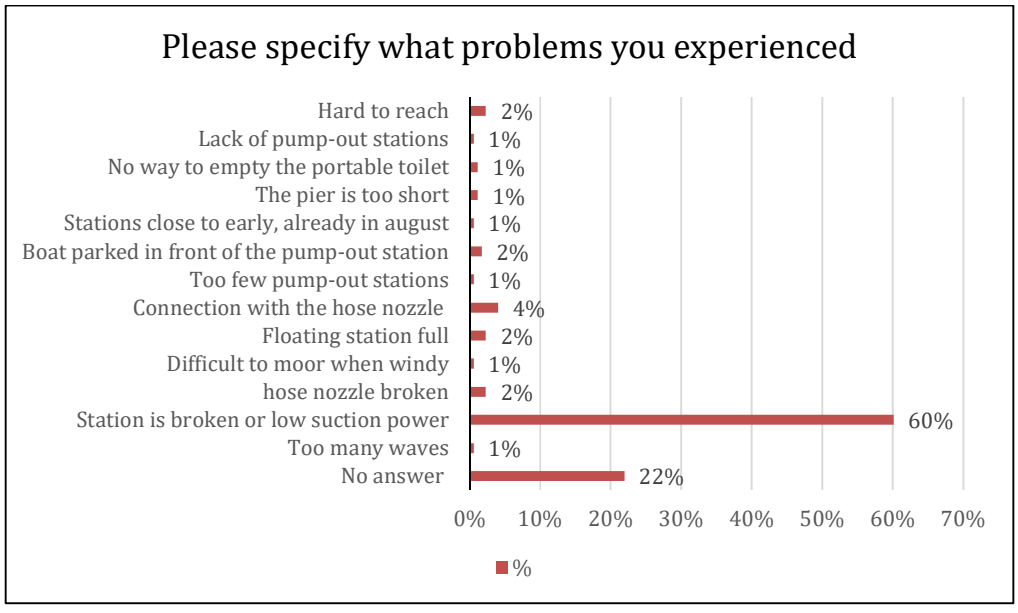
n_{tot} = 181



Answer	n.	tot	%
Yes (specify what kind of problems?)	134	181	74
No	42		23
No answers	5		3

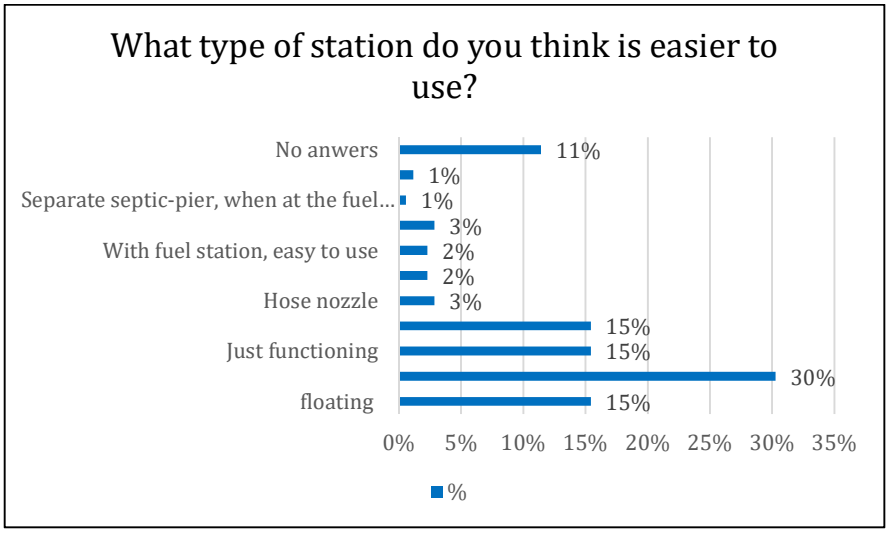
4. If you answered "Yes" to the previous question, please specify the type of problem you had.

n_{tot} = 173



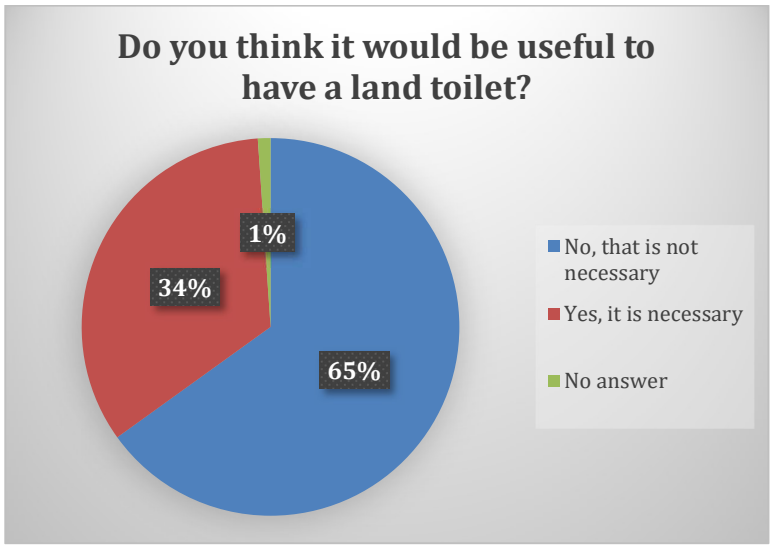
5. What kind of station do you think is easier or more comfortable to use?

n_{tot} = 175



6. Do you think it would be useful to have a toilet together with the pump-out station?

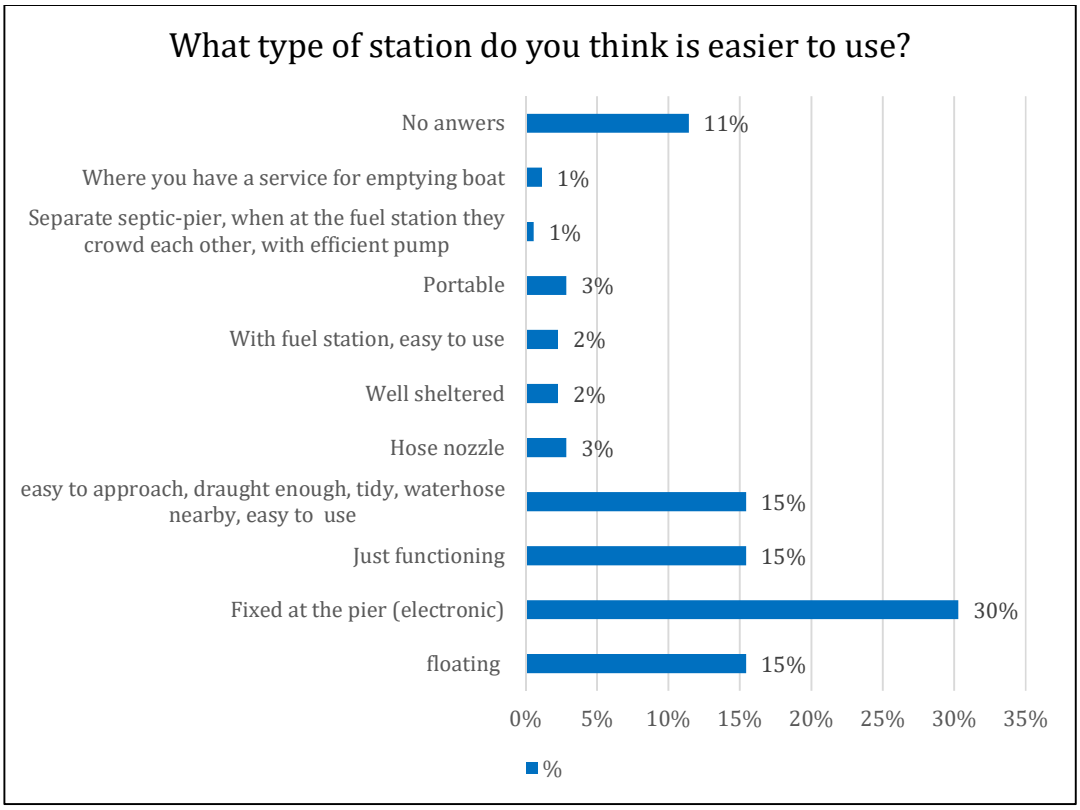
n_{tot} = 186



Answer	n.	tot	%
No, that is not necessary	121	186	65,1
Yes, it is necessary	63		33,9
No answer	2		1,1

7. What type of station do you think is easier to use?

n = 175



8. Any comments about what you think is important to consider for the installation of the new pump-out stations?

n_{tot} = 11

Answers:
Build those that do not smell bad.
Service and maintenance! Too often, pump stations are out of order. Very frustrating to find a pump that does not work if you have gone through a long way to empty your tank.
That there is fresh water and that it is possible to clean the equipment
Would be good with electric drainage, ie a sufficiently strong suction so that even really big boats can empty their tank.
More functional stations with sufficiently long suction hoses. And a phone number where you can call and report if the station is broken. And much easier to use, larger piers so it is possible to moor.
The pier must be large and have space for big boats
I use these stations in other boats. They don't work properly, no suction power, or they do not work at all.
Why not having two pumps, one on each side of the floating stations, so if one pump breaks you can use the other, or two boats can simultaneously empty their tank.
That they really are there, as it is advertised.
That they are in places that make it is easy to moor.

Attachment III

Questions asked in the interviews to ports managers and maintenance technicians:

1)	How many boats can stay in the port?
2)	When was the station installed?
3)	What kind of station is there? Who is the manufacturer (retailer, producer, pump producer)?
4)	How long is the hose?
5)	What type of pump has the station? (manual or electrical, impeller, eccentrical, etc..)
6)	What's the material of the pump?
7)	What's the capacity of the station and of the tank (if not directly connected to municipal net)?
8)	Are there maintenance problems?
9)	How much time do you spend for the maintenance?
10)	What's the cost for use and maintenance?
11)	How robust is the technology?
12)	How often do you have to replace components? Is it easy to find them?

13)	Can the station take the sludge from every kind of boat?
14)	How often do you have to stop the station and why?
15)	Total/average downtime?
16)	Is the station easy to access both for boat users and for the people who have to empty or maintain the station?
17)	Is the accessibility from land important?
18)	Does the geography/location of the port influence the operation of the station?
19)	Would it be easy to increase the capacity of the station?
20)	What's the optimum scale of the service?
21)	Where do you send the sludge?
22)	What kind of improvement would you suggest? If you could buy a new station now, what kind of station would you buy?
23)	Did you have any complaints from the boat users?
24)	Final cost of the station?

Glossary

Blackwater	Toilet wastewaters generated by humans
Central Baltic	Geographical area which includes land and sea areas around Northern Baltic Sea, southern Bay of Bothnia and Gulf of Finland
Deck fitting for boat toilet waste	Connecting part mounted on the deck of a leisure boat, where the pump-out nozzle penetrates to pump-out the boat toilet waste
Diaphragm or membrane pump	Pump which creates vacuum with the help of rubber film
Dry toilet	Toilet that operates without water flush
Eccentric pump	Eccentric disc pumps consist of a cylinder and pumping element mounted on an eccentric shaft. As the eccentric shaft is rotated, the pumping element forms chambers within the cylinder, which increase in size at the intake port, drawing fluid into the pumping chamber. The fluid is transported to the discharge port where the pumping chamber size is decreased. This action squeezes the fluid out into the discharge piping
Eutrophication	Process of where water is overly enriched mainly by nutrients (P and N) leading to excessive growth of algae and oxygen depletion.
Evacuation column	Vertical pipe for ventilation of a pump-out station's holding tank
Greywater	Water resulting from washing or cleaning, but does not contain toilet waste
HELCOM	HELCOM (Baltic Marine Environment Protection Commission - Helsinki Commission) is the governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area
Holding tank	Fixed tank mounted in a leisure boat where sewage or toilet waste is collected for temporary storage

Impeller or centrifugal pump	Pump, which uses an impeller (a vaned rotating disk) to move the fluid around in a circular movement. The rotational energy typically comes from an engine
Leisure boat	Watercraft or recreational craft with hull length commonly less than 24m, that are intended for leisure or sport use
Leisure boat harbour	Refers to home or guest harbour, port or marina
Nozzle	Cone shaped head or tip of a hose connected to the deck fitting of a leisure boat and with a hose to a pump-out station
Peristaltic pump	In a peristaltic pump, the fluid is contained within a flexible tube fitted inside a circular pump casing. A rotor equipped with rollers compresses the fluid as it turns, facilitating the movement of the fluid. Moreover, as the tube opens to its natural state after the passing of the cam fluid flow is induced to the pump
Pump-out station	Device designed to extract and collect sewage (toilet waste) from leisure boats
Sewage collection system	Network of different kind of pump-out stations for the use of boaters
Sludge	Semi-solid matter that is produced by a waste water treatment process or by a sanitation system
Wastewater	Water polluted by human waste (incl black and grey waters) or by other human activity, excluding bilge waters generated by the water craft and collected separately

Biological Or Chemical Parameters Analysed

BOD	Biological Oxygen Demand. The ratio between BOD:COD gives an indication of degradability.
COD	Chemical Oxygen Demand. The ratio between BOD:COD gives an indication of degradability.
pH	A measure of the H3O+ concentration on a logarithmic scale of 1-14. pH = 7 is neutral, pH < 7 is acidic and pH > 7 is alkaline.
Nitrification inhibition test	Test which investigates the activity of nitrification bacteria, which are active in converting and consequently removing ammonium from wastewater. The result is generally reported in the concentration which results in 50 % and 20 % inhibition in nitrification (EC50 and EC20, respectively). Substances which may cause inhibition are high levels of ammonia, conservatives, bleach products and other chemicals
Oil index	Indication of aliphatic compounds
N	Nitrogen (plant nutrient)
P	Phosphorous (plant nutrient)
Cl	Chloride
Pb	Lead
Cd	Cadmium
Cu	Copper
Cr	Chromium
Ni	Nickel
Zn	Zinc
Hg	Mercury
TS	Total solids (dry)

References

Transportstyrelsen, Båtlivundersökning, 2015.

Finnish Transport Agency, Veneilyn määrä sekä sen taloudelliset ja ympäristövaikutukset Suomessa, 2017.

Riigi Teataja – Water Act